

# “Why is unemployment a problem for the individual and for the economy?”

Who among the following would be counted as unemployed: a college student who is not working, a bank teller displaced by an automatic teller machine, Kristen Stewart between movies, and baseball slugger Miguel Cabrera in the off-season? Why is unemployment a problem for the individual and for the economy? What type of unemployment might be healthy for the economy? Why is the unemployment rate for young adults much higher than for other age groups? What's so bad about inflation? Why is anticipated inflation less of a problem than unanticipated inflation? These and other questions are answered in this chapter, where we explore two macroeconomic problems: unemployment and inflation.

To be sure, unemployment and inflation are not the only problems an economy could face. Sluggish growth and widespread poverty are others. But low unemployment and low inflation go a long way toward reducing other economic ills. Although unemployment and inflation are often related, each is discussed separately. The causes of each and the relationship between the two will become clearer as you learn more about how the economy works.

This chapter shows that not all unemployment or all inflation harms the economy. Even in a healthy economy, a certain amount of unemployment reflects the voluntary choices of workers and employers seeking their best options. And moderate inflation that is fully anticipated creates fewer distortions than does unanticipated inflation.

## What do **you** think?

**Inflation is harmful to the health of the economy.**

Strongly Disagree

1

2

3

4

5

6

7

Strongly Agree

### Topics discussed in Chapter 7 include

- Measuring unemployment
- Sources and consequences of inflation
- Frictional, structural, seasonal, and cyclical unemployment
- Relative price changes
- Full employment
- Nominal and real interest rates

## 7-1 Unemployment: Its Measure and Sources

“They scampered about looking for work. . . . They swarmed on the highways. The movement changed them; the highways, the camps along the road, the fear of hunger and the hunger itself, changed them. The children without dinner changed them, the

are either working or looking for work. Those who want a job but can't find one are unemployed. The Bureau of Labor Statistics interviews 60,000 households monthly (which translates into about 110,000 individuals) and counts people as unemployed if they have no job but want one and have looked for work at least once during the preceding four weeks. Thus, the college student, the displaced bank teller, Kristen Stewart, and Miguel Cabrera in the off-season would all be counted as unemployed if they wanted a job and looked for work in the previous month. The unemployment rate measures the percentage of those in the labor force who are unemployed. Hence, the unemployment rate, which is reported monthly, equals the number unemployed—that is, people without jobs who are looking for work—divided by the number in the labor force.

Only a fraction of adults who are not working are considered unemployed. The others may have retired, are students, are caring for children at home, or simply don't want to work. Others may be unable to work because of long-term illness or disability. Some may have become so discouraged by a long, unfruitful job search that they have given up in frustration. These discouraged workers have, in effect, dropped out of the labor force, so they are not counted as unemployed. Finally, about one-third of those working part time would prefer to work full time, yet all part-timers are counted as employed. Because the official unemployment rate does not

include discouraged workers and counts all part-time workers as employed, it may underestimate the true extent of unemployment in the economy. Later we consider some reasons why the unemployment rate may exaggerate the true extent of unemployment.

These definitions are illustrated in Exhibit 1, where circles represent the various groups, and the numbers (in millions) of individuals in each category and subcategory are shown in parentheses. The circle on the left depicts the entire U.S. labor force in April 2012, including both employed and unemployed people. The circle on the right represents those in the adult population who, for whatever reason, are not working. These two circles combine to show the adult population. The overlapping area identifies the number of unemployed workers—that is, people in the labor force who are not working. The unemployment rate is found by dividing the number unemployed by the number in the labor force. In April 2012, 12.5 million people were unemployed in a labor force of 154.4 million, yielding an unemployment rate of 8.1 percent.

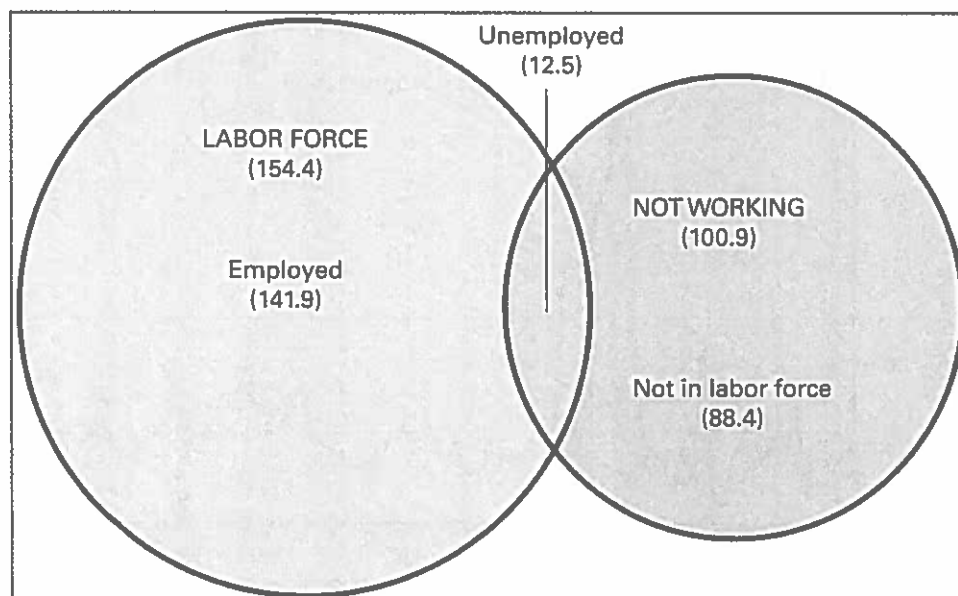
## 7-1b Labor Force Participation Rate

The productive capability of any economy depends in part on the proportion of adults in the labor force, measured as the *labor force participation rate*. In Exhibit 1, the U.S. adult population equals those in the labor force (154.4 million) plus those not in the labor force (88.4 million)—a total of 242.8 million people. The labor force participation rate therefore equals the number in the labor force divided by the adult population, or 63.6 percent ( $=154.4 \text{ million} / 242.8 \text{ million}$ ).

So, on average, nearly two out of three adults are in the labor force. The labor force participation rate increased from 60 percent in 1970 to 67 percent in

### Exhibit 1

The Adult Population Sums the Employed, the Unemployed, and Those Not in the Labor Force: April 2012 (in millions)



SOURCE: Figures are for April 2012 from the U.S. Bureau of Labor Statistics. For the latest data, go to <http://www.bls.gov/news.release/empst.toc.htm>.

#### unemployment rate

The number unemployed as a percentage of the labor force

#### discouraged workers

Those who drop out of the labor force in frustration because they can't find work

#### labor force participation rate

The labor force as a percentage of the adult population

1990, but declined after the Great Recession, as many dropped out of the labor market because jobs were hard to find. In fact, the labor force participation rate in April 2012 was the lowest in three decades.

One striking development since World War II has been the convergence in the labor force participation rates of men and women. In 1950, only 34 percent of adult women were in the labor force. Today, 58 percent are, with the greatest increase among younger women. The labor force participation rate among men has declined from 86 percent in 1950 to 70 percent today, primarily because of earlier retirement. The participation rate is higher among white males than black males but higher among black females than white females. Finally, the participation rate climbs with education—from only 45 percent for those lacking a high school diploma to 76 percent among those with at least a bachelor's degree.

## 7-1c Unemployment Over Time

Exhibit 2 shows the U.S. unemployment rate since 1900, with shaded bars to indicate periods of recession or depression. As you can see, rates rise during contractions and fall during expansions. Most striking is the jump during the Great Depression of the 1930s, when the rate topped 25 percent. Note that the rate trended upward from the end of World War II in the mid-1940s until the early 1980s; then it backed down, from a high of 10 percent in 1982 to a low of 4 percent in 2000. With the recession of 2001, the rate gradually increased to 6 percent by 2003, then declined into 2007. But the global financial crisis of 2008 and sharp U.S. recession boosted the rate to 10 percent by the end of 2009.

Let's examine some of the broad trends over the last three decades. Why did the unemployment rate trend down from 10 percent in 1982 to only 4 percent in 2000? First, the overall economy was on a roll during that period, interrupted by

**long-term unemployed**  
Those looking for work for 27 weeks or longer

only a brief recession in the early 1990s triggered by the first war in Iraq. The number employed increased by 37 million between 1982 and 2000, making the U.S. economy an incredible job machine and the envy of the world. The unemployment rate also trended down because there were fewer teenagers in the workforce. Teenagers have an unemployment rate about three times that of adults, so the declining share of teenage workers helped cut the overall unemployment rate.

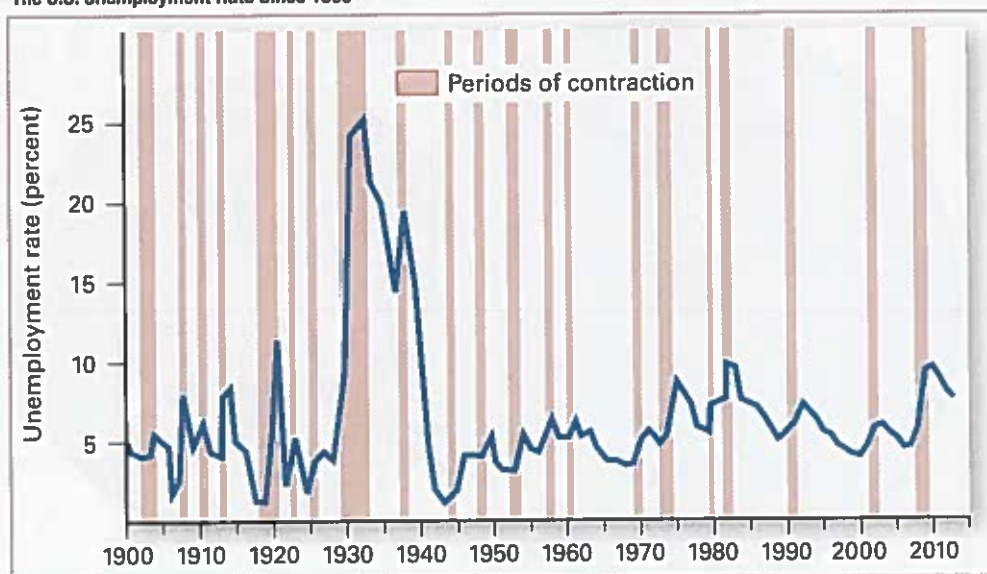
But job growth between 2000 and 2012 was hobbled by a mild recession in 2001 and a much sharper one in 2007–2009. Employment during the period increased by only about 5 million, not nearly enough to absorb the 11.5 million people joining the labor force. As a result, the number unemployed swelled from 6 million in 2000 to 12.5 million in 2012, and the unemployment rate climbed from only 4 percent to 8 percent. This was the worst stretch of employment growth since the Great Depression.

## 7-1d Duration of Unemployment

A given unemployment rate tells us little about how long people have been unemployed. In April 2012, with the unemployment rate at 8.1 percent, the average duration of unemployment was 39 weeks, the longest since the Great Depression. Some people were unemployed longer than others: 21 percent were unemployed less than 5 weeks; 23 percent 5–14 weeks; 15 percent 15–26 weeks, and 41 percent 27 weeks or longer. Those out of work 27 weeks or

Exhibit 2

The U.S. Unemployment Rate Since 1900



SOURCES: U.S. Census Bureau, *Historical Statistics of the United States: Colonial Times to 1970* (U.S. Government Printing Office, 1975); *Economic Report of the President*, February 2013; and U.S. Bureau of Labor Statistics. Figure for 2013 is estimated based on figures through September 2013, seasonally adjusted. For the latest unemployment rate, go to <http://www.bls.gov/news.release/empsit.toc.htm>.



longer are called the long-term unemployed, and are of special concern to policy makers. Thus, about 4 in 10 of those looking for work in April 2012 were long-term unemployed. Reported another way, in April 2012, 3.3 percent of the labor force consisted of the long-term unemployed. In 2007, prior to the financial crisis and Great Recession, only 0.8 percent of the labor force were long-term unemployed.

## 7-1e Unemployment Among Various Groups

The unemployment rate also says nothing about who is unemployed. The overall rate masks wide differences in the labor force based on education, race, gender, and age. For example, when the U.S. unemployment rate in April 2012 was 8.1 percent, the rate among workers 25 years of age or older who were high school dropouts was 12.5 percent; this was triple the rate among workers 25 or older who were college graduates. So education provides some insurance against unemployment. (But timing is important, even for college graduates. Not only do those who graduate from college during a recession have a harder time finding that first job, but their job opportunities can be limited for years.)<sup>5</sup> Unemployment also differs based on race and ethnicity; the rate was 7.4 percent among white workers, 13.0 percent among African Americans, 10.3 percent among those of Hispanic ethnicity, and 5.2 percent among Asian workers. (According to the 2010 Census, half of those over 25 years of age who identified themselves as Asian had at least a bachelor's degree, compared to only 28 percent for the entire U.S. population over 25.) Finally, the unemployment rate was 7.5 percent among males 20 and older, and 7.4 percent among females 20 and older, but 24.9 percent among workers 16 to 19 years of age.

Why is the unemployment rate among teenage workers so much higher than among other workers? Teenagers enter the labor force with little education or job experience, so they take unskilled jobs and are laid off first if the economy slows down (last hired, first fired). Teenagers also move in and out of the labor force more frequently as they juggle school demands. Even those who have left school often shop around more than workers 20 and older, quitting one job in search of a better one.

The unemployment rate is higher among black workers for several reasons. The black workforce is on average younger, and younger workers tend to

have higher unemployment rates. A smaller than average percentage of black workers graduated from college. Black workers tend to live in areas harder hit by recessions. And racial discrimination is also a contributing factor.

Unemployment rates for different groups appear in Exhibit 3. Each panel shows the rate by race and by gender since 1972. Panel (a) shows the rates for workers 20 and older, and panel (b) the rates for 16- to 19-year-old workers. Periods of recession are shaded pink. As you can see, rates are higher among black workers than among white workers, and rates are higher among teenage workers than among those 20 and older. During recessions, rates climbed for all groups. Rates peaked during the recession of 1982 and then trended down. After the recession of the early 1990s, unemployment rates continued downward, with the rate among black workers falling in 2000 to the lowest on record. Rates rose again beginning with the recession of 2001, peaking at 6.0 percent in 2003. The rate then declined over the next four years, but jumped with the sharp recession of 2007–2009. Exhibit 3 shows that the unemployment rate among black men was more than double that among white men. Notice that since the early 1990s the unemployment rate trended higher for a while even after each recession ended.

## 7-1f Unemployment Varies Across Occupations and Regions

The unemployment rate varies by occupation. Professional and technical workers experience lower unemployment rates than blue-collar workers. Construction workers at times face high rates because that occupation is both seasonal and subject to wide swings over the business cycle.

Partly because certain occupations dominate labor markets in certain regions, unemployment rates also vary by region. For example, because of the collapse in housing markets in California and Nevada, the unemployment rates in those states in April 2012 were more than double those in the upper Midwest farm states of Nebraska, North Dakota, and South Dakota. Even within a state, unemployment can vary widely. For example, the California city of El Centro had an unemployment rate of 26.8 percent, more than triple that of Santa Barbara.

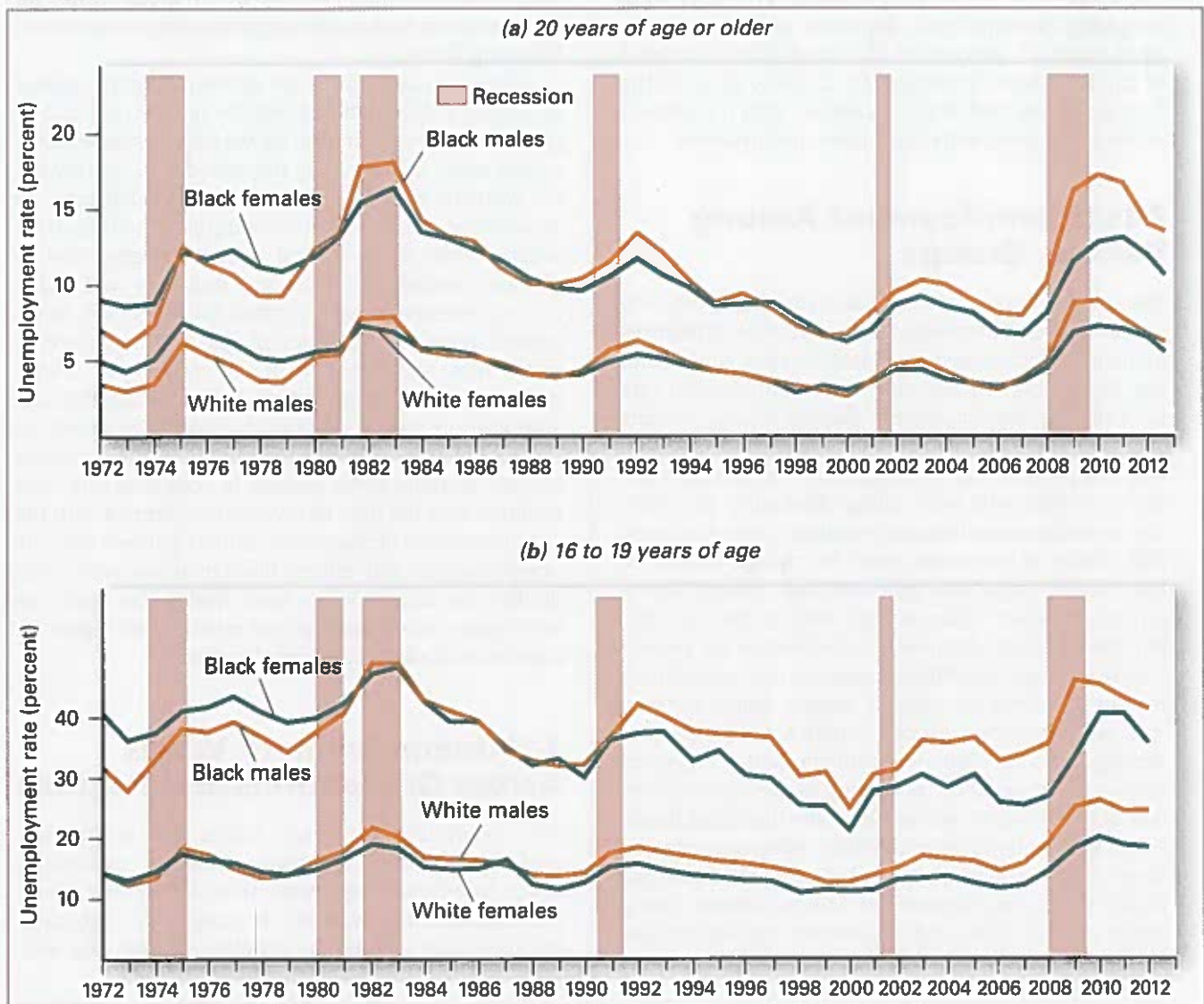
Exhibit 4 shows unemployment rates for 27 major metropolitan areas in April 2012. As you can see, Los Angeles had the highest unemployment rate, at 10.1 percent. This was nearly double the rate for Minneapolis and Washington, D.C. The point is that the national unemployment rate masks differences across the country and even across an individual state.

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5. Philip Oreopoulos, Till von Wachter, and Andrew Helms, "The Short- and Long-Term Career Effects of Graduating in a Recession," *American Economic Journal: Applied Economics*, 4 (January 2012): 1–29.

## Exhibit 3

### Unemployment Rates for Various Groups



SOURCE: *Economic Report of the President*, February 2013, Table B-43; and U.S. Bureau of Labor Statistics. For the latest data, go to <http://www.bls.gov/news.release/empst.toc.htm>.

Still, most cities in Exhibit 4 had rates between 6.0 percent and 9.0 percent.

## 7-1g International Comparisons of Unemployment

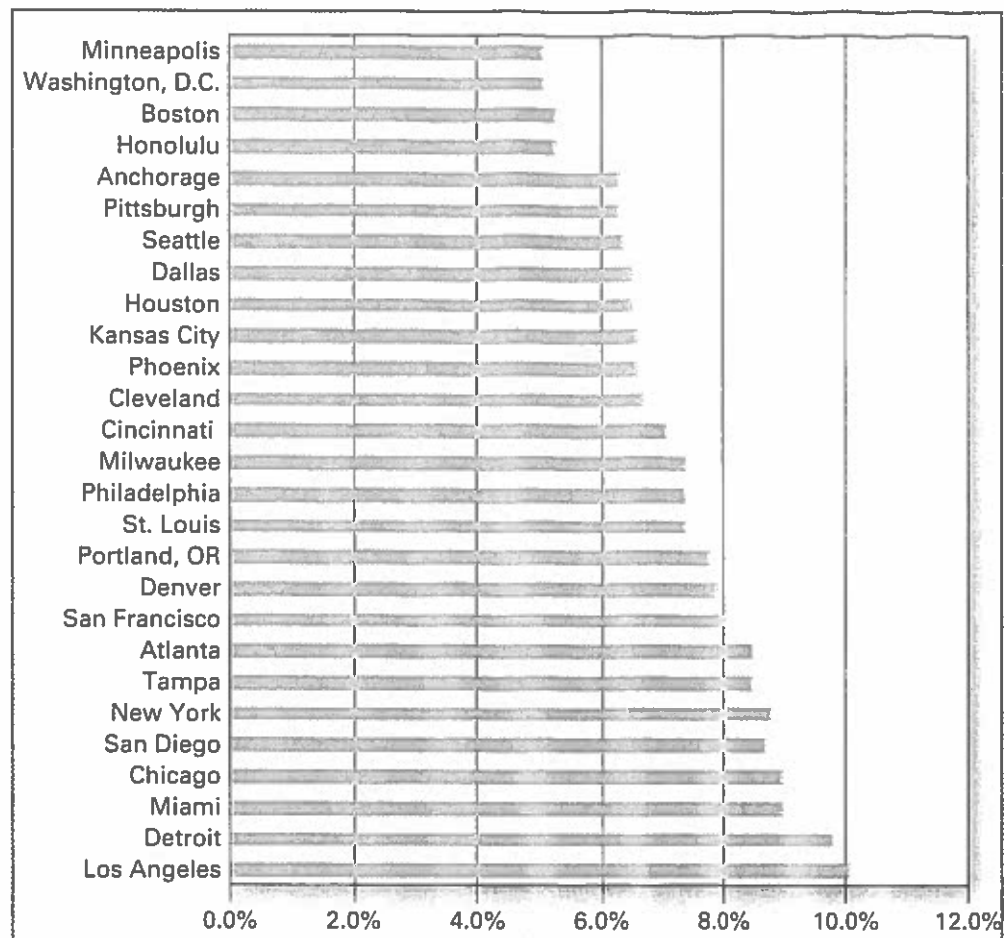
How do U.S. unemployment rates compare with those around the world? Exhibit 5 shows rates since 1980 for the United States, Japan, and the average of four major European economies (France, Germany, Italy, and the United Kingdom). Over the last two decades and prior to the recent recession, unemployment trended down in the United States, trended up in Japan, and remained high in Europe.

At the beginning of the period, the United States had the highest rate among the three economies. After trending lower between the early 1980s and late 2007, the U.S. rate spiked up to that of Western Europe because of the 2007–2009 recession. The rate in Japan remained relatively low.

The unemployment rate in Europe averaged 8.3 percent over the last three decades versus a U.S. average of 6.4 percent. Why have rates averaged higher in Europe? The ratio of unemployment benefits to average pay is higher in Europe than in the United States, and unemployment benefits last longer there, sometimes years. So those collecting unemployment benefits have less incentive to find work. What's more, government regulations have

## Exhibit 4

### Unemployment Rates Differ Across U.S. Metropolitan Areas



SOURCE: Based on figures for April 2012 from the U.S. Bureau of Labor Statistics. For the latest figures, go to <http://www.bls.gov/lau/home.htm>.

made European employers more reluctant to hire new workers because firing them can be difficult.

Historically, unemployment has been low in Japan, averaging only 3.5 percent over the last three decades, because many firms there offer job security for life. In a system called *shukatsu*, Japanese companies typically hire most workers right out of school and expect them to stay until retirement. Both labor laws and social norms limit layoffs in Japan. As a result, some employees who do little or no work are still carried on company payrolls. Unemployment has increased there since the early 1990s because more firms went bankrupt.

## 7-1h Sources of Unemployment

Pick up any metropolitan newspaper and thumb through the classifieds. The help-wanted section may include hundreds of jobs, from accountants to X-ray technicians. Online job sites such as Monster.com

list hundreds of thousands of openings. Why, when millions are unemployed, are so many jobs available? To understand this, we must think about all the reasons why people are unemployed. They may be looking for a first job, or they may be reentering the labor force after an absence. They may have quit or been fired from their last job. Fifty-five percent of those unemployed in April 2012 lost their previous job, 8 percent quit, 11 percent entered the labor market for the first time, and 26 percent reentered the labor market. Thus, 45 percent were unemployed either because they quit jobs or because they were just joining or rejoining the labor force.

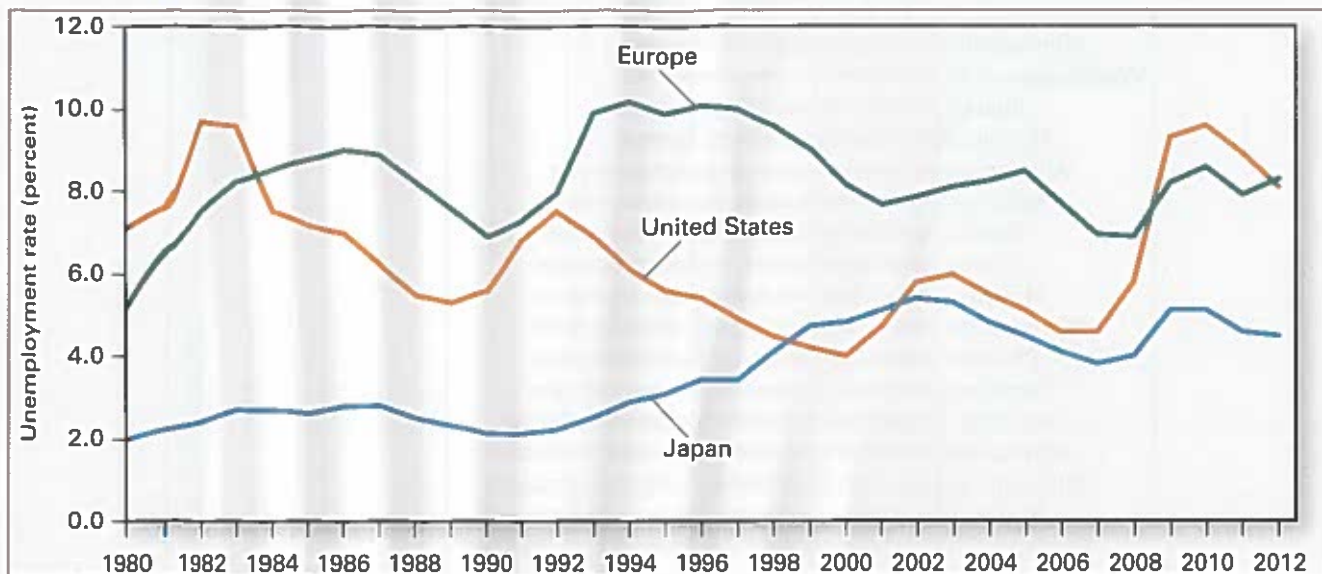
More generally, there are four sources of unemployment: frictional, seasonal, structural, and cyclical.

### Frictional Unemployment

Just as employers do not always hire the first applicant who comes through the door, job seekers do not always accept the first offer. Both employers

## Exhibit 5

Unemployment Rates Increased With the Global Financial Crisis of 2008



SOURCE: Based on standardized rates in *OECD Economic Outlook*, 93 (June 2013); and *Economic Report of the President*, February 2013. Figures for Europe are the averages for France, Germany, Italy, and the United Kingdom. For the latest international data, go to <http://www.bls.gov/fls/home.htm>.

and job seekers need time to explore the job market. Employers need time to learn about the talent available, and job seekers need time to learn about employment opportunities. The time required to bring together employers and job seekers is the source of **frictional unemployment**. Although unemployment often creates economic and psychological hardships, not all unemployment is necessarily bad. Frictional unemployment does not usually last long and it results in a better match between workers and jobs, so the entire economy works more efficiently. Policy makers and economists are not that concerned about frictional unemployment.

**frictional unemployment**  
Unemployment that occurs because job seekers and employers need time to find each other

**seasonal unemployment**  
Unemployment caused by seasonal changes in the demand for certain kinds of labor

**structural unemployment**  
Unemployment because (1) the skills demanded by employers do not match those of the unemployed, or (2) the unemployed do not live where the jobs are

### Seasonal Unemployment

Unemployment caused by seasonal changes in labor demand during the year is called **seasonal unemployment**. During cold winter months, demand for farm hands, lifeguards, landscapers, and construction workers shrinks, as it does for dozens of other seasonal occupations. Likewise, tourism in winter destinations

such as Miami and Phoenix melts in the heat of summer. The Christmas season increases the demand for sales clerks, postal workers, and Santa Clauses. Those in seasonal work realize their jobs disappear in the off-season. Some even choose such work to complement their lifestyles or academic schedules. To eliminate seasonal unemployment, we would have to outlaw winter and abolish Christmas. Monthly employment data are *seasonally adjusted* to smooth out the unemployment bulges that result from seasonal factors. Policy makers and economists are not that concerned about seasonal unemployment.

### Structural Unemployment

A third reason why job vacancies and unemployment coexist is that unemployed workers often do not have the skills in demand or do not live where their skills are demanded. For example, the Lincoln Electric Company in Ohio took a long time filling 200 openings because few among the thousands who applied could operate computer-controlled machines. Unemployment arising from a mismatch of skills or geographic location is called **structural unemployment**. Structural unemployment occurs because changes in tastes, technology, taxes, and competition reduce the demand for certain skills and increase the demand for other skills. In our dynamic economy, some workers, such as coal miners in West Virginia, are stuck with skills no longer demanded. Likewise, golf carts replaced caddies, ATMs replaced





bank tellers, and office technology is replacing clerical staff. For example, because of e-mail, voice mail, text messages, word processors, smart phones, and other electronic devices, the number of secretaries, typists, and administrative assistants in the United States has fallen by more than half over the past two decades. Structural unemployment may also arise from a change in tastes and preferences. For example, because Americans smoke less, some tobacco farmers had to look for other work. And because Americans buy fewer newspapers, employment in that industry has declined.

“Although most frictional unemployment is short term and voluntary, structural unemployment poses more of a problem because workers must either develop the skills demanded in the local job market or look elsewhere.”

Although most frictional unemployment is short term and voluntary, structural unemployment poses more of a problem because workers must either develop the skills demanded in the local job market or look elsewhere. Moving is not easy. Most people out of work prefer to remain near friends and relatives. Those laid off from good jobs hang around in hopes of getting rehired. Married couples with one spouse still employed may not want to give up that job to look for two jobs elsewhere. Finally, available jobs may be in regions where the living cost is much higher. So those structurally unemployed often stay put. U.S. interstate migration has slowed since the

1980s, which could worsen structural unemployment.<sup>6</sup> Some researchers have concluded that, as a result of the Great Recession, structural unemployment in the U.S. economy between 2006 and 2010 increased by 1.75 percentage points.<sup>7</sup> Some federal retraining programs aim to reduce structural unemployment. Policy makers and economists are very much concerned about structural unemployment.

## Cyclical Unemployment

As output declines during recessions, firms reduce their demand for nearly all resources, including labor. Cyclical unemployment increases during recessions and decreases during expansions. Between 1932 and 1934, when unemployment averaged about 24 percent because of the Great Depression, there was clearly much cyclical unemployment. Between 1942 and 1945, when unemployment averaged less than 2 percent because of the demands of war, there was no cyclical unemployment. Cyclical unemployment means the economy is operating inside its production possibilities frontier. Government policies that stimulate aggregate demand aim to reduce cyclical unemployment.

## 7-2 Other Unemployment Issues

Thus far we have discussed measures of unemployment, rates among various demographic groups, and sources of unemployment. Now we'll consider some other issues of unemployment.

### 7-2a The Meaning of Full Employment

In a dynamic economy such as ours, changes in product demand and in technology continually alter the supply and demand for particular types of labor. Thus, even in a healthy economy, there is some frictional, structural, and seasonal unemployment. The economy is viewed as operating at full employment if there is no cyclical unemployment. When economists talk

6. Raven Molloy, Christopher Smith, and Abigail Wozniak, “Internal Migration in the United States,” *Journal of Economic Perspectives*, 25 (Summer 2011): 173–196.  
7. Marcello Esteveo and Evridiki Tsounta, “Has the Great Recession Raised U.S. Structural Unemployment?” IMF Working Paper (May 2011).

**cyclical unemployment**  
Unemployment that fluctuates with the business cycle, increasing during recessions and decreasing during expansions



about “full employment,” they do not mean zero unemployment but low unemployment, with estimates ranging from 4 to 6 percent. Even when the economy is at **full employment**, there is some frictional, structural, and seasonal unemployment. Even after the recession of 2007–2009, 45 percent of those unemployed in April 2012 had quit their previous job or were new entrants or reentrants into the labor force. We can’t expect people to find jobs overnight. Many in this group would be considered frictionally unemployed.

## 7-2b Unemployment Compensation

As noted at the outset, unemployment often involves an economic and psychological hardship. For a variety of reasons, however, the burden of unemployment on the individual and the family may not be as severe today as it was during the Great Depression. Today, many households have two or more workers in the labor force, so if one loses a job, another may still have one—a job that could provide health insurance and other benefits for the family. *Having more than one family member in the labor force cushions the shock of unemployment.*

Moreover, unlike the experience during the Great Depression, most who lose jobs now collect unemployment benefits. In response to the Great Depression, Congress passed the Social Security Act of 1935, which provided unemployment insurance financed by a tax on employers. Unemployed workers who meet certain qualifications can receive **unemployment benefits** for up to six months, provided they actively look for work. During recessions, benefits usually extend beyond six months in states with especially high unemployment. During and following the Great Recession of 2007–2009, the extension of benefits was nationwide, and many states offered benefits for up to two years. Benefits go primarily to people who have lost jobs. Those just entering or reentering the labor force are not covered, nor are those who quit their last job or those fired for just cause, such as excessive absenteeism or theft. Despite these restrictions, more than half of those unemployed in April 2012 received benefits.

**full employment**  
Employment level when there is no cyclical unemployment

**unemployment benefits**  
Cash transfers to those who lose their jobs and actively seek employment

“Evidence suggests that those collecting unemployment benefits remain out of work weeks longer than those without benefits.”



**Having more than one family member in the labor force helps cushion the shock of unemployment.**

Unemployment benefits replace on average about half of a person’s take-home pay, with a higher percentage for those who lost lower-paying jobs. Benefits vary by state but averaged about \$330 per week in 2012. Because these benefits reduce the opportunity cost of remaining unemployed, they may reduce the incentives to find work. For example, if faced with a choice between washing dishes for \$350 per week and collecting \$250 per week in unemployment benefits, which would you choose?

Evidence suggests that those collecting unemployment benefits remain out of work weeks longer than those without benefits. Many leave the labor force once their benefits run out.<sup>8</sup> So although unemployment insurance provides a safety net, it may reduce the urgency of finding work, thereby increasing

8. See, for example, David Card, Raj Chetty, and Andrea Weber, “Cash-on-Hand and Competing Models of Intertemporal Behavior: New Evidence From the Labor Markets,” *Quarterly Journal of Economics*, 122 (November 2007): 1511–1560; and Kory Kroft and Matthew Notowidigdo, “Should Unemployment Insurance Vary With the Unemployment Rate? Theory and Evidence,” NBER Working Paper 17173 (June 2011).

## 7-2c Problems with Official Unemployment Figures

On the other hand, because unemployment insurance benefits and most welfare programs require recipients to seek work, some people may go through the motions of looking for a job just to qualify for these benefits. If they do not in fact want a job, counting them as unemployed overstates actual unemployment. Likewise, some people who would prefer to work part time can find only full-time jobs, and some forced to work overtime and weekends would prefer to work less. To the extent that people must work more than they would prefer, the official unemployment rate overstates the actual rate. Finally, people in the underground economy may not admit they have jobs because they are breaking the law. For example, someone working off the books or someone selling illegal drugs may not admit to being employed.

may not be huge, even in the wake of a recession. For example, counting discouraged workers as unemployed would have raised the unemployment rate in April 2012 from 8.1 percent to 8.7 percent. Adding in others who were marginally attached to the labor force would have raised the rate to 9.6 percent. There are no estimates of what the unemployment rate would be if we subtracted those looking for work only to qualify for government benefits.

We turn next to inflation.

### 7-3 Inflation: Its Measure and Sources

As noted already, inflation is a sustained increase in the economy's average price level, and we have already discussed inflation in different contexts. If the price level bounces around—moving up one month, falling back the next month—any particular increase in the price level would not necessarily be called inflation in a meaningful sense. We typically measure inflation on an annual basis. The annual inflation rate is the percentage increase in the average price level from one year to the next. For example, between April 2011 and April 2012, the U.S. consumer price index increased 2.3 percent. Extremely high inflation, as occurred recently in Zimbabwe, is called **hyperinflation**. A sustained decrease in the average price level is called **deflation**, as occurred in the United States during the Great Depression and in 2009. Japan, Hong Kong, and Taiwan have also experienced deflation in recent

**underemployment**  
Workers are overqualified for their jobs or work fewer hours than they would prefer

**hyperinflation**  
A very high rate of inflation

**deflation**  
A sustained decrease in the price level



years. And a reduction in the rate of inflation is called **disinflation**, as occurred in the United States from 1981 to 1986, 1991 to 1994, and 2000 to 2002.

In this section, we first consider two sources of inflation. Then, we examine the extent and consequences of inflation in the United States and around the world.

**“Inflation is a sustained increase in the economy’s price level; it results from an increase in aggregate demand, a decrease in aggregate supply, or both.”**

1960s came from demand-pull inflation, when federal spending for the Vietnam War and expanded social programs boosted aggregate demand.

Alternatively, inflation can arise from reductions in aggregate supply, as shown in panel (b) of Exhibit 6, where a leftward shift of

the aggregate supply curve raises the price level. For example, crop failures and OPEC price hikes reduced aggregate supply between 1973 and 1975, thereby raising the price level in the economy. Inflation stemming from decreases in aggregate supply is called **cost-push inflation**, suggesting that increases in the cost of production push up the price level. Prices increase and real GDP decreases, a combination identified earlier as *stagflation*. Again, to generate sustained and continuous cost-push inflation, the aggregate supply curve would have to keep shifting left along a given aggregate demand curve.

## 7-3a Two Sources of Inflation

Inflation is a sustained increase in the economy’s price level; it results from an increase in aggregate demand, a decrease in aggregate supply, or both. Panel (a) of Exhibit 6 shows that an increase in aggregate demand

### disinflation

A reduction in the rate of inflation

### demand-pull inflation

A sustained rise in the price level caused by a rightward shift of the aggregate demand curve

### cost-push inflation

A sustained rise in the price level caused by a leftward shift of the aggregate supply curve

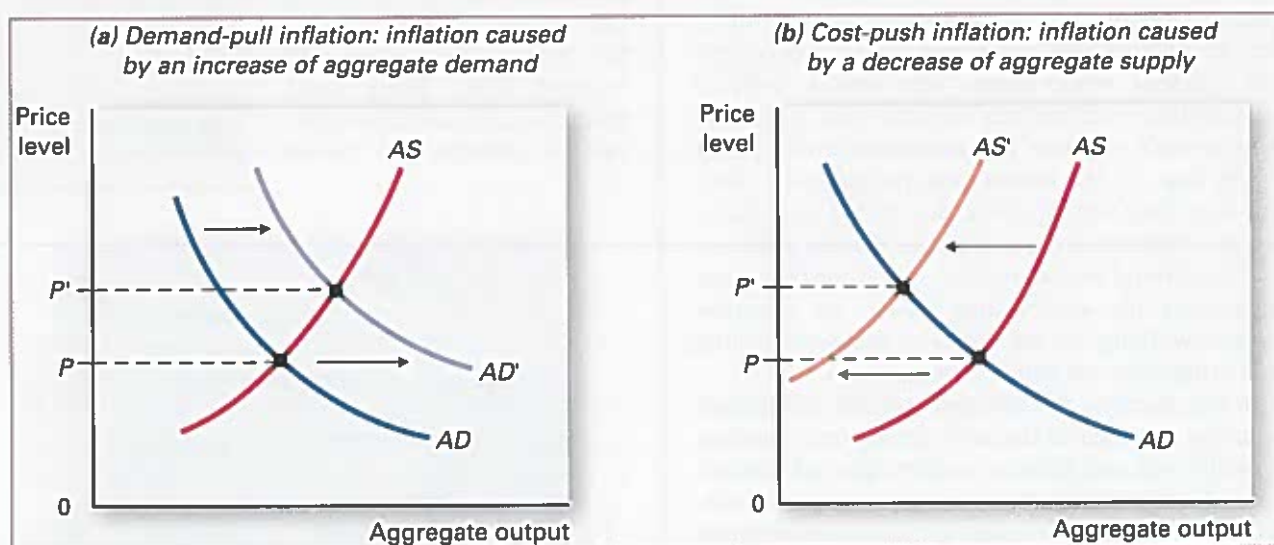
raises the economy’s price level from  $P$  to  $P'$ . In such cases, a shift to the right of the aggregate demand curve pulls up the price level. Inflation resulting from increases in aggregate demand is called **demand-pull inflation**. To generate continuous demand-pull inflation, the aggregate demand curve would have to keep shifting out along a given aggregate supply curve. Rising U.S. inflation during the late

## 7-3b A Historical Look at Inflation and the Price Level

The consumer price index is the inflation measure you most often encounter, so it gets the most attention here. As you learned in the previous chapter, the consumer price index, or CPI, measures the cost of a market basket of consumer goods and services over

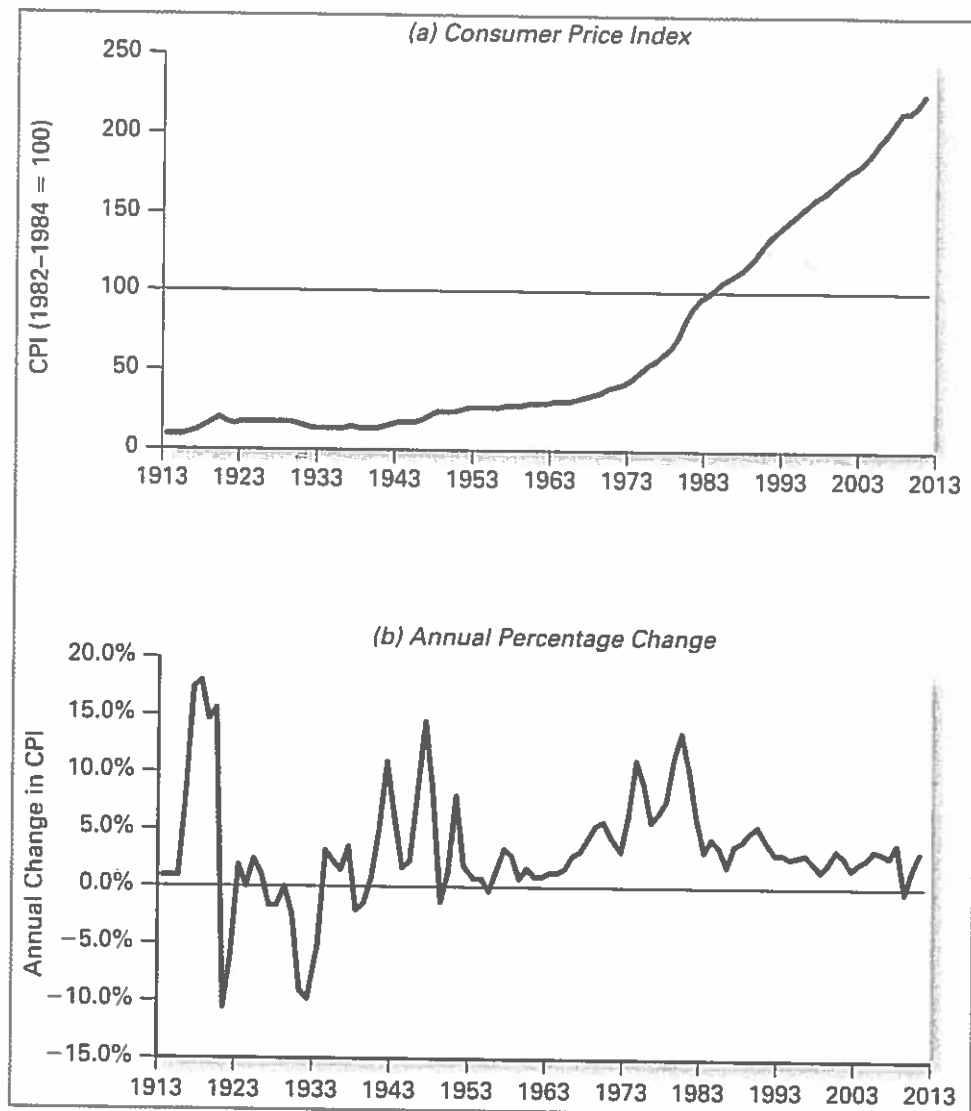
## Exhibit 6

Inflation Caused by Shifts of Aggregate Demand and Aggregate Supply Curves



## Exhibit 7

### Consumer Price Index Since 1913



SOURCE: The CPI home page of the U.S. Bureau of Labor Statistics is at <http://www.bls.gov/cpi/home.htm>. Go there for the latest figures.

time. Exhibit 7 shows prices in the United States since 1913, using the consumer price index. Panel (a) shows the price level, measured by an index number relative to the base period of 1982 to 1984. As you can see, the price level was lower in 1940 than in 1920. Since 1940, however, it has risen steadily, especially during the 1970s.

People are concerned less about the price level and more about year-to-year changes in that level. The lower panel shows the annual rate of change in the CPI, or the annual rate of inflation or deflation. The 1970s was not the only period of high inflation. Inflation exceeded 10 percent from 1916 to 1919 and in 1947—periods associated with world wars.

Prior to the 1950s, high inflation was war related and was usually followed by deflation. Such an inflation-deflation cycle stretches back over the last two centuries. In fact, between the Revolutionary War and World War II, the price level fell in about as many years as it rose. At the end of World War II, the price level was about where it stood at the end of the Civil War.

So fluctuations in the price level are nothing new. But prior to World War II, years of inflation and deflation balanced out over the long run. Therefore, people had good reason to believe the dollar would retain its purchasing power over the long term. Since the end of World War II, however, the CPI has



increased by an average of 3.7 percent per year. That may not sound like much, but it translates into a tenfold increase in the consumer price index since 1947. Inflation erodes confidence in the value of the dollar over the long term.

### 7-3c Inflation Across Metropolitan Areas

Inflation rates differ across regions mostly because of differences in housing prices, which rise or fall more in some places than in others. But most prices, such as for automobiles, refrigerators, or jeans, do not differ that much across regions. The federal government tracks separate CPIs for each of 27 U.S. metropolitan areas. Based on these CPIs, the average annual inflation rate from 2007 to 2011 is presented in Exhibit 8. Annual inflation averaged from a low of 1.1 percent in Atlanta to a high of 2.8 percent in Milwaukee and Pittsburgh. Most cities averaged between 1.5 percent and 2.5 percent. Again, the metropolitan inflation rate is heavily influenced by what's happening in the local housing market. Housing markets were generally weak throughout the United States during the period observed, but they were weaker in Atlanta than in Milwaukee and Pittsburgh.

### Exhibit 8

Average Annual Inflation from 2007 to 2011 Differed Across U.S. Metropolitan Areas



SOURCE: Annual averages for 2007 to 2011 based on CPI estimates from the U.S. Bureau of Labor Statistics. For the latest figures go to <http://www.bls.gov/cpi/home.htm> and find "Regional Resources."

### 7-3d International Comparisons of Inflation

Exhibit 9 shows annual inflation based on the GDP price index for the past three decades in the United States, Japan, and Europe, represented here as the average of four major nations (France, Germany, Italy, and the United Kingdom). All three economies show a similar trend, with declining inflation, or disinflation, during the first half of the 1980s, rising inflation during the second half of the 1980s to a peak in the early 1990s, and then another trend lower. The overall trend since 1980 has been toward lower inflation. Inflation rates in Europe were similar to those in the United States. Rates in Japan were consistently lower, even dipping into deflation from 2005 to 2012. In recent years inflation declined in all three areas because of slack aggregate demand from the global recession. Inflation since 1980 has

averaged 3.5 percent in Europe, 3.2 percent in the United States, and 0.6 percent in Japan.

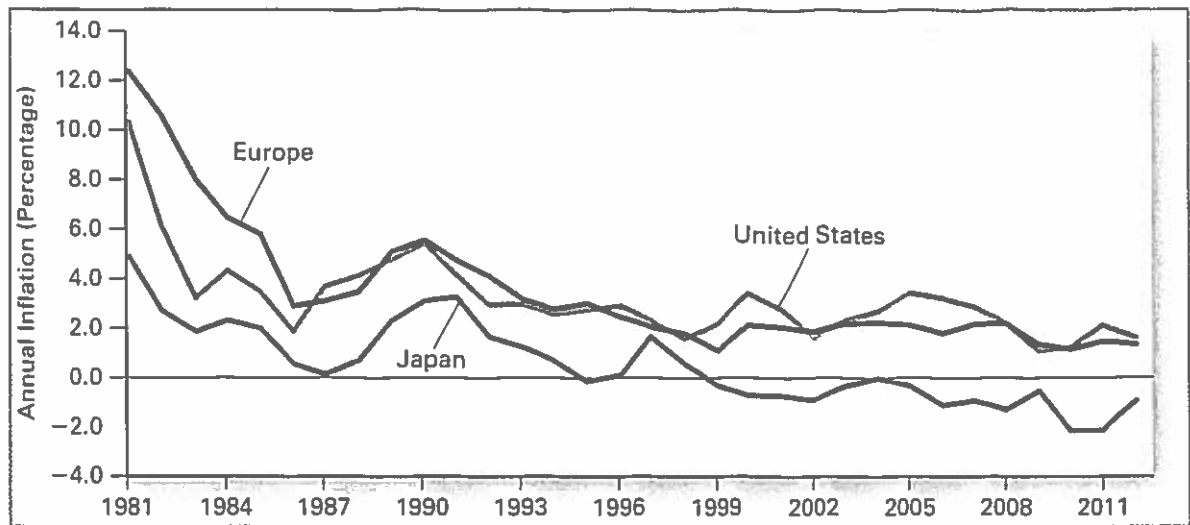
The quantity and quality of data used to measure inflation vary across countries. Governments in less-developed countries sample fewer products and measure prices only in the capital city. Although thousands of items are sampled to determine the U.S. consumer price index, as few as 30 might be sampled in some developing countries.

### 7-4 Effects of Inflation

We have defined inflation, considered sources of inflation, traced the record of inflation over the last century, and examined inflation both across metropolitan areas and across countries. Now let's consider some effects of inflation.

## Exhibit 9

Inflation Rates in Major Economies Have Trended Lower Over the Past Three Decades



SOURCE: Developed from CPI inflation reported in *OECD Economic Outlook*, 93 (June 2013). Figures for Europe are the averages for France, Germany, Italy, and the United Kingdom. For the latest data, go to <http://www.bls.gov/lts/home.htm>.

### 7-4a Anticipated Versus Unanticipated Inflation

What is the effect of inflation on the economy? Unanticipated inflation creates more problems than anticipated inflation. Unanticipated inflation created winners and losers in the economy. To the extent that inflation is higher or lower than anticipated, it arbitrarily creates winners and losers. For example, suppose inflation is expected to be 3 percent next year, and you and your employer agree to a 4 percent increase in your nominal, or money, wage. You both expect your *real* wage—that is, your wage measured in dollars of constant purchasing power—to increase by 1 percent. If inflation turns out to be 3 percent, as expected, you and your employer are both satisfied. After all, that's the wage your employer offered and you accepted. If inflation turns out to be 5 percent, your real wage will fall by 1 percent, so you are a loser and your employer a winner. If inflation turns out to be only 1 percent, your real wage increased by 3 percent, so you are a winner and your employer a loser.

More generally, if inflation is higher than expected, the losers are those who agreed to sell at a price that anticipated lower inflation and the winners are those who agreed to pay that price. If

inflation is lower than expected, the situation is reversed: The losers are those who agreed to pay a price that anticipated higher inflation, and the winners are those who agreed to sell at that price. The arbitrary gains and losses arising from unanticipated inflation are one reason inflation is so unpopular. Inflation just doesn't seem fair.

### 7-4b The Transaction Costs of Variable Inflation

During long periods of price stability, people correctly believe they can predict future prices and can therefore plan accordingly. If inflation changes unexpectedly, however, the future is cloudier, so planning gets harder. Uncertainty about inflation undermines money's ability to link the present with the future. U.S. firms dealing with the rest of the world face an added burden. They must not only anticipate U.S. inflation;

they must also guess how the value of the dollar will change relative to foreign currencies. Inflation uncertainty and the resulting exchange-rate uncertainty complicate international transactions. In this more uncertain environment, companies with international ties must shift attention from

"The arbitrary gains and losses arising from unanticipated inflation are one reason inflation is so unpopular."

production decisions to anticipating the effects of inflation and exchange-rate changes on the firm's finances. Market transactions, particularly long-term contracts, become more complicated as inflation becomes more unpredictable. Some economists believe that the high and variable U.S. inflation during the 1970s and early 1980s cut economic growth during those periods.

## 7-4c Inflation Obscures Relative Price Changes

Even with no inflation, some prices would increase and some would decrease, reflecting normal activity in particular markets. For example, since the mid-1980s the U.S. price level has more than doubled, yet the prices of flat-screen TVs, computers, long-distance phone service, and many other products have declined sharply. Prices for education and for hospital care increased more than fivefold. Because the prices of various goods change by different amounts, *relative prices* change. Consider price changes over a longer period. In the last hundred years, consumer prices overall increased about 2000 percent, but the price of a hotel room in New York City jumped 7500 percent, while the price of a three-minute phone call from New York to Chicago dropped 99 percent. Whereas the economy's price level describes the exchange rate between a market basket and money, relative prices describe the exchange rate among goods—that is, how much one good costs compared to another.

Inflation does not necessarily cause a change in relative prices, but it can obscure that change. During periods of volatile inflation, there is greater uncertainty about the price of one good relative to another—that is, about relative prices. But relative price changes are important signals for allocating the economy's resources efficiently. If all prices moved together, suppliers could link the selling prices of their goods to the overall inflation rate. Because prices usually do not move in unison, however, tying a particular product's price to the overall inflation rate may result in a price that is too high or too low based on market conditions. The same is true of agreements to link wages with inflation.

If the price of an employer's product grows more slowly than the rate of inflation in the economy, the employer may be hard-pressed to increase wages by the rate of inflation. Consider the problem confronting oil

refiners who signed labor contracts agreeing to pay their workers cost-of-living wage increases. In some years, those employers had to increase wages at a time when the price of oil was falling like a rock.

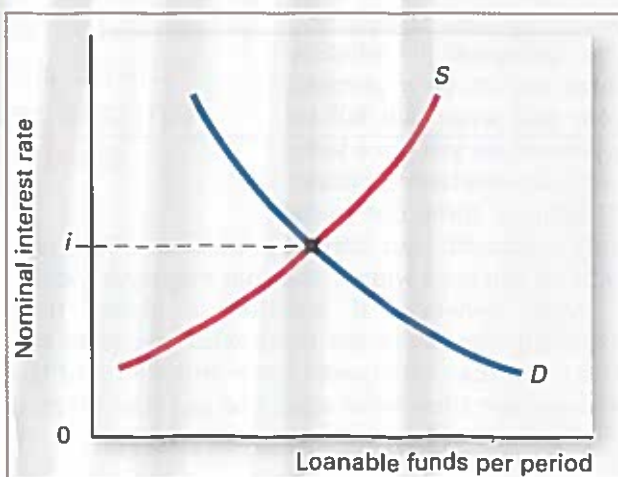
## 7-4d Inflation and Interest Rates

No discussion of inflation would be complete without some mention of the interest rate. **Interest** is the dollar amount paid by borrowers to lenders. Lenders must be rewarded for forgoing present consumption, and borrowers are willing to pay a premium to spend now. The **interest rate** is the amount paid per year as a percentage of the amount borrowed. For example, an interest rate of 5 percent means \$5 per year on a \$100 loan. The greater the interest rate, other things constant, the greater the reward for lending money. The amount of money people are willing to lend, called *loanable funds*, increases as the interest rate rises, other things constant. The supply curve for loanable funds therefore slopes upward, as indicated by curve S in Exhibit 10.

These funds are demanded by households, firms, and governments to finance homes, buildings, machinery, college, and other major purchases. The lower the interest rate, other things constant, the cheaper the cost of borrowing. So the quantity of loanable funds demanded increases as the interest rate decreases, other things constant. That is, the interest rate and the quantity of loanable funds demanded are inversely related. The demand curve therefore slopes downward, as indicated by curve D in Exhibit 10. The downward-sloping demand curve and the upward-sloping supply curve intersect to yield the equilibrium nominal rate of interest,  $i$ .

### Exhibit 10

The Market for Loanable Funds



**interest**  
The dollar amount paid by borrowers to lenders

**interest rate**  
Interest per year as a percentage of the amount loaned

The nominal interest rate measures interest in terms of the current dollars paid. The nominal rate is the one that appears on the loan agreement; it is the rate discussed in the news media and is often of political significance. The real interest rate equals the nominal rate minus the inflation rate:

$$\text{Real interest rate} = \text{Nominal interest rate} - \text{Inflation rate}$$

For example, if the nominal interest rate is 5 percent and the inflation rate is 3 percent, the real interest rate is 2 percent. With no inflation, the nominal rate and the real rate would be identical. But with inflation, the nominal rate exceeds the real rate. If inflation is unexpectedly high—higher, for example, than the nominal interest rate—then the real interest rate would be negative. In this case, the nominal interest earned for lending money would not even cover the loss of spending power caused by inflation. Lenders would lose purchasing power. This is why lenders and borrowers are concerned more with the real rate than the nominal rate. The real interest rate, however, is known only after the fact—that is, only after inflation actually occurs.

Because the future is uncertain, lenders and borrowers must form expectations about inflation, and they base their willingness to lend and borrow on those expectations. The higher the expected inflation, the higher the nominal rate of interest that lenders require and that borrowers are willing to pay. Lenders and borrowers base their decisions on the expected real interest rate, which equals the nominal rate minus the expected inflation rate.

Although the discussion has implied that there is only one market rate of interest, there are many rates. Rates differ depending on such factors as the duration of the loan, tax treatment of interest, and the risk the loan will not be repaid.

## 7-4e Why Is Inflation So Unpopular?

Whenever the price level increases, spending must increase just to buy the same amount of goods and services. If you think of inflation only in terms of

spending, you consider only the problem of paying those higher prices. But if you think of inflation in terms of the higher money income that results, you see that higher prices mean higher receipts for resource suppliers, including higher nominal wages for workers. When viewed from the income side, inflation is not so bad.

If every higher price is received by some resource supplier, why are people so troubled by inflation? People view their higher incomes as well-deserved rewards for their labor, but they see inflation as a penalty that unjustly robs them of purchasing power. Most people do not stop to realize that unless they are producing more with each hour of labor, higher wages must result in higher prices. Prices and wages are simply two sides of the same coin. To the extent that nominal wages on average keep up with inflation, workers retain their purchasing power.

Presidents Ford and Carter could not control inflation and were turned out of office. Inflation slowed significantly during President Reagan's first term, and he won reelection easily.

During the 1988 election, George H. W. Bush won in part by reminding voters what inflation was in 1980, the last time a Democrat was president. But he lost his bid at reelection in part because inflation spiked to 6.0 percent in 1990, the highest in nearly a decade. Inflation remained under 3.0 percent during President Clinton's first term, and he was reelected easily. In the presidential elections of 2000, 2004, 2008, and 2012, inflation remained low enough not to be a campaign issue.

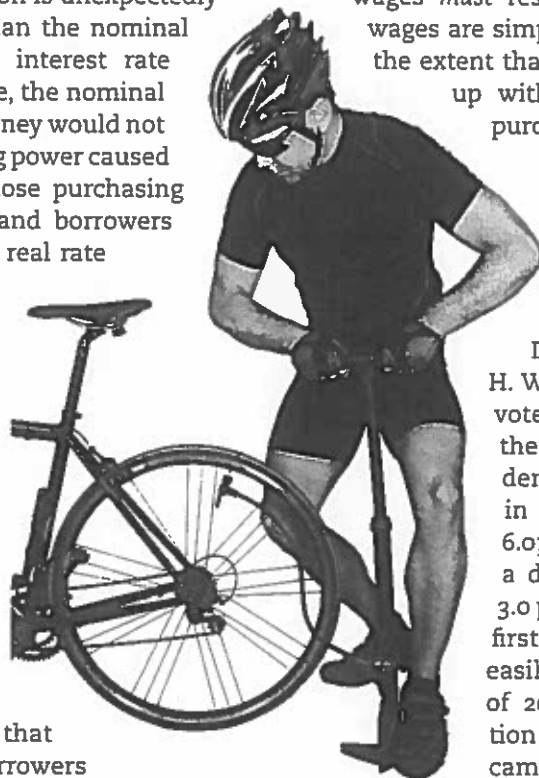
As noted earlier, unanticipated inflation creates winners and losers in the economy. The perceived unfairness and arbitrariness of these gains and losses are more reasons why people hate inflation. Finally, although inflation affects everyone to some extent, it hits hardest those whose incomes are fixed in nominal terms. For example, pensions are often fixed amounts and are eroded by inflation. And retirees who rely on fixed nominal interest

### nominal interest rate

The interest rate expressed in dollars of current value (that is, not adjusted for inflation) as a percentage of the amount loaned; the interest rate specified on the loan agreement

### real interest rate

The interest rate expressed in dollars of constant purchasing power as a percentage of the amount loaned; the nominal interest rate minus the inflation rate



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income also see their incomes shrunk by inflation. But the benefits paid by the largest pension program, Social Security, are adjusted annually for changes in the CPI. Thus, Social Security recipients get a cost-of-living adjustment, or a **COLA**.

“Unanticipated inflation arbitrarily redistributes income and wealth from one group to another, reduces the ability to make long-term plans, and forces people to focus more on money and prices.”

**To Review:** anticipated inflation is less of a problem than unanticipated inflation. Unanticipated inflation arbitrarily redistributes income and wealth from one group to another, reduces the ability to make long-term plans, and forces people to focus more on money and prices. The more unpredictable inflation becomes the harder it is to negotiate long-term contracts. Productivity suffers because people must spend more time coping with inflation, leaving less time for production.

**COLA**  
Cost-of-living adjustment; an increase in a transfer payment or wage that is tied to the increase in the price level

## 7-5 Final Word

This chapter has focused on unemployment and inflation. Although we have discussed them separately, they are related in ways that will unfold in later chapters. Politicians sometimes add the unemployment rate to the inflation rate to come up with what they refer to as the “misery index.” In 1980, for example, an unemployment rate of 7.1 percent combined with a CPI increase of 12.5 percent to yield a misery index of 19.6—a number that helps explain why President Carter was not reelected. By 1984 the misery index dropped to 11.8, and by 1988 to 9.6; Republicans retained the White House in both elections. In 1992, the index climbed slightly to 10.4 percent, spelling trouble for President George H. W. Bush. And in 1996, the index fell back to 8.4 percent, helping President Clinton’s reelection. During the election of 2000, the misery index was down to 7.7, which should have helped Al Gore, the candidate of the incumbent party. But during the campaign, Gore distanced himself from President Clinton and thus was not able to capitalize on the strong economy. In the 2004 election, the misery index remained about the same as in 2000, which helps explain why challenger John Kerry had difficulty making much of an issue of the economy. A misery index of 10.4 right before the 2008 election helped defeat the incumbent party and put Barack Obama in office. The misery index showed no improvement in 2012, and this made President Obama’s reelection more of a challenge.

Households interviewed monthly by the Bureau of Labor Statistics >

60,000

U.S. unemployment rate during the worst years of the Great Depression >

25%

U.S. unemployment rate in August 2013 >

7.3%

\$330

< Average weekly unemployment check in 2012

20.0

< Misery Index at its highest in 1980

9.4

< Misery Index in July 2013

Misery Index at its lowest in 1953 >

3.7

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# Productivity *and* Growth

## Learning Outcomes

- 8-1** Describe how we measure labor productivity, and explain why it is important for a nation's standard of living
- 8-2** Summarize the history of U.S. labor productivity changes since World War II, and explain why these changes matter
- 8-3** Evaluate the evidence that technological change increases the unemployment rate

# “Why is the long-term growth rate more important than short-term fluctuations in economic activity?”

Why is the standard of living so much higher in some countries than in others? How does an economy increase its living standard? Why is the long-term growth rate more important than short-term fluctuations in economic activity? What's labor productivity, why is it important, and why has it varied so much over time? What's been the impact of computers and the Internet on labor productivity? Answers to these and other questions are addressed in this chapter, which focuses on arguably the most important criteria for judging an economy's performance—productivity and growth.

The single most important determinant of a nation's standard of living in the long run is the productivity of its resources. Even seemingly low growth in productivity, if sustained for years, can have a substantial effect on the standard of living—that is, on the average availability of goods and services per capita. Growing productivity is therefore critical to a rising standard of living and has kept the U.S. economy a world leader.

You may not realize it, but you now live in one of the most technologically innovative times in human history. Each day brings faster computers, smarter phones, higher-definition video, more sophisticated social media, more effective medicines, more automated machines, and other breakthroughs that raise your productivity and your standard of living.

Economic growth is a complicated process, one that even experts do not yet fully understand. Since before Adam Smith inquired into the sources of the *Wealth of Nations*, economists have puzzled over what makes some economies prosper while others founder. Because a market economy is not the product of conscious design, it does not reveal its secrets readily, nor can it be easily manipulated in pursuit of growth. We can't simply push here and pull there to achieve the desired result. Changing the economy is not like remodeling a home by knocking out a wall to expand the kitchen. Because we have no clear blueprint of the economy, we cannot make changes to specifications.

Still, there is much economists do know. In this chapter, we first develop a few simple models to examine productivity and growth. Then, we use these models to help explain why some nations are rich and some poor. The U.S. performance gets special attention, particularly compared with other major economies around the world. We close with some controversies of technology and growth.

## What do you think?

**Governments should be closely involved in the technological development of domestic industries.**

Strongly Disagree

Strongly Agree

1 2 3 4 5 6 7

### Topics discussed in Chapter 8 include

- Labor productivity
- Technological change and unemployment
- The production function
- Research and development
- U.S. productivity and growth
- Industrial policy
- Rules of the game
- Income and happiness



## 8-1 The Theory of Productivity and Growth

Two centuries ago, 90 percent of the American workforce was in agriculture, where the hours were long and rewards unpredictable. Other workers had it no better, toiling from sunrise to sunset for a wage that bought just the bare necessities. People had little intellectual stimulation and little contact with the outside world. A skilled worker's home in 1800 was described as follows: "Sand sprinkled on the floor did duty as a carpet. . . . What a stove was he did not know. Coal he had never seen. Matches he had never heard of. . . . He rarely tasted fresh meat. . . . If the food of a [skilled worker] would now be thought coarse, his clothes would be thought abominable."<sup>1</sup>

Over the last two centuries, there has been an incredible increase in the U.S. standard of living as measured by the amount of goods and services available on average per person. Note that economic progress was unusual during the long sweep of history. For example, people of Shakespearean England had a living standard little better than those of ancient Greece, who lived more than a thousand years earlier.

An economy's standard of living grows over the long run because of (1) increases in the amount and quality of resources, especially labor and capital; (2) better technology; and (3) improvements in the rules of the game that facilitate production and exchange, such as tax laws, property rights, patent laws, the legal system, and the manners, customs, and conventions of the market. Perhaps the easiest way to introduce economic growth is by beginning with something you have already read about, the production possibilities frontier.

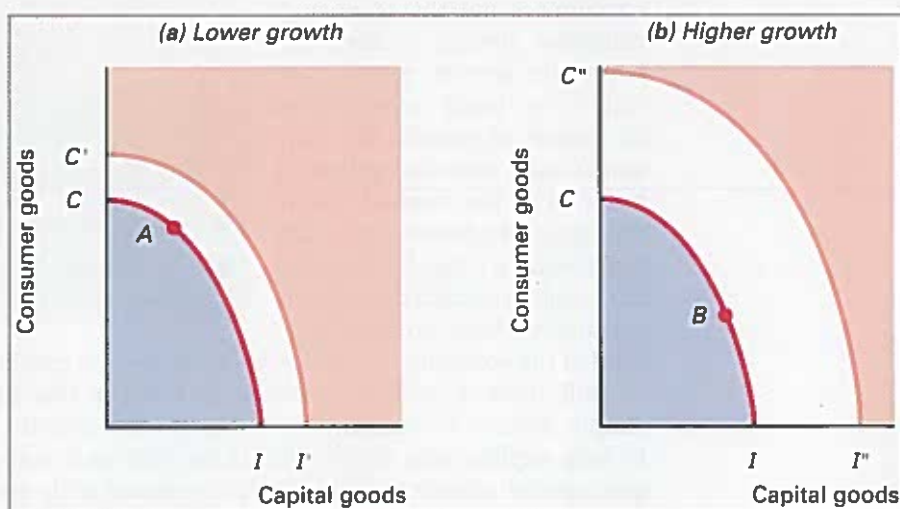
During the period under consideration, usually a year, the quantity of resources in the economy and the level of technology are assumed to be fixed. Also assumed fixed during the period are the rules of the game that facilitate production and exchange. We classify all production into two broad categories—in this case, consumer goods and capital goods. Capital goods are used to produce other goods. For example, the economy can bake pizzas and make pizza ovens. Pizzas are consumer goods, and ovens are capital goods.

When resources are employed efficiently, the production possibilities frontier  $CI$  in each panel of Exhibit 1 shows the possible combinations of consumer goods and capital goods that can be produced in a given year. Point  $C$  depicts the quantity of consumer goods produced if all the economy's resources are employed efficiently to produce them. Point  $I$  depicts the same for capital goods. Points inside the frontier are inefficient combinations, and points outside the frontier are unattainable combinations, given the resources, technology, and rules of the game. The production possibilities frontier is bowed out because resources are not perfectly adaptable to the production of both goods; some resources are specialized.

Economic growth is shown by an outward shift of the production possibilities frontier, as reflected in each panel of Exhibit 1. What can cause growth? An increase in resources, such as a growth in the labor supply or in the capital stock, shifts the frontier outward from one period to the next. Labor supply can increase either because of population growth or because the existing population works more. The capital stock increases if the economy produces more capital this year than it uses up. The more capital produced this year, on net, the more the economy grows, as reflected by an outward shift of the production frontier next year.

### Exhibit 1

Economic Growth Shown by Shifts Outward of the Production Possibilities Frontier



### 8-1a Growth and the Production Possibilities Frontier

The production possibilities frontier, or PPF, first introduced in Chapter 2, shows what the economy can produce if available resources are used efficiently. Let's briefly review the assumptions made in developing the frontier shown in Exhibit 1.

1. E. L. Bogart, *The Economic History of the United States* (Longmans Green, 1912), pp. 157–158.

Breakthroughs in technology also shift out the frontier by making more efficient use of resources. Technological change often improves the quality of capital, but it can enhance the productivity of any resource. And technological change can free up resources for other uses. For example, the development of synthetic dyes in the 19th century freed up millions of acres of agricultural land around the world that had been growing dye crops such as madder (red) and indigo (blue). The development of fiber-optic cable and cellular technology freed up the world's largest stock of copper in the form of existing telephone wires strung on poles.

Finally, any improvement in the rules of the game that nurtures production and exchange promotes growth and expands the frontier. For example, the economy can grow as a result of improved patent laws that encourage more inventions<sup>2</sup> or legal reforms that reduce transaction costs. Extending the length of patent protection could lead to more R&D, more inventions, and more innovations.

Thus, the economy grows because of a greater availability of resources, an improvement in the quality of resources, technological change that makes better use of resources, or improvements in the rules of the game that enhance production.

The amount of capital produced this year shapes the PPF next year. For example, in panel (a) of Exhibit 1, the economy has chosen point A from possible points along CI. The capital produced this year shifts the PPF out to C'I' next year. But if more capital goods are produced this year, as reflected by point B in panel (b), the PPF shifts farther out next year, to C''I'. An economy that produces more capital this year is said to invest more in capital. As you can see, to invest more, people must give up some consumer goods this year. Thus, the opportunity cost of producing more capital goods this year is producing fewer consumer goods. More generally, we can say that people must save more now—that is, forgo some current consumption—to invest in capital. Investment cannot occur without saving. Economies that save more can invest more, as we'll see later. But let's get back to production.

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2. For evidence of how the greater protection of intellectual property stimulates technological change, see Sunil Kanwar and Robert Evenson, "Does Intellectual Property Protection Spur Technological Change?" *Oxford Economic Papers*, 55 (April 2003): 235–264.

“An economy grows because of a greater availability of resources, an improvement in the quality of resources, technological change that makes better use of resources, or improvements in the rules of the game that enhance production.”

## 8-1b What is Productivity?

Production is a process that transforms resources into goods and services. Resources coupled with technology produce output. Productivity measures how efficiently resources are turned into goods and services. In simplest terms, the greater the productivity, the more can be produced from a given amount of resources, and the farther out the production possibilities frontier. Economies that use resources more efficiently create a higher standard of living, meaning that more goods and services are produced per capita.

Productivity is defined as the ratio of total output to a specific measure of input. Productivity usually reflects an average, expressing total output divided by the amount of a particular kind of resource employed to produce that output. For example, labor productivity is the output per unit of labor and measures total output divided by the hours of labor employed to produce that output.

We can talk about the productivity of any resource, such as labor, capital, or natural resources. When agriculture accounted for most output in the economy, land productivity, such as bushels of grain per acre, was a key measure of economic welfare. Where soil was rocky and barren, people were poorer than where soil was fertile and fruitful. Even

today, soil productivity determines the standard of living in some economies. Industrialization and trade, however, have liberated many from dependence on soil fertility. Today, some of the world's most productive economies have little land or have land of poor fertility. For example, Japan has only 2 percent as much land per capita as Russia, but Japan's GDP per capita is double that of Russia's.

## 8-1c Labor Productivity

Labor is the resource most commonly used to measure productivity. Why labor? First, labor accounts for most

### production

A process that transforms resources into goods and services

### productivity

The ratio of a specific measure of output, such as real GDP, to a specific measure of input, such as labor; in this case productivity measures real GDP per hour of labor

### labor productivity

Output per unit of labor, measured as real GDP divided by the hours of labor employed to produce that output



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production cost—about 70 percent on average. Second, labor is more easily measured than other inputs, whether we speak of hours per week or full-time workers per year. Statistics about employment and hours worked are more readily available and more reliable than those about other resources.

But the resource most responsible for increasing labor productivity is capital. As introduced in Chapter 1, the two broad categories are human capital and physical capital. *Human capital* is the accumulated knowledge, skill, and experience of the labor force. As workers acquire more human capital, their productivity and their incomes grow. That's why surgeons earn more than butchers and accountants earn more than file clerks. You are reading this book right now to enhance your human capital. *Physical capital* includes the machines, buildings, roads, airports, communication networks, and other human creations used to produce goods and services. Think about digging a ditch with bare hands versus using a shovel. Now switch the shovel for a backhoe. More physical capital obviously makes diggers more productive. Or consider picking oranges with bare hands versus using a picking machine that combs the trees with steel bristles. In less than 15 minutes that machine can pick 18 tons of oranges from 100 trees, catch the fruit, and drop it into storage carts. Without the machine, that job would take four workers all day.<sup>3</sup> The operator

of the picking machine is at least 128 times more productive than someone picking oranges by hand.

**per-worker production function**  
The relationship between the amount of capital per worker in the economy and average output per worker

\*\*\*

3. Eduardo Porter, "In Florida Groves, Cheap Labor Means Machines," *New York Times*, 22 March 2004.

In poorer countries labor is cheap and capital dear, so producers substitute labor for capital. For example, in India a beverage truck makes its rounds festooned with workers so as to minimize the time the truck, the valuable resource, spends at each stop. In the United States, where labor is more costly (compared with capital), the truck makes its rounds with just the driver. As another example, in Haiti, the poorest country in the Western Hemisphere, a ferry service could not afford to rebuild a dock, so it hired workers to carry passengers through the water to and from the ferry on their shoulders.<sup>4</sup>

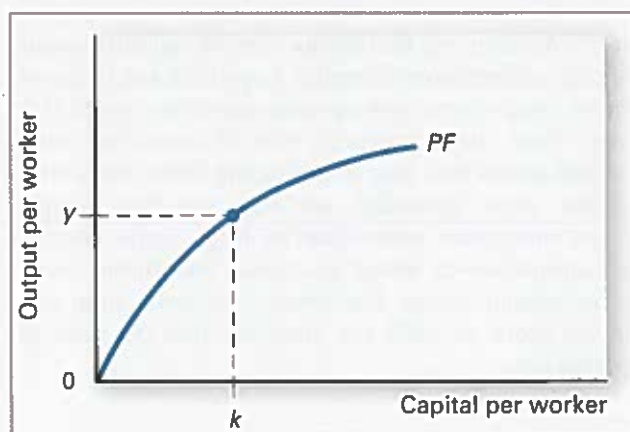
As an economy accumulates more capital per worker, labor productivity increases and the standard of living grows. The most productive combination of all is human capital combined with physical capital. For example, one certified public accountant with a computer and specialized software can sort out a company's finances more quickly and more accurately than could a thousand high-school-educated file clerks using just pencils and paper.

## 8-1d Per-Worker Production Function

We can express the relationship between the amount of capital per worker and the output per worker as an economy's **per-worker production function**. Exhibit 2 shows the amount of capital per worker, measured along the horizontal axis, and average output per worker, or labor productivity, measured along the vertical axis, other things constant—including the amount of labor, the level of technology, and rules of the game. Any point on the

### Exhibit 2

Per-Worker Production Function



\*\*\*

4. This example was noted by Tyler Cowen in "The Ricardo Effect in Haiti," 23 February 2004, <http://www.marginalrevolution.com>.



production function,  $PF$ , shows the average output per worker on the vertical axis for each level of capital per worker on the horizontal axis. For example, with  $k$  units of capital per worker, the average output per worker in the economy is  $y$ . The curve slopes upward from left to right because an increase in capital per worker helps each worker produce more output. For example, bigger trucks make truck drivers more productive.

An increase in the amount of capital per worker is called **capital deepening** and is one source of rising productivity. Capital deepening contributes to labor productivity and economic growth. As the quantity of capital per worker increases, output per worker increases but at a diminishing rate, as reflected by the shape of the per-worker production function. The diminishing slope of this curve reflects the law of diminishing marginal returns from capital, which says that beyond some level of capital per worker, increases in capital add less and less to output per worker. For example, increasing the size of trucks beyond some point has diminishing returns as trucks become too large to negotiate some public roads. Thus, given the amount of labor, the level of technology, and the rules of the game, additional gains from more capital per worker eventually diminish and could turn negative.

### 8-1e Technological Change

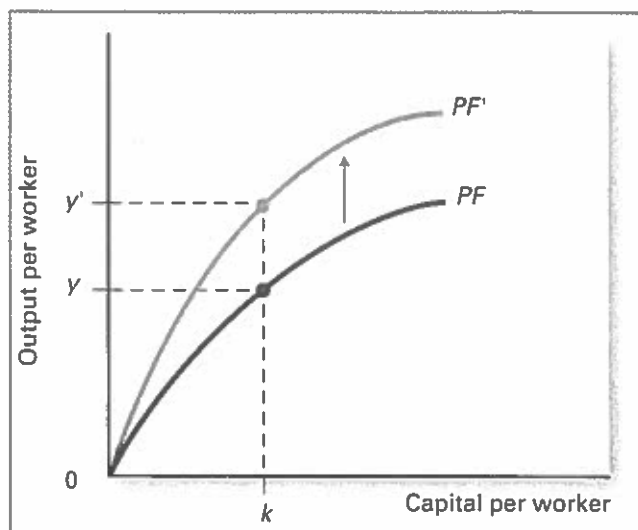
Held constant along a per-worker production function is the level of technology in the economy. Technological change usually improves the quality of capital and represents another source of increased productivity. For example, a tractor is more productive than a horse-drawn plow, a word processor more productive than a typewriter, and an Excel spreadsheet more productive than pencil and paper. Better technology is reflected in Exhibit 3 by an upward rotation in the per-worker production



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### Exhibit 3

Impact of a Technological Breakthrough on the Per-Worker Production Function



function from  $PF$  to  $PF'$ . As a result of a technological breakthrough, more is produced at each level of capital per worker. For example, if there are  $k$  units of capital per worker, a major breakthrough in technology increases the output per worker in the economy from  $y$  to  $y'$ .

Simon Kuznets, who won a Nobel Prize in part for his analysis of economic growth, claimed that technological change and the ability to apply such breakthroughs to all aspects of production are the driving forces behind economic growth in market economies. Kuznets argued that changes in the quantities of labor and capital account for only one-tenth of the increase in economic growth. Nine-tenths came from improvements in the quality of these inputs. As technological breakthroughs become embodied in new capital, resources are combined more efficiently, increasing total output. From the wheel to the assembly-line robot, capital embodies the fruits of discovery and drives economic growth.

Thus, two kinds of changes in capital improve worker productivity: (1) an increase in the quantity of capital per worker, as reflected by a movement along the per-worker production function, and (2) an improvement in the quality of capital per worker, as reflected by technological change that rotates the curve upward. More capital per worker and better capital per worker result in more output per worker, which, over time, translates into more output per capita, meaning a higher standard of living.

**capital deepening**  
An increase in the amount of capital per worker; one source of rising labor productivity

## 8-1f Rules of the Game

Perhaps the most elusive ingredients for productivity and growth are the **rules of the game**, the formal and informal institutions that promote economic activity: the laws, customs, manners, conventions, and other institutional elements that encourage people to undertake productive activity. A stable political environment and a system of well-defined property rights are important. It's been said that capital goes where it's welcome and remains where it is well treated. Less is invested in human and physical capital if people believe the fruits of their investment could be seized by the government, stolen by thieves, destroyed by civil unrest, or blown up by terrorists. For example, countries whose colonizers established strong property rights hundreds of years ago have, on average, much higher incomes today than countries whose colonizers did not.<sup>5</sup> And recent research finds that economies grow faster if people are more trusting and more trustworthy.<sup>6</sup> After all, one sign of an advanced economy is a willingness to participate in impersonal market exchange. More generally, some countries are more inviting to talented people than other countries. For example, one recent study found that 38 percent of scientists working in the United States came from abroad (China and India are the two biggest sources of scientists). On the other hand, only 5 percent of the scientists in Japan came from abroad.<sup>7</sup>

Improvements in the rules of the game could result in more output for each level of capital per worker, thus reflected by a rotation up in the per-worker production function as shown in Exhibit 3. On the other hand, a deterioration in the rules of the game would rotate down the per-worker production function. As an example, "Capital flight out of Russia has been high, blamed in part on a lack of confidence in the country's respect

**"More capital per worker and better capital per worker result in more output per worker, which, over time, translates into more output per capita, meaning a higher standard of living."**

for property rights and on persistent, rampant corruption."<sup>8</sup>

We tend to think that laws are the backbone of market exchange, but we should not underestimate the role of manners, customs, and conventions. According to the 18th century British philosopher Edmund Burke, "Manners are of more importance than law. . . . The

law touches us but here and there and now and then. Manners are what vex or soothe, corrupt or purify, exalt or debase, barbarize or refine us, by a constant, steady, uniform and insensible operation like that of the air we breathe in."<sup>9</sup> The Russian proverb, "Custom is stronger than law," makes a similar point.

Simply put, a more stable political climate could benefit productivity just like a technological improvement could. Conversely, events that foster instability can harm an economy's productivity and rotate the per-worker production function downward. The terrorist attacks on the World Trade Center and Pentagon were such a destabilizing event. According to Albert Abadie, a Harvard economist, the attack affected "the spinal cord of any favorable business environment"—the ability of business and workers "to meet and communicate effectively without incurring risks."<sup>10</sup> The 9/11 attacks increased the vacancy rates of tall buildings even in cities other than New York, such as Chicago's Sears Tower, making that capital less productive.<sup>11</sup> As other examples, a greater threat to airport security adds to the time and cost of flying. Shops in countries plagued by suicide bombers must hire security guards to deter such horror, and this increases the cost of doing business. And the mortgage meltdown of 2007–2009 reduced the trust that one bank had in another, thereby freezing up credit markets and increasing the cost of borrowing.

Now that you have some idea about the theory of productivity and growth, let's look at them in practice, beginning with the vast difference in performance among economies around the world. Then we will turn to the United States.

**rules of the game**  
The laws, customs, manners, conventions, and other institutional elements that determine transaction costs and thereby affect people's incentive to undertake production and exchange

5. Daron Acemoglu, Simon Johnson, and James A. Robinson, "The Colonial Origins of Comparative Development," *American Economic Review*, 91(December 2001): 1369–1401.

6. Yann Algan and Pierre Cahuc, "Inherited Trust and Growth," *American Economic Review*, 100 (December 2010): 2060–2092.

7. Chiara Franzoni, Giuseppe Scellato, and Paula Stephan, "Foreign Born Scientists: Mobility Patterns in Sixteen Countries," NBER Working Paper 18067 (May 2012).

8. Megan Davies and Melissa Akins, "Russian Risks Bear Down on Oligarch Fridman," Reuters, 6 June 2012.

9. Edmund Burke, *Letters to Parliament*, 2nd ed. (London, 1796), p. 105.

10. As quoted in Greg Ip and John McKinnon, "Economy Likely Won't See Gain From War Against Terrorism," *Wall Street Journal*, 25 September 2001.

11. Alberto Abadie and Sofia Dermisi, "Is Terrorism Eroding Agglomeration Economies in Central Business Districts? Lessons From the Office Real Estate Market in Downtown Chicago," *Journal of Urban Economics*, 64 (September 2008): 451–463.

## 8-2 Productivity and Growth in Practice

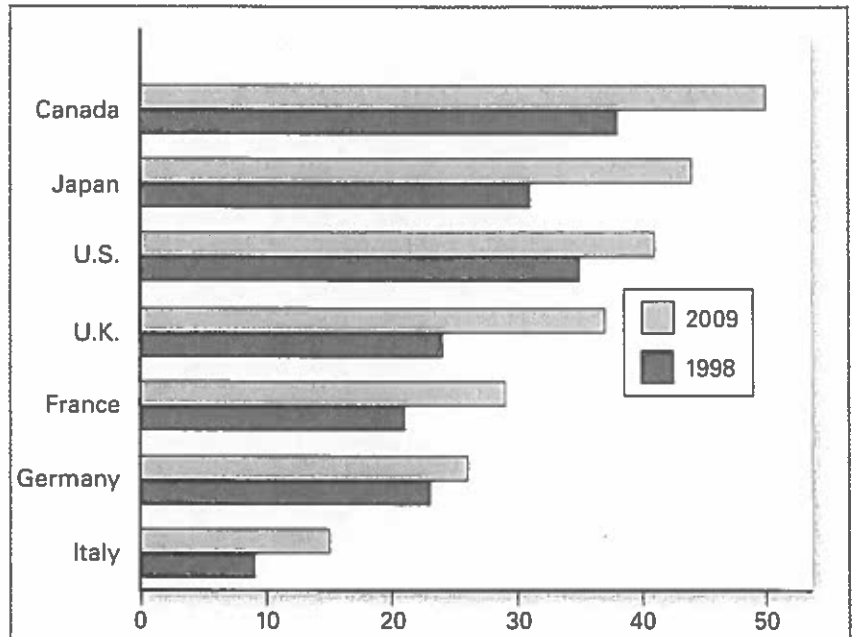
Differences in the standard of living among countries are vast. To give you some idea, per capita output in the United States, a world leader among major economies, is at least 150 times that of the world's poorest countries. Poor countries are poor because they experience low labor productivity. We can sort the world's economies into two broad groups. Industrial market countries, or *developed countries*, make up about 16 percent of the world's population. They consist of the economically advanced capitalist countries of Western Europe, North America, Australia, New Zealand, and Japan, plus the newly industrialized Asian countries of Taiwan, South Korea, Hong Kong, and Singapore. Industrial market countries were usually the first to experience long-term economic growth during the 19th century, and today have the world's highest standard of living based on abundant human and physical capital. Industrial market countries produce more than half the world's output. The rest of the world, the remaining 84 percent of the world's population, consists of developing countries, which have a lower standard of living because they have less human and physical capital. Many workers in developing countries are farmers. Because farming methods there are often primitive, labor productivity is low and most people barely subsist, much like Americans two centuries ago.

### 8-2a Education and Economic Development

Another important source of productivity is human capital—the skill, experience, and education of workers. If knowledge is lacking, other resources may not be used efficiently. Education makes workers aware of the latest production techniques and more receptive to new approaches and methods. Exhibit 4 shows the percentage of the population ages 25 to 64 who have at least a degree beyond high

Exhibit 4

Percent of Population Ages 25 to 64 with at Least a Post-High School Degree: 1998 and 2009



SOURCE: Based on figures in OECD, *Education at a Glance: 2011*, at <http://www.oecd.org>.

school. Figures are presented for the United States and six other industrial market economies, together called the *Group of Seven*, or G-7 (sometimes Russia is added to form the G-8, but Russia is not yet an industrial market economy and has a per capita income less than half that of any G-7 country). In 1998, 35 percent of the U.S. adult population had at least a degree beyond high school, ranking second behind Canada. The U.S. percentage grew to 41 by 2009, though America slipped to third behind Canada and Japan.

Not shown in Exhibit 4 are developing countries, which have far lower education levels. For example, only 16 percent of those in Mexico between the ages of 25 and 64 have a degree beyond high school. And while the literacy rate exceeds 95 percent in industrial market economies, more than half the adults in the world's poorest countries can't read or write.

**industrial market countries**  
The economically advanced capitalist countries of Western Europe, North America, Australia, New Zealand, and Japan, plus the newly industrialized Asian economies of Taiwan, South Korea, Hong Kong, and Singapore

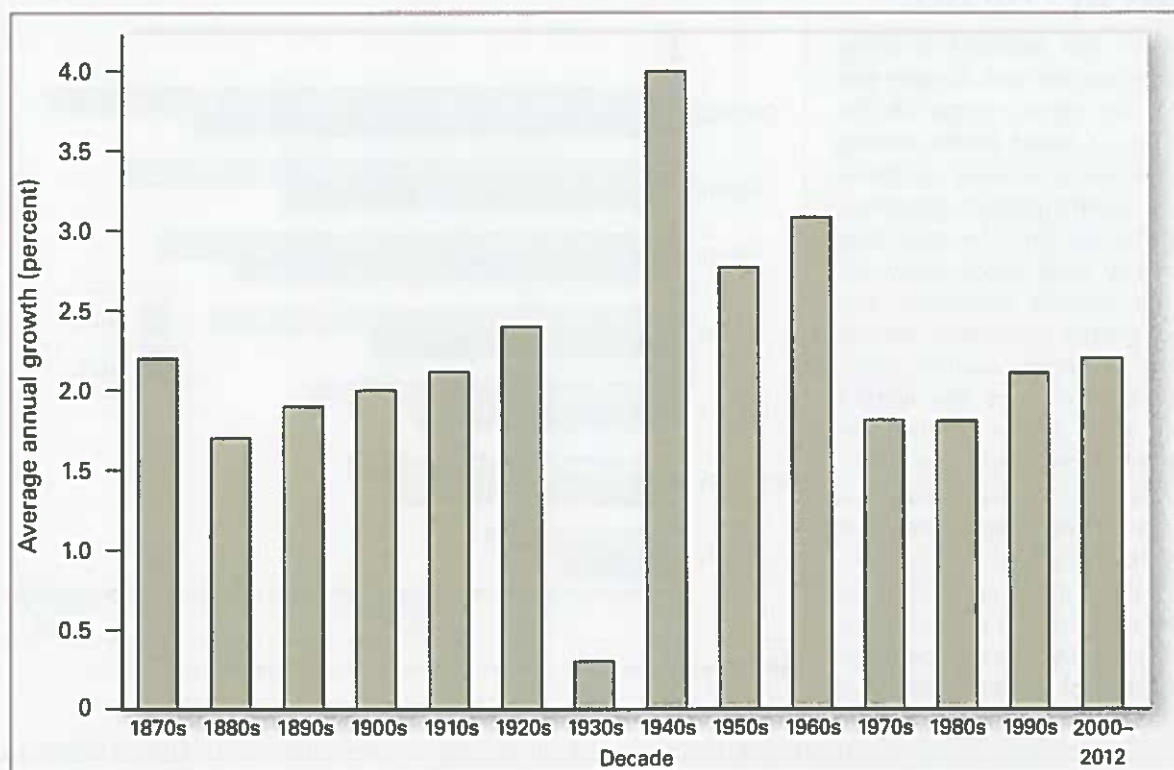
**developing countries**  
Countries with a lower living standard because of less human and physical capital per worker





## Exhibit 5

Long-Term Trend in U.S. Labor Productivity Growth: Annual Average by Decade



SOURCES: Angus Maddison, *Phases of Capitalist Development* (Oxford University Press, 1982); and U.S. Bureau of Labor Statistics. For the latest data, go to <http://www.bls.gov/lpc/>.

### 8-2b U.S. Labor Productivity

What has been the record of labor productivity in the United States? Exhibit 5 offers a long-run perspective, showing growth in real output per work hour for the last 142 years. Annual productivity growth is averaged by decade (except for the most recent period, which averages 2000 to 2012). The huge dip during the Great Depression and the strong rebound during World War II are unmistakable. Growth slowed during the 1970s and 1980s but has recovered somewhat since 1990. Labor productivity has grown an average of 2.1 percent per year since 1870. This may not impress you, but because of the power of compounding, output per hour has jumped 1,800 percent during the period. To put this in perspective, if a roofer in 1870 could shingle one roof in a day, today's roofer could shingle 19 roofs in a day.

Over long periods, small differences in productivity can make huge differences in the economy's ability to produce and therefore in the standard of living. For example, if productivity grew only 1.0 percent per year instead of 2.1 percent, output per work hour since 1870 would have increased by only 311 percent, not 1,800 percent. On the other hand, if productivity grew 2.4 percent per year (the average since 1995), output per work hour



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If a roofer in the 1870s could shingle one roof in a day, today's roofer could shingle 19 in a day.

since 1870 would have jumped about 2,900 percent! The wheels of progress seem to grind slowly but they grind very fine, and the cumulative effect is powerful.

So far, we have averaged productivity growth for all workers. Productivity has grown more in some industries than in others. In ocean shipping, for example,

cargo carried per worker hour is about 100 times greater now than in 1900, for an average annual growth of 4.2 percent. On the other hand, those making wooden office furniture are only about three times more productive today than in 1900, for an average annual growth in productivity of only 1.0 percent. Consider productivity gains in TV journalism. Not long ago, a TV reporter covering a story would need a camera operator, a sound technician, and a broadcast editor. Now, because of technological advances in the size, quality, and ease of use of equipment, TV reporters set up their own cameras on the scene, shoot their own footage, and do their own editing. One person can do what used to take four to accomplish. And because of technological advances in car manufacturing, some automakers can now produce twice as many vehicles per worker as they did a decade ago.<sup>12</sup>

## 8-2c Slowdown and Rebound in Productivity Growth

You can see in Exhibit 5 that productivity growth slowed to 1.8 percent per year during the 1970s and 1980s, and has recovered a bit to 2.2 percent since 1990. By breaking the data down into intervals other than decades, we can get a better feel for years since World War II. Exhibit 6 offers average annual growth for five periods. Labor productivity growth averaged 2.8 percent per year between 1948 and 1973; these could be called the golden years of

productivity growth. But, between 1973 and 1982, productivity growth slowed to only about a third of that, averaging just 1.0 percent. Why the slowdown? First, oil prices jumped from 1973 to 1974 and again from 1979 to 1980 as a result of OPEC actions, boosting inflation and contributing to stagflation and three recessions. Second, federal legislation in the early 1970s necessary to protect the environment and improve workplace safety slowed the growth of labor productivity.

Fortunately, productivity rebounded off the 1973–1982 low, averaging 1.8 percent from 1982 to 1995 and 3.0 percent from 1995 to 2005. Why the rebound? The information revolution powered by the computer chip and the Internet started paying off. One study of industrial economies found that the greater the penetration of broadband Internet service, the higher the economic growth per capita.<sup>13</sup>

The U.S. dominance in computer technology carries over to U.S. multinational firms, which experienced higher productivity growth after 1995 than did multinationals from other countries.<sup>14</sup>

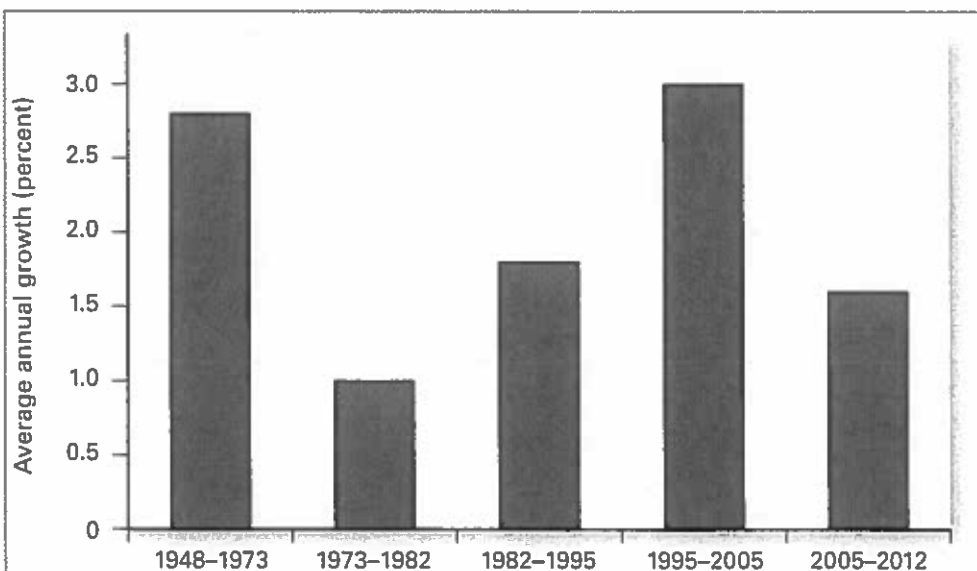
Unfortunately, between 2005 and 2012, U.S. labor productivity growth averaged only 1.6 percent, little more than half the average for 1995 to 2005. The reasons for this slowdown are not yet obvious, though the uncertainty created by the Great Recession no doubt has played a role.

Higher labor productivity growth can make up for output lost from most recessions. For example, if over

the next 10 years U.S. labor productivity grows an average of 3.0 percent per year (the average from 1995 to 2005) instead of 1.6 percent (the average from 2005 to 2012), that higher growth would add about \$2.3 trillion to GDP in the 10th year—more than enough to make up for the output lost during the worst recession since the Great Depression. This cumulative power of productivity growth is why economists pay so much attention to long-term growth.

### Exhibit 6

U.S. Labor Productivity Growth Slowed During 1973 to 1982, Rebounded to 2005, Then Slowed Again



SOURCE: Averages based on annual estimates from the U.S. Bureau of Labor Statistics. For the latest data go to <http://www.bls.gov/lpc/home.htm>.

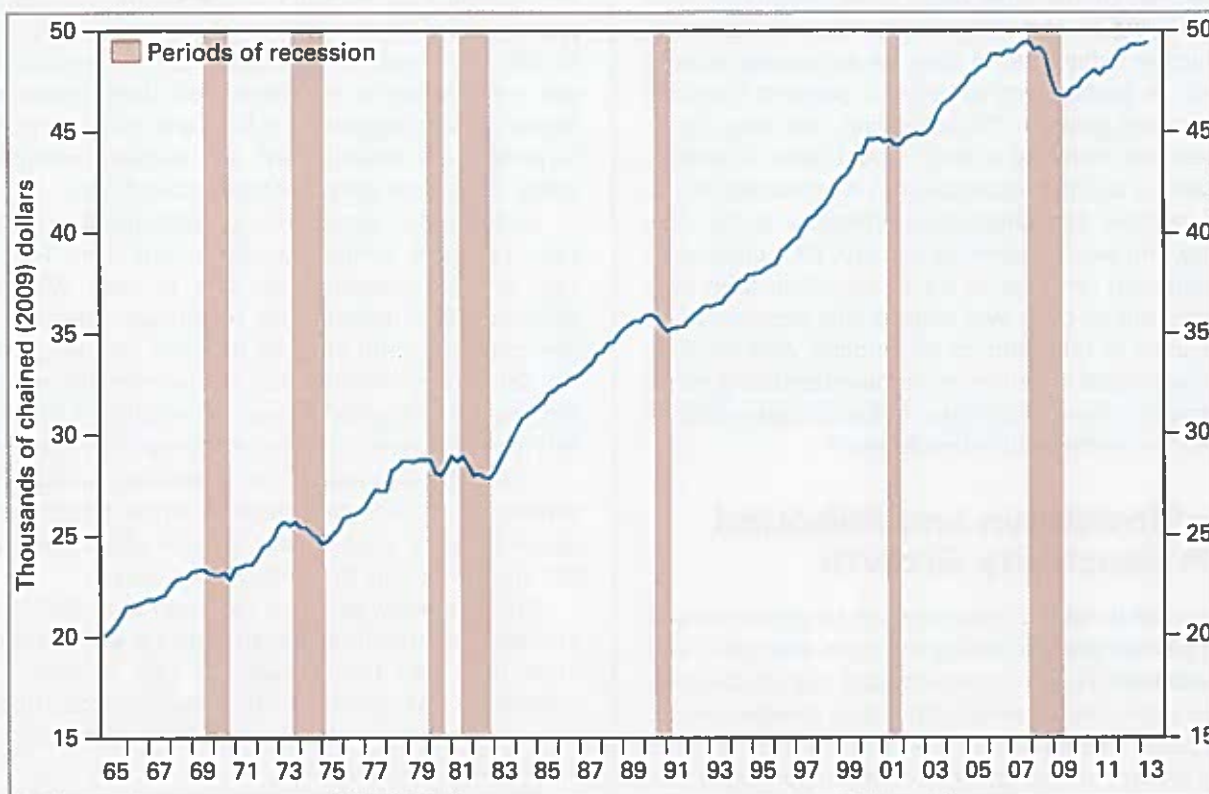
12. "The Third Industrial Revolution," *The Economist*, 21 April 2012.

13. Nina Czernich et al., "Broadband Infrastructure and Economic Growth," *Economic Journal*, 121 (May 2011): 505–532.

14. Nicholas Bloom, Raffaella Sadun, and John Van Reenen, "Americans Do IT Better: U.S. Multinationals and the Productivity Miracle," *American Economic Review*, 102 (March 2012): 167–201.

## Exhibit 7

U.S. Real GDP Per Capita has Nearly Tripled Since 1962



SOURCES: *Survey of Current Business*, 93 (August 2013): D-61. For the latest data, go to <http://www.bea.gov/scb/index.htm>. Select the most recent month, go to the "National Data" section toward the end of the page, and then select "Charts."

### 8-2d Output Per Capita

As noted earlier, the best measure of an economy's standard of living is output per capita. Output per capita, or GDP divided by the population, indicates how much an economy produces on average per resident. Exhibit 7 presents real GDP per capita for the United States since 1962. Notice the general upward trend, interrupted by seven recessions, indicated by the pink bars. Real GDP per capita nearly tripled, for an average annual growth rate of 2.0 percent.

### 8-2e International Comparisons

How does U.S. output per capita compare with that of other industrial countries? Exhibit 8 compares GDP per capita in 2012 for the United States and the six other leading industrial nations. Local currencies have been converted to U.S. dollars of 2012 purchasing power. With nominal GDP per capita of \$50,700 in 2012, the United States stood alone at the top, with a per capita GDP 17 percent above second-ranked Canada and at least 27 percent above the rest. Thus, the United States produced more per capita than any other major economy. GDP per capita for the world was

about \$12,700 in 2012. Hence, U.S. per capita income in 2012 was about four times the world average.

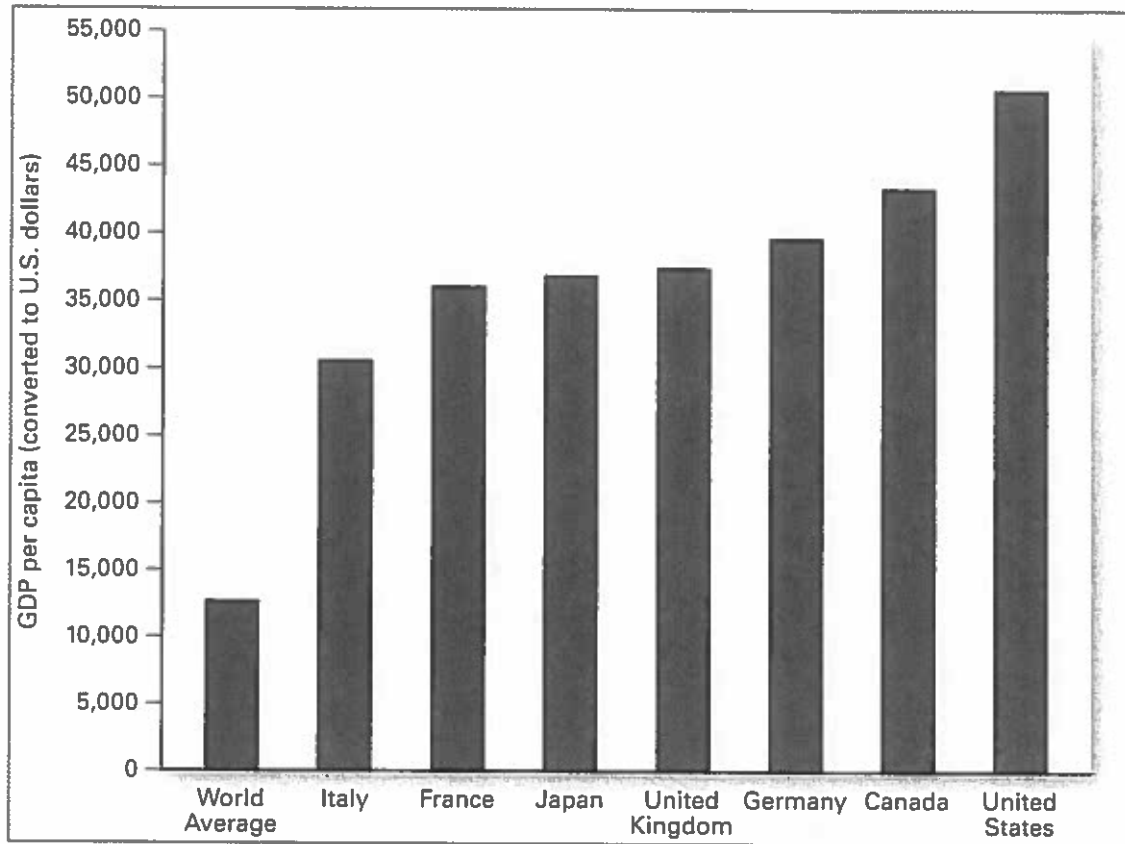
Exhibit 8 looks at the level of output per capita. What about the growth in output per capita? Exhibit 9 shows growth in real GDP per capita from 1990 to 2010. With an average growth of 1.4 percent per year, the United States ranked second among the seven major economies. The United Kingdom ranked first, thanks in part to Prime Minister Margaret Thatcher, who converted some crusty government enterprises into dynamic for-profit firms. Industries she privatized during the 1980s include coal, iron and steel, gas, electricity, railways, trucking, airlines, telecommunications, and the water supply. She also cut income tax rates.

**To Review:** U.S. labor productivity growth has averaged 2.1 percent per year since 1870. Productivity growth slowed between 1973 and 1982, because of spikes in energy prices and implementation of necessary but costly new environmental and workplace regulations. After 1982 labor productivity growth picked up, especially between 1995 and 2005, due primarily to breakthroughs in information technology. The Great Recession probably contributed to the slowdown in labor productivity growth from 2005 to 2012, when the rate averaged little more than half that



## Exhibit 8

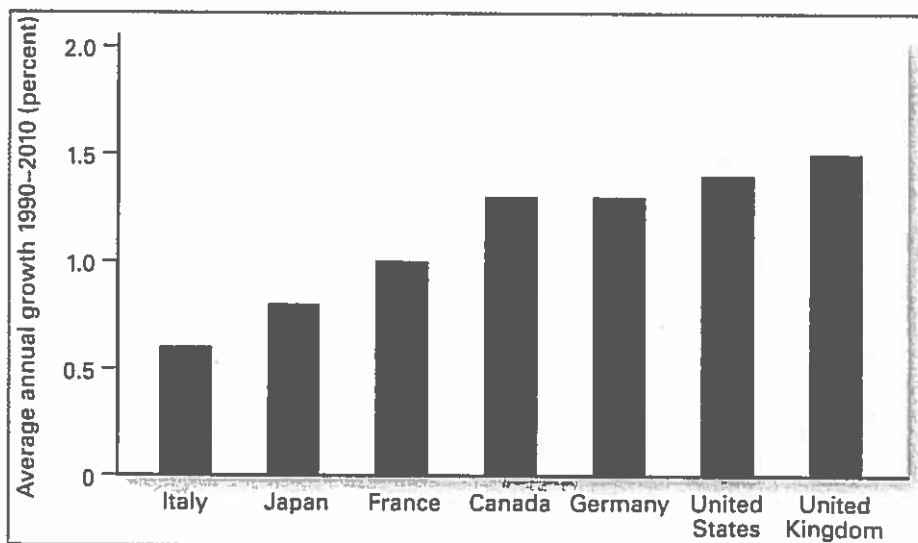
U.S. GDP Per Capita Highest of Major Economies and Four Times the World Average



SOURCE: Based on 2012 dollar estimates from the OECD at <http://www.oecd.org/home/>; and *The World Factbook 2013*: at <https://www.cia.gov/library/publications/the-world-factbook/index.html>. Estimates have been adjusted across countries using the purchasing power of the local currency in 2012.

## Exhibit 9

U.S. Real GDP Per Capita Outgrew Most Other Major Economies Between 1990 and 2010

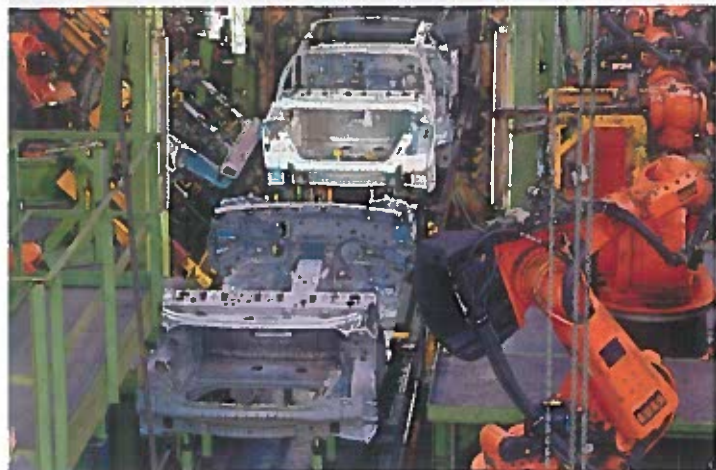


SOURCE: Based on annual figures from 1990 to 2010 from the U.S. Bureau of Labor Statistics at <http://www.bls.gov/fls/#productivity>. Figures were converted into U.S. dollars based on the purchasing power of local currency. For the latest data, go to <http://www.stats.bls.gov/fls/>.

of the decade from 1995 to 2005. Among the seven major economies, the United States experienced the second fastest growth in real GDP per capita income between 1990 and 2010, and in 2012 had the highest GDP per capita among major economies.

## 8-3 Other Issues of Technology and Growth

In this section we consider some other issues of technology and growth, beginning with the question whether technological change creates unemployment.



HANS-PETER MERTEN/STONE/GETTY IMAGES

### 8-3a Does Technological Change Lead to Unemployment?

Because technological change usually reduces the labor needed to produce a given amount of output, some observers fear technological change increases unemployment. True, technological change can create dislocations as displaced workers try to find jobs elsewhere. But technological change can also create new products and job opportunities and make existing products more affordable. For example, the assembly line cut the cost of automobiles, making them more affordable for the average household. This increased the quantity of automobiles demanded, boosting production and employment. Even in industries where machines displace some workers, those who keep their jobs become more productive, so they earn more. And because human wants are unlimited, displaced workers usually find jobs producing other goods and services demanded in a growing economy.

Although job data from the 19th century are sketchy, there is no evidence that the unemployment rate is any higher today than it was in 1870. Since then, worker productivity has increased about 1,800 percent, and the length of the average workweek has been cut nearly in half. Although technological change may displace some workers in the short run, long-run benefits include higher real incomes and more leisure—in

short, a higher standard of living.

If technological change causes unemployment, then the spurt in productivity growth from 1995 to 2005 should have increased

“Most displaced workers find other jobs, often in new industries created by technological change.”

unemployment compared to the slow-growth years from 1973 to 1982. But the unemployment rate, the share of the workforce looking for jobs, averaged 7.0 percent during 1973 to 1982, compared to only 5.1 percent from 1995 to 2005. What’s more, the unemployment rate increased during the slowdown in labor productivity growth after 2005. And if technological change causes unemployment, then unemployment rates should be lower in economies where the latest technology has not yet been adopted, such as in developing countries. But unemployment is far worse there, and those fortunate enough to find work earn little because they are not very productive.

Again, there is no question that technological change sometimes creates job dislocations and hardships in the short run, as workers scramble to adjust to a changing world. Because of technological progress, labor is becoming less important in some types of production. For example, the \$499 charged for the first-generation iPad included only about \$33 of manufacturing labor. And the final assembly in China accounted for just \$8 of that \$33.<sup>15</sup> Some workers with specialized skills made obsolete by technology may be unable to find jobs that pay as well as the ones they lost. These dislocations are one price of progress.

Over time, however, most displaced workers find other jobs, often in new industries created by technological change. In a typical month of expansion, the U.S. economy sheds about 3.8 million jobs but creates about 4 million new ones.

### 8-3b Research and Development

As noted several times already, a prime contributor to labor productivity growth has been an improvement in the quality of human and physical capital. Human capital has benefited from better education, better health care, and more job training. Better technology embodied in physical capital has also helped labor productivity. For example, because of extensive investments in cellular transmission, new satellites, and fiber-optic technology, labor productivity in the telecommunications industry has increased by an average of 5.5 percent per year during the past three decades.

Improvements in technology arise from scientific discovery, which is the fruit of research. We can distinguish between basic research and applied research. **Basic research**, the search for knowledge without

#### basic research

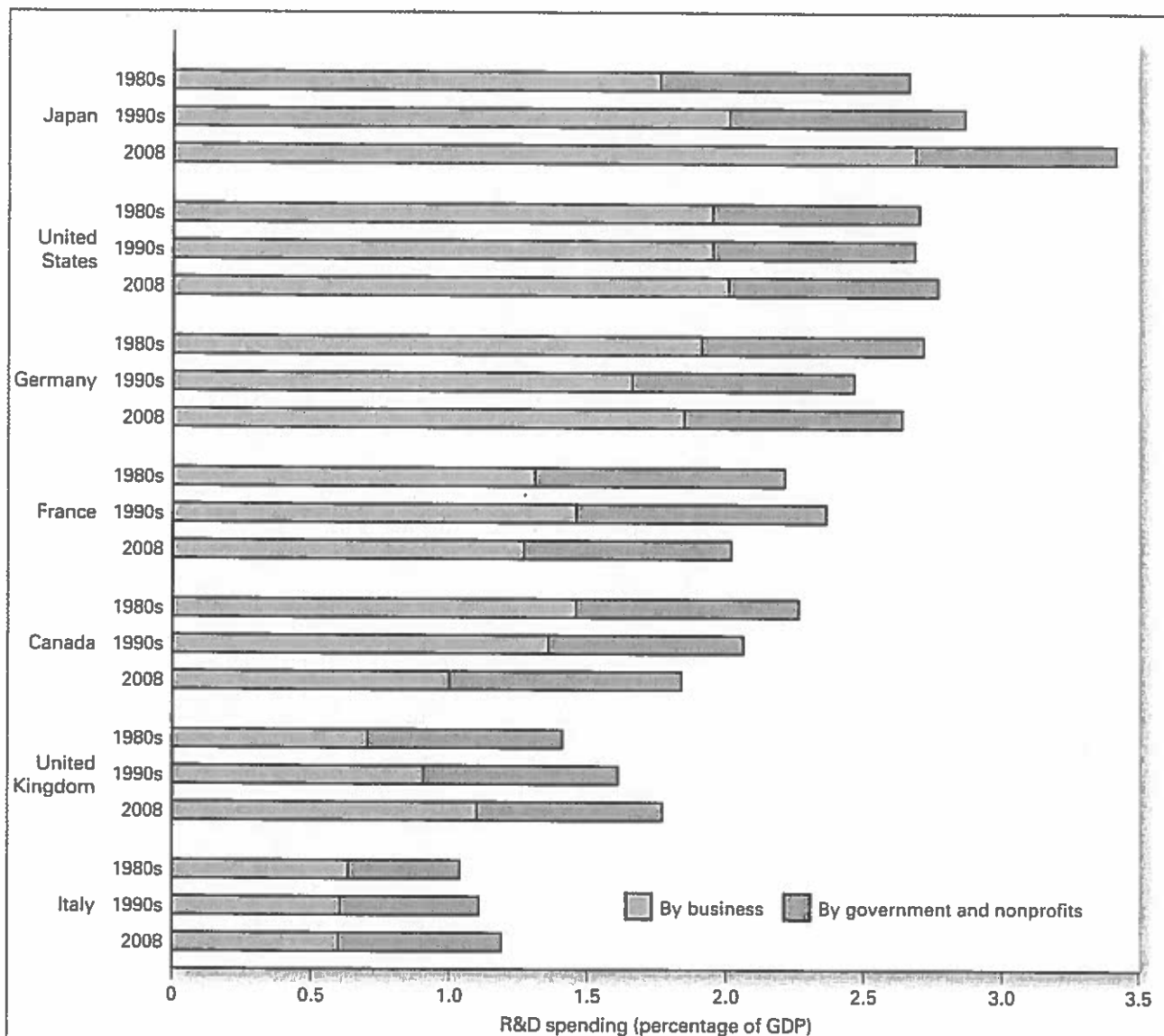
The search for knowledge without regard to how that knowledge will be used

...

15. “The Third Industrial Revolution,” *The Economist*, 21 April 2012.

## Exhibit 10

R&D Spending as a Percentage of GDP for Major Economies During the 1980s, 1990s, and 2008



SOURCE: Based on estimates developed by the OECD at [www.oecd.org](http://www.oecd.org).

regard to how that knowledge will be used, is a first step toward technological advancement. In terms of economic growth, however, scientific discoveries are meaningless until they are implemented, which requires

applied research. Applied research seeks to answer particular questions or to apply scientific discoveries to the development of specific products. Because technological breakthroughs may or may not have commercial possibilities, the payoff is less immediate with basic research than with applied research. Yet basic

“Basic research yields a higher return to society as a whole than does applied research.”

research yields a higher return to society as a whole than does applied research.

Because technological change is the fruit of research and development (R&D),

investment in R&D improves productivity through technological discovery. One way to track R&D spending is to measure it relative to gross domestic product, or GDP.

**applied research**  
Research that seeks answers to particular questions or to apply scientific discoveries to develop specific products



Exhibit 10 shows R&D spending as a share of GDP for the United States and the six other major economies. Overall R&D spending in the United States has remained constant, averaging 2.7 percent of GDP in the 1980s, in the 1990s, and in 2008. During the 1990s and in 2008, the United States ranked second among the major economies, behind Japan.

Bar segments in the chart distinguish between R&D by businesses (shown as green segments) and R&D by governments and nonprofit institutions (shown as orange segments). Business R&D is more likely to target applied research and innovations. R&D spending by governments and nonprofits, such as universities, may generate basic knowledge that has applications in the long run (for example, the Internet sprang from R&D spending on national defense). R&D by U.S. businesses averaged about 1.9 percent of GDP in all three periods. Again, only Japan had higher business R&D than the United States in the 1990s and in 2008. In short, the United States devotes more resources to R&D than most other advanced economies, and this helps America maintain a higher standard of living. Incidentally, manufacturers undertake more R&D than other types of producers. Manufacturing accounts for only 11 percent of U.S. GDP but is responsible for 68 percent of R&D spending.<sup>16</sup>

### 8-3c Industrial Policy

Policy makers have debated whether the government should become more involved in shaping an economy's technological future. One concern is that technologies of the future will require huge sums to develop, sums that an individual firm cannot easily raise and put at risk. Another concern is that the benefits of some technological breakthroughs spill over to other firms and other industries, but the firm that develops the breakthrough may not be in a position to reap benefits from these spillover effects, so individual firms may underinvest in such research. One possible solution is more government involvement in economic planning.

**Industrial policy** is the idea that government, using taxes, subsidies, regulations, and coordination of the private sector, could help nurture the industries and technologies of the future to give domestic industries an advantage over foreign competitors. The idea is to secure a leading role for domestic industry in the world economy. One example

**industrial policy**  
The view that government—using taxes, subsidies, and regulations—should nurture the industries and technologies of the future, thereby giving these domestic industries an advantage over foreign competition

16. "Manufacturing and Innovation: Back to Making Stuff," *The Economist*, 21 April 2012.



HO NEW/REUTERS

of European industrial policy is Airbus Industrie, a four-nation aircraft consortium. With an estimated \$20 billion in government aid, the aircraft maker has become Boeing's main rival. When Airbus seeks aircraft orders around the world, it can draw on government backing to promise favorable terms, such as landing rights at key European airports and an easing of regulatory constraints. U.S. producers get less government backing.

For decades, U.S. industrial policy was aimed at creating the world's most advanced military production capacity. With the demise of the Soviet Union, however, defense technologies became less important, but wars in Iraq and Afghanistan shifted some attention back to military applications. Some argue that U.S. industrial policy should shift from a military to a civilian focus. Many state governments are also trying to identify what industries to support. Economists have long recognized that firms in some industries gain a performance advantage by *clustering*—that is, by locating in a region already thick with firms in the same industry or in related industries. For example, new entrants to an industry can hire experienced workers from established firms.<sup>17</sup> New entrants can also buy other specialized factors of production from local suppliers.<sup>18</sup> And new entrants can benefit from local knowledge about industry trends, such as which production methods work best.<sup>19</sup>

Clusters such as Hollywood studios, Wall Street brokers, Broadway theaters, Las Vegas casinos, Boston colleges, Orlando theme parks, and Silicon Valley software makers facilitate communication and promote

17. Andrey Stoyonov and Nikolay Zubanov, "Productivity Spillovers Across Firms Through Worker Mobility," *American Economic Journal: Applied Economics*, 4 (April 2012): 168–198.

18. Ejaz Ghani, William Kerr, and Stephen O'Connell, "Spatial Determinants of Entrepreneurship in India," NBER Working Paper 17514 (October 2011).

19. Glenn Ellison, Edward Glaeser, and William Kerr, "What Causes Agglomeration? Evidence From Coagglomeration Patterns," *American Economic Review*, 100 (June 2010): 1195–1213.

healthy competition among cluster members. The flow of information and cooperation between firms, as well as the competition among firms in close proximity, stimulates regional innovation and propels growth. Thus, by locating in a region already settled with similar firms, a firm can also tap into established local markets for specialized labor and for other inputs.

But skeptics wonder whether the government should be trusted to identify emerging technologies and to pick the industry clusters that will lead the way. Critics of industrial policy believe that markets allocate scarce resources better than governments do. For example, European governments' costly attempt to develop the supersonic transport Concorde never became cost efficient. Airbus has also run into financial difficulties, and sponsoring governments have tried to distance themselves from the company. As a U.S. example, in the early 1980s, the U.S. government spent \$1 billion to help military contractors develop a high-speed computer circuit. But Intel, a company getting no federal aid, was the first to develop the circuit. The 2009 federal stimulus program included funds to promote green energy, such as a \$527 million loan to Solyndra, a California maker of solar panels. In 2011, that company went bankrupt, leaving taxpayers on the hook for the loan. Some other green energy companies getting federal aid also went bankrupt. The federal government's promotion of green energy sources such as solar panels and biofuels is an example of industrial policy.

There is also concern that an industrial policy could evolve into a government giveaway program. Rather than going to the most promising technologies, the money and the competitive advantages would go to the politically connected. Critics also wonder how wise it is to sponsor corporate research when beneficiaries may share their expertise with foreign companies or even build factories abroad. Most economists would prefer to let Microsoft, General Electric, Google, Facebook, or some start-up bet its own money on the important technologies of

the future. Note that the advantages of clustering create an economic impetus for firms in certain industries to group together. Most clusters form on their own, without government direction or support.

## 8-4 Final Word

Productivity and growth depend on the supply and quality of resources, the level of technology, and the rules of the game that nurture production and exchange. These elements tend to be correlated with one another. An economy with an unskilled and poorly educated workforce usually is deficient in physical capital, in technology, and in the institutional support that promotes production and exchange. Similarly, an economy with a high-quality workforce likely excels in the other sources of productivity and growth.

We should distinguish between an economy's standard of living, as measured by output per capita, and improvements in that standard of living, as measured by the growth in output per capita. Growth in output per capita can occur when labor productivity increases or when the number of workers in the economy grows faster than the population. *In the long run, productivity growth and the growth in workers relative to the growth in population will determine whether or not the United States continues to enjoy one of the world's highest standards of living.*

One closing thought: Recent research suggests that a reduction in racial and gender discrimination in the United States since 1960 has made labor markets more efficient, as African Americans and women entered professions where they could be more productive. Researchers argue that these more open labor markets, by allocating labor more efficiently, have accounted for 15–20 percent of U.S. economic growth since 1960.<sup>20</sup>

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20. Chang-Tai Hsieh et al., "The Allocation of Talent and U.S. Economic Growth," NBER Working Paper No. 18696 (January 2013).

Percent of Americans in 2011 between 25 and 64 with at least a degree beyond high school >

42%

52%

< Percent of Canadians in 2011 between 25 and 64 with at least a degree beyond high school

Percent of the world's population that lives in developing countries >

84%

\$12,700

< World GDP per capita in 2012

\$50,700

< U.S. GDP per capita in 2012



## Learning Outcomes

- 9-1 Explain what a consumption function illustrates and interpret its slope
- 9-2 Describe what can shift the consumption function up or down
- 9-3 Explain why investment varies more than consumption from year to year
- 9-4 Describe how the aggregate expenditure line determines the quantity of aggregate output demanded
- 9-5 Determine the simple spending multiplier and explain its relevance
- 9-6 Summarize the relationship between the aggregate expenditure line and the aggregate demand curve

# Aggregate Expenditure *and* Aggregate Demand