

“When driving through a neighborhood new to you, how can you guess the income of the residents?”

When driving through a neighborhood new to you, how can you guess the income of the residents? What's one of the most predictable and useful relationships in macroeconomics? Why are consumer confidence and business confidence in the economy so important? How is spending linked to income? Why did Americans spend less and save more after the financial crisis of 2008? Answers to these and other questions are addressed in this chapter, which focuses on the makeup of aggregate expenditure, especially consumption, to develop the aggregate demand curve.

Your economic success depends in part on the overall performance of the economy. When the economy grows, job opportunities expand, so your chances of finding a good job increase. When the economy contracts, job opportunities shrink, and so do your job prospects. Thus, you have a personal stake in the economy's success.

Consumption is the most important component of aggregate expenditure, accounting for about 70 percent of the total. We discuss how consumption and the other spending components relate to income in the economy. We then see how a change in the economy's price level affects aggregate expenditure. All this is aimed at getting to the economy's aggregate demand curve. In the next chapter, we develop the aggregate supply curve and see how the two curves interact to determine the economy's equilibrium levels of price and output.

What do you think?

If I were to get a raise, I would already know how I'd spend it.

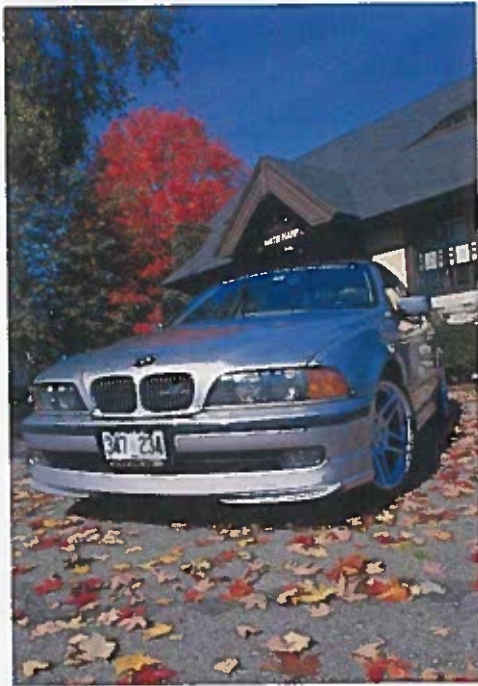
Strongly Disagree

Strongly Agree

1 2 3 4 5 6 7

Topics discussed in Chapter 9 include

- Consumption and income
- Marginal propensities to consume and to save
- The consumption function
- Income-expenditure model
- Aggregate expenditure line
- Simple spending multiplier
- Aggregate demand curve



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9-1 Consumption

What if a college friend invited you home for the weekend? On your first visit, you would get some idea of the family's standard of living. Is their house a mansion, a modest rental, or in between? Do they drive a new BMW or take the bus? The simple fact is that consumption tends to reflect income. Although some people can temporarily live beyond their means and others still have the first nickel they ever earned, in general, consumption depends on income. The positive and stable relationship between consumption and income, both for the household and for the economy as a whole, is a fundamental point of this chapter.

A key decision in the circular-flow model developed three chapters back was how much households spent and how much they saved. Consumption depends primarily on income. Although this relationship seems obvious, the link between consumption and income will help you understand how the economy works. Let's look at this link in the U.S. economy over time.

9-1a Consumption and Income

Exhibit 1 shows the relationship between consumption and income in the United States since 1959; consumption is measured along the vertical axis and disposable income along the horizontal axis. Notice that each axis measures the same units: trillions of 2009 dollars. Each year is depicted by a point that reflects two flow variables: disposable income and consumption. For example, the combination for 2000 identified by the red point, shows that when disposable income (measured along the horizontal axis) was \$8.9 trillion, consumption (measured along the vertical axis) was \$8.3 trillion.

As you can see, there is a clear and direct relationship between consumption and disposable income. You need little imagination to grasp that by connecting the dots, you could trace a line relating consumption to income. This relationship has special significance in macroeconomics.

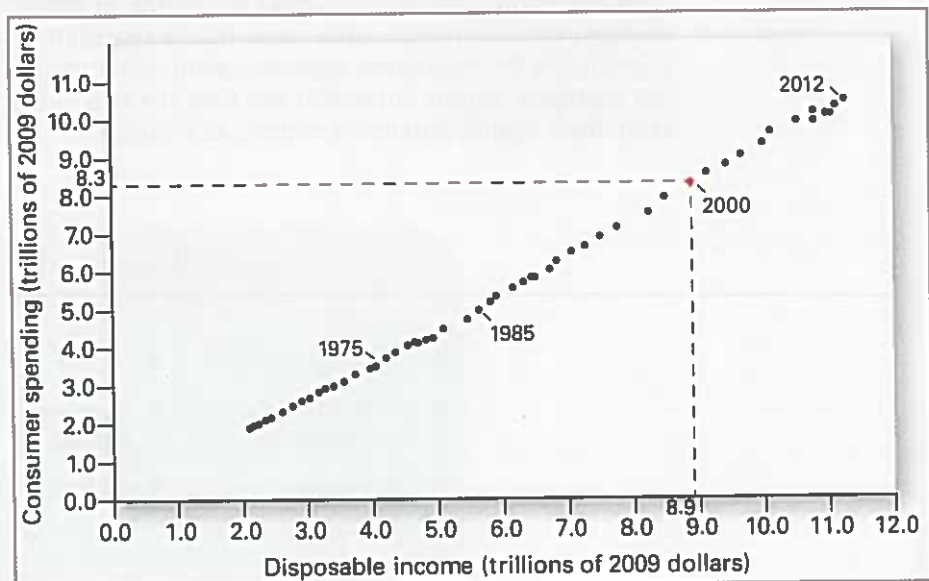
9-1b The Consumption Function

After examining the link between consumption and income, we found it to be quite stable. Based on their

“There is a clear and direct relationship between consumption and disposable income.”

Exhibit 1

U.S. Consumption Depends on Disposable Income, As Shown Here Since 1959

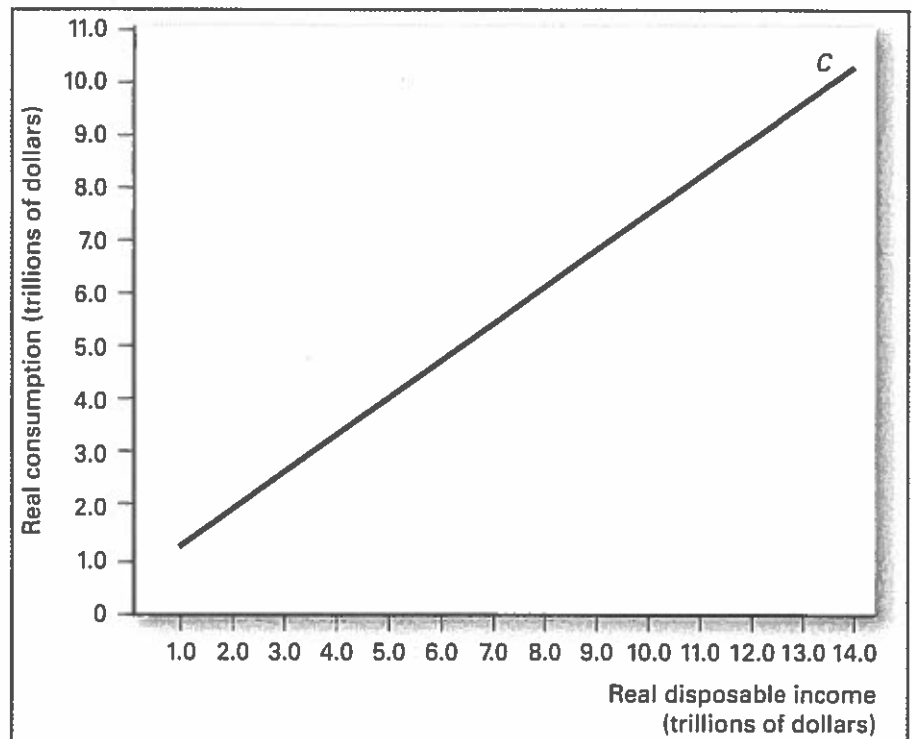


SOURCE: Based on estimates from the Bureau of Economic Analysis, U.S. Department of Commerce. For the latest data, go to <http://bea.gov/>.

disposable income, households decide how much to consume and how much to save. So consumption depends on disposable income. Consumption is the dependent variable and disposable income is the independent variable. Because consumption depends on income, we say that consumption is a function of income. Exhibit 2 presents for the economy a hypothetical consumption function, which shows that consumption increases with disposable income, assuming other determinants of consumption remain constant. Again, both consumption and disposable income are in real terms, or in inflation-adjusted dollars. Notice that this hypothetical consumption function reflects the historical relationship between consumption and income shown in Exhibit 1.

Exhibit 2

The Consumption Function



9-1c Marginal Propensities to Consume and to Save

In Chapter 1, you learned that economic analysis focuses on activity at the margin. For example, what happens to consumption if income changes by a certain amount? Suppose U.S. households receive another billion dollars in disposable income. Some is spent on consumption, and the rest is saved. The fraction of the additional income that is spent is called the marginal propensity to consume. More precisely, the marginal propensity to consume, or MPC, equals the change in consumption divided by the change in income. Likewise, the fraction of that additional income that is saved is called the marginal propensity to save. More precisely, the marginal propensity to save, or MPS, equals the change in saving divided by the change in income.

For example, if U.S. income increases by \$0.5 trillion, suppose consumption increases by \$0.4 trillion and saving by \$0.1 trillion. The marginal propensity to consume equals the change in consumption divided by the change in income. In this case, the change in consumption is \$0.4 trillion and the change in income is \$0.5 trillion, so the marginal propensity to consume is $0.4/0.5$, or $4/5$. Income not spent is saved. Saving increases by \$0.1 trillion as a result of the \$0.5 trillion

increase in income, so the marginal propensity to save equals $0.1/0.5$, or $1/5$. Because disposable income is either spent or saved, the marginal propensity to consume plus the marginal propensity to save must sum to 1. In our example, $4/5 + 1/5 = 1$. We can say more generally that $MPC + MPS = 1$.

9-1d The MPC Is the Slope of the Consumption Function

You may recall from the appendix to Chapter 1 that the slope of a straight line is the vertical distance between any two points divided by the horizontal distance between those same two points. Consider, for example, the slope between points *a* and *b* on the consumption function in Exhibit 3, where the delta symbol (Δ) means "change in." The horizontal distance between these points shows the change in disposable income, denoted

consumption function

The relationship in the economy between consumption and income, other things constant

marginal propensity to save (MPS)

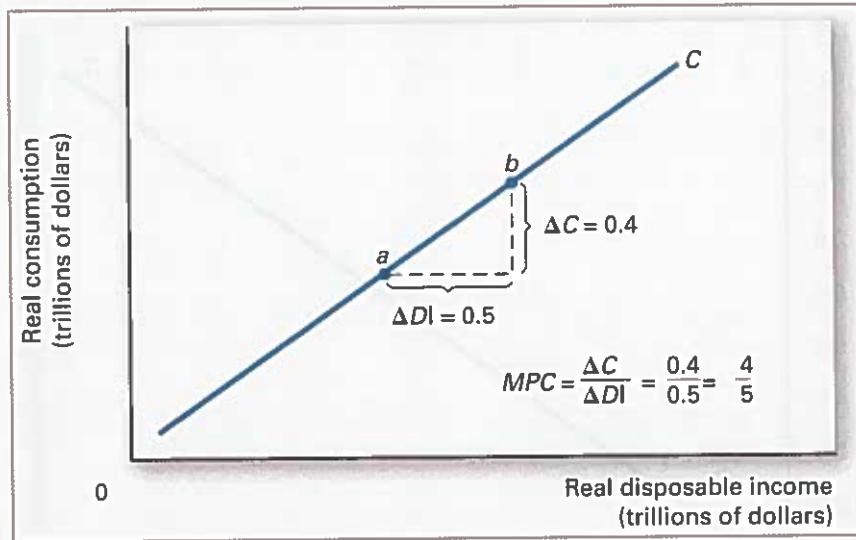
The fraction of a change in income that is saved; the change in saving divided by the change in income that caused it

marginal propensity to consume (MPC)

The fraction of a change in income that is spent on consumption; the change in consumption divided by the change in income that caused it

Exhibit 3

The Marginal Propensity to Consume and the Consumption Function



“The marginal propensity to consume is measured graphically by the slope of the consumption function.”

as ΔDI —in this case, \$0.5 trillion. The vertical distance shows the change in consumption, denoted as ΔC —in this case, \$0.4 trillion. The slope equals the vertical distance divided by the horizontal distance, or $0.4/0.5$, which equals the marginal propensity to consume of $4/5$.

Thus, the marginal propensity to consume is measured graphically by the slope of the consumption function. After all, the slope is nothing more than the increase in consumption divided by the increase in income. Because the slope of any straight line is constant everywhere along the line, the MPC for any linear, or straight-line, consumption function is constant at all incomes. We assume here for convenience that the consumption function is a straight line, though it need not be.

net wealth
The value of assets
minus liabilities



9-2 Nonincome Determinants of Consumption

Along a given consumption function, consumer spending depends on disposable income in the economy, other things constant. Now let's see what factors are held constant and how changes in them could shift the entire consumption function up or down.

9-2a Net Wealth and Consumption

Given the economy's income, an important influence on consumption is each household's **net wealth**—that is, the value of all

assets that each household owns minus any liabilities, or debts. Net wealth is a stock variable. Consumption and income are *flow* variables. Your family's assets may include a home, furnishings, automobiles, bank accounts, corporate stocks and bonds, cash, and the value of any pensions. Your family's liabilities, or debts, may include a mortgage, car loans, student loans, credit card balances, and the like.

Net wealth is assumed to be constant along a given consumption function. A decrease in net wealth would make consumers less inclined to spend and more inclined to save at each income level. To see why, suppose prices fall sharply on the stock market. Stockholders are poorer than they were, so they spend less. For example, the stock market crash of 2008 combined with the slide in home prices to cut the net wealth of U.S. households from \$64.5 trillion in 2007 to \$54.5 trillion in 2009.¹

As a result, people spent less and saved more at each income level. Consumption as a share of disposable income fell from 95 percent in 2007 to 92 percent in 2009.

1. Figures are from Board of Governors of the Federal Reserve System, *Flow of Funds Accounts of the United States: 2005 to 2009* (March 11, 2010), Table B.100, at <http://www.federalreserve.gov/RELEASES/z1/Current/annuals/a2005-2009>.

Compared to families surveyed in 2007, families surveyed in 2009 expressed a greater desire to build up savings as a buffer against hard times.² The sharp drop in stockholder wealth thus reduced consumption and contributed to the Great Recession.³

Some economists believe that changing home prices had a greater impact on consumption than changing stock market prices.⁴ Between 2006 and 2008, the average price of homes in the United States dropped 22 percent, and this drop reduced consumption at each income level. Our original consumption function is depicted as line *C* in Exhibit 4. If net wealth declines, the consumption function shifts from *C* down to *C'*, because households now spend less and save more at every income level.

Conversely, suppose stock prices increase sharply. This increase in net wealth increases the desire to spend. For example, stock prices surged in 1999, increasing stockholders' net wealth. Consumers spent 93 percent of disposable income that year compared with an average of about 90 percent during the first half of the decade. Purchases of homes and cars soared. Because of an increase in net wealth, the consumption function in Exhibit 4 shifts from *C* up to *C''*, reflecting households' desire to spend more at each income level. Research by the Federal Reserve indicates that consumer spending eventually rises or falls between three to five cents for every dollar rise or fall in the value of stock market holdings.

Again, it is a change in net wealth, not a change in disposable income, that shifts the consumption function. A change in disposable income, other things constant, means a movement along a given consumption function, not a shift of that function. Be mindful of the difference between a movement along the consumption function, which results from a change in income, and a shift of the consumption function, which results from a change in one of the nonincome determinants of consumption, such as net wealth.

•••

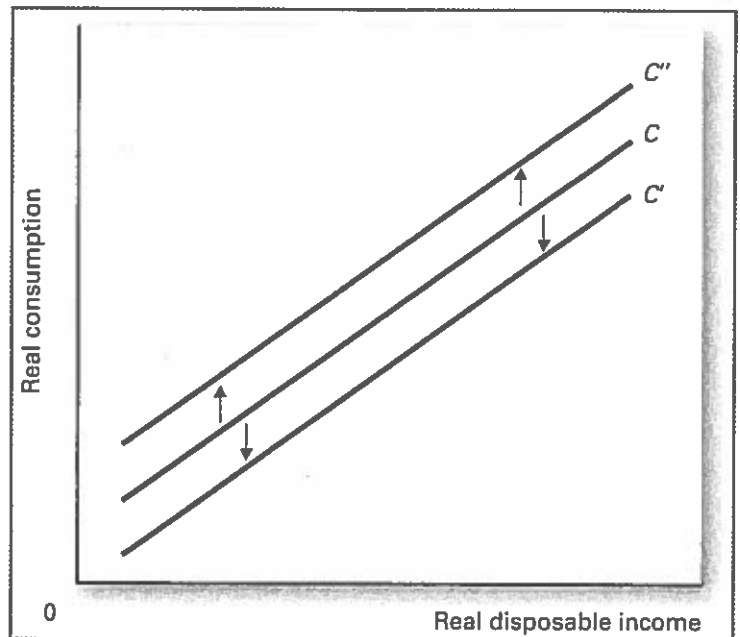
2. Jesse Bricker et al., "Drowning or Weathering the Storm? Changes in Family Finances From 2007 to 2009," NBER Working Paper 16985 (April 2011).

3. Roger Farmer, "The Stock Market Crash of 2008 Caused the Great Recession: Theory and Evidence," *Journal of Economic Dynamics and Control*, 36 (issue 5, 2012): 693-707.

4. Karl Case, John Quigley, and Robert Schiller, "Wealth Effects Revisited 1978-2009," NBER Working Paper 16848 (March 2011).

Exhibit 4

Shifts of the Consumption Function



9-2b The Price Level

Another variable that affects the consumption function is the price level prevailing in the economy. As we have seen, net wealth is an important determinant of consumption. The greater the net wealth, other things constant, the greater the consumption at each income level. Some household wealth is held as money, such as cash and bank accounts. When the price level changes, so does the real value of cash and bank accounts.

For example, suppose your wealth consists of a \$20,000 bank account. If the economy's price level increases by 5 percent, your bank account buys about 5 percent less in real terms. You feel poorer because you are poorer. To rebuild the real value of your money holdings to some desired comfort level, you decide to spend less and save more. *An increase in the price level reduces the purchasing power of money holdings, causing households to consume less and save more at each income level. So the consumption function would shift downward from C to C', as shown in Exhibit 4.*

Conversely, should the price level fall, as it did frequently before World War II, in 2009, and recently in Japan, Hong Kong, and Taiwan, the real value of money holdings increases. Households would be wealthier, so they decide to consume more and save less at each income level. For example, if the price level declined by 5 percent, your \$20,000 bank account would then buy about 5 percent more in

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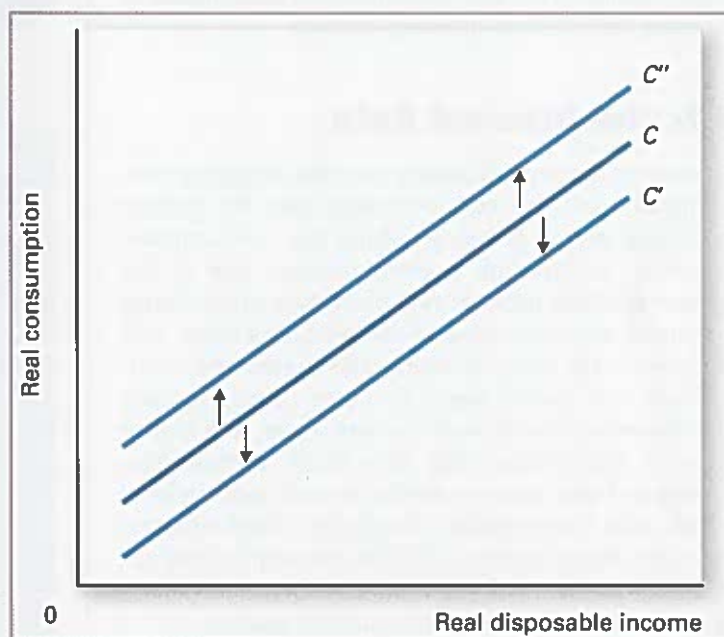
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movement along a given consumption function, which results from a change in income, and a shift of the consumption function, which results from a change in one of the factors assumed to remain constant along the consumption function.

We turn next to the other component of aggregate expenditure, with a special emphasis on investment. Keep in mind that our initial goal is to understand the relationship between aggregate expenditure and income.

9-3 Other Spending Components

While consumption is the most important spending component and the one that gets the most attention here, aggregate expenditure also includes investment, government purchases, and net exports. Here we look briefly at how each relates to income.

9-3a Investment

The second component of aggregate expenditure is investment, or, more precisely, *gross private domestic investment*. Again, by *investment* we do not mean buying stocks, bonds, or other financial assets. Investment consists of spending on (1) new factories, office buildings, malls, and new equipment, such as computers; (2) new housing; and (3) net increases to inventories. People invest now in the expectation of a future return. Because the return is in the future, a would-be investor must estimate how much a particular investment will yield this year, next year, the year after, and in all years during the productive life of the investment. Firms buy new capital goods only if they expect this investment to yield a higher return than other possible uses of their funds.

Investment Demand Curve

The market interest rate is the opportunity cost of investing in capital. More is invested when the opportunity cost of borrowing is lower, other things constant. A downward-sloping investment demand curve for the entire economy can be derived, with some qualifications, from a horizontal summation of each firm's downward-sloping investment demand curves. The economy's investment demand curve is depicted as D_I in Exhibit 5, which shows the inverse relationship between

the quantity of investment demanded and the market interest rate, other things—including business expectations—held constant. For example, in Exhibit 5, when the market rate is 8 percent, the quantity of investment demanded is \$1.0 trillion. If the interest rate rises to 10 percent, investment declines to \$0.9 trillion, and if the rate falls to 6 percent, investment increases to \$1.1 trillion.

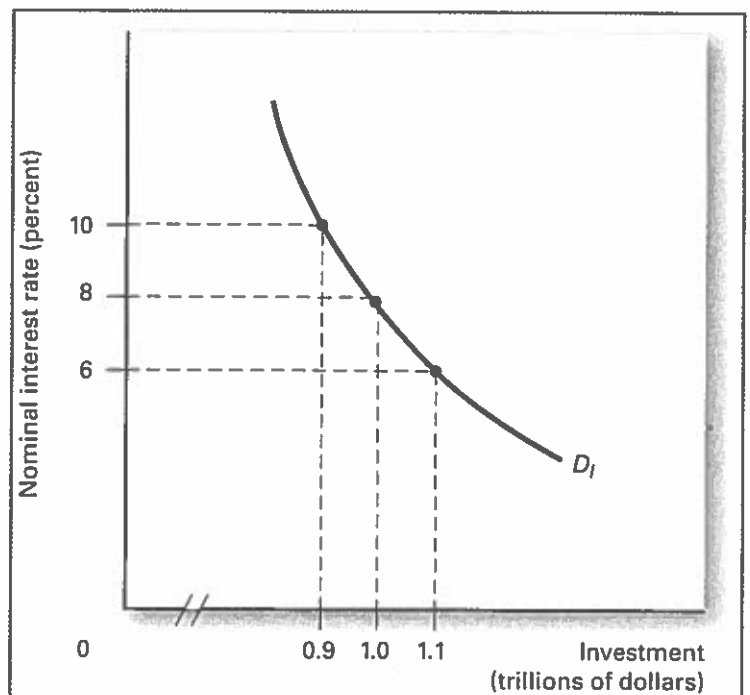
Assumed constant along the investment demand curve are business expectations about the economy. If firms grow more optimistic about profit prospects, the demand for investment increases, so the investment demand curve shifts to the right. Investment demand depends primarily on what Keynes called the "animal spirits" of business. Examples of factors that could affect business expectations, and thus investment demand, include wars, technological changes, tax changes, and destabilizing events such as terrorist attacks or financial panics.

Investment and Income

To integrate the discussion of investment with our earlier analysis of consumption, we need to know if and how investment varies with income in the economy. Whereas we were able to present evidence relating consumption to income over time, the link between investment and income is weaker. Investment in a particular year shows little relation

Exhibit 5

Investment Demand Curve for the Economy



to income that year. *Investment depends more on interest rates and business expectations than on the prevailing income level.* One reason investment is less related to income is that some investments, such as a new power plant, take years to build. And investment, once in place, is expected to last for years, sometimes decades. The investment decision is thus said to be *forward looking*, based more on expected profit than on current income in the economy.

So how does the amount firms plan to invest relate to income? The simplest assumption is that investment is unrelated to income. For example, suppose that, given current business expectations and a market interest rate of 8 percent, firms plan to invest \$1.0 trillion per year, regardless of the economy's income level.

Now that we have examined consumption and investment, let's take a look at their year-to-year variability. Although consumption averaged 70 percent of GDP and investment only 15 percent of GDP during the most recent decade, Exhibit 6 illustrates that investment varies much more from year to year than consumption does. In fact, investment spending variations account for nearly all the variability in real GDP. This is why economic forecasters

pay special attention to the business outlook and investment plans.

9-3b Government Purchases

The third component of aggregate expenditure is government purchases of goods and services.

Federal, state, and local governments buy thousands of goods and services, ranging from weapon systems to traffic lights to education. During the most recent decade, government purchases in the United States accounted for 19 percent of GDP, most of that by state

and local governments. Decisions about government purchases are largely under the control of public officials, such as the decision to build an interstate highway, boost military spending, or hire more teachers. These spending decisions do not depend directly on income in the economy. We therefore assume that government purchases are independent of income.

As noted earlier, government purchases represent only one of the two government outlays; the other is *transfer payments*, such as for Social Security, welfare benefits, and unemployment insurance. Government outlays equal government purchases plus transfer payments. Transfer payments, which make up more than a third of government outlays, are outright grants from governments to households and are

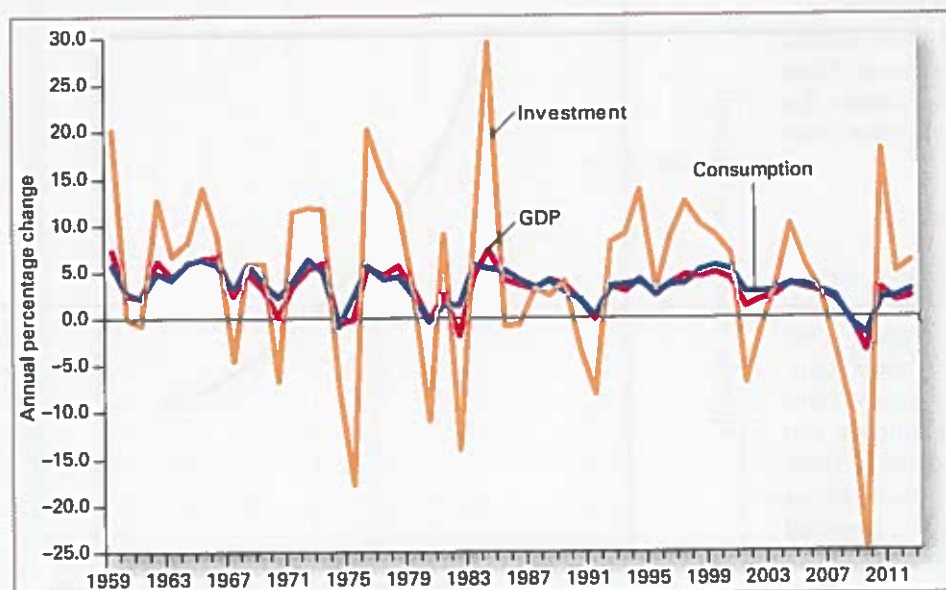
thus not considered part of aggregate expenditure. Transfer payments vary inversely with income—as income increases, transfer payments decline.

To fund government outlays, governments impose taxes. Taxes vary directly with income; as income increases, so do taxes. Net taxes equal taxes minus transfers. Because taxes tend to increase with income but transfers tend to decrease with income, for simplicity, let's assume that net taxes do not vary with income. Thus, we assume that net taxes are independent of income.

“Investment depends more on interest rates and business expectations than on the prevailing income level.”

Exhibit 6

Annual Percentage Change in U.S. Real GDP, Consumption, and Investment



SOURCE: Based on annual estimates from the Bureau of Economic Analysis, U.S. Department of Commerce. For the latest data, go to <http://bea.gov/>.



Net taxes affect aggregate spending indirectly by changing disposable income, which in turn changes consumption. We saw from the discussion of the circular flow that by subtracting net taxes, we transform real GDP into *disposable income*. Disposable income is take-home pay—the income households can spend or save. We examine the impact of net taxes in the next few chapters.

9-3c Net Exports

The rest of the world affects aggregate expenditure through imports and exports and has a growing influence on the U.S. economy. The United States, with only one-twentieth of the world's population, accounts for about one-eighth of the world's imports and one-ninth of the world's exports. How do imports and exports relate to the economy's income? When incomes rise, Americans spend more on all normal goods, including imports. Higher incomes lead to more spending on Persian rugs, French wine, Korean DVD players, German cars, Chinese toys, European

vacations, African safaris, and thousands of other foreign goods and services.

How do U.S. exports relate to the economy's income? U.S. exports depend on the income of foreigners, not on U.S. income. U.S. disposable income does not affect Europe's purchases of U.S. DVDs or Africa's purchases of U.S. grain. Because our exports are insensitive to U.S. income but our imports tend to increase with income, *net exports*, which equal the value of exports minus the value of imports, tend to decline as U.S. incomes increase. For simplicity, we will assume that net exports are independent of income.

If exports exceed imports, net exports are positive; if imports exceed exports, net exports are negative; and if exports equal imports, net exports are zero. U.S. net exports have been negative nearly every year during the past three decades.

9-4 Aggregate Expenditure and Income

The big idea so far in this chapter is that consumption depends on income, other things constant; this link is one of the most stable in all of macroeconomics. Let's build on that connection to learn how total

“If exports exceed imports, net exports are positive; if imports exceed exports, net exports are negative; and if exports equal imports, net exports are zero.”

spending in the economy changes with income. If we try to confront the economy head-on, it soon becomes a bewildering maze, which is why we make progress by starting with simple models. We continue to assume, as we did in developing the circular-flow model, that there is no capital depreciation and no business saving.

Thus, we can say that *each dollar of spending translates directly into a dollar of income*. Therefore, gross domestic product, or GDP, equals aggregate income.

9-4a The Components of Aggregate Expenditure

When income increases, consumption increases. As noted already, the marginal propensity to consume indicates the fraction of each additional dollar of income that is spent on consumption. For example, if the marginal propensity to consume is $4/5$ (four-fifths), spending increases by \$4 for every \$5 increase in income. The consumption function shows how much consumption increases with income.



PETER ADAMS/GETTY IMAGES

aggregate expenditure line

A relationship tracing, for a given price level, spending at each level of income, or real GDP; the total of $C + I + G + (X - M)$ at each level of income, or real GDP

income-expenditure model

A relationship that shows how much people plan to spend at each income level; this model identifies, for a given price level, where the amount people plan to spend equals the amount produced in the economy

For simplicity, we continue to assume that investment, government purchases, and net exports are independent of the economy's income level.

If we add to the consumption function, investment, government purchases, and net exports, we get the aggregate expenditure line presented in Exhibit 7 as $C + I + G + (X - M)$. Real GDP is measured on the horizontal axis, and aggregate expenditure is measured on the vertical axis. The **aggregate expenditure line** shows how much households, firms,

governments, and the rest of the world plan to spend on U.S. output at each level of real GDP, or real income, assuming a given price level in the economy. Again, the only spending component that varies with real GDP is consumption. Because only consumption varies with income, the slope of the aggregate expenditure line equals the marginal propensity to consume. Please give that a little thought.

9-4b Real GDP Demanded

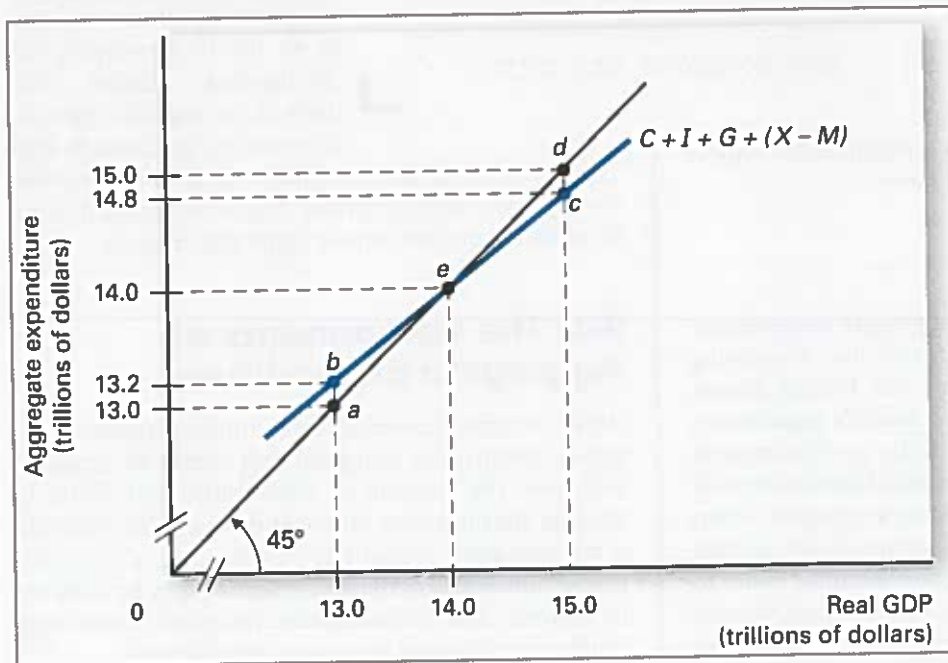
Let's begin developing the aggregate demand curve by asking how much aggregate output would be demanded at a given price level. By finding the quantity demanded at a given price level, we'll end up identifying a single point on the aggregate demand curve. We begin by considering the relationship between aggregate spending in the economy and aggregate income. To get us started, suppose that the price level in the economy is 110, or 10 percent higher than in the base-year price level. We want to find out how much is spent at various levels of real income, or real GDP. By *real GDP*, we mean GDP measured in terms of real goods and services produced. Exhibit 7 combines the relationships introduced earlier—consumption, investment, government purchases, and net exports. Although the entries are hypothetical, they bear some relation to current levels in the U.S. economy.

Real GDP, measured along the horizontal axis in Exhibit 7, can be viewed in two ways—as the value of *aggregate output* and as the *aggregate income* generated by that output. Because real GDP or aggregate income

is measured on the horizontal axis, and aggregate expenditure is measured on the vertical axis, this graph is often called the **income-expenditure model**. To gain perspective on the relationship between income and expenditure, we use a handy analytical tool: the 45-degree ray from the origin. The special feature of this line is that any point along it is the same distance from each axis. Thus, the 45-degree line identifies all points where spending equals real GDP. Aggregate output demanded at a given price level occurs where aggregate expenditure, measured along the vertical axis, equals

Exhibit 7

Deriving the Real GDP Demanded for a Given Price Level



real GDP, measured along the horizontal axis. In Exhibit 7, this occurs at point *e*, where the aggregate expenditure line intersects the 45-degree line. At point *e*, the amount people spend equals the amount produced. We conclude that, at the given price level of 110, the quantity of real GDP demanded equals \$14.0 trillion.

9-4c What If Spending Exceeds Real GDP?

To find the real GDP demanded at the given price level, consider what happens if real GDP is initially less than \$14.0 trillion. As you can see from Exhibit 7, when real GDP is less than \$14.0 trillion, the aggregate expenditure line is above the 45-degree line, indicating that spending exceeds the amount produced (again, give this a little thought). For example, if real GDP is \$13.0 trillion, spending is \$13.2 trillion, as indicated by point *b* on the aggregate expenditure line, so spending exceeds output by \$0.2 trillion. When the amount people want to spend exceeds the amount produced, something has to give. Ordinarily what gives is the price, but remember that we are seeking the real GDP demanded for a given price level, so the price level is assumed to remain constant, at least for now. What gives in this model are inventories. Unplanned reductions in inventories cover the \$0.2 trillion shortfall in output. Because firms can't draw down inventories indefinitely, inventory reductions prompt firms to produce more output. That increases employment and consumer income, leading to more spending. As long as spending exceeds output, firms increase production to make up the difference. This process of more output, more income, and more spending continues until spending equals real GDP, an equality achieved at point *e* in Exhibit 7.

When output reaches \$14.0 trillion, spending exactly matches output, so no unintended inventory adjustments occur. More importantly, when output reaches \$14.0 trillion, the amount people want to spend equals the amount produced and equals the total income generated by that production. Earlier we assumed a price level of 110. Therefore, \$14.0 trillion is the real GDP demanded at that price level.

9-4d What If Real GDP Exceeds Spending?

To reinforce the logic of the model, consider what happens when the amount produced exceeds the

“Unplanned inventory buildups cause firms to cut production until the amount they produce equals aggregate spending.”

amount people want to spend. Notice in Exhibit 7 that, to the right of point *e*, spending indicated on the aggregate expenditure line falls short of production. For example, suppose real GDP is \$15.0 trillion. Spending, as indicated by point *c* on the aggregate expenditure line, is \$0.2 trillion less than real GDP, indicated by point *d* on the 45-degree line. Because real GDP exceeds spending, unsold goods accumulate. This swells inventories by \$0.2 trillion more than firms planned on. Rather than allow inventories to pile up indefinitely, firms cut production, which reduces employment and income. As an example of such behavior, a recent news account read, “General Motors will idle two assembly plants in a move to trim inventories in the wake of slowing sales.” *Unplanned inventory buildups* cause firms to cut production until the amount they produce equals aggregate spending,

which occurs, again, where real GDP is \$14.0 trillion. Given the price level, real GDP demanded is found where the amount people spend equals the amount produced. For a given price level, there is only one point

“Inventory reductions prompt firms to produce more output.”

along the aggregate expenditure line at which spending equals real GDP.

We have now discussed the forces that determine real GDP demanded for a given price level. In the next section, we examine changes that can alter spending plans.

9-5 The Simple Spending Multiplier

We just used the aggregate expenditure line to find real GDP demanded for a particular price level. In this section, we continue to assume that the price level stays the same as we trace the effects of other changes that could affect spending plans. Like a stone thrown into a still pond, the effects of any change in spending ripple through the economy, generating changes in aggregate output that could exceed the initial change in spending.

9-5a An Increase in Spending

Let's consider the effect of an increase in one of the components of spending. Suppose that firms become more optimistic about profit prospects and decide to increase their investment from \$1.0 trillion to \$1.1 trillion per year, other things constant.

What happens to real GDP demanded? An instinctive response is to say that real GDP demanded increases by \$0.1 trillion as well. The idea of the circular flow is central to an understanding of the adjustment process.

Recall that production yields income, which generates spending. We can think of each trip around the circular flow as a "round" of income and spending.

Round One

OK, so planned spending now exceeds the amount produced by \$0.1 trillion, or \$100 billion. Initially, firms supply this increased investment spending by drawing down their inventories. John Deere, for example, satisfies the increased demand for tractors by drawing down tractor inventories. But reduced inventories prompt firms to expand production by \$100 billion. This generates \$100 billion more income. The income-generating process does not stop there, however, because those who earn this additional income spend some of it and save the rest, leading to round two of spending and income.

Round Two

Given a marginal propensity to consume of 0.8, those who earn the additional \$100 billion spend \$80 billion on toasters, backpacks, gasoline, restaurant meals, and thousands of other goods and services. They save the other \$20 billion. Firms respond by increasing their output by \$80 billion. Thus, the \$100 billion in new income increases real GDP by \$80 billion during round two.

Round Three and Beyond

We assume that four-fifths of the \$80 billion earned during round two gets spent during round three and one-fifth gets saved. Thus, \$64 billion is spent during round three on still more



goods and services. The remaining \$16 billion gets saved. The added spending causes firms to increase output by \$64 billion. Round three's additional production generated \$64 billion more income, which sets up subsequent rounds of spending, output, and income. As long as spending exceeds output, production increases, thereby creating more income, which generates still more spending.

Exhibit 8 summarizes the multiplier process, showing the first three rounds, round 10, and the cumulative effect of all rounds. The new spending from each round is shown in the second column, and the accumulation of new spending appears in the third column. For example, the cumulative new spending as of the third round totals \$244 billion—the sum of the first three rounds of spending (\$100 billion + \$80 billion + \$64 billion). The new saving from each round appears in the fourth column, and the accumulation of new saving appears in the final column. All this develops with the price level assumed to remain unchanged.

9-5b Using the Simple Spending Multiplier

In our model, consumers spend four-fifths of the change in income each round, with each fresh round equal to the change in spending from the previous round times the marginal propensity to consume, or the MPC. This goes on round after round, leaving less and less to fuel more spending and income. At some point, the new rounds of income and spending become so small that they disappear and the process stops. The question is, by how much does total spending increase? We can get some idea of the total by working through a limited number of rounds. For example, as shown in Exhibit 8, total new spending after 10 rounds sums to \$446.3 billion. But calculating the exact total for all rounds would require us to work through an infinite number of rounds—an impossible task.

Fortunately, we can borrow a shortcut from mathematicians, who have shown that the sum of an infinite number of rounds, each of which is MPC times the previous round, equals $1/(1 - MPC)$ times the initial change. Translated,

“As long as spending exceeds output, production increases, thereby creating more income, which generates still more spending.”

Exhibit 8

Tracking the Rounds of Spending Following a \$100 Billion Increase in Investment (billions of dollars)

Round	New Spending This Round	Cumulative New Spending	New Saving This Round	Cumulative New Saving
1	100	100	—	—
2	80	180	20	20
3	64	244	16	36
⋮	⋮	⋮	⋮	⋮
10	13.4	446.3	3.35	86.6
⋮	⋮	⋮	⋮	⋮
∞	0	500	0	100

the cumulative spending change equals $1/(1 - MPC)$, which, in our example, was $1/0.2$, or 5, times the initial increase in spending, which was \$100 billion. In short, the increase in investment eventually boosts real GDP demanded by 5 times \$100 billion, or \$500 billion—and again, all this happens with the price level assumed to remain unchanged.

The simple spending multiplier is the factor by which real GDP demanded changes for a given initial change in spending.

$$\text{Simple spending multiplier} = \frac{1}{1 - MPC}$$

The simple spending multiplier provides a shortcut to the total change in real GDP demanded. This multiplier depends on the MPC. The larger the MPC, the larger the simple spending multiplier. That makes sense—the more people spend from each dollar of fresh income, the more total spending increases. For example, if the MPC was 0.9 instead of 0.8, the denominator of the multiplier formula would equal 1.0 minus 0.9, or 0.1, so the multiplier would be $1/0.1$, or 10. With an MPC of 0.9, a \$0.1 trillion investment increase would boost real GDP demanded by \$1.0 trillion. On the other hand, an MPC of 0.5 would yield a denominator of 0.5 and a multiplier of 2. So a \$0.1 trillion investment increase would raise real GDP demanded by \$0.2 trillion.

Let's return to what started all this. The \$0.1 trillion rise in investment raised real GDP demanded by \$0.5 trillion. Note that real GDP demanded would have increased by the same amount if consumers had decided to spend \$0.1 trillion more at each income level. Aggregate demand likewise would have increased if government purchases or net exports increased

“A higher price level reduces consumption, investment, and net exports, which all reduce aggregate spending.”

\$0.1 trillion at each income level. The change in aggregate output demanded depends on how much the aggregate expenditure line shifts, not on which spending component causes the shift.

In our example, investment increased by \$0.1 trillion in the year in question. If this greater investment is not sustained the following year, real GDP demanded would fall back. For example, if investment returns to its initial level, other things constant, real GDP demanded would return to \$14.0 trillion. Finally, recall from the earlier discussion that the MPC and the MPS sum to 1, so 1 minus the MPC equals the MPS. With this information, we can define the simple spending multiplier in terms of the MPS as follows:

$$\text{Simple spending multiplier} = \frac{1}{1 - MPC} = \frac{1}{MPS}$$

We can see that the smaller the MPS, the less leaks from the spending stream as saving. Because less is saved, more gets spent each round, so the spending multiplier is greater. Incidentally, this spending multiplier is called “simple” because consumption is the only spending component that varies with income.

9-6 The Aggregate Demand Curve

In this chapter, we have identified the quantity demanded for a given price level. But what happens if the price level changes? As you will see, for each price level, there is a unique aggregate expenditure line, which yields a unique real GDP demanded. By altering the price level, we find a different real GDP demanded. By pairing a price level with the real GDP demanded at that price level, we can derive the aggregate demand curve.

9-6a A Higher Price Level

What is the effect of a higher price level on the quantity of real GDP demanded? Recall that consumers hold many assets that are fixed in dollar terms, such as currency and bank accounts.

simple spending multiplier

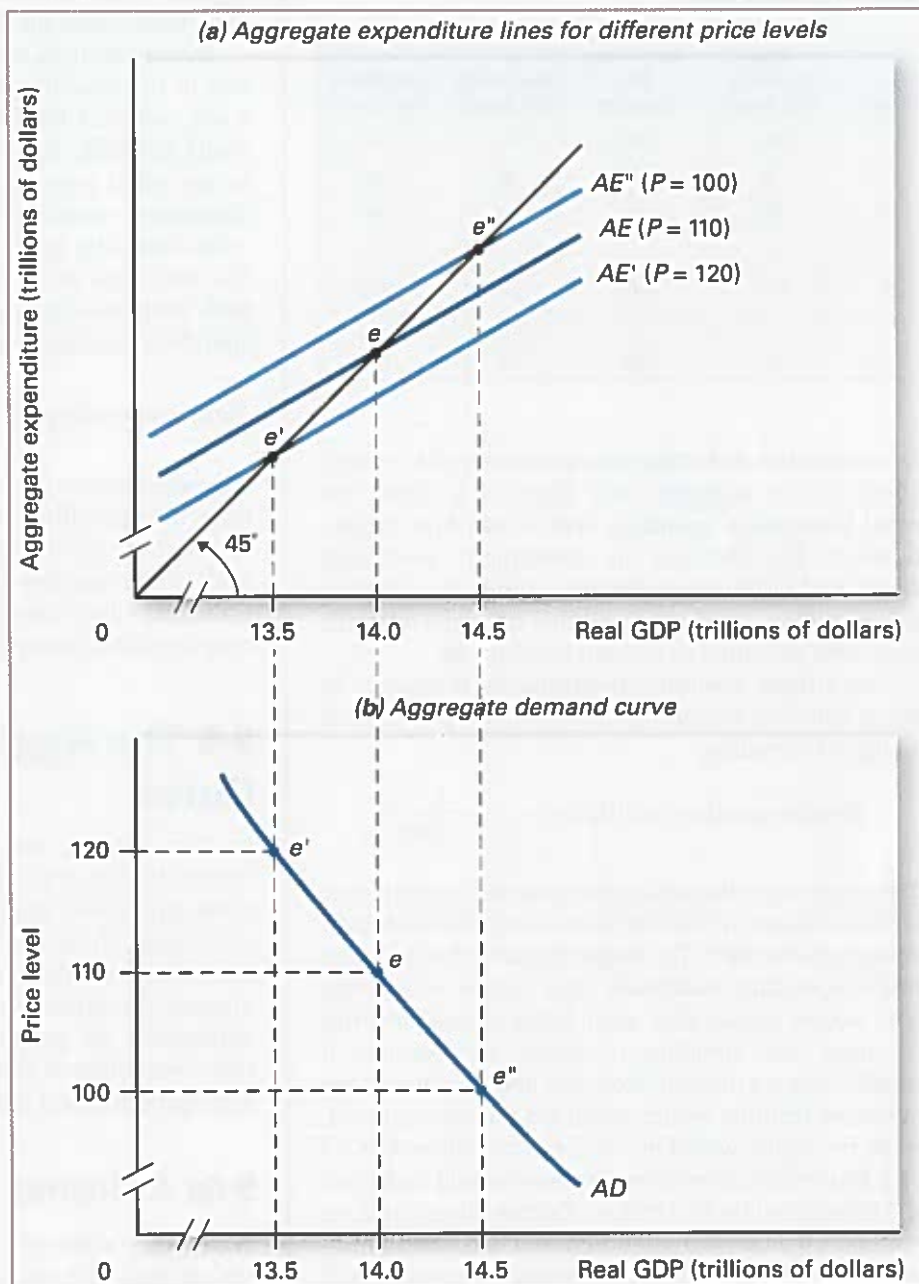
The ratio of a change in real GDP demanded to the initial change in spending that brought it about; the numerical value of the simple spending multiplier is $1/(1 - MPC)$; called “simple” because only consumption varies with income

A higher price level decreases the real value of these money holdings. This cuts consumer wealth, making people less willing to spend at each income level. For reasons that will be explained in a later chapter, a higher price level also tends to increase the market interest rate, and a higher interest rate reduces investment. Finally, a higher U.S. price level, other things constant, means that foreign goods become relatively cheaper for U.S. consumers, and U.S. goods become more expensive abroad. So imports rise and exports fall, decreasing net exports. Therefore, a higher price level reduces consumption, investment, and net exports, which all reduce aggregate spending. This decrease in spending reduces real GDP demanded.

Exhibit 9 represents two different ways of expressing the effects of a change in the price level on real GDP demanded. Panel (a) offers the income-expenditure model, and panel (b) offers the aggregate demand curve, showing the inverse relationship between the price level and real GDP demanded. The idea is to find the real GDP demanded for a given price level in panel (a), and then show that price-quantity combination as a point on the aggregate demand curve in panel (b). The two panels measure real GDP on the horizontal axes. At the initial price level of 110 in panel (a), the aggregate expenditure line, now denoted simply as AE , intersects the 45-degree line at point e to yield real GDP demanded of \$14.0 trillion. Panel (b) shows more directly the link between real GDP demanded and the price level. As you can see, when the price level is 110, the quantity of real GDP demanded is \$14.0 trillion. This combination is identified by point e on the aggregate demand curve.

Exhibit 9

Changing the Price Level to Find the Aggregate Demand Curve



What if the price level increases from 110 to, say, 120? As you've just learned, an increase in the price level reduces consumption, investment, and net exports. This reduction in spending is reflected in panel (a) by a downward shift of the aggregate expenditure line from AE to AE' . As a result, real GDP demanded declines from \$14.0 trillion to \$13.5 trillion. Panel (b) shows that an increase in the price level from 110 to 120 decreases real GDP demanded from \$14.0 trillion to \$13.5 trillion, as reflected by the movement from point e to point e' .

9-6b A Lower Price Level

The opposite occurs if the price level falls. At a lower price level, the value of bank accounts, currency, and other money holdings increases. Consumers on average are wealthier and thus spend more at each income level. A lower price level also tends to decrease the market interest rate, which increases investment. Finally, a lower U.S. price level, other things constant, makes U.S. products cheaper abroad and foreign products relatively more expensive here, so exports increase and imports decrease. *Because of a decline in the price level, consumption, investment, and net exports increase at each income level.*

Refer again to Exhibit 9 and suppose the price level declines from 110 to, say, 100. This increases spending at each income level,

as reflected by an upward shift of the spending line from AE to AE'' in panel (a). An increase in spending increases real GDP demanded from \$14.0 trillion to \$14.5 trillion, as indicated by the intersection of the top aggregate expenditure line with the 45-degree line at point e'' . This same price decrease can be viewed more directly in panel (b). As you can see, when the price level decreases to 100, real GDP demanded increases to \$14.5 trillion.

The aggregate expenditure line and the aggregate demand curve present real output from different perspectives. The aggregate expenditure line shows, for a given price level, how spending relates to income, or the amount produced in the economy. Real GDP demanded is found where spending equals income, or the amount produced. The aggregate demand curve shows, for various price levels, the quantities of real GDP demanded.

9-6c The Multiplier and Shifts in Aggregate Demand

Now that you have some idea of how changes in the price level shift the aggregate expenditure line to generate the aggregate demand curve, let's reverse

course and return to the situation where the price level is assumed to remain constant. What we want to do now is trace through the effects of a shift of a spending component on aggregate demand, assuming the price level does not change. For example, suppose that a jump in business confidence spurs a \$0.1 trillion increase in investment at each real GDP level. Each panel of Exhibit 10 shows a different way of expressing the effects of an increase in spending on real GDP demanded, assuming the price level remains unchanged. Panel (a) presents the income-expenditure model and panel (b), the aggregate demand model. Again, the two panels measure real GDP on the horizontal axes. At a price level of 110 in panel (a), the aggregate expenditure line, $C + I + G + (X - M)$, intersects the 45-degree line at point e to yield \$14.0 trillion in real GDP demanded. Panel (b) shows

more directly the link between real GDP demanded and the price level. As you can see, when the price level is 110, real GDP demanded is \$14.0 trillion, identified as point e on the aggregate demand curve.

Exhibit 10 shows how a shift of the aggregate expenditure line relates to a shift of the aggregate demand curve, given a constant price level. In panel (a), a \$0.1 trillion increase in investment shifts the aggregate expenditure line up by \$0.1 trillion. Because of the multiplier effect, real GDP demanded climbs from \$14.0 trillion to \$14.5 trillion. Panel (b) shows the effect of the increase in spending on the aggregate demand curve, which shifts to the right, from AD to AD' . At the prevailing price level of 110, real GDP demanded increases from \$14.0 trillion to \$14.5 trillion as a result of the \$0.1 trillion increase in investment.

As noted earlier in the chapter, the simple spending multiplier is the ratio of a change in real GDP demanded to the initial change in spending that brought it about. Here the change in real GDP demanded is \$0.5 trillion, and the change that brought it about is the \$0.1 trillion increase in investment. So the simple spending multiplier is 5.

Our discussion of the simple spending multiplier exaggerates the actual effect we might expect. For



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price-quantity combinations generate the aggregate demand curve; and (3) at a given price level, changes in spending plans shift the aggregate demand curve.

The simple multiplier provides a crude but exaggerated idea of how a change in spending plans affects real GDP demanded.

70% < Consumption's share of U.S. GDP in the last decade

15% < Investment's share of U.S. GDP in the last decade

\$64.5 trillion < Net worth of U.S. Households in 2007

Net worth of U.S. Households in 2009 after the global financial crisis >

\$54.5 trillion

95% < Consumption as a share of U.S. disposable income in 2007

Consumption as a share of U.S. disposable income in 2009 after the global financial crisis >

92%

Aggregate Supply

Learning Outcomes

- 10-1** Explain what determines the shape and position of the short-run aggregate supply curve
- 10-2** Describe the market forces that push the economy toward its potential output in the long run
- 10-3** Explain why shifts of the aggregate demand curve change the price level in the long run but do not change potential output
- 10-4** Summarize what can shift an economy's potential output in the long run

“When the economy is already operating at full employment, how can it produce more?”

What is your normal capacity for academic work, and when do you exceed that effort? When the economy is already operating at full employment, how can it produce more? What valuable piece of information do employers and workers lack when they negotiate wages? Why do employers and workers fail to agree on pay cuts that could save jobs? These and other questions are answered in this chapter, which develops the aggregate supply curve in the short run and in the long run.

Up to this point, we have focused on aggregate demand. We have not yet examined in any detail aggregate supply, a much-debated topic. The debate involves the shape of the aggregate supply curve and the reasons for that shape. This chapter develops

a single, coherent approach to aggregate supply. Although the focus continues to be on economic aggregates, you should keep in mind that aggregate supply reflects billions of production decisions

made by millions of individual resource suppliers and firms in the economy. Each firm operates in its own little world, dealing with its own suppliers and customers, and keeping a watchful eye on existing and potential competitors.

Yet each firm recognizes that success also depends on the performance of the economy as a whole. The theory of aggregate supply described here must be consistent with both the microeconomic behavior of individual suppliers and the macroeconomic behavior of the economy.

What do you think?

I would accept a pay cut rather than be laid off from work.

Strongly Disagree

Strongly Agree

1

2

3

4

5

6

7

Topics discussed in Chapter 10 include

- Expected price level and long-term contracts
- Potential output
- Short-run aggregate supply
- Long-run aggregate supply
- Expansionary gap
- Recessionary gap
- Changes in aggregate supply
- Beneficial supply shocks
- Adverse supply shocks

10-1 Aggregate Supply in the Short Run

Aggregate supply is the relationship between the economy's price level and the amount of output firms are willing and able to supply, with other things constant. Assumed constant along a given aggregate supply curve are resource prices, the state of technology, and the rules of the game—the formal and informal institutions that structure production incentives, such as the system of property rights, patent laws, tax systems, respect for laws, and the customs and conventions of the marketplace. The greater the supply of resources, the better the technology, and the more effective the rules of the game, the greater the aggregate supply. Let's begin with the key resource—labor.



10-1a Labor and Aggregate Supply

Labor is the most important resource, accounting for about 70 percent of production costs. The supply of labor in an economy depends on the size and abilities of the adult population and their preferences for work versus leisure. Along a given labor supply curve—that is, for a given adult population with given abilities and preferences for work and leisure—the quantity of labor supplied depends on the wage. The higher the wage, other things constant, the more labor supplied.

So far, so good. But things start getting complicated once we recognize that the purchasing power of any given nominal wage depends on the economy's price level. The higher the price level, the less any given money wage purchases, so the less attractive that wage is to workers. Consider wages and the price level over time. Suppose a worker in 1970 was offered a job paying \$20,000 per year. That salary may not impress you today, but its real purchasing power back then would exceed \$80,000 in

nominal wage

The wage measured in dollars of the year in question; the dollar amount on a paycheck

real wage

The wage measured in dollars of constant purchasing power; the wage measured in terms of the quantity of goods and services it buys

today's dollars. Because the price level matters, we must distinguish between the **nominal wage**, or money wage, which measures the wage in dollars of the year in question (such as 1970), and the **real wage**, which measures the wage in constant dollars—that is, dollars measured by the goods and services they buy. A higher real wage means workers can buy more goods and services.

Both workers and employers care more about the real wage than about the nominal wage. The problem is that nobody knows for sure how the price level will change during the life of the wage agreement, so labor contracts must be negotiated in terms of nominal wages, not real wages. Some resource prices, such

as wages set by long-term contracts, remain in force for extended periods, often for two or three years. Workers as well as other resource suppliers must therefore negotiate based on the *expected* price level.

Even where there are no explicit labor contracts, there is often an implicit agreement that the wage, once negotiated, will not change for a while. For example, in many firms the standard practice is to revise wages annually. So wage agreements may be either *explicit* (based on a labor contract) or *implicit* (based on labor market practices). These explicit and implicit agreements are difficult to renegotiate while still in effect, even if the price level in the economy turns out to be higher or lower than expected.

10-1b Potential Output and the Natural Rate of Unemployment

Here's how resource owners and firms negotiate resource price agreements for a particular period, say, a year. Firms and resource suppliers expect a certain price level to prevail in the economy during the year. You could think of this as the *consensus* view for the upcoming year. Based on consensus expectations, firms and resource suppliers reach agreements on resource prices, such as wages. For example, firms and workers may expect the price level to increase 3 percent next year, so they agree on a nominal wage increase of 4 percent, which would increase the real wage by 1 percent. If these price-level expectations are realized, the agreed-on nominal wage translates into the expected real wage, so everyone is satisfied with the way things work out—after all, that's what

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they willingly negotiated. When the actual price level turns out as expected, we call the result the economy's potential output. *Potential output is the amount produced when there are no surprises about the price level.* So, at the agreed-on real wage, workers are supplying the quantity of labor they want and firms are hiring the quantity of labor they want. Both sides are content with the outcome.

We can think of potential output as the economy's maximum sustainable output, given the supply of resources, the state of technology, and the formal and informal production incentives offered by the rules of the game. Potential output is also referred to by other terms, including the *natural rate of output* and the *full-employment rate of output*.

The unemployment rate that occurs when the economy produces its potential GDP is called the **natural rate of unemployment**. That rate prevails when cyclical unemployment is zero. When the economy produces its potential output, the number of job openings equals the number of people unemployed for frictional, structural, and seasonal reasons. Widely accepted estimates of the natural rate of unemployment range from about 4 percent to about 6 percent of the labor force. Some economists believe that, in the aftermath of the Great Recession, the natural rate of unemployment increased toward the higher end of that range.¹

Potential output provides a reference point, an anchor, for the analysis in this chapter. *When the price-level expectations of both workers and firms are fulfilled, the economy produces its potential output.* Complications arise, however, when the actual price level differs from expectations, as we'll see next.

10-1c What If the Actual Price Level Is Higher Than Expected?

As you know, each firm's goal is to maximize profit. Profit equals total revenue minus total cost. Suppose workers and firms agree on a wage. What if the economy's price level turns out to be higher than expected? What happens in the short run to real GDP supplied? The short run in macroeconomics is a period during which some resource prices remain fixed by explicit or implicit

•••

1. See, for example, Murat Tasci and Saeed Zaman, "Unemployment After the Recession: A New Natural Rate?" *Economic Commentary*, September 2010, at <http://www.clevelandfed.org/research/commentary/2010/2010-11.cfm>.

“Potential output is also referred to by other terms, including the *natural rate of output* and the *full-employment rate of output*.”



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agreements. Does output in the short run exceed the economy's potential, fall short of that potential, or equal that potential?

Because the prices of many resources are fixed for the duration of contracts, firms welcome a higher than expected price level. After all, the selling prices of their products, on average, are higher than expected, while the costs of at least some of the resources they employ

potential output
The economy's maximum sustainable output, given the supply of resources, technology, and rules of the game; the output level when there are no surprises about the price level

natural rate of unemployment
The unemployment rate when the economy produces its potential output

short run
In macroeconomics, a period during which some resource prices, especially those for labor, are fixed by explicit or implicit agreements

remain constant. A price level that is higher than expected results in a higher profit per unit, so firms have a profit incentive in the short run to increase production beyond the economy's potential level.

At first it might appear odd to talk about producing beyond the economy's potential, but remember that potential output means not zero

unemployment but the natural rate of unemployment. Even in an economy producing its potential output, there is some unemployed labor and some unused production capacity. If you think of potential GDP as the economy's *normal capacity*, you get a better idea of how production can temporarily exceed that capacity. For example, during World War II, the United States pulled out all the stops to win the war. Factories operated around the clock. Overtime was common. The unemployment rate dropped below 2 percent—well under its natural rate. People worked longer and harder for the war effort than they normally would have.

Think about your own study habits. During most of the term, you display your normal capacity for academic work. As the end of the term draws near, however, you may shift into high gear, finishing term papers, studying late into the night for final exams, and generally running yourself ragged trying to pull things together. During those final frenzied days of the term, you study beyond your normal capacity, beyond the schedule you follow on a regular or sustained basis. We often observe workers exceeding their normal capacity for short bursts: fireworks technicians around the Fourth of July, accountants at tax time, farmers at harvest time, and elected officials toward the end of a campaign or legislative session. Similarly, firms and their workers are able, in the short run, to push output beyond the economy's potential. But that higher rate of output is not normal and not sustainable.

10-1d Why Costs Rise When Output Exceeds Potential

The economy is flexible enough to expand output beyond potential GDP, but as output expands, the cost of additional output increases. Although many workers are bound by contracts, wage agreements may require overtime pay for extra hours or weekends. As the economy expands and the unemployment rate declines, additional workers are harder to find. Retirees, homemakers, and students may require extra pay to draw them into the labor force. If few additional workers are available or if workers require additional pay for overtime, the nominal cost of labor increases as output expands in the short run, even though most wages remain fixed by implicit or explicit agreements.

As production increases, the demand for nonlabor resources increases too, so the prices of those resources in markets where prices are flexible—such as the market for oil—will increase, reflecting their greater scarcity. Also, as production increases, firms use their machines and trucks more intensively, so equipment wears out faster and is more prone to breakdowns. Thus, the nominal cost per unit of output rises when production is pushed beyond the economy's potential output. But *because some resource prices are fixed by contracts, the economy's price level rises faster than the per-unit production cost, so firms still find it profitable to increase the quantity supplied.*

When the economy's actual price level exceeds the expected price level, the real value of an agreed-on nominal wage declines. We might ask why workers would be willing to increase the quantity of labor they supply when the price level is higher than expected. One answer is that labor agreements require workers to do so, at least until workers have a chance to renegotiate.

In summary: If the price level is higher than expected, firms have a profit incentive to increase the quantity of goods and services supplied. At higher rates of output, however, the per-unit cost of additional output increases. Firms expand output as long as the revenue from additional production exceeds the cost of that production.

“A price level that is higher than expected results in a higher profit per unit, so firms have a profit incentive in the short run to increase production beyond the economy's potential level.”

10-1e What If the Actual Price Level Is Lower Than Expected?

We have learned that if the price level is greater than expected, firms expand output in the short run, but as they do, the marginal cost of production increases. Now let's look at the effects of a price level that turns out to be lower than expected. Again, suppose that firms and resource suppliers have reached an agreement based on an expected price level. If the price level turns out to be lower than expected, firms find production less profitable, as reflected in the recent headline, “Consumer Price Drop Squeezes Profits.”² The prices firms receive for their output are on average lower than they expected, yet many of their production costs, such as nominal wages, do not fall.

Because production is less profitable when prices are lower than expected, firms reduce their

2. Sudeep Reddy and Dana Mattioli, “Consumer Price Drop Squeezes Profits,” *Wall Street Journal*, 18 June 2010.



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quantity supplied, so the economy's output is below its potential. As a result, some workers are laid off, some work fewer hours, and unemployment exceeds the natural rate. Not only is less labor employed, but machines go unused, delivery trucks sit idle, and entire plants may shut down—for example, automakers sometimes halt production for weeks. Cyclical unemployment increases.

Just as some costs increase in the short run when output is pushed beyond the economy's potential, some costs decline when output falls below that potential. As resources become unemployed, resource prices decline in markets where prices are flexible.

To Review: If the economy's price level turns out to be higher than expected, firms maximize profit by increasing the quantity supplied beyond the economy's potential output. As output expands, the per-unit cost of additional production increases, but firms expand production as long as prices rise more than costs. If the economy's price level turns out to be lower than expected, firms produce less than the economy's potential output because prices fall more than costs. All of this is a long way of saying that *there is a direct relationship in the short run between the actual price level and real GDP supplied.*

10-1f The Short-Run Aggregate Supply Curve

What we have been describing so far traces out the short-run aggregate supply (SRAS) curve, which shows the relationship between the actual price level and real GDP supplied, other things constant. Again,

“There is a direct relationship in the short run between the actual price level and real GDP supplied.”

the *short run* in this context is the period during which some resource prices, especially those for labor, are fixed by implicit or explicit agreements. For simplicity, we can think of the short run as the duration of labor contracts, which are based on the expected price level.

Suppose the expected price level is 110. The short-run aggregate supply curve in Exhibit 1, $SRAS_{110}$, is based on that expected price level (hence the subscript 110). If the price level turns out as expected, producers supply the economy's potential output, which in Exhibit 1 is \$14.0 trillion. Although not shown in the exhibit, the aggregate demand curve would intersect the aggregate supply curve at point *a*. If the economy produces its potential output, unemployment is at the *natural rate*. Nobody is surprised, and all are content with the outcome. There is no tendency to move away from point *a* even if workers and firms could renegotiate wages.

In Exhibit 1, output levels that fall short of the economy's potential are shaded pink, and output levels that exceed the economy's potential are shaded blue. The slope of the short-run aggregate supply curve depends on how sharply the marginal cost of production rises as real GDP expands. If costs increase modestly as output expands, the supply curve is relatively flat. If these costs increase sharply as output

expands, the supply curve is relatively steep. Much of the controversy about the short-run aggregate supply curve involves its shape. Shapes range from flat to steep. Notice that the short-run aggregate supply curve

becomes steeper as output increases, because some resources become scarcer and thus more costly as output increases.

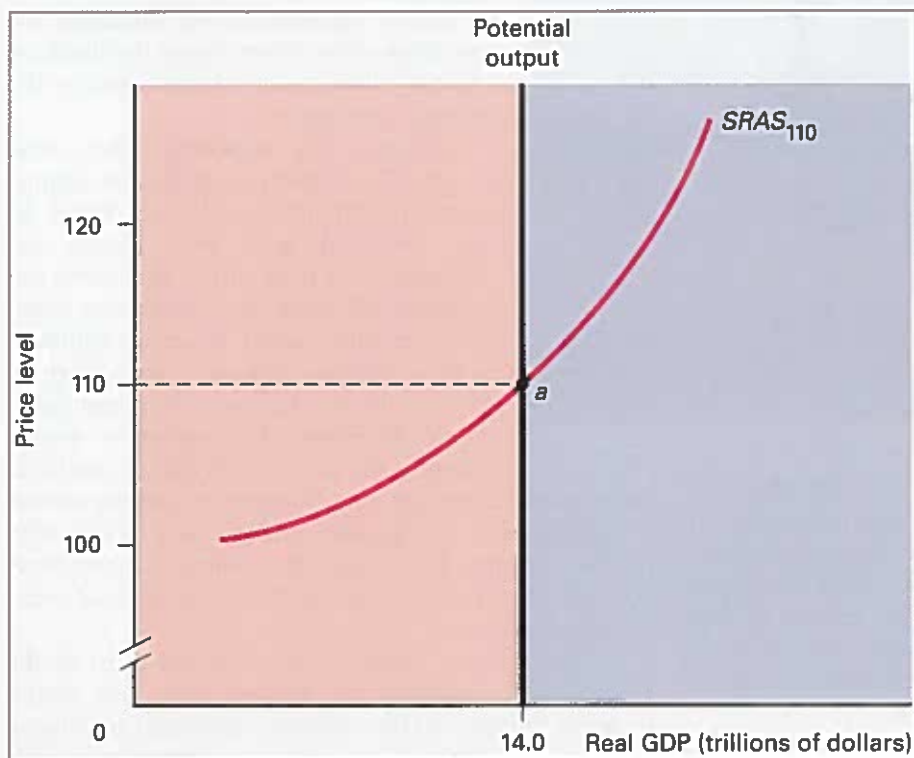
10-2 From the Short Run to the Long Run

This section begins with the price level exceeding expectations in the short run to see what happens in the long run. The long run is long enough that firms and resource

short-run aggregate supply (SRAS) curve
A curve that shows a direct relationship between the actual price level and real GDP supplied in the short run, other things constant, including the expected price level

Exhibit 1

Short-Run Aggregate Supply Curve



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suppliers can renegotiate all agreements based on knowledge of the actual price level. So in the long run, there are no surprises about the economy's price level.

10-2a Closing an Expansionary Gap

Let's begin our look at the long-run adjustment in Exhibit 2 with an expected price level of 110. The short-run aggregate supply curve for that expected price level is $SRAS_{110}$. Given this short-run aggregate supply curve, the equilibrium price level and real GDP depend on the aggregate demand curve. The actual price level would equal the expected price level only

if the aggregate demand curve intersects the aggregate supply curve at point *a*—that is, where the short-run quantity equals potential output. Point *a* reflects potential output of \$14.0 trillion and a price level of 110, which is the expected price level.

But what if aggregate demand turns out to be greater than expected, such as AD' , which intersects the short-run

aggregate supply curve $SRAS_{110}$ at point *b*. Point *b* is the **short-run equilibrium**, reflecting a price level of 115 and a real GDP of \$14.2 trillion. The actual price level in the short run is higher than expected, and output exceeds the economy's potential of \$14.0 trillion.

The amount by which short-run output exceeds the economy's potential is called an **expansionary gap**. In Exhibit 2, that gap is the short-run output of \$14.2 trillion minus potential output of \$14.0 trillion, or \$0.2 trillion. When real GDP exceeds its potential, the unemployment rate is less than its natural rate. Employees are working overtime, machines are being pushed to their limits, and farmers are sandwiching extra crops between usual plantings. Remember that the nominal wage was negotiated based on an expected price level of 110;

because the actual price level is higher, that nominal wage translates into a lower-than-expected real wage. As we will see, output exceeding the economy's potential creates inflationary pressure. The more that short-run output exceeds the economy's potential, the larger the expansionary gap and the greater the upward pressure on the price level.

short-run equilibrium

The price level and real GDP that result when the aggregate demand curve intersects the short-run aggregate supply curve

expansionary gap

The amount by which actual output in the short run exceeds the economy's potential output

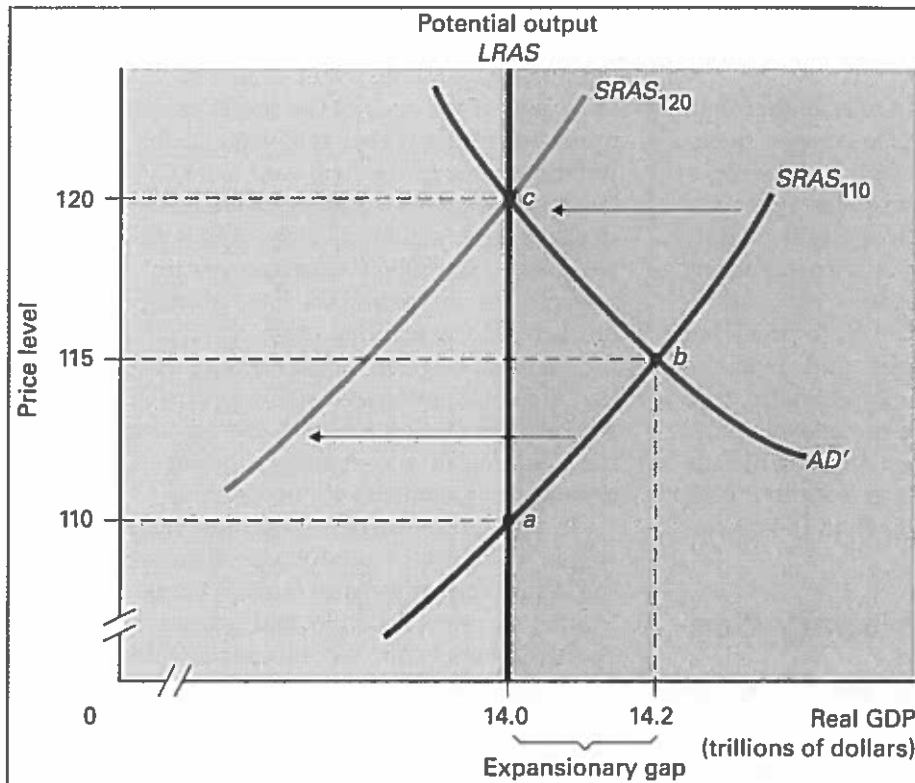


CHRIS BATSON/ALAMY

Production exceeding the economy's potential creates inflationary pressure, which causes the short-run aggregate supply curve to shift to the left, reducing output, increasing the price level, and closing the expansionary gap.

Exhibit 2

Long-Run Adjustment When the Price Level Exceeds Expectations



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supply curve from $SRAS_{110}$ left to $SRAS_{120}$. Whereas $SRAS_{110}$ was based on resource contracts reflecting an expected price level of 110, $SRAS_{120}$ is based on

resource contracts reflecting an expected price level of 120. At point c the expected price level and the actual price level are identical, so the economy is not only in short-run equilibrium, but is also in long-run equilibrium. Consider all the equalities that hold at point c : (1) the expected price level equals the actual price level; (2) the quantity supplied in the short run equals potential output, which also equals the quantity supplied in the long run; and (3) the quantity supplied equals the quantity demanded. Looked at another way, long-run equilibrium occurs where the aggregate demand curve intersects the vertical line drawn at potential output. Point c continues to be the equilibrium point unless there is some change in aggregate demand

What happens in the long run? The long run is a period during which firms and resource suppliers know all about market conditions, particularly aggregate demand and the actual price level, and have the time to renegotiate resource payments based on that knowledge. Because the higher-than-expected price level cuts the real value of the nominal wage originally agreed to, workers try to negotiate a higher nominal wage at their earliest opportunity. Workers and other resource suppliers negotiate higher nominal payments, raising production costs for firms, so the short-run aggregate supply curve shifts leftward, resulting in cost-push inflation. In the long run, the expansionary gap causes the short-run aggregate supply curve to shift leftward to $SRAS_{120}$, which results in an expected price level of 120. Notice that the short-run aggregate supply curve shifts until the equilibrium output equals the economy's potential output. Actual output can exceed the economy's potential in the short run but not in the long run.

As shown in Exhibit 2, the expansionary gap is closed by long-run market forces that shift the short-run aggregate

or in aggregate supply.

Note that the situation at point c is no different in real terms from what had been expected at point a . At both points, firms supply the economy's potential output of \$14.0 trillion. The same amounts of labor and other resources are employed, and although the price level, the nominal wage, and other nominal resource payments are higher at point c , the real wage and the real return to other resources are the same as they would have been at point a . For example, suppose the nominal wage averaged \$22 per hour when the expected price level was 110. If the expected price level increased from 110 to 120, an increase of 9.1 percent, the

long run

In macroeconomics, a period during which wage contracts and resource price agreements can be renegotiated; there are no surprises about the economy's actual price level

long-run equilibrium

The price level and real GDP that occur when (1) the actual price level equals the expected price level, (2) real GDP supplied equals potential output, and (3) real GDP supplied equals real GDP demanded

“Actual output can exceed the economy's potential in the short run but not in the long run.”

nominal wage would also increase by that same percentage to an average of \$24 per hour, leaving the real wage unchanged. With no change in real wages between points *a* and *c*, firms demand enough labor and workers supply enough labor to produce \$14.0 trillion in real GDP.

Thus, if the price level turns out to be higher than expected, the short-run response is to increase quantity supplied. But production exceeding the economy's potential creates inflationary pressure. In the long run this causes the short-run aggregate supply curve to shift to the left, reducing output, increasing the price level, and closing the expansionary gap.

If an increase in the price level were predicted accurately year after year, firms and resource suppliers would build these expectations into their long-term agreements. The price level would move up each year by the expected amount, but the economy's output would remain at potential GDP, thereby skipping the round-trip beyond the economy's potential and back.

10-2b Closing a Recessionary Gap

Let's begin again with an expected price level of 110 as presented in Exhibit 3, where blue shading indicates output exceeding potential and pink shading indicates output below potential. If the price level turned out as expected, the resulting equilibrium combination would occur at *a*, which would be both a short-run and a long-run equilibrium. Suppose this time that the aggregate demand curve intersects the short-run aggregate supply curve to the left of potential output, yielding a price level below that expected. The intersection of the aggregate demand curve, AD'' , with $SRAS_{110}$ yields the short-run equilibrium at point *d*, where the price level is below expectations and production is less than the economy's potential. The amount by which

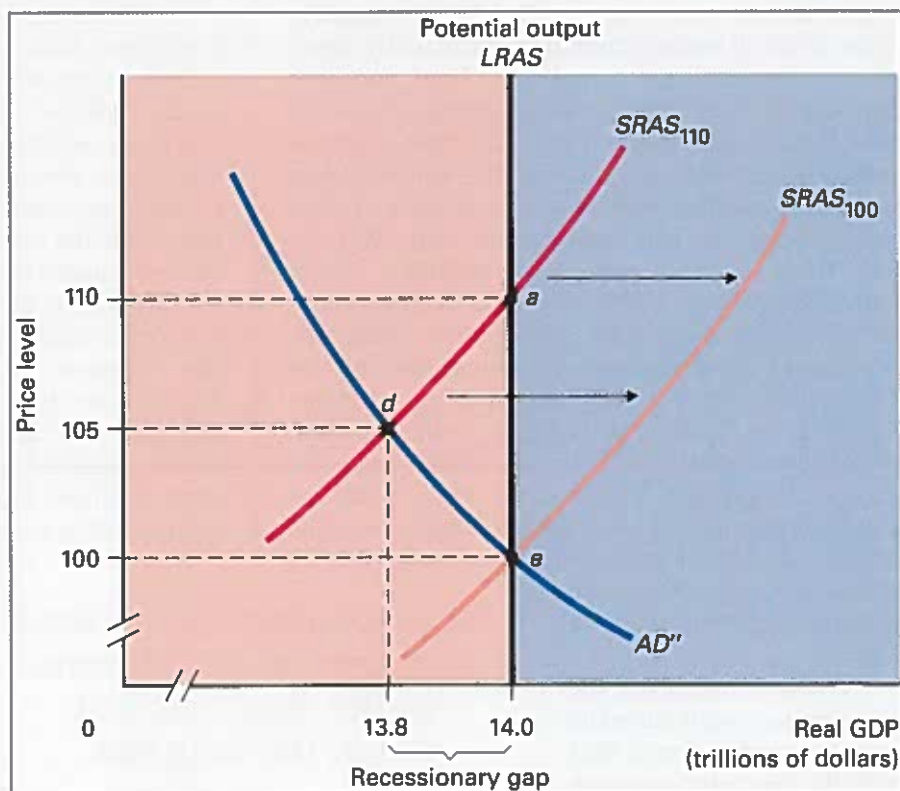
actual output falls short of potential GDP is called a **recessionary gap**. In this case, the recessionary gap is \$0.2 trillion, and unemployment exceeds its natural rate.

Because the price level is less than expected, the nominal wage, which was based on the expected price level of 110 and not the actual price level of 105, translates into a higher real wage in the short run. What happens in the long run? With the price level lower than expected, employers are no longer willing to pay as high a nominal wage. And with the unemployment rate higher than the natural rate, more workers are competing for jobs, putting downward pressure on the nominal wage. If the price level and the nominal wage are flexible enough, the combination of a lower price level and a pool of unemployed workers competing for jobs should make workers more willing to accept lower nominal wages next time wage agreements are negotiated.

If firms and workers negotiate lower nominal wages, the cost of production decreases, shifting the short-run aggregate supply curve rightward, leading to price deflation and greater output. The short-run supply curve continues to shift rightward until it intersects the aggregate demand curve where the economy produces its potential output. This

Exhibit 3

Long-Run Adjustment When the Price Level Is Below Expectations



recessionary gap
The amount by which actual output in the short run falls short of the economy's potential output

is reflected in Exhibit 3 by a rightward shift of the short-run aggregate supply curve from $SRAS_{110}$ to $SRAS_{100}$. If the price level and nominal wage are flexible enough, the short-run aggregate supply curve shifts rightward until the economy produces its potential output. The new short-run aggregate supply curve is based on an expected price level of 100. Because the expected price level and the actual price level are now identical, the economy is in long-run equilibrium at point e .

Although the nominal wage is lower at point e than that originally agreed to when the expected price level was 110, the real wage is the same at point e as it was at point a . Because the real wage is the same, the amount of labor that workers supply is the same and real output is the same. All that has changed between points a and e are nominal measures—the price level, the nominal wage, and other nominal resource prices.

We conclude that when incorrect expectations cause firms and resource suppliers to overestimate the actual price level, output in the short run falls short of the economy's potential. As long as wages and prices are flexible enough, however, firms and workers should be able to renegotiate wage agreements based on a lower expected price level. The negotiated drop in the nominal wage shifts the short-run aggregate supply curve to the right until the economy once again produces its potential output. If wages and prices are not flexible, they will not adjust quickly to a recessionary gap, so shifts of the short-run aggregate supply curve may be slow to move the economy to its potential output. The economy can therefore get stuck at an output and employment level below its potential.

10-3 The Long-Run Aggregate Supply Curve

We are now in a position to provide an additional interpretation of the pink- and blue-shaded areas of our

exhibits. If a short-run equilibrium occurs in the blue-shaded area, that is, to the right of potential output, then market forces in the long run increase nominal resource costs, shifting the short-run aggregate supply to the left. If a short-run equilibrium occurs in the pink-shaded area, then market forces in the long run reduce nominal resource costs, shifting the short-run aggregate supply curve to the right. Closing an expansionary gap involves inflation and closing a recessionary gap involves deflation.

“Closing an expansionary gap involves inflation and closing a recessionary gap involves deflation.”

10-3a Tracing Potential Output

If wages and prices are flexible enough, the economy produces its potential output in the long run, as indicated in Exhibit 4 by the vertical line drawn at the economy's potential GDP of \$14.0 trillion. This vertical line is called the economy's long-run aggregate supply (LRAS) curve. The long-run aggregate supply curve depends on the supply of resources in the economy, the level of technology,

long-run aggregate supply (LRAS) curve
A vertical line at the economy's potential output; aggregate supply when there are no surprises about the price level and all resource contracts can be renegotiated

Exhibit 4
Long-Run Aggregate Supply Curve

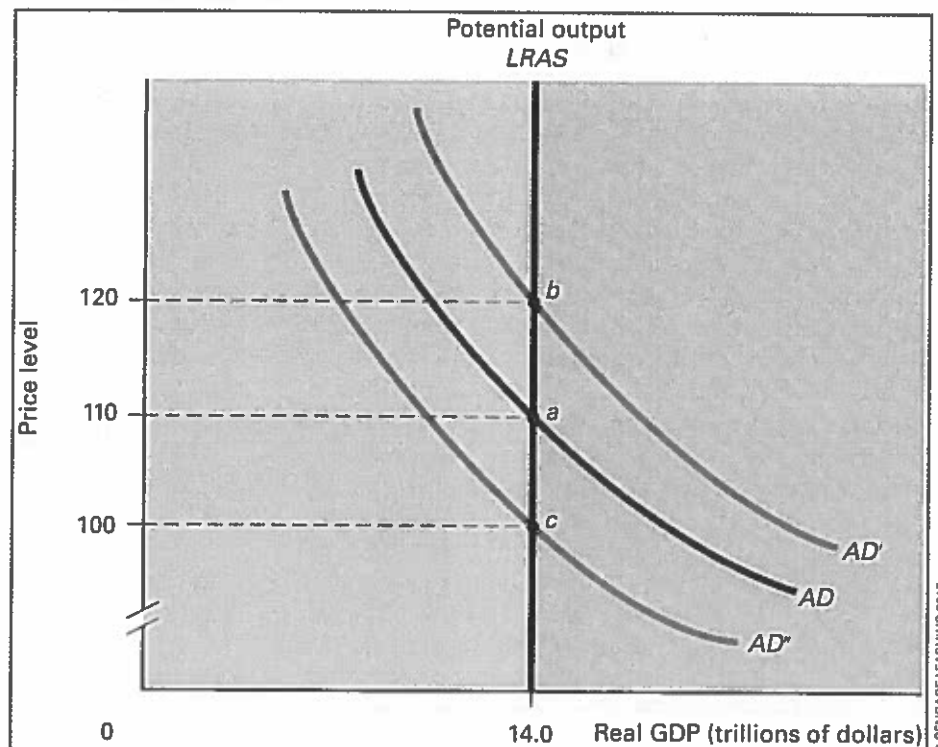
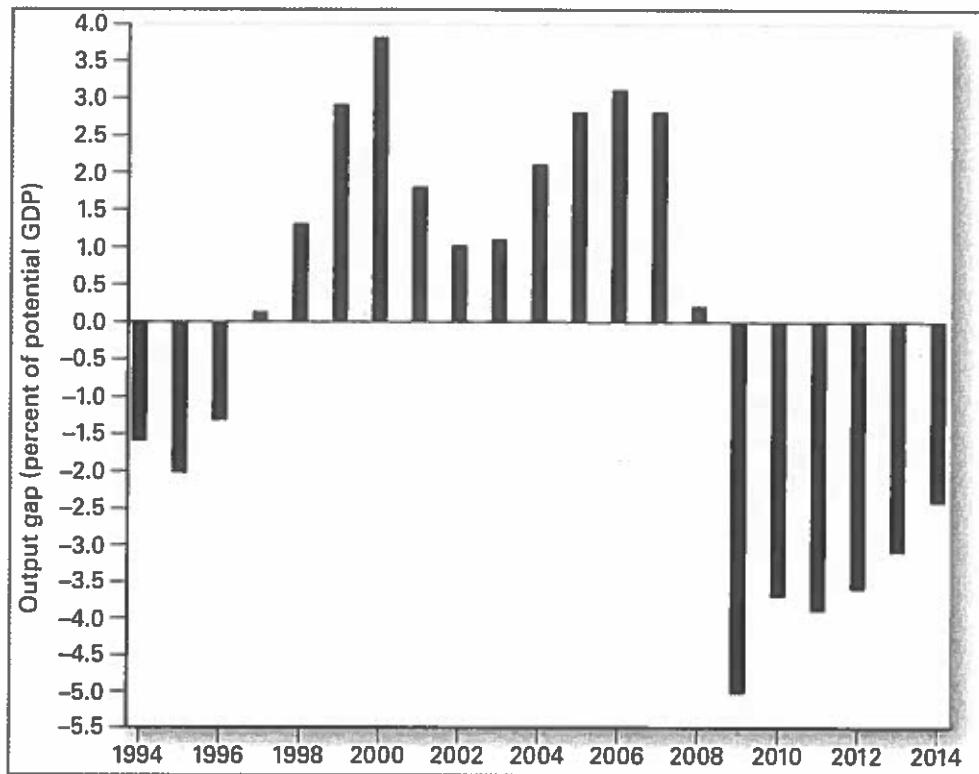


Exhibit 5

The U.S. Output Gap Measures Actual Output Minus Potential Output as a Percentage of Potential Output



SOURCE: Developed from estimates by the *OECD Economic Outlook*, 93 (June 2013), Annex Table 10. Figures for 2013 and 2014 are OECD projections. OECD data can be found at <http://www.oecd.org/home/>.

why not negotiate shorter ones? First, negotiating contracts is costly and time consuming (for example, airline union contracts take an average of 1.3 years to negotiate). Longer contracts reduce the frequency, and thus reduce the average annual cost, of negotiations. Second, long-term contracts reduce the frequency of strikes, lockouts, and other settlement disputes. Thus, both workers and employers gain from longer contracts, even though such contracts make wages more sticky and make recessionary gaps more likely to linger.

To Review: When the actual price level differs from the expected price level, output in the short run departs from the economy's potential. In the long

“Shifts of the aggregate demand curve change the price level but do not affect potential output, or long-run aggregate supply.”

run, however, market forces shift the short-run aggregate supply curve until the economy once again produces its potential output. Thus, surprises about the price level change real GDP in the short run but not in the long run. Shifts of the aggregate demand curve change the price level but do not affect potential output, or long-run aggregate supply.

10-4 Shifts of the Aggregate Supply Curve

In this section, we consider factors other than changes in the expected price level that may affect aggregate supply. We begin by distinguishing between long-term trends in aggregate supply and **supply shocks**, which are unexpected events that affect aggregate supply, sometimes only temporarily.

10-4a Aggregate Supply Increases

The economy's potential output is based on the willingness and ability of

supply shocks
Unexpected events that affect aggregate supply, sometimes only temporarily

households to supply resources to firms, the level of technology, and the institutional underpinnings of the economic system. Any change in these factors could affect the economy's potential output. Changes in the economy's potential output over time were introduced in Chapter 8, which focused on U.S. productivity and growth. The supply of labor may change over time because of a change in the size, composition, or quality of the labor force or a change in preferences for labor versus leisure. For example, the U.S. labor force has more than doubled since 1948 as a result of population growth and a growing labor force participation rate, especially among women with children. At the same time, job training, education, and on-the-job experience has increased the quality of labor. Increases in the quantity and the quality of the labor force have increased the economy's potential GDP, or long-run aggregate supply.

The quantity and quality of other resources also change over time. The capital stock—machines, buildings, and trucks—increases when gross investment exceeds capital depreciation. And the capital stock improves with technological breakthroughs. Even the quantity and quality of land can be increased—for example, by claiming land from the sea, as is done in the Netherlands and Hong Kong, or by revitalizing soil that has lost its fertility. These increases in the quantity and quality of resources increase the economy's potential output.

Finally, institutional changes that define property rights more clearly or make contracts more enforceable, such as the introduction of clearer patent and copyright laws, will increase the incentives to undertake productive activity, thereby increasing potential output. Changes in the labor force, in the quantity and quality of other resources, and in the institutional arrangements of the economic system tend to occur gradually. Exhibit 6 depicts a gradual shift of the economy's potential output from \$14.0 trillion to \$14.5 trillion. The long-run aggregate supply curve shifts from LRAS out to LRAS'.

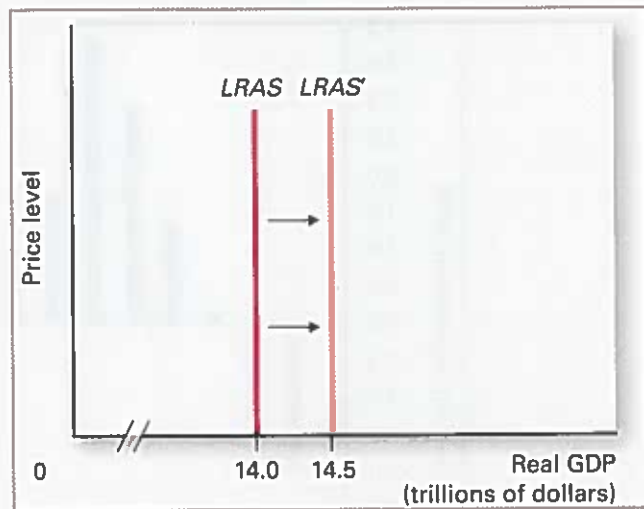
In contrast to the gradual, or long-run, changes that often occur in the supply of resources, supply shocks are unexpected events that change aggregate supply,

beneficial supply shocks

Unexpected events that increase aggregate supply, sometimes only temporarily

Exhibit 6

Effect of a Gradual Increase in Resources on Aggregate Supply



“The economy’s potential output is based on the willingness and ability of households to supply resources to firms, the level of technology, and the institutional underpinnings of the economic system.”

sometimes only temporarily. **Beneficial supply shocks** increase aggregate supply; examples include (1) abundant harvests that increase the food supply; (2) discoveries of natural resources, such as oil in Alaska or the North Sea; (3) technological breakthroughs that allow firms to combine resources more efficiently, such as faster computers or the Internet; and (4) sudden

changes in the economic system that promote more production, such as tax cuts that stimulate production incentives or stricter limits on frivolous product liability lawsuits.



Exhibit 7 shows the effect of a beneficial supply shock from a technological breakthrough. The beneficial supply shock shown here shifts the short-run and long-run aggregate supply curves rightward. Along the aggregate demand curve, AD, the equilibrium combination of price and output moves from point *a* to point *b*. For a given aggregate demand curve, the happy outcome of a beneficial supply shock is an increase in output and a decrease in the price level. The new equilibrium at point *b* is a short-run and a long-run equilibrium in the sense that there is no tendency to move from that point as long as whatever caused the beneficial effect continues, and a technological discovery usually has a lasting effect. Likewise, substantial new oil discoveries usually benefit the economy for a long time. On the other hand, an unusually favorable growing season won't last. When a normal growing season returns, the short-run and long-run aggregate supply curves return to their original equilibrium position—back to point *a* in Exhibit 7.

10-4b Aggregate Supply Decreases

Adverse supply shocks are sudden, unexpected events that reduce aggregate supply, sometimes only temporarily. For example, a drought could reduce the supply of a variety of resources, such as food, building materials, and water-powered electricity. An overthrow of a government could destabilize the

economy. Or terrorist attacks could shake the institutional underpinnings of the economy, as occurred in America, England, and Spain. Such attacks add to the cost of doing business—everything from airline screening to building security.

An adverse supply shock is depicted as a leftward shift of both the short-run and long-run aggregate supply curves, as shown in Exhibit 8, moving the equilibrium combination from point *a* to point *c* and reducing potential output from \$14.0 trillion to \$13.8 trillion. As mentioned earlier, the combination of reduced output and a higher price level is often referred to as stagflation. The United States encountered stagflation during the 1970s, when the economy was rocked by a series of adverse supply shocks, such as crop failures around the globe and the oil price hikes by OPEC in 1974 and again in 1979. If the effect of the adverse supply shock is temporary, such as a poor growing season, the aggregate supply curve returns to its original position once things return to normal.

10-5 Final Word

This chapter explains why the aggregate supply curve slopes upward in the short run and is vertical at the economy's potential output in the long run. Firms and resource suppliers negotiate contracts based

adverse supply shocks
Unexpected events that reduce aggregate supply, sometimes only temporarily

Exhibit 7

Effects of a Beneficial Supply Shock on Aggregate Supply

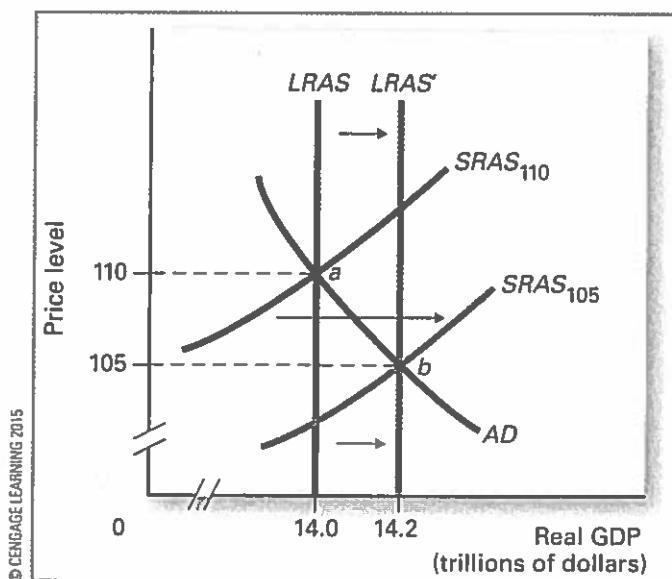
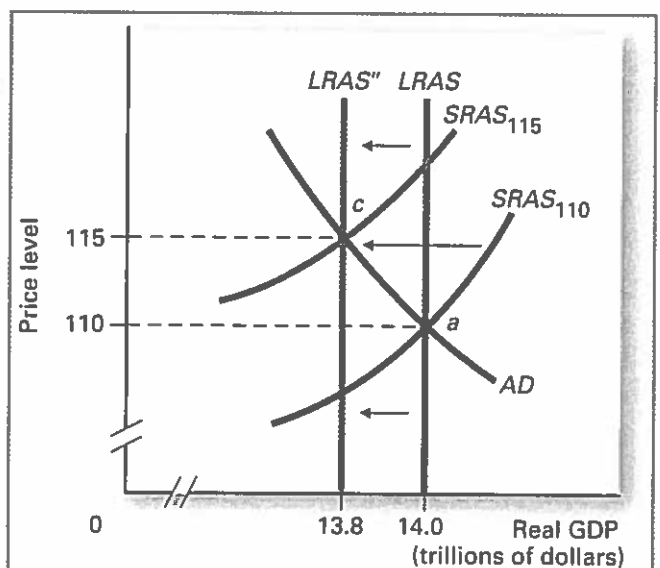


Exhibit 8

Effects of an Adverse Supply Shock on Aggregate Supply



on the economy's expected price level, which depend on expectations about aggregate demand. Unexpected changes in the price level can move output in the short run away from its potential level. But if firms and

resource suppliers fully adjust to price surprises, the economy in the long run moves toward its potential output. Potential output is the anchor for analyzing aggregate supply in the short run and long run.

70% < Percent of total production costs accounted for by labor

\$80,000 < The approximate equivalent pay today for a salary of \$20,000 in 1970

Expected recessionary gap in 2014 > **2.4%**

2% < U.S. unemployment rate during World War II

