

■ Answers to Textbook Problems

Review Questions

1. The three approaches to national income accounting are the product approach, the income approach, and the expenditure approach. They all give the same answer because they are designed that way; any entry based on one approach has an entry in the other approaches with the same value. Whenever output is produced and sold, its production is counted in the product approach, its sale is counted in the expenditure approach, and the funds received by the seller are counted in the income approach.
2. Goods are measured at market value in GDP accounting so that different types of goods and services can be added together. Using market prices allows us to count up the total dollar value of all the economy's output. The problem with this approach is that not all goods and services are sold in markets, so we may not be able to count everything. Important examples are homemaking and environmental quality.
3. Intermediate goods and services are used up in producing other goods in the same period (year) in which they were produced, while final goods and services are those that are purchased by consumers or are capital goods that are used to produce future output. The distinction is important, because we want to count only the value of final goods produced in the economy, not the value of goods produced each step along the way.
4. GNP is the market value of final goods and services newly produced by domestic factors of production during the current period, whereas GDP is production taking place within a country. Thus, GNP differs from GDP when foreign factors are used to produce output in a country, or when domestic factors are used to produce output in another country. $GDP = GNP - NFP$, where NFP = net factor payments from abroad, which equals income paid to domestic factors of production by the rest of the world minus income paid to foreign factors of production by the domestic economy. A country that employs many foreign workers will likely have negative NFP , so GDP will be higher than GNP.
5. The four components of spending are consumption, investment, government purchases, and net exports. Imports must be subtracted, because they are produced abroad and we want GDP to count only those goods and services produced within the country. For example, suppose a car built in Japan is imported into the United States. The car counts as consumption spending in U.S. GDP, but is subtracted as an import as well, so on net it does not affect U.S. GDP. However, it is counted in Japan's GDP as an export.
6. Private saving is private disposable income minus consumption. Private disposable income is total output minus taxes paid plus transfers and interest received from the government. Private saving is used to finance investment spending, the government budget deficit, and the current account. National saving is private saving plus government saving.
7. National wealth is the total wealth of the residents of a country, and consists of its domestic physical assets and net foreign assets. Wealth is important because the long-run economic well-being of a country depends on it. National wealth is related to national saving because national saving is the flow of additions to the stock of national wealth.
8. Real GDP is the useful concept for figuring out a country's growth performance. Nominal GDP may rise because of increases in prices rather than growth in real output.
9. The CPI is a price index that is calculated as the value of a fixed set of consumer goods and services at current prices divided by the value of the fixed set at base-year prices. CPI inflation is the growth

rate of the CPI. CPI inflation overstates true inflation because it is hard to measure changes in quality, and because the price index doesn't account for substitution away from goods that become relatively more expensive towards goods that become relatively cheaper.

10. The nominal interest rate is the rate at which the nominal (or dollar) value of an asset increases over time. The real interest rate is the rate at which the real value or purchasing power of an asset increases over time, and is equal to the nominal interest rate minus the inflation rate. The expected real interest rate is the rate at which the real value of an asset is *expected* to increase over time. It is equal to the nominal interest rate minus the expected inflation rate. The concept that is most important to borrowers and lenders is the expected real interest rate, because it affects their decisions to borrow or lend.

Numerical Problems

1. GDP is the value of all final goods and services produced during the year. The final output of coconuts is 1000, which is worth 500 fish, because two coconuts are worth one fish. The final output of fish is 500 fish. So in terms of fish, GDP consists of 500 fish worth of coconuts plus 500 fish, with a total value of 1000 fish.

To find consumption and investment, we must find out what happens to all the coconuts and fish. Gilligan consumes all his 200 coconuts (worth 100 fish) and 100 fish, so his consumption is worth 200 fish. The Professor stores 100 coconuts with a value of 50 fish. In an ideal accounting system, these stored coconuts would be treated as investment. However, in the national income accounts, because it is so difficult to tell when durable goods are consumed and when they are saved, they are counted as consumption. So the Professor's consumption consists of 800 coconuts (value 400 fish) and 400 fish, for a total value of 800 fish. Thus the economy's total consumption is valued at 1000 fish and investment is zero.

In terms of income, Gilligan's income is clearly worth 200 fish (100 fish plus 200 coconuts worth 100 fish). The Professor's income is 800 coconuts (1000 coconuts minus the 200 coconuts paid to Gilligan) plus 400 fish (500 fish minus 100 fish paid to Gilligan). In terms of fish, the Professor's income has a value of 800 fish.

This question illustrates some of the nuances of national income accounting. Many difficult choices and measurement issues are involved in constructing the accounts. Here, for example, it is clear that what we call consumption really isn't just the amount of goods consumers use up during the year, but also includes consumption goods that are purchased but saved for the future. Since there is no way to measure when goods are used after they are purchased, the accounts are unable to distinguish consumption from storage of goods.

2.
 - (a) Furniture made in North Carolina that is bought by consumers counts as consumption, so consumption increases by \$6 billion, investment is unchanged, government purchases are unchanged, net exports are unchanged, and GDP increases by \$6 billion.
 - (b) Furniture made in Sweden that is bought by consumers counts as consumption and imports, so consumption increases by \$6 billion, investment is unchanged, government purchases are unchanged, net exports fall by \$6 billion, and GDP is unchanged.
 - (c) Furniture made in North Carolina that is bought by businesses counts as investment, so consumption is unchanged, investment increases by \$6 billion, government purchases are unchanged, net exports are unchanged, and GDP increases by \$6 billion.
 - (d) Furniture made in Sweden that is bought by businesses counts as investment and imports, so consumption is unchanged, investment increases by \$6 billion, government purchases are unchanged, net exports decline by \$6 billion, and GDP is unchanged.
3.
 - (a) ABC produces output valued at \$2 million and has total expenses of \$1.3 million (\$1 million for labor, \$0.1 million interest, \$0.2 million taxes). So its profits are \$0.7 million. XYZ produces output valued at \$3.8 million (\$3 million for the three computers that were sold, plus \$0.8 million for the unsold computer in inventory) and has expenses of \$3.2 million (\$2 million for components, \$0.8 million for labor, and \$0.4 million for taxes). So its profits are \$0.6 million.

According to the product approach, the GDP contributions of these companies are \$3.8 million, the value of the final product of XYZ. ABC's production is of an intermediate good, used completely by XYZ, and so is not counted in GDP.

According to the expenditure approach, the GDP contribution is also \$3.8 million, with \$3 million (of sold computers) adding to the capital stock (as investment spending), and \$0.8 million (the unsold computer) as inventory investment.

The income approach yields the same GDP total contribution. The amounts are:

	ABC	XYZ	TOTAL
Labor	\$1.0 million	\$0.8 million	\$1.8 million
Profit	\$0.7 million	\$0.6 million	\$1.3 million
Taxes	\$0.2 million	\$0.4 million	\$0.6 million
Interest	\$0.1 million	\$0.0 million	\$0.1 million

Total of all incomes = \$3.8 million

- (b) If ABC pays an additional \$.5 million for computer chips from abroad, the results change slightly. The correct answer is easiest to see using the expenditure approach. As in part *a*, there is \$3.8 million spent on final goods, but now there are also net exports of $-\$0.5$ million. So the total expenditure on domestically produced goods is only \$3.3 million. The product approach gets the same answer because the \$.5 million is a contribution to GDP of the country in which the chips were made, and so must be deducted from the GDP of the United States. The value added in the United States is only \$3.3 million. Finally, the income approach gives the same answer as in part *a*, except that the cost of importing the chips reduces ABC's profits by \$.5 million, so the sum of the incomes is only \$3.3 million.
4. (a) Product approach: \$2 = gas station's value added = \$28 product minus \$26 value of product produced in the previous year. Expenditure approach: \$2 = \$28 consumption spending plus inventory investment of $-\$26$. Income approach: \$2 paid to the factors of production at the gas station (wages of employees, interest, taxes, profits).
- (b) Product approach: \$60,000 broker's fee for providing brokerage services. Expenditure approach: \$60,000 counts as residential investment made by the homebuyer. The important point here is that the transfer of an existing good, even at a higher value than that at which it was originally sold, does not add to GDP. Income approach: \$60,000 income to the broker for wages, profits, etc.
- (c) Product approach: \$40,000 salary plus \$16,000 childcare equals \$56,000. Note that there is a sense in which the childcare is an intermediate service and should not be counted, because without it the homemaker would not be able to work. But in practice there is no way to separate such intermediate services from final services, so they are all added to GDP. Expenditure approach: \$56,000 (\$16,000 consumption spending on child care services plus \$40,000 in categories that depend on what the homemaker spends his or her income). Income approach: \$56,000 (\$40,000 compensation of homemaker plus \$16,000 income to the factors producing the child care: employees' wages, interest, taxes, profits).
- (d) Product approach: \$100 million of a capital good. Since it is produced with local labor and materials, and assuming no payments go to Japanese factors of production, this is all added to U.S. GDP. Expenditure approach: \$100 million net exports, since the plant is owned by the Japanese. (It is not part of gross domestic investment because the plant is not a capital good owned by U.S. residents.) Income approach: \$100 million paid to U.S. factors of production.
- (e) Product approach: \$0 because nothing is produced. Expenditure approach: \$0 because this is a transfer, not a government purchase of goods or services. Income approach: \$0, because this is not a payment to a factor of production, just a transfer.
- (f) Product approach: \$5,000 worth of advertising services. Expenditure approach: \$5,000 of government purchases. Income approach: \$5,000 compensation of employees.

- (g) Product approach: \$120 million composed of \$100 million of new cars produced plus \$20 million of sales services provided by the consortium (\$60 million sales price minus \$40 million cost). Expenditure approach: \$100 million by Hertz as investment plus \$60 million by the public for consumption of the used cars minus \$40 million of investment goods sold by Hertz, for a total of \$120 million. Income approach: \$100 million to the factors of production of GM plus \$20 million in payments to the factors of production and profits for the consortium.

5. Given data: $I = 40$, $G = 30$, $GNP = 200$, $CA = -20 = NX + NFP$, $T = 60$, $TR = 25$, $INT = 15$, $NFP = 7 - 9 = -2$. Since $GDP = GNP - NFP$, $GDP = 200 - (-2) = 202 = Y$. Since $NX + NFP = CA$, $NX = CA - NFP = -20 - (-2) = -18$. Since $Y = C + I + G + NX$, $C = Y - (I + G + NX) = 202 - (40 + 30 + (-18)) = 150$.

$$S_{pvt} = (Y + NFP - T + TR + INT) - C = (202 + (-2) - 60 + 25 + 15) - 150 = 30. S_{govt} = (T - TR - INT) - G = (60 - 25 - 15) - 30 = -10. S = S_{pvt} + S_{govt} = 30 + (-10) = 20.$$

- (a) Consumption = 150
 (b) Net exports = -18
 (c) GDP = 202
 (d) Net factor payments from abroad = -2
 (e) Private saving = 30
 (f) Government saving = -10
 (g) National saving = 20

6.

Base-Year Quantities at Current-Year Prices		At Base-Year Prices
Apples	$3000 \times \$3 = \$9,000$	$3000 \times \$2 = \$6,000$
Bananas	$6000 \times \$2 = \$12,000$	$6000 \times \$3 = \$18,000$
Oranges	$8000 \times \$5 = \$40,000$	$8000 \times \$4 = \$32,000$
Total	\$61,000	\$56,000

Current-Year Quantities at Current-Year Prices		At Base-Year Prices
Apples	$4,000 \times \$3 = \$12,000$	$4,000 \times \$2 = \$8,000$
Bananas	$14,000 \times \$2 = \$28,000$	$14,000 \times \$3 = \$42,000$
Oranges	$32,000 \times \$5 = \$160,000$	$32,000 \times \$4 = \$128,000$
Total	\$200,000	\$178,000

- (a) Nominal GDP is just the dollar value of production in a year at prices in that year. Nominal GDP is \$56 thousand in the base year and \$200 thousand in the current year. Nominal GDP grew 257% between the base year and the current year: $[(\$200,000/\$56,000) - 1] \times 100\% = 257\%$.
 (b) Real GDP is calculated by finding the value of production in each year at base-year prices. Thus, from the table above, real GDP is \$56,000 in the base year and \$178,000 in the current year. In percentage terms, real GDP increases from the base year to the current year by

$$[(\$178,000/\$56,000) - 1] \times 100\% = 218\%.$$

- (c) The GDP deflator is the ratio of nominal GDP to real GDP. In the base year, nominal GDP equals real GDP, so the GDP deflator is 1. In the current year, the GDP deflator is $\$200,000/\$178,000 = 1.124$. Thus the GDP deflator changes by $[(1.124/1) - 1] \times 100\% = 12.4\%$ from the base year to the current year.
- (d) Nominal GDP rose 257%, prices rose 12.4%, and real GDP rose 218%, so most of the increase in nominal GDP is because of the increase in real output, not prices. Notice that the quantity of oranges quadrupled and the quantity of bananas more than doubled.

7. Calculating inflation rates:

$$1929-30: [(50.0/51.3) - 1] \times 100\% = -2.5\%$$

$$1930-31: [(45.6/50.0) - 1] \times 100\% = -8.8\%$$

$$1931-32: [(40.9/45.6) - 1] \times 100\% = -10.3\%$$

$$1932-33: [(38.8/40.9) - 1] \times 100\% = -5.1\%$$

These all show deflation (prices are declining over time), whereas recently we have had nothing but inflation (prices rising over time).

8. The nominal interest rate is $[(545/500) - 1] \times 100\% = 9\%$. The inflation rate is $[(214/200) - 1] \times 100\% = 7\%$. So the real interest rate is 2% (9% nominal rate – 7% inflation rate). Expected inflation was only $[(210/200) - 1] \times 100\% = 5\%$, so the expected real interest rate was 4% (9% nominal rate – 5% expected inflation rate).
9. (a) The annual rate of inflation from January 1, 2011, to January 1, 2013, is 10%. This can be found by calculating the constant rate of inflation that would raise the deflator from 200 to 242 in two years. This gives the equation $(1 + \pi)(1 + \pi) = (242/200)$, which has the solution $\pi = 10\%$.
An easy way to think about this question is this. A constant inflation rate of π raises the deflator from 200 on January 1, 2011, to $200 \times (1 + \pi)$ on January 1, 2012, and to $200 \times (1 + \pi) \times (1 + \pi) = 242$ on January 1, 2013. So we need to solve the expression $(1 + \pi)^2 = 242/200$.
- (b) By similar reasoning, the inflation rate over the three-year period is $(1 + \pi)^3 = 266.2/200$, or $\pi = 10\%$.
- (c) We can derive a general expression in the same way:

$$1 + \pi = P_1/P_0$$

$$1 + \pi = P_2/P_1$$

...

...

...

$$1 + \pi = P_n/P_{n-1}$$

Multiplying all these lines together, we get:

$$(1 + \pi)^n = (P_1/P_0) \times (P_2/P_1) \times \cdots \times (P_n/P_{n-1}) = P_n/P_0$$

Analytical Problems

1. The key to this question is that real GDP is not the same thing as well-being. People may be better off even if real GDP is lower; for example, this may occur because the improvement in the health of workers is more valuable to society than the loss of GDP due to the regulation. Ideally, we would like to be able to compare the costs and benefits of such regulations; they should be put in place if the overall costs (the reduced GDP in this case) are valued less than the overall benefits (the workers' health).
2. National saving does not rise because of the switch to CheapCall because although consumption spending declines by \$2 million, so have total expenditures (GDP), which equal total income. Since income and spending both declined by the same amount, national saving is unchanged.
3.
 - (a) The problem in a planned economy is that prices do not measure market value. When the price of an item is too low, then goods are really more expensive than their listed price suggests—we should include in their market value the value of time spent by consumers waiting to make purchases. Because the item's value exceeds its cost, measured GDP is too low.

When the price of an item is too high, goods stocked on the shelves may be valued too highly. This results in an overvaluation of firms' inventories, so that measured GDP is too high.

A possible strategy for dealing with this problem is to have GDP analysts estimate what the market price should be (perhaps by looking at prices of the same goods in market economies) and use this "shadow" price in the GDP calculations.
 - (b) The goods and services that people produce at home are not counted in the GDP figures because they are not sold on the market, making their value difficult to measure. One way to do it might be to look at the standard of living relative to a market economy, and estimate what income it would take in a market economy to support that standard of living.
4. Example from 2012:Q1 (amounts in billions of dollars): Gross saving = 1945.6, gross domestic investment = 2499.9, and current account balance = -553.6. So gross domestic investment + current account balance = 1946.3, which is 0.7 larger than gross saving. Capital account transactions = 0.5 and the statistical discrepancy is 1.1, so if we add the statistical discrepancy to gross saving and subtract capital account transactions, we get 1946.2, which is almost equal to gross domestic investment + current account balance; the very small difference occurs from rounding error.