

*Output,
Business Cycles,
and Employment*

LEARNING OUTCOMES

By the end of this chapter you should understand:

- Short-run aggregate demand and supply
- Equilibrium output and potential output
- Changes in equilibrium output and income
- Business cycles and output gaps
- Okun's Law: output gaps and unemployment rates
- Adjustments to output gaps
- The role for macroeconomic policy

Macroeconomic analysis has important time dimensions. In the long run, over periods of several years and decades, real GDP in most industrial economies grows and per capita real GDP grows as well, raising standards of living. We have seen the data for Canada on this long-run performance in Chapter 4. We have also seen that growth rates fluctuate over short time periods of a few months or a few years. At some times real output declines, and at other times it grows very rapidly. Economists describe these short-run fluctuations as business cycles, using the words recession, recovery, boom, and slump to describe different stages of the cycle. These words are also part of the everyday language of the news media.

In this chapter we introduce a basic economic model and use it to examine the causes and effects of business cycle fluctuations in real output and prices.

5.1 A Short-Run Aggregate Demand and Aggregate Supply Model

The **short run** in macroeconomics is defined by assuming a specific set of conditions in the economy. These are:

1. There are constant prices for factors of production, especially money wage rates for labour.
2. The supply of labour, the stock of capital, and the state of technology are fixed.

In the short run, changes in output cause changes in the employment of labour and in the use of plant and equipment, but these changes are not sustainable over longer time periods. Furthermore, because supplies of factor inputs and technology are fixed, there is no growth in real GDP. We leave that topic for a later chapter.

The national accounts we studied in Chapter 4 describe and measure economic activity in terms of aggregate expenditures, outputs, and incomes. But they do not explain the level of economic activity and prices or the reasons for changes in output and prices from time to time. For that we need an analytical framework that looks at cause and effect. An **aggregate demand (AD)** and **aggregate supply (AS) model** is such an analytical framework. It helps us to understand the conditions that determine output and prices, and changes in output and prices over time.

The short-run AD/AS model is closely related to the national accounts framework. Aggregate demand is the relationship between aggregate expenditure on final goods and services and the general price level. Real GDP by the expenditure approach measures this expenditure at the price level given by the GDP deflator. Aggregate supply is the relationship between the output of goods and services produced by business and the general price level. Real GDP by the income approach measures this output, and the corresponding real incomes. The price level is again the GDP deflator. National accounts tell us that, by definition, these *measured* outputs and incomes are equal. AD and AS use the national accounts framework to describe *expenditure plans and output*. This distinction between measured and planned expenditure and output is important. Planned expenditure is the current output households and businesses would want to buy at different levels of income and price. Output is what businesses actually produce. They may not be the same.

Figure 5.1 gives us a first look at output, real income, and prices for the year 2005 from Table 4.5 (page 79), using an aggregate demand and aggregate supply diagram. The price level as measured by the GDP deflator is measured on the vertical axis. Real output and income are measured on the horizontal axis. The point of intersection of the AD and AS lines shows that real output by the expenditure approach is equal to real income by the income approach at the price level 117.0, as required by national accounts. However, we need to explain the aggregate demand and aggregate supply relationships indicated by the slopes and positions of the AD and AS lines in the diagram before we use the model to study output and prices.

Aggregate Demand (AD) is **planned aggregate expenditure** on final goods and services ($C + I + G + NX$) at different price levels when all other conditions are constant. We will examine this relationship in detail in the chapters that follow. The relationship between planned aggregate expenditure and the general price level is negative. A higher price level reduces the expenditures planned by households, businesses, and residents of other countries. Lower price levels increase those expenditure plans.

In the **short run**, factor prices, supplies of factors of production, and technology are fixed by assumption.

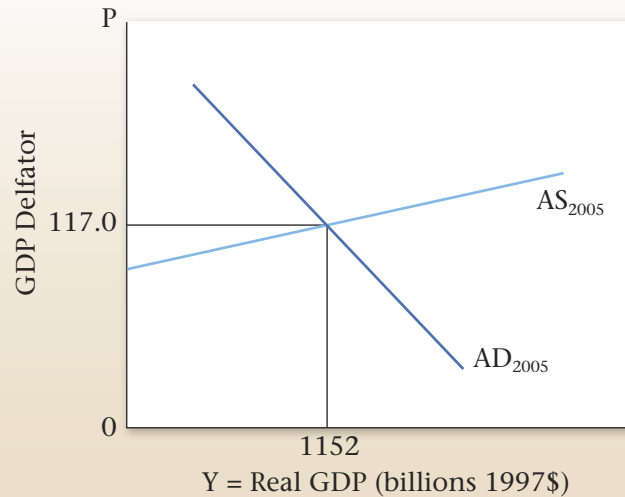
An **AD/AS model** is a framework used to explain the behaviour of real output and prices in the national economy.

Aggregate Demand is **planned aggregate expenditure** on final goods and services at different price levels, all other conditions remaining constant.

FIGURE 5.1

The Aggregate Demand and Supply Model

The intersection of the AD and AS lines shows real output measured by the expenditure approach (AD) equal to real income measured by the income approach (AS) at the price level given by the GDP deflator.



The **wealth effect** is the change in planned consumption when household wealth changes.

The **substitution effect** is the change in net exports when relative national prices change.

The **interest rate effect** is the change in expenditures when interest rates change.

There are three explanations for the negative relationship between planned aggregate expenditure and the general price level. First, there is the **wealth effect**. This comes from the change in the purchasing power of fixed price financial assets like money holdings when the price level changes. Second, there is the **substitution effect**. This comes from the change in the price of domestically produced goods and services compared with the prices of goods and services produced in other countries. Third, and perhaps most important, there is the **interest rate effect**. This comes from the changes in asset prices and interest rates in financial markets when the price level changes. We consider each of these briefly here, and in more detail in later chapters.

Households hold money balances like bank deposits as a part of their financial wealth. They use those balances to pay for routine purchases, and as reserves against unpredictable expenses. As a student, you might have a bank balance at the start of term that you expect will cover your expenses for the term, perhaps with a bit left over in case you need to fix your computer. The purchasing power of money balances at any point in time depends on the general price level. A rise in the price level reduces the quantity of goods and services that can be purchased with a fixed number of dollars. A fall in the price level increases the quantity. In other words, price changes cause changes in real financial wealth. Changes in real financial wealth change the quantities of goods and services households can buy with their fixed money balances. This is the *wealth effect*. It reduces planned aggregate expenditure by households when prices rise, and increases planned aggregate expenditure if prices fall.

The *substitution effect* changes the net export component of planned aggregate expenditure. Planned expenditures on exports and imports are based in part on the prices of domestic goods and services relative to foreign goods and services. A rise in the domestic price level increases the price of domestic output both in the home market and in foreign markets. Domestic goods become more expensive relative to foreign goods and services. Some households and businesses at home and abroad react to the change in relative price by substituting foreign goods and services for domestic goods and services. Imports rise and exports fall, lowering net exports and aggregate expenditure on

domestic goods and services. A fall in the domestic price level would cause a rise in net exports for the same reasons. The negative relationship between planned aggregate expenditure and the general price level is in part a result of these substitution effects, which change net exports.

Changes in the price level also cause changes in aggregate expenditure plans by changing interest rates. As we will see in later chapters, interest rates are determined in financial markets by the demand for and the supply of financial assets, including money balances. A rise in the general price level increases the size of the money balances that households, businesses, and governments need to pay their expenses. (We have seen this already in terms of the wealth effect.) This increase in the demand for money balances raises interest rates, which are the costs of borrowing. Interest rates on household lines of credit, mortgages, business bank loans, and other means of financing expenditure rise, increasing the cost of expenditures. As a result, some expenditure plans are reduced and others postponed. The *interest rate effect* provides another reason for the negative relationship between price levels and planned aggregate expenditure.

It is important to notice that the relationship between planned expenditure and price does *not* come from the effect of price changes on income. From national accounts we know that a change in the general price level changes money incomes in exactly the same proportion. A 10 percent rise in the general price level for goods and services is also a 10 percent rise in money incomes. Changes in the price level don't make goods and services either more or less affordable in terms of incomes. That is why we explain the aggregated demand effects of prices on planned expenditures in terms of wealth, substitution, and interest effects.

In Figure 5.2, the negatively sloped AD line shows planned aggregate expenditures at different price levels, on the assumption that anything other than price that might affect expenditure plans is held constant. A change in price level causes a movement along the AD curve resulting from wealth, substitution, and interest rate effects. If the

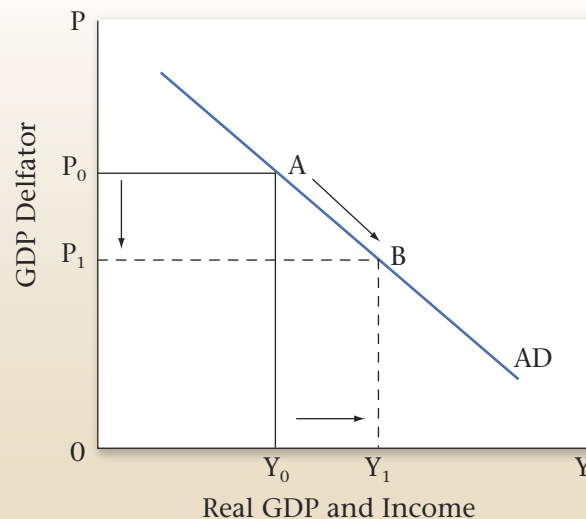
**Review
Question 1**

FIGURE 5.2

The Aggregate Demand Curve

The AD curve shows planned aggregate expenditures at different prices. At point A the price P_0 results in planned aggregate expenditure Y_0 . A fall in price from P_0 to P_1 would result in an increase in planned aggregate expenditure to Y_1 .

The wealth, substitution, and interest rate effects of price changes *cause movements along* the AD curve.



price level falls from P_0 to P_1 , the movement along AD from A to B shows the negative relationship between planned aggregate expenditure and price. A rise in price would reduce planned expenditure as shown by moving up the AD curve.

The negative slope of the AD curve illustrates the way price changes affect planned aggregate expenditures. The *position of the curve* depends on all the conditions other than price that affect aggregate expenditure plans. We study these other conditions in detail in later chapters.

Aggregate Supply is the output of final goods and services businesses would produce at different price levels, all other conditions held constant.

Aggregate Supply (AS) is the relationship between outputs and real incomes at different price levels, with all other conditions held constant. From national accounts we know that the costs of production include labour costs, business and investment income, and depreciation. Market prices depend on these costs per unit of output plus the net indirect taxes imposed by governments. Aggregate supply is the positive relationship between quantities of final goods and services businesses are willing to produce and prices. Higher outputs of final goods and services and higher prices go together.

We can explain the aggregate supply relationship between outputs and prices using the national accounts framework. As we saw earlier, prices measured by the GDP deflator reflect factor costs of production and indirect taxes as follows:

$$P = \text{labour costs per unit} + \text{business income and depreciation per unit} \\ + \text{net indirect tax per unit,}$$

$$P = \frac{W}{Y} + \frac{BI + CCA}{Y} + \frac{T_{IN}}{Y} \quad (5.1)$$

Changes in prices are the result of changes in labour income per unit of output, or in business and investment income plus capital consumption per unit of output, or in net indirect taxes per unit of output, or some combination of these three components. We start by assuming constant net indirect taxes, which are government policy, and concentrate on factor costs.

The relationship between aggregate output, factor costs, and prices reflects two different market conditions on the supply side of the economy. In some markets, particularly those for commodities and standardized products, supply and demand in international markets establish price. Producers of those products are price takers. They decide how much to produce and sell based on market price. Many raw material markets are like this, including those for agricultural products, forestry products, base metals, and crude oil. When the market price changes, these producers change their output. A rise in price offers an increase in business profit per unit of output, and an opportunity to increase total profit by producing and selling more. A fall in price reduces profitability and output. This is one reason for a positive relationship between aggregate output and price.

In other parts of the economy, producers are price setters. Major manufacturing and service industries like auto producers and banks face different market conditions. They set prices based on costs of production and profit targets, and supply the number of cars or bank services that are in demand at those prices. If increased demand and output push up their labour costs (W/Y), as will happen if labour productivity declines as output expands, they raise prices to cover their increased costs. Alternatively, if weak markets have squeezed profits, increased demand may result in increased prices to restore profit margins, raising business income per unit of output (BI/Y). Producer price-setting behaviour in this part of the economy also gives a positive aggregate supply relationship between real output and price. Producers are willing to produce more

if they can raise prices to cover their increased production costs. If markets are weak and sales fall, some producers may cut profit margins and prices.

The upward-sloping aggregate supply curve shows the positive relationship between the aggregate output of real goods and services that producers are willing to produce and the price level. The aggregate supply curve in Figure 5.3 is drawn on the assumption that money wage rates, net indirect taxes, and all other conditions except price that might affect output decisions are constant. As we will see in later chapters, money wage rates and productivity are the most important of these conditions. They determine the *position* of the AS curve. The positive *slope* of the AS curve shows how changes in aggregate output and price are related.

In Figure 5.3, if price were P_2 the AS curve shows that business would be willing to produce aggregate output Y_2 , which would generate an equal flow of real income. A rise in aggregate output from Y_2 to Y_3 would mean a rise in price to P_3 to meet the increased costs and profits associated with output at this level. Changes in output or price, holding all other conditions constant, move the economy along the AS curve. The move from point C to point D in the diagram shows this relationship.

Equilibrium real GDP and price are the results of the interaction of aggregate demand and aggregate supply. Aggregate demand is planned aggregate expenditure at different prices. Aggregate supply is aggregate output at different prices. The circular flow diagram and national accounts show how aggregate expenditure provides the flow of revenue business needs to cover its costs of production, and that those costs of production are income flows to households. When planned aggregate expenditure is equal to output, we have equilibrium real GDP. The revenues businesses receive from aggregate expenditure are just what they require to cover their costs, including expected profit. As long as conditions affecting expenditure and output plans are constant, business has no incentive to change output. This *equilibrium* between aggregate expenditure, outputs, and income and the general price level is illustrated by the intersection of the AD and AS curves.

Review Question 2

Equilibrium real GDP and price are determined by aggregate demand and supply.

FIGURE 5.3

The Aggregate Supply Curve

The AS curve shows aggregate output as measured by real GDP at different prices. At point C the price P_2 results in aggregate output Y_2 . A rise in price from P_2 to P_3 would accompany an increase in output to Y_3 .

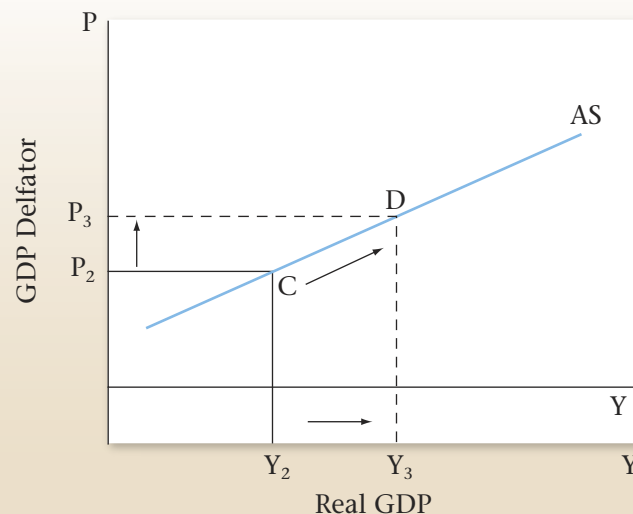


FIGURE 5.4

Equilibrium Real GDP and Price

The intersection of AD and AS gives equilibrium real GDP and price at A.

In equilibrium, planned aggregate expenditure is equal to aggregate output. Producers' revenues cover costs of production, including profit.

Any change in economic conditions or policy would shift AD or AS and result in a new equilibrium P and Y .

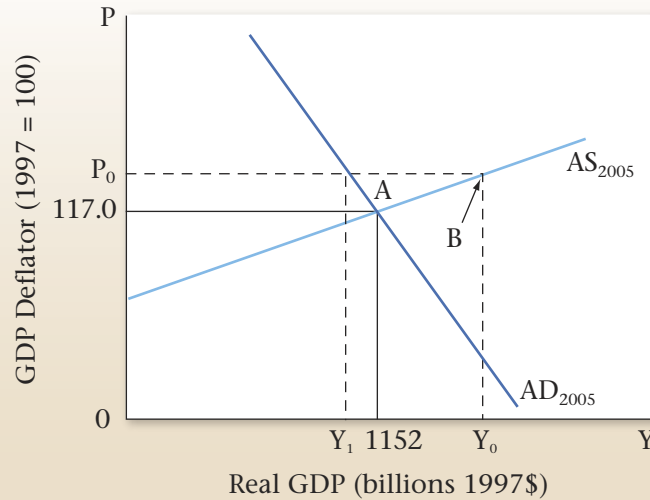


Figure 5.4 takes us back to Figure 5.1. *Equilibrium* real GDP and price are shown by the intersection of AD and AS at point A with $P = 117.0$ and $Y = 1152$.

It helps us to understand what equilibrium means if we consider what would happen if the economy were not at point A in the diagram. Suppose, for example, business produced output and paid costs greater than \$1152, as would be the case at point B on the AS curve. Output would be Y_0 , but planned expenditure at Y_1 would be less than business needs to cover its costs. Faced with weak markets and prices, business would cut output, moving back to point A. Alternatively, if output were less than \$1152, markets would be strong and provide strong incentives to increase output. Market conditions push the economy to equilibrium, the point where AD equals AS.

The equilibrium determined by aggregate demand and aggregate supply at point A is the result of the economic conditions at a moment in time, and the expenditure and output decisions in the economy. It is a short-run equilibrium. The aggregate supply curve is based on the assumption that money wage rates and other factor prices are constant. However, any change in the conditions that affect expenditure and output plans would change the AD and AS curves and lead to a new short-run equilibrium real GDP and price.

Review Question 3

5.2

Equilibrium Output and Potential Output

Potential output is the economy's output measured by real GDP when the markets for all the factors of production, labour, capital, and land are in equilibrium.

Short-run equilibrium real GDP is determined by AD and AS conditions. Fluctuations in real GDP and price are a result of short-run changes in economic conditions. To evaluate the economy's performance and understand how it behaves over time, we need a benchmark. **Potential output**, the output the economy would produce when markets for all factors of production were in equilibrium, is the benchmark.

In the short run, the labour force, the capital stock, and technology are fixed by assumption. Potential output is the economy's output based on "full employment" of

these inputs, but it is not the maximum output an economy can conceivably make. For short periods of time we could make more by using labour for longer hours and factories for extra production shifts. Just as a marathon runner can sprint from time to time but cannot sustain the sprint over the whole race, the economy can operate for short time periods at levels of output above potential. Potential output is the output the economy can produce on a sustained basis when every market in the economy is in equilibrium.

When the economy is at potential output, every worker wanting a job at the equilibrium wage rate can find a job, and every machine that can be profitably used at the equilibrium cost for capital is in use. Thus, potential output includes an allowance for “equilibrium unemployment” and some excess capacity. Some people, who would work at higher wage rates, do not want to work at the equilibrium wage rate. Moreover, in a constantly changing economy, some people are joining the labour force, others are leaving, and still others are temporarily between jobs. Today, Canadian potential output means an unemployment rate of about 6.5 to 7 percent.

Actual output can also fall below potential output. Workers who want jobs may be unemployed, and producers may have idle plant and equipment or excess capacity. The unemployment rate rises above the 6.5 to 7 percent “full employment” rate. A key issue in macroeconomics is the way differences between actual output and potential output affect unemployment rates, wage rates, and inflation rates. These effects are important to how the economy adjusts equilibrium output to potential output, as we will see later in this chapter.

The distinction between equilibrium output and potential output is very important to our study of the economy. In the short run, AD and AS determine equilibrium output. Potential output is determined by the size of the labour force, the stock of capital, and the state of technology. The general level of prices and short-run aggregate demand and supply conditions do not affect potential output.

Figure 5.5 illustrates potential real GDP (Y_p) with a vertical line. Changes in price from P_0 to P_1 , for example, have no effect on Y_p . Changes in the supply of labour, the stock of capital, or the state of technology would increase the economy’s potential output and shift the Y_p line horizontally to the right or left.

FIGURE 5.5**Potential GDP**

Potential GDP (Y_p) is the economy’s output when the markets for the factor inputs are in equilibrium.

Y_p is not affected by changes in the price level.

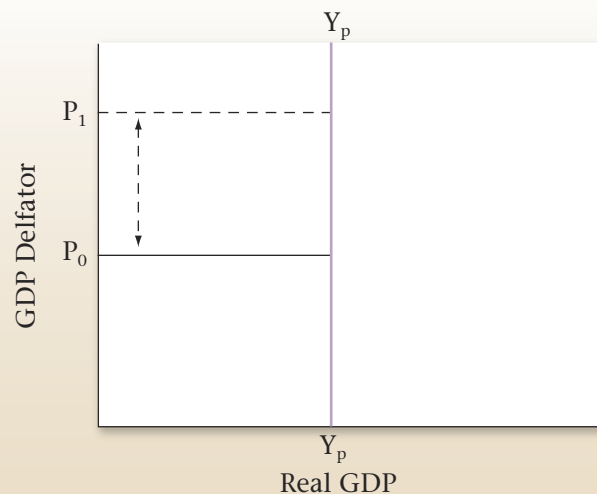
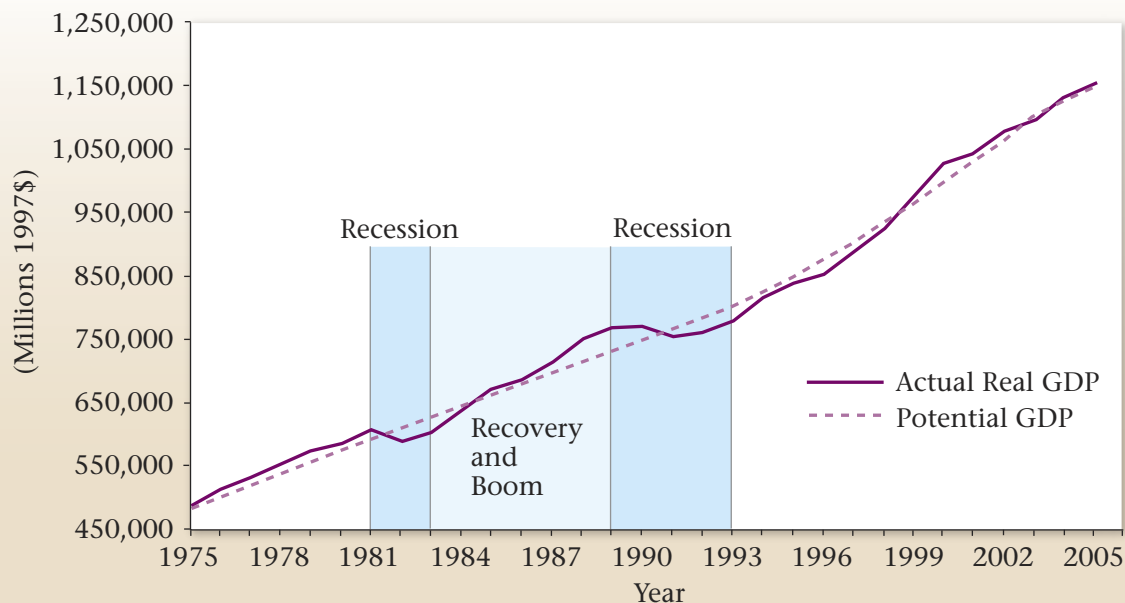


FIGURE 5.6

Potential and Actual GDP in Canada 1975 to 2004



Potential GDP in any year is the real output the economy could produce using the existing labour force, stock of capital equipment, and available technology, if all markets were in equilibrium. Potential output grows over time as the labour force and capital stock grow and technology improves. Actual real GDP fluctuates around potential GDP as a result of short-run variations in aggregate demand and supply. The recession of 1981 created a recessionary gap. The subsequent recovery and boom, from 1983 to 1989, eliminated the recessionary gap and resulted in an inflationary gap.

Source: Statistics Canada, Real GDP: CANSIM II, Series V3860085. Potential GDP calculated using H-P Filter.

Review Questions 4 and 5

Figure 5.6 shows actual real GDP each year in Canada over the period from 1975 to 2005 compared with estimates of potential GDP. Actual and potential GDP had strong upward trends, reflecting the underlying growth in labour force, the stock of capital, and improved technology. However, sometimes actual GDP was lower than potential, and at other times higher, as the growth in actual GDP fluctuated around the growth in potential GDP. These fluctuations in actual GDP relative to potential GDP were the result of fluctuations in short-run AD and AS conditions.

5.3

Business Cycles and Output Gaps

The **business cycle** is the short-term fluctuation of actual real GDP.

Output gaps are the differences between actual and potential output.

Figure 5.6 shows us that actual real GDP does not grow smoothly. In some years GDP grows very rapidly, and in other years it actually falls. The smooth growth of potential GDP we see in Figure 5.6 was the trend path of output with the short-run fluctuations smoothed out. Actual output fluctuates about this measure of potential output. These up and down fluctuations in the growth of real GDP are described as **business cycles** in economic activity.

Business cycles cause differences between actual and potential GDP. **Output gaps** measure these differences. Figure 5.6 plots the Bank of Canada's estimates of



APPLICATION BOX 5.1

Measuring Output Gap

The Bank of Canada offers the following description of the importance and measurement of the output gap:

“THE OUTPUT GAP is the difference between the economy’s actual output and the level of output it can achieve with existing labour, capital, and technology without putting sustained upward pressure on inflation.

“The output gap is also referred to as spare capacity or excess capacity. The gap is positive when actual output exceeds the economy’s potential, and negative when actual output is below potential. A positive gap is also referred to as excess demand, and a negative gap is referred to as excess supply.”

However, while the output gap is clearly defined in terms of economic theory and simple

to illustrate in a diagram, there is no consensus on its measurement. The Bank of Canada notes:

“Both the level of potential output and the output gap are estimates, and therefore there is major uncertainty in their calculation.

“This uncertainty may be larger now because the estimated output gap is relatively small, and the economy seems to have undergone significant changes in the 1990s. As a result the Bank now places increased weight on a range of indicators to assess the degree of pressure on the economy’s productive capacity.”

Nevertheless, the potential output and output gaps are very important to our study of the economy’s performance.

Source: Bank of Canada, *BACKGROUNDERS: The Output Gap*, <http://www.bankofcanada.ca/en/backgrounders/bg-p5.html>.

the differences between actual and potential GDP for Canada for each year, expressed as a percentage of potential GDP.

$$\text{Output gap} = \frac{Y - Y_p}{Y_p} \times 100\% \quad (5.2)$$

When we look at the growth in actual real GDP and potential GDP in Canada in the 1980s, we see an example of the business cycle and the output gaps it creates. Real GDP declined in the early 1980s, and actual GDP fell below potential GDP in Figure 5.6. This was a *recession*. It created the negative output gap in Figure 5.7 in 1982.

By 1983 growth in real GDP was positive again as the economy entered a *recovery* phase of the business cycle. Indeed, this growth was strong enough and lasted long enough to eliminate the output gap by 1985. In Figure 5.6 we see that the line plotting actual real GDP is steeper than the line plotting potential GDP. Actual GDP rose above potential GDP in the late 1980s, and the economy entered a *boom* phase of the business cycle. Actual GDP was then greater than potential GDP during the late 1980s and the output gap was positive until 1990, when a new cycle began.

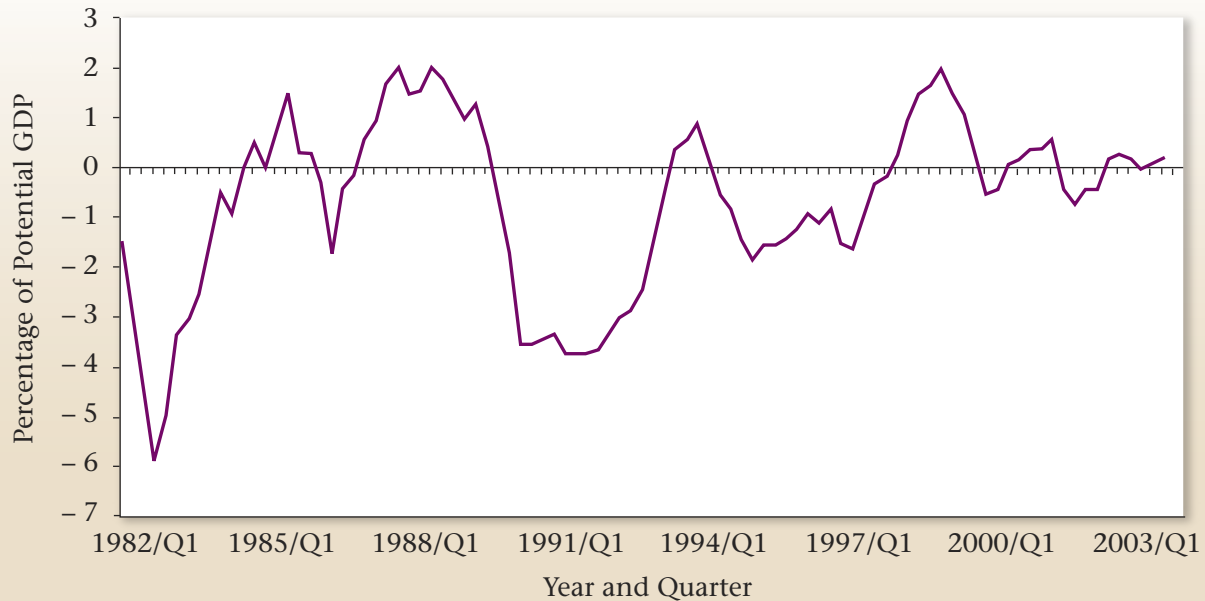
Output gaps describe and measure these short-run economic conditions, and indicate the strength or weakness of the economy’s performance. High growth rates in the boom phase of the cycle create positive output gaps, which are called **inflationary gaps** because they put upward pressure on costs and prices. Low or negative growth rates that result in negative output gaps and rising unemployment rate are called **recessionary gaps**. They put downward pressure on costs and prices. As economic conditions change over time, business cycle fluctuations move the economy through recessionary

An **inflationary gap** is a measure of the amount by which actual GDP is greater than potential GDP.

A **recessionary gap** is a measure of the amount by which actual GDP is less than potential GDP.

FIGURE 5.7

The Output Gap in Canada, 1982 to 2005



The output gap measures the difference between actual real GDP and potential GDP as a percentage of potential GDP. When output gaps are negative, as in the early 1980s and most of the 1990s, the economy is operating below potential. There is a recessionary gap. Positive output gaps are inflationary gaps.

Source: Bank of Canada, Rates and Statistics, "Indicators of Capacity and Inflation Pressures for Canada," www.bankofcanada.ca.

and inflationary gaps. However, you will notice in Figure 5.7 that recessionary gaps in Canada have been deeper and more persistent than inflationary gaps over the past 25 years.

We can show output gaps in diagrams using the aggregate demand and supply curves and the potential output line. Figure 5.8 provides an example. The left-hand panel illustrates a recessionary gap. The right-hand panel shows an inflationary gap. In both cases the aggregate supply curve crosses the potential output line at price level P_0 , the price level consistent with equilibrium at potential output at the assumed factor prices.

The AD and AS model provides a basic explanation of the differences we see between actual real GDP and potential real GDP. Short-run AD and AS conditions determine equilibrium real GDP, which may be either greater or less than potential GDP. Furthermore, the business cycles are the results of changes in the short-run AD and AS conditions.

We have made an important first step in our study of the performance of the macro economy. Now we need to ask more questions:

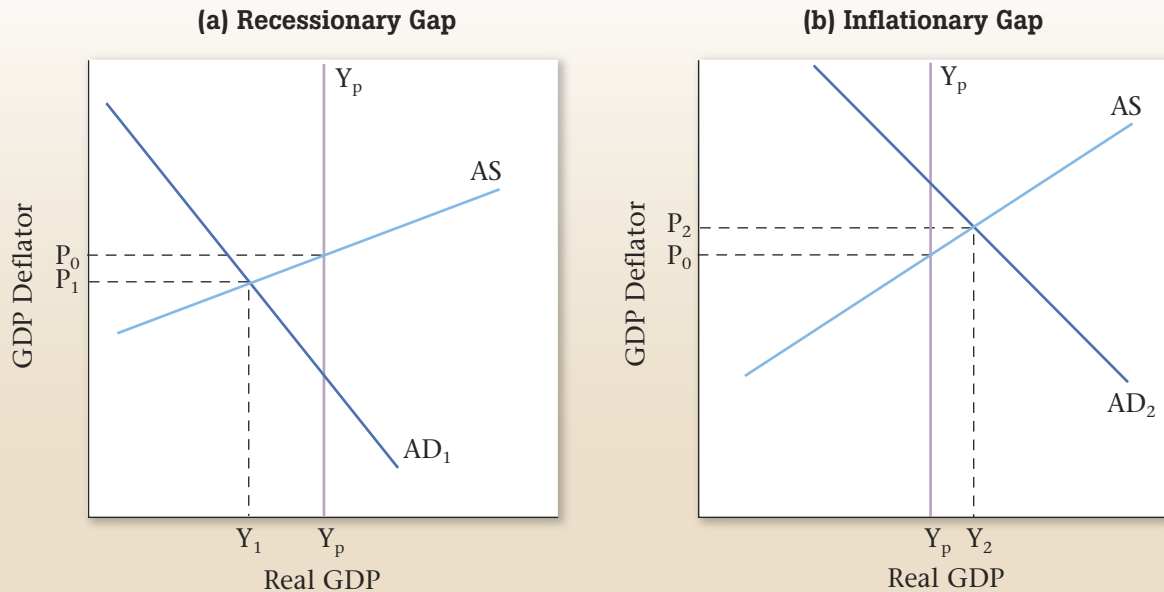
- What is the relationship between output gaps and unemployment?
- How would the economy react to a persistent output gap?
- Why do short-run AD and AS conditions change from time to time?

The first two questions are considered in the remainder of this chapter. The third question is much larger. Chapter 6 starts to examine it in detail.

Review
Questions 6
and 7

FIGURE 5.8

Output Gaps



AD_1 in panel (a) is not strong enough to give equilibrium real GDP at Y_p . The result is a recessionary GDP gap in the amount $Y_1 - Y_p$. By contrast, stronger AD_2 in panel (b) gives equilibrium real GDP greater than potential output and an inflationary GDP gap $Y_2 - Y_p$. In each case, short-run AD and AS determine equilibrium real GDP which may be different from potential GDP. The output gaps measure the differences.

5.4 Output Gaps and Unemployment Rates

The unemployment rate is measured and reported monthly. In Chapter 4 we used it as one measure of macroeconomic performance, and noted how it changed from year to year. The unemployment rate measures the difference between the number of people employed and the number of people in the labour force, expressed as a percentage of the labour force, as we saw in Chapter 4. If the letter u indicates the unemployment rate,

$$u = \frac{\text{Labour force} - \text{number of people employed}}{\text{Labour force}} \times 100\% \quad (5.3)$$

The **equilibrium** or **natural unemployment rate** is the unemployment rate when the economy is at potential output and the labour market is in equilibrium. Although this is full employment, the unemployment rate will not be zero. Some people are between jobs and some are looking for work but not willing to work at current wage rates. When the economy is at potential output, Y_p , we will use u_n to indicate the equilibrium or natural unemployment rate.

The **equilibrium** or **natural unemployment rate** is the unemployment rate when the economy is at potential output Y_p .

$$u_n = \frac{\text{Labour force} - \text{equilibrium employment}}{\text{Labour force}} \times 100\% \quad (5.4)$$

Okun's Law: Changes in unemployment rates result from differences between the growth rate of Y and the growth rate of Y_p .

Potential GDP, actual real GDP, and unemployment rates are tied together. The linkage between them is often summarized by a relationship known as **Okun's Law**. According to this "law," when the growth rate of actual real GDP is faster than the growth rate of potential GDP, the unemployment rate falls. Conversely, when real GDP grows more slowly than potential GDP, the unemployment rate increases. This negative relationship between growth rates in real GDP and changes in the unemployment rate is one of the most consistent relationships in macroeconomics.

A numerical example and a diagram show this relationship. The basic relationship suggested by Okun is:

$$\text{Change in unemployment rate} = \Delta u = -\frac{1}{2}(\text{growth rate of } Y - \text{growth rate of } Y_p) \quad (5.5)$$

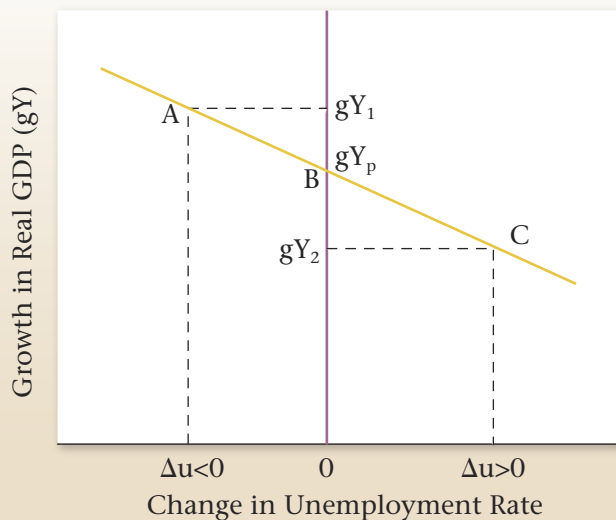
A change in the unemployment rate that is one-half the difference between the growth rates is used here as an illustration. A link of this size is roughly correct for the Canadian and United States economies. When the growth rate of actual real GDP is greater than that of potential GDP during the recovery and boom phases of the business cycle, the unemployment rate falls by half the difference, and vice versa. For example, if the growth rate in potential output is 3 percent but actual output grows by 4 percent, the unemployment rate will fall by 0.5 percentage points.

Figure 5.9 shows this relationship in a simple diagram. Growth rates of real GDP (gY) are measured on the vertical axis. Changes in the unemployment rate (Δu), either positive or negative, are measured on the horizontal axis. The negatively sloped line labelled A B C illustrates Okun's Law. At point B the growth rates of actual and potential GDP are equal, and there is no change in the unemployment rate. At point A, growth in actual GDP is higher than growth in potential GDP, and the unemployment rate declines. Point C shows the opposite case, with unemployment rising as a result of slow growth in actual GDP.

FIGURE 5.9

Okun's Law

Growth rates in real GDP are measured on the vertical axis. Changes in the unemployment rate are measured on the horizontal axis. The line A B C shows the relationship described by Okun's Law. When the growth rate of real GDP (gY) is equal to the growth rate of potential GDP (gY_p), the unemployment rate does not change. $\Delta u = 0$ at point B. At point A the growth rate of actual real GDP (gY_1) is higher than the growth rate of potential output (gY_p), the demand for labour inputs is growing faster than the labour force, and the unemployment rate falls. Point C shows the opposite condition and result.





APPLICATION BOX 5.2

Okun's Law in Canada

Over the years from 1976 to 2005, the real GDP in the Canadian economy grew at an average annual rate of 2.9 percent. In the same period, the unemployment rates for the core labour force—men aged 25 years and over—were as low as 4.3 percent in 1976 and as high as 10.4 percent in 1992.

The annual data for the unemployment rate, and the difference between the actual and the average growth of real GDP, are shown in the

table. These data are plotted in a scatter diagram to illustrate the negative relationship described by Okun's Law. The regression line drawn in the diagram has a slope of -0.42 . This slope shows that an increase in the growth rate of real GDP by 1 percentage point lowered the unemployment rate by 0.42 percentage points on average in this time period in Canada. By the same argument, a decrease in the growth rate resulted in an increase in the unemployment rate.

Deviations in Annual Growth in Real GDP and the Unemployment Rate, Canada 1976 to 2005¹

Year	Real GDP Growth Rate (%)	Deviation in the Real GDP Growth Rate (%)	Unemployment Rate	Change in the Unemployment Rate
1976	—	—	4.3	
1977	3.5	0.6	5.0	0.7
1978	4.0	1.1	5.3	0.3
1979	3.8	0.9	4.7	-0.6
1980	2.2	-0.7	4.9	0.2
1981	3.5	0.6	5.0	0.1
1982	-2.9	-5.8	8.4	3.4
1983	2.7	-0.2	9.5	1.1
1984	5.8	2.9	9.2	-0.3
1985	4.8	1.9	8.6	-0.6
1986	2.4	-0.5	7.8	-0.8
1987	4.3	1.4	7.1	-0.7
1988	5.0	2.1	6.2	-0.9
1989	2.6	-0.3	6.2	0
1990	0.2	-2.7	6.9	0.7
1991	-2.1	-5.0	9.2	2.3
1992	0.9	-2.0	10.4	1.2
1993	2.3	-0.6	10.4	0
1994	4.8	1.9	9.5	-0.9
1995	2.8	-0.1	8.5	-1.0
1996	1.6	-1.3	8.7	0.2
1997	4.2	1.3	7.9	-0.8
1998	4.1	1.2	7.1	-0.8
1999	5.5	2.6	6.4	-0.7
2000	5.2	2.3	5.6	-0.8
2001	1.8	-1.1	6.2	0.6
2002	3.3	0.2	6.7	0.5
2003	2.0	-0.9	6.6	-0.1
2004	2.9	0.0	6.1	-0.5
2005	2.1	-0.8	6.5	0.4

Note: Deviations in annual growth rates of real GDP are differences between annual growth rate and the average annual growth rate of 2.9 percent for 1976–2005.

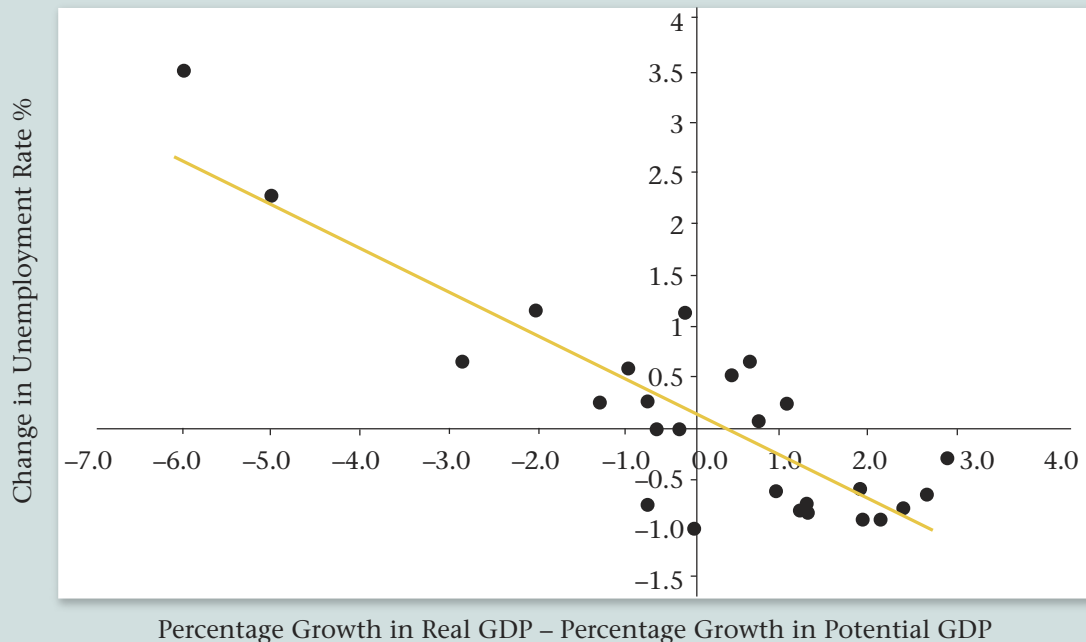
Sources: Statistics Canada, CANSIM II, "Unemployment Rate Males Aged 25 Years and Over," V2170281; "GDP in Constant 1997 Dollars," V3860085.



APPLICATION BOX 5.2 *continued*

Okun's Law: The Effect of Growth in Real GDP on Unemployment

$$\text{Change in } u \text{ rate} = 0.11 - 0.4234 (\text{growth in } Y - \text{growth in } Y_p)$$



Source: Statistics Canada, CANSIM II, Series V2170281 and V3860085.

Review Question 8

Now we can see that output gaps occur when the growth rate in real GDP differs from the growth rate of potential output during the business cycle. Okun's Law shows us that those output gaps also result in changes in the employment and unemployment rates. Recessions, when growth in output is slow or negative, produce recessionary output gaps and rising unemployment rates. Recoveries and booms, when growth in output is rapid, close the recessionary gaps and may go on to produce inflationary gaps. Unemployment rates fall during these periods. Stable unemployment rates mean the economy is growing over time at the same rate as the growth in potential output based on growth in the labour force, growth in capital stock, and improvements in productivity. It may also mean that the economy is growing along the potential output growth path if the unemployment rate is equal to the natural rate.

5.5 Adjustments to Output Gaps

Potential output is real GDP when all markets are in equilibrium. Output gaps indicate disequilibria in some markets. If we leave the short run and drop the assumption that factor prices are constant, we can ask:

How does the economy react to persistent output gaps?

Okun's Law suggests that the labour market is one of the markets not in equilibrium when there is an output gap. We also know from national accounts that labour costs are the largest part of factor costs of production, and labour costs per unit of output are the largest part of prices. If disequilibria in the labour market—which means unemployment rates not equal to the natural rate—result in changes in money wage rates, persistent output gaps will change wage rates and other factor prices and costs. Changes in costs will change prices, shifting the short-run AS curve. The economy has an adjustment mechanism that tries to eliminate output gaps over time.

The effects of output gaps on factor prices and factor costs are the source of adjustment to output gaps. The recession phase of the business cycle creates recessionary gaps. Demands for factor inputs to production are low, and there is downward pressure on factor prices. The boom phase of the cycle creates inflationary gaps. Demands for factor inputs are high and there is upward pressure on factor prices. If factor prices, especially money wage rates for labour, are flexible *over time*, output gaps cause changes in factor prices, in factor costs, and in short-run aggregate supply conditions.

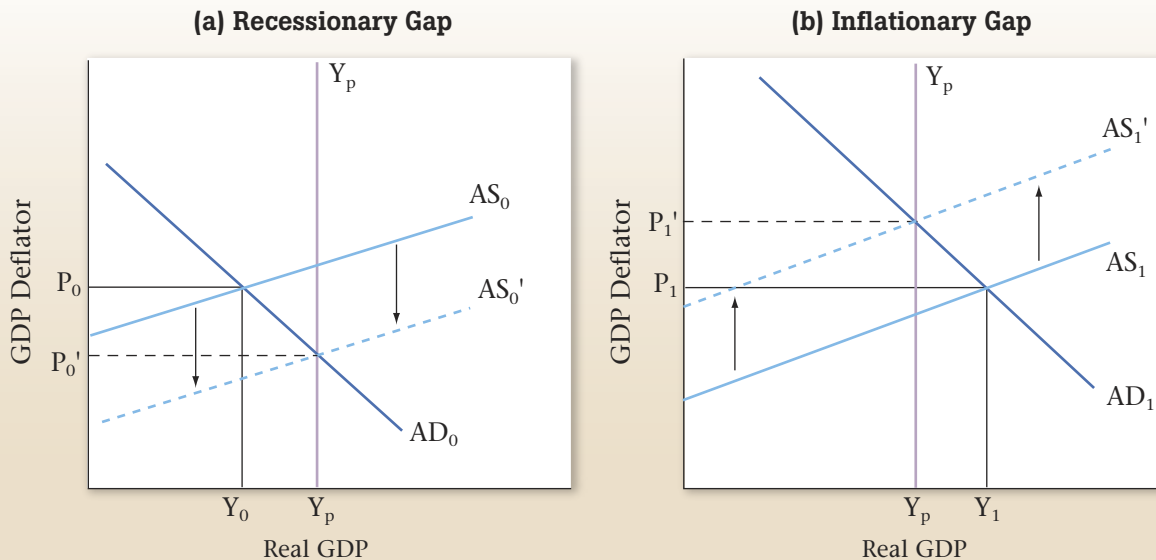
Figure 5.10 illustrates the changes in real outputs as the economy adjusts over time to output gaps. In panel (a), the high unemployment of a recessionary gap lowers wage rates and other factor prices. You will recall that the curve AS_0 in the diagram is drawn on the assumption that factor costs are fixed. A change in factor costs changes the entire AS curve. In this case it shifts down to AS_0' . With lower costs, producers are willing to produce and sell at lower prices. The change in factor costs and AS conditions continues until the recessionary gap is eliminated and output is at Y_p .

Panel (b) in Figure 5.10 shows adjustment to an inflationary gap. Rising factor prices and costs shift the AS curve up to AS_1' . Producers need higher prices to cover

Review
Question 9

FIGURE 5.10

Adjustments to Eliminate Output Gaps



In panel (a), a recessionary gap results in lower wage rates and other factor prices. AS shifts down, and equilibrium output increases to eliminate the gap. In panel (b), an inflationary gap raises factor prices and costs. AS shifts up, and equilibrium output falls to eliminate the gap.

the higher production costs. Upward pressure on costs and prices continues until the economy is in equilibrium at Y_p and the inflationary gap is eliminated.

5.6 The Role for Macroeconomic Policy

In Chapter 4, performance of the economy was evaluated based on the standard of living, or real GDP per capita, it provided. Recessionary gaps reduce the standard of living in the economy by reducing employment, real GDP, and per capita real GDP.

Inflationary gaps reduce standards of living in more subtle ways. They push up the price level, raising the cost of living. But the rise in the cost of living affects different people in different ways. Those on fixed money incomes suffer a reduction in their standards of living. People holding their wealth in fixed price financial assets like bank deposits and bonds suffer a loss in their real wealth. On the other hand, inflation reduces the real value of debt, whether it is mortgage debt used to finance the purchase of a house, or a student loan used to finance education. The money repaid in the future has a lower purchasing power than the money borrowed. In these and other ways, the costs of inflation are distributed unevenly in the economy, making decisions about employment, household expenditure, and investment more difficult.

Using Figure 5.10, we have described the self-adjusting mechanism within the AD/AS model that could eliminate output gaps and move the economy to equilibrium at potential output. We have also seen, in Figure 5.7 (page 96), that output gaps have been persistent in the Canadian economy despite the possibility that flexible wages and prices might automatically eliminate gaps. These observations raise two questions:

- Why are output gaps, especially recessionary gaps, persistent?
- Can government policy work to eliminate output gaps?

To answer the first question, we need to think about the flexibility or rigidity of wages and prices. The economy's reaction to output gaps takes time, because wage rates and prices are sticky and slow to adjust to changed economic circumstances.

In the modern economy, wage rates for labour are often fixed by contract or custom for finite periods of time. Labour contracts often set wage rates for periods of several years. Even without explicit contracts, employers are unlikely to change the wages they pay on an hour-by-hour or day-to-day basis. Custom may suggest an annual adjustment. Minimum wage laws prevent cuts in the lowest wage rates. These institutional arrangements mean that the money wage rates paid to labour adjust slowly to changes in economic conditions. Cuts to money wage rates are particularly difficult and controversial.

Contracts and custom also affect the speed of price adjustment to economic conditions. Producers in many cases have supply contracts with their customers that fix prices for a finite time period. Sellers may be reluctant to change prices frequently, in part because they are uncertain about how their competitors will react to their price changes, and in part to avoid alienating their customers. Retailers often issue catalogues in which prices are fixed for a specified period. The result is slow price adjustment to changing economic conditions in many parts of the economy.

Nevertheless, if the economy experiences a persistent output gap, that gap will lead eventually to changes in factor prices, costs, and market prices for goods and services. Indeed, the adjustment to inflationary gaps may come more quickly than to recessionary gaps because it is easier to raise money wage rates than to cut them. The important

policy question is: When wages and prices are sticky, should government wait for the self-adjustment process to work, accepting the costs of high unemployment or rising inflation that it produces?

Government has policies it can use to reduce or eliminate output gaps. In Chapter 7 we will examine **fiscal policy**, the government expenditures and tax policy that establish the government's budget and its effect on aggregate demand. Government can use its fiscal policy to change the AD curve and eliminate an output gap without waiting for the economy to adjust itself. Chapters 9 and 10 discuss **monetary policy**, actions by the monetary authorities designed to change aggregate demand and eliminate output gaps by changing interest rates and money supply. Both fiscal and monetary policy work to change aggregate demand and eliminate output gaps, which reduce the standard of living the national economy provides for its citizens.

Fiscal policy: government expenditure and tax changes designed to influence AD

Monetary policy: changes in interest rates and money supply designed to influence AD

**Review
Questions 10
and 11**

Next

In Chapter 6 we study the expenditure decisions by households and business that determine the consumption and investment components in aggregate demand.

SUMMARY

- The **Aggregate Demand and Supply** model provides a framework for our study of the operation of the economy.
- **Aggregate Demand** is the negative relationship between planned aggregate expenditure on final goods and services and the price level, assuming money supply, interest rates, exchange rates, and all other conditions in the economy are constant.
- **Aggregate Supply** is the positive relationship between planned outputs of goods and services and the price level, assuming factor prices, capital stock, and technology are constant.
- **Short-Run Equilibrium Real GDP and Price** are determined by the equality of short-run Aggregate Demand and Aggregate Supply, illustrated by the intersection of the AD and AS curves.
- **Potential Output** is the economy's output in terms of real GDP when labour and capital are fully employed at their equilibrium rates of utilization, using the available technology. The corresponding unemployment rate is called the **natural unemployment rate**.
- **Business Cycles** are the short-run fluctuations of actual real GDP around Potential Output caused by short-run changes in Aggregate Demand and Supply.
- **Output Gaps** are the differences between actual real GDP and Potential GDP that occur during business cycles.
- **Okun's Law** makes a link between output gaps and unemployment rates. Negative output gaps cause unemployment rates that are higher than the natural unemployment rate.
- **Inflationary Gaps and Recessional Gaps** are the terms used to describe positive and negative output gaps based on the effects the gaps have on factor prices.
- **Actual output adjusts to Potential Output** over time if factor prices are flexible and changes in factor prices shift the Aggregate Supply curve to equilibrium with Aggregate Demand at Y_p .
- **Fiscal and monetary policy** are tools governments and monetary authorities can use to speed up the economy's adjustment to output gaps.

KEY TERMS

Short run	87	Business cycle	94
AD/AS model	87	Output gaps	94
Aggregate Demand	87	Inflationary gap	95
Planned aggregate expenditure	87	Recessionary gap	95
Wealth effect	88	Equilibrium or natural unemployment rate	97
Substitution effect	88	Okun's Law	98
Interest rate effect	88	Fiscal policy	103
Aggregate Supply	90	Monetary policy	103
Equilibrium real GDP and price	91		
Potential output	92		

KEY EQUATIONS AND RELATIONS

Equations

$$\text{The price level } P = \frac{W}{Y} + \frac{BI + CCA}{Y} + \frac{T_{IN}}{Y} \quad (5.1) \quad \text{p. 90}$$

$$\text{The output gap} = \frac{Y - Y_p}{Y_p} \times 100\% \quad (5.2) \quad \text{p. 95}$$

$$\text{Unemployment rate: } u = \frac{\text{Labour force} - \text{number of people employed}}{\text{Labour force}} \times 100\% \quad (5.3) \quad \text{p. 97}$$

$$\text{Natural unemployment rate } u_n = \frac{\text{Labour force} - \text{equilibrium employment}}{\text{Labour force}} \times 100\% \quad (5.4) \quad \text{p. 97}$$

$$\text{Change in unemployment rate} = \Delta u = -\frac{1}{2}(\text{growth rate of } Y - \text{growth rate of } Y_p) \quad (5.5) \quad \text{p. 98}$$

Relations

Aggregate demand AD: $\Delta P \rightarrow \Delta$ real financial wealth + Δ domestic/foreign prices
+ Δ interest rates $\rightarrow \Delta$ expenditure and real output, $(\Delta Y/\Delta P) < 0$

Aggregate supply AS: Δ real output $\rightarrow \Delta$ costs of production $\rightarrow \Delta P$, $(\Delta P/\Delta Y) > 0$

Equilibrium real GDP and price: $AD = AS$

Output gaps ($Y \neq Y_p$): Fluctuations in AD or AS \rightarrow business cycles in $Y \rightarrow$ output gaps

Okun's Law: Output gaps $\rightarrow \Delta$ employment and unemployment, $Y < Y_p \rightarrow u > u_n$, $Y > Y_p \rightarrow u < u_n$

Adjustments to output gaps: Output gaps $\rightarrow \Delta$ wage rates $\rightarrow \Delta$ production costs $\rightarrow \Delta AS$, $Y \rightarrow Y_p$

REVIEW QUESTIONS

Answers to odd-numbered Review Questions can be found in Appendix A on the Online Learning Centre.

1. Define the Aggregate Demand curve. Explain the reasons for the negative relationship between real GDP and the price level that is described by the AD curve.
2. Define the Aggregate Supply curve. Explain the reasons why the Aggregate supply curve is upward sloping from left to right when we draw it in a diagram.
3. Suppose we have the following information for an economy:

GDP Deflator	Planned Aggregate Expenditure	Planned Aggregate Output
90	550	150
100	500	300
110	450	450
120	400	600
130	350	750

- a. Plot the AD and AS curves in a carefully labelled diagram.
 - b. What are the short-run equilibrium values of real GDP and the price level?
4. Explain what we mean by potential output (GDP). Explain why potential GDP does not depend on the price level. Is it possible that real GDP might be larger or smaller than potential GDP?
 5. Suppose we learn that potential output is 500 for the economy in question 3.
 - a. Add a line to your diagram for question 3 to illustrate potential GDP.
 - b. Does your diagram show an output gap for this economy?
 - c. What is the size of any output gap you see in the diagram?
 - d. If there is an output gap, is it an inflationary gap or a recessionary gap? Explain why.
 6. What are the implications of differences between actual and potential GDP for the unemployment

rate and the rate of utilization of factories and machinery?

7. Suppose we have the following data for an economy:

Year	Potential Output (billions 99\$)	Real GDP (billions 99\$)
1998	1,038	1,017
1999	1,069	1,030
2000	1,101	1,101
2001	1,134	1,160
2002	1,168	1,139
2003	1,203	1,130
2004	1,240	1,187


Calculate the output gap for each year in this economy. Plot the output gap in a time series diagram. Describe the timing of the phases of any business cycles you see in your plot of the output gap.

8. Okun's Law says that differences between the growth rate in potential output and the growth rate in real GDP change the unemployment rate as follows:

$$\Delta u = -\frac{1}{2} (gY - gY_p)$$

Based on the data in the table, calculate the annual growth rates of potential output and real GDP. If the unemployment rate in 2000 were 7.0 percent, what unemployment rate would Okun's Law predict for the years 2001, 2002, and 2003?

9. a. Construct an Aggregate Demand and Aggregate Supply diagram that shows an economy in short-run equilibrium with an inflationary gap.
- b. Explain what a persistent inflationary gap means for wage rates and other factor prices when there is enough time for factor prices to adjust.
- c. In your diagram, show the effects of any change in factor prices on Aggregate Demand and Aggregate Supply conditions and on short-run equilibrium real output and price.
- d. What equilibrium real output and price would you expect, based on your diagram, once factor prices have adjusted and the unemployment is at the natural rate?

10. *Internet* Visit the Bank of Canada's Web site at www.bankofcanada.ca and, using the link to "Indicators of Capacity and Inflationary Pressures," record the data provided for the output gap and the unemployment rate. Describe the relationship you see between changes in the output gap and the unemployment rate. 
11. *Internet* Visit the Bank of Canada's Web site and follow the links through "Monetary Policy" to "Inflation." What are the costs of inflation and the benefits of low inflation, according to the Bank? 