

Chapter 5

MEASURING GDP AND ECONOMIC GROWTH*

Key Concepts

■ Gross Domestic Product

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

- ◆ A **final good or service** is an item that is bought by its final user during a specified time period. In contrast, an **intermediate good** is an item produced by one firm, bought by another and used as a component of a final good or service. Intermediate goods are not directly included in real GDP.

The circular flow of income and expenditure shows real and monetary flows in the economy. The circular flow involves:

- ◆ Four economic sectors — households, firms, governments, and the rest of the world.
- ◆ Three major markets — factor markets, goods markets, and financial markets.

In these markets people make their economic decisions by choosing the amounts of key economic variables:

- ◆ **Consumption expenditures** (C) — total household spending on consumption goods and services.
- ◆ **Investment** (I) — firms' purchase of new plants, equipment, buildings, and additions to inventories.
- ◆ **Government purchases** (G) — government spending on goods and services. **Net taxes** (T) are taxes paid to the government minus transfer payments received from governments and minus interest payments on the government's debt.

- ◆ **Net exports** (NX) — **exports** (X , sales of U.S. goods and services abroad) minus **imports** (M , purchases of foreign good and services).

Aggregate expenditure, $C + I + G + NX$, equals aggregate production, GDP, and also equals aggregate income, Y . This equality is the basis for measuring GDP.

- ◆ **National saving** equals saving by households and businesses plus government saving: $S + (T - G)$.
- ◆ Borrowing from the rest of the world equals $M - X$.

Investment is financed by national saving plus borrowing from the rest of world, $I = S + (T - G) + M - X$.

A **flow** is a quantity over a unit of time. A **stock** is a quantity that exists at a moment in time. Wealth and capital are stocks; saving and investment are flows.

- ◆ **Wealth**, the value of things that people own, is a stock; *income*, what people earn, is a flow.
- ◆ Saving is the amount of income remaining after spending on consumption. Saving is a flow that adds to wealth.
- ◆ Capital, the amount of plant, equipment, and inventories used to produce other goods, is a stock.
- ◆ **Depreciation** (also called **capital consumption**) is the decrease in the capital stock because of wear and tear and obsolescence. **Gross investment** is the total amount of investment. **Net investment** is gross investment minus depreciation. Net investment is the flow that is the amount by which the capital stock changes.

Gross domestic product includes depreciation and so on the income side includes firms' gross profit (before subtracting depreciation) and on the expenditure side includes gross investment. Net domestic product excludes (subtracts) depreciation so it includes firms' net profits and net investment.

* This is Chapter 21 in *Economics*.

■ Measuring U.S. GDP

In 2003, U.S. GDP equaled \$10,847 billion.

- ◆ The *expenditure approach* measures GDP by adding final expenditures, $C + I + G + NX$. Of these expenditures, personal consumption expenditure is the largest, at about 71 percent. Gross private investment is about 15 percent, government purchases of goods and services is about 19 percent, and net exports is about -5 percent.
- ◆ The *income approach* adds the compensation of employees, net interest, rental income, corporate profits and proprietors' income to give *net domestic income at factor cost*. Indirect taxes and depreciation are added and subsidies subtracted to obtain GDP.

■ Real GDP and the Price Level

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

Nominal GDP is the value of the final goods and services produced in a given year valued at the prices that prevailed in that same year.

The base year prices method, which is the traditional method of calculating real GDP, values the quantities produced in each year using the prices of the base year. The **chain-weighted output index** method, which is the new method of calculating real GDP, uses the prices of two adjacent years to calculate the real GDP growth rate.

- ◆ The chain-weighted output index first calculates the value of GDP for this year and last year, using prices from last year and then calculates the growth rate of GDP between the two years.
- ◆ Next the chain-weighted index calculates the value of GDP for this year and last year, using prices from this year and again calculates the growth rate of GDP between the two years.
- ◆ The two growth rates are averaged. This average is used to scale up last year's real GDP by multiplying last year's real GDP by the average.

The **price level** is the average level of prices. One measure of the price level is the **GDP deflator**, which is an average of current year prices as a percentage of base-year prices. The GDP deflator equals $(\text{Nominal GDP} \div \text{Real GDP}) \times 100$.

■ Measuring Economic Growth

The **economic growth rate** is the percentage change in the quantity of goods and services produced from one year to the next. It equals the growth rate of real GDP. Real GDP is used for economic welfare comparisons, for making international comparisons of output, and for business cycle forecasting.

Economic welfare is a comprehensive measure of general economic well being. Real GDP is an imperfect measure of economic welfare because real GDP:

- ◆ Over adjusts for inflation — many quality improvements that lead to higher prices are counted as only price hikes.
- ◆ Omits household production — all household production is omitted.
- ◆ Omits the underground economy — the underground economy (transactions hidden from the government) is not included.
- ◆ Omits health and life expectancy — neither people's health nor life expectancy are indicated by real GDP.
- ◆ Omits leisure time — the value of leisure time is not included.
- ◆ Omits environmental quality — the consequences of adverse and beneficial environmental changes are omitted.
- ◆ Ignores political freedom and social justice — the extent of political freedom or social justice within a nation is not measured.

Making international comparisons of real GDP can be tricky because the real GDP of one country must be converted into the other nation's currency. Using exchange rates for such conversions might understate the real GDP in less developed nations. However, use of purchasing power parity prices might give a more accurate comparison.

Though real GDP probably overstates the size of fluctuations in total production and economic welfare, it is a reasonably good indicator of the phase of the business cycle, e.g., expansion, peak, and so on.

Helpful Hints

1. **GDP, AGGREGATE EXPENDITURE, AND AGGREGATE INCOME** : Some of the most important re-

sults in this chapter show the equality between GDP, aggregate expenditure, and aggregate income. A key point about these equalities is that GDP, aggregate expenditure, and aggregate income are linked. For instance, the production of output (GDP) creates income (aggregate income) as firms pay their workers and also creates expenditure (aggregate expenditure) as households use their incomes to buy goods and services.

2. **THE DIFFERENCE BETWEEN GOVERNMENT PURCHASES AND GOVERNMENT TRANSFER PAYMENTS:** Government spending on goods and services (G) and government transfer payments are fundamentally different. Both involve payments by the government, but transfer payments are not payments for goods and services. Instead, they are simply a flow of money. Transfer payments are like gifts; they do not buy a good or service for the government in exchange. Transfer payments are not payment for a good or service, so they are not part of the G component of aggregate expenditure, $C + I + G + NX$, because aggregate expenditure measures purchases of goods and services.

Questions

■ True/False and Explain

Gross Domestic Product

1. The market value of *all* the goods and services produced within a country in a given time period are included in GDP.
2. Wages paid to households for their labor is part of aggregate income.
3. Transfer payments are included in the government purchases component of aggregate expenditure.
4. Aggregate income equals aggregate expenditure.
5. Capital is a stock; investment is a flow.
6. Gross domestic product is larger than net domestic product.

Measuring U.S. GDP

7. GDP can be measured only one way.
8. The expenditure approach to measuring GDP adds firms' expenditures on wages, rent, interest, and profit.

Real GDP and the Price Level

9. The chain-weighted output index method is how real GDP is calculated.
10. The GDP deflator is calculated as real GDP divided by nominal GDP, multiplied by 100.
11. If prices rise, nominal GDP is smaller than real GDP.

Measuring Economic Growth

12. If two nations have the same GDP, economic welfare must be the same in each.
13. Real GDP is a good measure of economic welfare in less developed nations, but is a bad measure in developed nations.
14. Real GDP is a good measure of the phase of the business cycle.

■ Multiple Choice

Gross Domestic Product

1. Which of the following is NOT a final good?
 - a. a new computer sold to an NYU student
 - b. a new car sold to Avis for use in their fleet of rental cars
 - c. a purse sold to a foreign visitor
 - d. a hot dog sold to a spectator at a Chicago Bears football game
2. GDP equals
 - a. aggregate expenditure.
 - b. aggregate income.
 - c. the value of the aggregate production in a country during a given time period.
 - d. all of the above.
3. A nation's investment must be financed by
 - a. national saving only.
 - b. the government's budget deficit.
 - c. borrowing from the rest of the world only.
 - d. national saving plus borrowing from the rest of the world.
4. Which of the following is a flow?
 - a. GDP
 - b. Wealth
 - c. The amount of money in a savings account
 - d. Capital

5. Which of the following is a stock?
- Income
 - Depreciation
 - Investment
 - Capital

Measuring U.S. GDP

6. Gross private domestic investment is a component of which approach to measuring GDP?
- Incomes approach
 - Expenditure approach
 - Linking approach
 - Output approach
7. Which of the following is NOT a component of the incomes approach to GDP?
- Net exports
 - Wages and salaries
 - Corporate profits
 - Proprietors' income

Use Table 5.1 for the next eight questions. Assume there are no indirect taxes, subsidies, or depreciation.

TABLE 5.1

Multiple Choice Questions 8–15

Consumption expenditure	\$200 billion
Government purchases	60 billion
Net taxes	50 billion
Investment	50 billion
Corporate profits	30 billion
Imports	20 billion
Exports	10 billion

8. How much is aggregate expenditure?
- \$440 billion
 - \$330 billion
 - \$300 billion
 - \$270 billion
9. How much is GDP?
- \$440 billion
 - \$330 billion
 - \$300 billion
 - \$270 billion
10. How much is aggregate income?
- \$440 billion
 - \$330 billion
 - \$300 billion
 - \$270 billion
11. How much are net exports?
- \$20 billion
 - \$10 billion
 - \$0
 - −\$10 billion
12. How much is household saving?
- \$300 billion
 - \$200 billion
 - \$100 billion
 - \$50 billion
13. How much is government saving?
- \$60 billion
 - \$50 billion
 - \$0
 - −\$10 billion
14. How much is national saving?
- \$200 billion
 - \$50 billion
 - \$40 billion
 - −\$10 billion
15. How much is the borrowing from the rest of the world?
- \$20 billion
 - \$10 billion
 - \$0
 - −\$10 billion

Real GDP and the Price Level

16. Currently, real GDP is calculated using
- the quantities only method.
 - base year prices method.
 - current year prices method.
 - chain-weighted output index method.

17. Real GDP in 2002 is \$100. Between 2002 and 2003, using 2002 prices GDP grew 8 percent and using 2003 prices real GDP grew 4 percent. What does real GDP in 2003 equal?
- \$104
 - \$106
 - \$108
 - None of the above answers is correct.

Use Table 5.2 for the next two questions.

TABLE 5.2

Multiple Choice Questions 18 and 19

Year	Nominal GDP (billions of dollars)	Real GDP (billions of 2000 dollars)	GDP deflator
2003	\$4,500	—	150
2004	—	\$3,100	156

18. What is real GDP in 2003?
- \$675,000 billion
 - \$4,500 billion
 - \$3,100 billion
 - \$3,000 billion
19. What is nominal GDP in 2004?
- \$4,836 billion
 - \$3,100 billion
 - \$3,000 billion
 - \$1,987 billion

Measuring Economic Growth

20. Pollution is a by-product of some production processes, so real GDP as measured
- is adjusted downward to take into account the pollution.
 - is adjusted upward to take into account the expenditures that will be made in the future to clean up the pollution.
 - tends to overstate economic welfare.
 - tends to understate economic welfare.

21. Which of the following is NOT a reason that real GDP is a poor measure of a nation's economic welfare?
- Real GDP omits measures of political freedom.
 - Real GDP does not take into account the value of people's leisure time.
 - Real GDP does not include the underground economy.
 - Real GDP overvalues household production.
22. Which of the following statements about the comparison between GDP in China and in the U.S. is correct?
- Using the exchange rate to value China's GDP in dollars shows that China's GDP per person exceeds the GDP per person in the United States.
 - Using purchasing power parity prices to value China's GDP in dollars shows that China's GDP per person exceeds the GDP per person in the United States.
 - China's GDP per person is higher using purchasing power parity prices rather than the exchange rate when valuing China's GDP in dollars.
 - None of the above answers are correct because they are all false statements.

Short Answer Problems

- Robert buys 100 shares of stock in Microsoft and pays a total of \$10,000. Is his expenditure of \$10,000 part of GDP? Explain your answer.
- How can we measure gross domestic product, GDP, with either the expenditure or the incomes approach, when neither of these approaches actually measures production?
- Betty receives a Social Security check for \$1,500 from the government. Is her check part of the government purchases component of GDP? Explain your answer.
- How is a nation's investment financed? Define national saving and borrowing from the rest of world in your answer.

TABLE 5.3

Data From Mallville

Consumption expenditure	\$400 billion
Government purchases	120 billion
Net taxes	100 billion
Investment	80 billion
Corporate profits	50 billion
Imports	50 billion
Exports	60 billion

5. Table 5.3 shows data for the nation of Mallville. Depreciation in Mallville is zero. Using these data, what is the value of Mallville's
- GDP?
 - aggregate expenditure?
 - net exports?
 - aggregate income?
 - household saving?
 - government saving?
 - national saving?
 - borrowing from the rest of world?

- Use the data and your answers from problem 6 to show how Mallville's investment of \$80 billion is financed.
- Igor has been hired to use the chain-weighted output index method for calculating real GDP for Transylvania's real GDP in 2003. Igor likes chains, so he thought he would be good at his new job, but he needs help. Real GDP in 2002 was \$500. Igor calculates that GDP using 2002 prices is \$1,000 in 2002 and \$1,100 in 2003. He also calculates that GDP using 2003 prices is \$1,200 in 2002 and \$1,440 in 2003. Help Igor avoid chains himself by calculating real GDP in 2003.

■ You're the Teacher

- "Even though I studied this chapter a lot, just like our teacher told us to, I don't understand why I had to study it so much. What's the big deal? Do you know why?" Your friend probably didn't study this chapter quite enough. Because you did, you can help your friend by explaining why this chapter is worthy of study.

Answers

■ True/False Answers

Gross Domestic Product

1. **F** The market value of only *final* goods and services is included in GDP; the market value of intermediate goods is not included.
2. **T** Compensation of employees (wages) is the single largest component of aggregate income.
3. **F** The government purchases part of aggregate expenditure is the goods and services the government buys. Transfer payments buy no good or service and so they are not part of government purchases.
4. **T** Aggregate income equals aggregate expenditure and both equal GDP.
5. **T** Investment is the flow that adds to the stock of capital.
6. **T** Gross domestic product includes depreciation.

Measuring U.S. GDP

7. **F** Because of the equality between aggregate expenditure, aggregate income, and GDP, GDP can be measured using the expenditure approach or using the income approach.
8. **F** The expenditure approach to measuring GDP adds consumption expenditure, investment, government purchases, and net exports.

Real GDP and the Price Level

9. **T** The chain-weighted output index method is the new method used to calculate real GDP. The base year prices method is the older method that is no longer in use.
10. **F** The GDP price deflator is equal to $(\text{Nominal GDP} \div \text{Real GDP}) \times 100$.
11. **F** When prices rise, nominal GDP is larger than real GDP and must be deflated to equal real GDP.

Measuring Economic Growth

12. **F** Economic welfare depends on more than just real GDP, so even if the nations' real GDPs are equal, their economic welfare can be different.
13. **F** In developed nations real GDP is not a perfect measure of economic welfare and is an even poorer measure in less developed nations.

14. **T** Real GDP generally is a reliable indicator of business cycle phases.

■ Multiple Choice Answers

Gross Domestic Product

1. **b** The new car sold to Avis is an intermediate good.
2. **d** The equality of these three measures of GDP is a key result developed in this chapter.
3. **d** A nation's investment can be financed through borrowing from foreigners and/or saving by domestic citizens.
4. **a** GDP is the flow of production during a year.
5. **d** Capital is the total amount of plant, equipment, and inventories that exists at a moment in time.

Measuring U.S. GDP

6. **a** The expenditures approach adds the expenditures made on all final goods and services.
7. **a** Net exports is a component of the expenditure approach to measuring GDP.
8. **c** Aggregate expenditure equals the sum of consumption expenditure (\$200 billion) plus gross investment (\$50 billion) plus government purchases (\$60 billion) plus net exports (−\$10 billion, exports minus imports).
9. **c** GDP equals aggregate expenditure.
10. **c** Aggregate income equals GDP.
11. **d** Net exports equals exports (\$10 billion) minus imports (\$20 billion).
12. **d** Household saving equals aggregate income (\$300 billion) minus consumption expenditure (\$200 billion) and net taxes (\$50 billion), so household saving is \$50 billion.
13. **d** Government saving equals net taxes (\$50 billion) minus government purchases (\$60 billion) so government saving is −\$10 billion.
14. **c** National saving equals the sum of household saving plus government saving. From question 12, household saving is \$50 billion. From question 13, government saving is −\$10 billion. So, national saving is \$40 billion.
15. **b** Borrowing from the rest of the world equals the negative of net exports.

Real GDP and the Price Level

16. **d** The base year prices method is the old method for calculating real GDP; currently the chain-weighted output index is the method used to calculate real GDP.
17. **b** The average growth rate between 2002 and 2003 is 6 percent, so real GDP grew at 6 percent to \$106.
18. **d** Real GDP equals nominal GDP deflated by (divided by) the GDP deflator, then multiplied by 100.
19. **a** Nominal GDP equals real GDP multiplied by the GDP deflator, then divided by 100.

Measuring Economic Growth

20. **c** Because pollution is not subtracted from real GDP, real GDP overstates economic welfare.
21. **d** Real GDP omits household production.
22. **c** When the exchange rate is used to value China's GDP, GDP per person in the United States is 34 times larger than China's GDP per person. If purchasing power parity prices are used to value China's GDP, U.S. GDP per person is 6 times larger than China's GDP per person.

■ Answers to Short Answer Problems

1. No, Robert's purchase of Microsoft stock is not part of GDP. GDP includes the purchase of final goods and services. So included in GDP would be, say, Microsoft's purchase of a new telephone system because this is the purchase of a piece of capital. When Robert purchased Microsoft stock, no good or service changed hands. So it is excluded from GDP because the expenditures in GDP represent the purchase of goods or services.
2. The analysis of the circular flow showed that firms produce goods and services (what we want to measure, GDP); sell them (what the expenditure approach measures); and then use the proceeds to pay incomes, such as rents, profits, and the like (what the incomes approach measures). Therefore aggregate expenditure = aggregate income = production = GDP.
3. No, Betty's \$1,500 Social Security check is not part of the government purchases (G) component of GDP. That measures the government's purchases of goods and services. The government is not buying a

good or service when it gives Betty her Social Security check. Instead, the check is a transfer payment, that is, a transfer of income from the people who paid Social Security taxes to Betty. Transfer payments are not part of the government purchases component of GDP.

4. Investment can be financed by national saving and/or borrowing from the rest of the world. National saving equals the sum of household saving, S , plus government saving, $T - G$. Hence national saving equals $S + (T - G)$. Borrowing from the rest of world is $M - X$. So investment must equal what is saved in the nation plus what is borrowed from abroad, which in terms of a formula is equal to $S + (T - G) + M - X$.
5.
 - a. GDP in Mallville equals the sum of consumption expenditure (C , \$400 billion) plus investment (I , \$80 billion) plus government purchases (G , \$120 billion) plus net exports (NX), which equals exports (X , \$60 billion) minus imports (M , \$50 billion). So GDP in Mallville is \$610 billion.
 - b. Aggregate expenditure equals GDP, so aggregate expenditure is \$610 billion.
 - c. Net exports, NX , is equal to exports (\$60 billion) minus imports (\$50 billion), or \$10 billion.
 - d. Aggregate income, Y , equals GDP, or \$610 billion.
 - e. Household saving equals aggregate income (\$610 billion) minus net taxes (\$100 billion) minus consumption expenditure (\$400 billion), or \$110 billion.
 - f. Government saving is net taxes minus government purchases, or $T - G$. So government saving equals \$100 billion - \$120 billion, or -\$20 billion.
 - g. National saving equals household saving plus government saving. From parts (e) and (f), national saving in Mallville is \$90 billion.
 - h. Borrowing from the rest of the world equals imports minus exports, $M - X$. Therefore Mallville's borrowing from the rest of the world is \$50 billion - \$60 billion = -\$10 billion, that is, Mallville's residents *loan* \$10 billion to the rest of the world.
6. Investment is financed by national saving and borrowing from the rest of the world. In Mallville's

case, gross investment is \$80 billion. That equals the sum of national saving, \$90 billion plus borrowing from the rest of world, -\$10 billion. Basically, Mallville has national saving of \$90 billion, but only \$80 billion of investment. Hence the difference, \$10 billion, is loaned to the rest of the world.

7. Using 2002 prices, Transylvania's GDP grew from \$1,000 in 2002 to \$1,100 in 2003, so the percentage increase is 10 percent, $\frac{\$1,100 - \$1,000}{\$1,000} \times 100$.

Using 2003 prices, GDP increased from \$1,200 in 2002 to \$1,440 in 2003, for a 20 percent increase. The average percent increase is 15 percent. As a result, real GDP is calculated as growing 15 percent between 2002 and 2003, so real GDP in 2003 is $(15 \text{ percent}) \times (\$500) = \$575$.

■ You're the Teacher

1. "Yes, I have an idea why this chapter is important. Basically, it is a lot of the foundation for the next 12 or so chapters!
"That statement sure got your attention! Now, listen: We're trying to learn what factors affect the ag-

gregate economy in order to discover what makes our economy grow more or less rapidly and what causes business cycles and other stuff. Look, these are important issues! I don't know about you, but I sure hope the economy's not in a recession when we graduate and have to look for jobs. At least I sure hope there's no recession going on when I have to look for a job! And once we get jobs, I sure hope that the economy grows rapidly so that our incomes grow rapidly along with it.

"Anyway, we have to know what GDP is in order to understand growth and business cycles. After all, how would we measure these things if we didn't know what the GDP is? So, we're going to be studying what makes GDP grow faster and what makes it fluctuate. And, when we do, a lot of the stuff we learned in this chapter will be important, like the idea that aggregate expenditure equals aggregate income and both equal GDP. So, I'm glad you studied this stuff, because if you'd blown it off, I'd be alone, without any friends, in the last half of the class."