

GDP and the Measurement of Progress

Facts and Tools

1. According to Table 26.1, what country has the highest GDP? What country on the list has the highest GDP per person? What countries on the list have the *second* highest GDP and the *second* highest GDP per person?

Solution

1. The United States has the highest GDP with \$14,447 and the highest GDP per capita. The second-highest GDP is in China with \$10,807, but the second-highest GDP per person is in Canada with \$46,569.

2. What is included in GDP: all goods, all services, or both?

Solution

2. Both.

3. What happened to spending on medical services and recreational activities since 1950?

Solution

3. Spending on medical services and recreation has increased by more than 10 times since 1950. Clearly, we are a service economy.

4. Police officer: "I pulled you over for speeding. You were going 80 miles per hour." Driver: "But that's impossible, officer! I've only been driving for 15 minutes!"

The government reports GDP numbers every quarter. How does this story illustrate the meaning of "GDP per year" when the GDP number gets reported every three months?

Solution

4. Your speedometer measures how far you would travel if, hypothetically, you traveled at that speed for a whole hour. Similarly, when GDP gets reported for a given quarter, the government reports a number that is four times the actual number: It reports "GDP per year" just as the speedometer reports "miles per hour."

5. Calculate the annual growth rate of nominal GDP in the following examples:

Nominal GDP in 1930: \$97 billion. Nominal GDP in 1931: \$84 billion.

Nominal GDP in 1931: \$84 billion. Nominal GDP in 1932: \$68 billion.

Nominal GDP in 2000: \$9,744 billion. Nominal GDP in 2001: \$10,151 billion.

(Source: Historical Tables, Budget of the United States Government, Congressional Budget Office)

Solution

5. 1930 to 1931 nominal GDP growth rate: $(\$84 \text{ billion} - \$99 \text{ billion}) / \$97 \text{ billion} = -0.134 = -13.4\%$

1931 to 1932 nominal GDP growth rate: $(\$68 \text{ billion} - \$84 \text{ billion}) / \$84 \text{ billion} = -0.190 = -19.0\%$

2000 to 2001 nominal GDP growth rate: $+4.2\%$

6. Are the following included in U.S. GDP? Briefly explain why or why not:

- a. Used cars sold at a used car store
- b. Your used car sold at your cousin's garage sale
- c. Wine made in Napa Valley at a vineyard owned by Australians
- d. Wine made in Australia at a vineyard owned by Americans
- e. The price paid by a French tourist when staying at a San Francisco hotel
- f. The price paid by an American tourist staying at a Paris hotel
- g. A ticket for a Lakers game

Solution

6. a. No. Used items aren't "produced" during that year so they are not included in GDP, but the services produced by the college bookstore in selling the textbooks would be included in GDP.
- b. No. Used items don't count, and because of measuring problems, the services of people who sell items at garage sales are not included in GDP either.
- c. Yes. What matters is where it's made, not whether an Australian company owns the factory.
- d. No. What matters is where it's made, not whether an American company owns the factory.
- e. Yes. The transaction made in the country itself! So, technically, it counts as an "exported service."
- f. No. GDP is about production in the country. This service transaction occurred in Germany. So, if we are considering U.S. GDP, it will not be included in GDP.
- g. Yes. Entertainment services are part of the country's income and to be included in GDP.

7. By definition, is nominal GDP higher than real GDP?

Solution

7. No. The "price level" is just a number. The exact number is arbitrary so long as we use the same system to compare real GDP in different years. We could say the price level in year one is 100 and calculate that in year 10 the price level is 200, for example, or we could say that the price level in year one is 7 and calculate that in year 10 it is 14. It's the same idea as with temperature; we can measure in the Fahrenheit scale or Celsius scale so long as when we compare two temperatures, we use the same scale. Bottom line is that nominal GDP could be higher or lower than real GDP, depending on how we define the price level.

8. In the last 20 years, have recessions been getting more frequent or less frequent than they used to be?

Solution

8. Less frequent.

9. According to the National Bureau of Economic Research, which of the following are "normally" part of the definition of a recession?

A fall in nominal income

A fall in employment

A fall in real income

A fall in the price level

Solution

9. A fall in employment and a fall in real income are part of the official definition of a recession, while a fall in prices is not. Declines in real things like jobs and spending power are what matter for defining a recession.

So if the dollars in your paycheck fall, but the price of the things you buy falls by even more, then you've got a rise in your real income. The NBER won't call that a recession.

10. Looking back over the last 10,000 years of human history, which is more “normal”: For GDP per capita to grow or for GDP per capita to stay about the same?

Solution 10. It’s normal in human history for GDP per capita to stay about the same. Though admittedly, it’s closer to $1/6$.

11. Attach the appropriate fractions to the “long-term averages” in Figure 26.6. (Some fractions will be left over.) These fractions may turn out to be more memorable than the exact percentages in the figure.

Long-Run Averages	Fraction of GDP
Consumption	$1/3$
	$1/8$
Investment	$1/5$
	$-1/14$
Government purchases	$1/4$
	$2/3$
Net exports	$9/10$

Solution 11. Consumption: $2/3$. Investment: $1/8$. Government purchases: $1/5$. Net exports: $-1/100$. The text accidentally omitted the $-1/100$ option.

12. What is the national spending identity? This identity is very important in macroeconomics. It is as important as basic anatomy in medical school: You won’t be able to cure anyone until you know what’s inside a person.

Solution 12. $Y = C + I + G + NX$, or gross domestic product equals consumption plus investment plus government purchases plus net exports.

Thinking and Problem Solving

1. Calculate GDP in this simple economy:

Consumer purchases: \$100 per year

Investment purchases: \$50 per year

Government purchases: \$20 per year

Total exports: \$50 per year

Total imports: \$70 per year

Solution 1. $Y = C + I + G + NX = \$100 + \$50 + \$20 + (\$50 - \$70) = \150 per year

2. Since World War II, who were the only three recession-free U.S. presidents? (We’ll revisit the question of how presidents matter for the economy in later chapters.)

Solution 2. Kennedy, Johnson, and Clinton

3. We noted that “government purchases” don’t include all government spending. A big part of what the U.S. government does is transfer money from one person to another. Social security (payments to retirees), and Medicare and Medicaid (paying for medical care for the elderly and the poor) make up most of these “government transfers.” We’ll look into this in more detail in Chapter 36, but right now, let’s see how big “government transfers” are and how fast they’ve grown in the federal government’s budget. The figures in this table are all in non-inflation-adjusted dollars. Complete the table.

Year	Total Federal Transfers	Total Federal Spending	Transfers as Percent of Spending
1950	\$13.6 Billion	\$42.5 Billion	
2000	\$1,057 Billion	\$1,788 Billion	
Growth Rate in %:			
Source: Budget of the United States Government: Historical Tables, Fiscal Year 2003. Washington, D.C.: U.S. Government Printing Office.			

- Solution**
3. Transfers as percent of spending in 1950: 32%
Transfers as percent of spending in 2000: 59%
Growth in transfers: 7,672%
Growth in federal spending: 4,107%

4. Let's see what fraction of the economic pie goes to workers in the form of wages, and let's see if it has changed over the years. The "wage share" seems like it should be easy to calculate, but there's a problem. That problem brings us back to the big idea of opportunity cost. The problem itself is straightforward: When a small business owner makes money, should we count that as "wages" or as "profit?" Usually, a small business owner is working at the business most days, doing the kinds of tasks that you could easily pay someone else to do: In other words, from the looking-in-the-window perspective, a business owner looks like a worker, and workers earn wages. But since the owner gets to keep all the profits that are left over after paying off the other workers and the bank, it looks like the money that he or she earns should count as profit.

What to do? The *best* solution is to calculate the "opportunity cost" of the business owner's time: In other words, estimate roughly how much the business owner would get paid if or she were working as an employee. It tells us how much of the business owner's income is truly wage income.

The *second* best solution, which we'll use in this question, is to just guess that one-third, one-half, or two-thirds of the business owner's income is really wages, and the rest is profit. As so often in economics, we make some assumptions; Let's see if that changes our view of the economy. Using this measure, let's see what has happened to the slice of the pie going to workers:

Year	Wages (including salaries and bonuses)	Business Owner's Income
1959	62% of national income	11% of national income
2003	64% of national income	9% of national income
Source: Survey of Current Business, Bureau of Economic Analysis, March 2004.		

Using these data, complete the following table:

Year	Total Wages (as percentage of national income)		
	Including one-third of business income	Including one-half of business income	Including two-thirds of business income
1959			
2003			

So, now that you've calculated this, does it appear that "wage share" has risen by more than 5%, fallen by more than 5%, or stayed roughly the same over the decades? Does the one-third, one-half, or two-thirds business owner adjustment affect this conclusion?

Solution

4. 1959: One-third = 65.7%, one-half = 67.5%, two-thirds = 69.4%

2003: One-third = 67.0%, one-half = 68.5%, two-thirds = 70.0%

Regardless of the adjustment we use, about two-thirds of output goes for wages. In this case (but not all cases!), the particular assumption we made about how much of business income is wages and how much is profit didn't really matter.

5. Let's figure out GDP for Robinson Crusoe.

a. Initially he is stuck on an island without the wisdom and local knowledge of Friday. Because Crusoe is a proper Englishman, he wants to keep his accounts. This year, he catches and eats 2,000 fish valued at one British pound (£) each, grows and eats 4,000 coconuts valued at £0.5 each, and makes 2 huts (housing) valued at £200 each.

If government purchases are zero and there is no trade, what is C for Crusoe? What is I ? What is Y ? (We are going to start using those letters as if they mean something: See question 12 in the previous section.)

b. One year, he learns of a tribe on a nearby island who are willing to trade with him: If he gives fish, they give clams. He produces just as much as before, but he trades 500 of the 2,000 fish and receives 10,000 clams valued at 5 clams per British pound. What is the British pound value of the exported fish? Of the imported clams? What are C , I , and X now? What is GDP now?

c. The following year, Crusoe produces the same as in every other year, but a tribe on the other side of the island steals his two huts after he makes them, and gives him nothing in return. So he exports, but does not import at all. What are C , I , X , and Y now?

d. In Crusoe's final year on the island, he produces the same as in every other year (he's a reliable worker), but a new shipwreck washes up on his island containing a clock worth £3, a new shirt worth £2, and a copy of Milton's *Paradise Lost* and Shakespeare's complete works, each worth £1. Treat these as imported consumer goods. What is GDP this year? (Note: Emphasize the "P" in GDP when considering your answer.) What are C , I , X , and Y this year? (Note: One of the four is bigger than usual, one is negative.)

e. Is Crusoe probably happy about what happens in question 5c? Is he probably happy about what happens in question 5d? Keep these answers in mind for when we discuss the economics of trade later on.

Solution

5. a. £4,400: £2,000 + £2,000 + £400. $C = £4,000$, $I = £400$.

b. The fish are worth £500, the clams are worth £2,000. $C = £1,500 + £2,000 + £2,000 = £5,500$. $I = £400$, $X = £500 - £2,000 = £1,500$. GDP = 4,400.

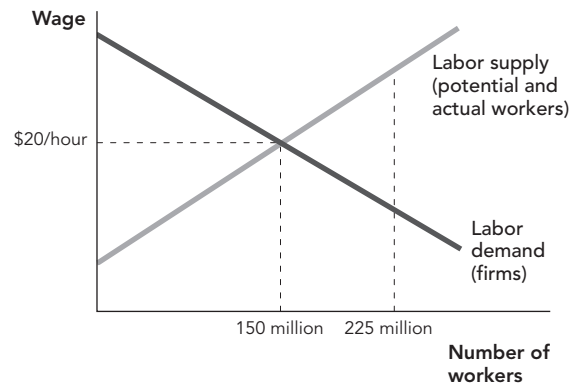
c. Production (GDP) is still the same! But he now has no investment: That becomes an export. $C = £4,000$, $I = 0$, and $NX = £400$.

d. As always, GDP is £4,400. But now $C = £4,007$, $I = £400$, and $X = -£7$. Note that all of the washed-up goods are consumer goods, but they are all "imported," so we have to make sure they don't show up in the final GDP value!

e. Crusoe is unhappy in question 5c: Those exports give him nothing in return. He is probably happier about question 5d: Importing stuff gives him more to consume, plus he gets to consume new things that he values more.

6. Let's think about an economically sound way to measure the value of leisure. To keep this simple, we'll just think about the value of leisure to people who *could* work but who decide to stay home. Also, we won't think about how much *actual* workers value their free time, or how much children and retirees value their time.

In a standard supply and demand labor model, firms “demand” labor while workers “supply” labor. Let's think about a labor market that is in equilibrium, with a wage of \$20 per hour (close to the U.S. average) and with 150 million Americans working out of a total of 225 million working-age Americans.



- a. According to this simplified model of the U.S. economy, some workers *would* work if the wage were higher, but at the current wage, they'd rather stay home and watch reruns of *Seinfeld* or (don't let this be you!) *Tivo and a Half Men*. For the workers who are right on the margin between working and not working, what would their wage be if wages rose ever so slightly and they went to work?
- b. Let's use this wage as a shorthand for how much nonworkers value their time. After all, the “opportunity cost” of their free time must be at least this high, because otherwise they'd take a job. Now, let's calculate a GDP measure that adds in a rough estimate of the value enjoyed by these nonworkers. We'll use the following identity, and we'll round the value of nominal GDP to \$14 trillion (close to the actual 2008 level).

Leisure-augmented GDP = Regular GDP + Total monetary value of leisure

If the average working person works 2,000 hours per year (that's a 40-hour week for 50 weeks a year), then what is the leisure augmented value of U.S. GDP?

Solution

6. a. \$20 per hour or if you like \$20.01, but we will use \$20.
b. \$14 trillion + 75 million \times \$20 \times 2,000 hours = \$17 trillion.
7. Consider the following two claims. The first would be a typical statement in the magazine *The Nation*, while the second would be a typical statement in the magazine *National Review*:

Europeans have strong labor unions, so their workers get a bigger share of the pie than American workers.

Since European businesses are highly regulated, they have little incentive to make big profits. Therefore, they get a much smaller share of national product than American workers.

It is true that Europeans have stronger labor unions than Americans, and it is true that European businesses face higher regulatory burdens than American businesses. But with that in mind, what is wrong with these two statements? What fact are they ignoring? And what does that fact tell us about what strong unions and high levels of government regulation *can't* do?

- Solution** 7. What's wrong is that workers get about the same share of the pie in the United States and in Europe. It's about two-thirds in both cases. It appears that strong unions and high levels of regulation don't change the fact that in modern economies, workers get two-thirds of the pie in the form of wages and salaries.
8. The underground economy and other nonpriced production make it hard to accurately measure the precise level of GDP. But GDP could still be very accurate for measuring changes in the economy. If Ben Bernanke, the Federal Reserve chairman, is trying to find out whether the U.S. economy has gone into a recession, are the difficulties of measuring nonpriced production likely to be important problems for his purposes? How is this like always wearing your shoes when you step on the bathroom scale?

- Solution** 8. No, the underground economy doesn't necessarily pose a problem for Chairman Bernanke. It's about the same size, year in and year out, so it's like measuring temperature in Centigrade versus Fahrenheit: If all you care about is whether it's getting hotter or getting cooler, either thermometer will work just fine. Again, it's like going on the bathroom scale with your shoes on: As long as you always wear your shoes, you can still tell whether you're gaining or losing weight every week.
9. a. U.S. GDP is approximately \$14 trillion. If GDP were divided up equally among all 300 million Americans, what would each person get? If you and your nine best friends took almost all of the GDP for yourselves, but gave \$1,000 per person for everyone else, how much would you get each year, just for yourself?
- b. More seriously, currently 150,000 people in the United States earn over \$1.5 million per year. If you could take their money and divide it up among the approximately 300 million other Americans, how much money could you give to each person every year? Note that \$1.5 million is only the cutoff: On average, this group earns \$3 million per year, so use that number in your calculations. (Source: Johnston, David Cay "Richest are leaving even the rich far behind," *New York Times*, June 5, 2005, based on U.S. government data.)

- Solution** 9. a. If you divided it up equally, it would be \$46,667 per person, GDP per capita. Since it would only cost \$300 billion to give \$1,000 to every person in the United States, that would leave almost everything, \$13.7 trillion, for you to divide up among your friends. That would give each of you \$1.37 trillion for each of the 10 of you.
- b. You could give everyone \$1,500 per year: That's \$3 million 3,150,000/300 million.

10. Let's sum up some basic facts of U.S. economic history with numbers:
- a. First, let's measure the size of the Great Depression:

Real GDP in 1929 (peak): \$323 billion	Real GDP in 1933 (trough): \$206 billion
Price level in 1929: 33	Price level in 1933: 24

Calculate the percent change in real GDP and the percent change in the price level from 1929 to 1933. First, calculate the total change, and then divide it by the number of years to get the more typical measure of "percent per year."
(Note: This is four full years, not three or five.)

- b. Second, let's measure how much the economy grew from the lowest depths of the Depression to the peak of World War II's economic boom:

Real GDP in 1933 (trough): \$206 billion	Real GDP in 1945: \$596 billion
Price level in 1933: 24	Price level in 1945: 38

Again, first calculate the total change, and then divide it by the number of years to get the more typical measure of “percent per year.”

- c. Finally, let’s see if a growing economy must mean growing prices:

Real GDP in 1870: \$36 billion	Real GDP in 1900: \$124 billion
Price level in 1870: 22	Price level in 1900: 16

Calculate the total and annual growth rates as before. Note: The price level fell fairly smoothly across these three decades, a time when the economy grew rapidly and many great American novels were written about life in the growing cities.

(Source: Gordon, Robert J. ed., *The American Business Cycle: Continuity and Change*. Cambridge, MA, National Bureau of Economic Research, 1986.)

- Solution** 10. a. Real GDP fell by 36%, and the price level fell by 27%; 9% per year fall in real GDP, and 6.75% fall in prices per year.
 b. 189% and 58%, and annually it’s 16% and 5%.
 c. 244% and -27% , and annually it’s 8% and -1% . (After calculating, value of annual price growth is $-27\%/29 = -0.93$. It is not exact -1% .) So prices can indeed fall during long periods of economic growth. Worth keeping in mind for later.
11. What is the difference between a nation’s *wealth* and its *GDP*? How are the two related?

- Solution** 11. Wealth is a nation’s stock of useful goods and resources at a given point in time.
 | GDP is the flow of goods and services and thus is the annual addition to this stock.

Challenges

1. During World War II, the government did a good job measuring nominal GDP. But if the price level was calculated incorrectly, we might get a completely wrong idea about what happened with real GDP. During World War II, price ceilings were in place. That means that some things that would’ve been expensive were artificially cheap instead. Within a few years of the war’s end, price controls finally ended, and the price level spiked up about 20%. If the true price level during the war was actually 20% higher than reported, would that mean that real GDP is higher than the official number in question 10b in the previous section, lower than that number, or is it still the same as that number?

- Solution** 1. If the true price level during the war was 20% higher, then real GDP was lower than we think. In other words, the growth rate in real GDP in 1945 is much too high. In addition, munitions were added to GDP during the war. True, that is part of gross domestic production but it’s not the same as the production of consumer items, so GDP during the war also exaggerates the standard of living.
2. If U.S. government statistics counted education spending as part of investment, which would rise, which would fall, and which of the following would remain unchanged? (Note: You might use rise, fall, and unchanged more than once each or you might not.)
- Consumption
 Investment
 Gross domestic product

Solution 2. Consumption would fall, investment would rise, and GDP would remain unchanged.

3. If U.S. government statistics counted people who are receiving unemployment benefits as people who are “government employees” hired to “search for work,” which of the following would rise, which would fall, and which would remain unchanged? (Note: You might use rise, fall, and unchanged more than once each or you might not.)

Consumption

Government purchases

Gross domestic product

Solution 3. Consumption would stay the same, government purchases would rise, and GDP would rise.

4. According to legend, some government employees do very little work. If this legend is true enough to be important, then we may be measuring GDP incorrectly. Officially, we say that these are “employed workers,” but to a great extent these “employees” are really unemployed in any useful task; they are receiving transfer payments and watching YouTube for 40 hours per week. If instead government statistics counted these YouTube-watching government employees as simply retired or unemployed, which of the following would rise, which would fall, and which would remain unchanged? (Note: You might use rise, fall, and unchanged more than once each or you might not.)

Consumption

Government purchases

Gross domestic product

Solution 4. Consumption would remain unchanged, government purchases would fall, and GDP would fall.

