CHAPTER 2
A Tour of the Book

The words *output*, *unemployment* and *inflation* appear daily in newspapers and on the evening news. So, when we used them in Chapter 1, you were familiar with them. At least, you knew roughly what we were talking about. We now need to define them precisely and this is what we do in the first three sections of this chapter.

- **Section 2.1** looks at output.
- **Section 2.2** looks at the unemployment rate.
- **Section 2.3** looks at the inflation rate.
- **Section 2.4** introduces two important relations between these three variables, Okun's law, and the Phillips curve.
- **Section 2.5** then introduces the three central concepts around which the book is organised:
  - the *short run:* what happens to the economy from year to year
  - the *medium run:* what happens to the economy over a decade or so
  - the *long run:* what happens to the economy over a half century or longer.

Building on these three concepts, Section 2.6 gives you the road map to the rest of the book.

2.1 AGGREGATE OUTPUT

Economists studying economic activity in the 19th century or during the Great Depression had no measure of aggregate activity (*aggregate* is the word macroeconomists use for *total*) on which to rely. They had to put together bits and pieces of information, such as the shipments of iron ore, or sales at some department stores, to try to infer what was happening to the economy as a whole.

It wasn't until the end of World War II that **national income and product accounts** (or national income accounts, for short) were put together. Measures of aggregate output have been published on a regular basis in Australia since 1960. (You will find measures of aggregate output for earlier times, but these have been constructed retrospectively.)

Two economists, Simon Kuznets, from Harvard University, and Richard Stone, from Cambridge University, were given the Nobel Prize for their contributions to the development of the national income and product accounts—a gigantic intellectual and empirical achievement.

Like any accounting system, the national income accounts first define concepts, and then construct measures corresponding to these concepts. You need only to look at statistics from countries that haven't yet developed such accounts to realise that precision and consistency in such accounts are crucial. Without these characteristics, numbers that should add up don't; trying to understand what is going on feels like trying to balance someone else's books. We won't burden you with the details

of national income accounting here. But, because you will occasionally need to know the definition of a variable and how variables relate to each other, Appendix 1 at the end of the book gives you the basic accounting framework used in Australia (and, with minor variations, in most other countries) today. You will find it useful whenever you want to look at economic data on your own.

You may come across another term, **gross national product**, or **GNP**. There is a subtle difference between 'domestic' and 'national', and thus between GDP and GNP. We examine the distinction in Chapter 18 and in Appendix 1 at the end of the book.

GDP: Production and income

The measure of **aggregate output** in the national income accounts is called **gross domestic product**, or **GDP** for short. To understand how GDP is constructed, it is best to work with a simple example. Consider an economy composed of just two firms:

- Firm 1 produces steel, employing workers and using machines to produce the steel. It sells the steel for $100 to Firm 2, which produces cars. Firm 1 pays its workers $80, leaving $20 in profit to the firm.
- Firm 2 buys the steel and uses it, together with workers and machines, to produce cars. Revenues from car sales are $200. Of the $200, $100 goes to pay for steel and $70 goes to workers in the firm, leaving $30 in profit to the firm.

In reality, not only workers and machines are required for steel production, but so are iron ore, electricity, etc. We will ignore these to keep the example simple.

We can summarise this information in a table:

Steel company (Firm 1)			Car company (Firm 2)		
Revenues from sales		$100	Revenues from sales		$200
Expenses		$80	Expenses		$170
Wages	$80		Wages	$70	
			Steel purchases	$100	
Profit		$20	Profit		$30

How would you define aggregate output in this economy? As the sum of the values of all goods produced in the economy—the sum of $100 from the production of steel and $200 from the production of cars, so $300? Or as just the value of cars, which is equal to $200?

Some thought suggests that the right answer must be $200. Why? Because steel is an **intermediate good**: it is used up in the production of cars. Once we count the production of cars, we don't want to count the production of the goods that went into the production of these cars.

An intermediate good is a good used in the production of another good. Some goods can be both final goods and intermediate goods. Potatoes sold directly to consumers are final goods. Potatoes used to produce potato chips are intermediate goods. Can you think of other examples?

This motivates the first definition of GDP:

1. *GDP is the value of the final goods and services produced in the economy during a given period.*

The important word here is *final*. We want to count only the production of **final goods**, not intermediate goods. Using our example, we can make this point in another way. Suppose the two firms merged, so that the sale of steel took place inside the new firm and was no longer recorded. The accounts of the new firm would be given by the following table:

Steel and Car company	
Revenues from sales	$200
Expenses (wages)	$150
Profit	$50

All we would see would be one firm selling cars for $200, paying workers $80 + $70 = $150, and making $20 + $30 = $50 in profits. The $200 measure would remain unchanged—as it should. We don't want our measure of aggregate output to depend on whether firms decide to merge or not.

This first definition gives us one way to construct GDP: by recording and adding up the production of all final goods—and this is indeed roughly the way actual GDP numbers are put together. But it also suggests a second way of thinking about and constructing GDP:

2. *GDP is the sum of value added in the economy during a given period.*

The term **value added** means exactly what it suggests. The value added by a firm is defined as the value of its production minus the value of the intermediate goods used in production.

In our two-firm example, the steel company doesn't use intermediate goods. Its value added is simply equal to the value of the steel it produces, \$100. The car company, however, uses steel as an intermediate good. Thus, the value added by the car company is equal to the value of the cars it produces minus the value of the steel it uses in production, \$200 – \$100 = \$100. Total value added in the economy, or GDP, equals \$100 + \$100 = \$200. (Note that aggregate value added would remain the same if the steel and car firms merged and became a single firm. In this case, we would not observe intermediate goods at all—as steel would be produced and then used to produce cars within the single firm—and the value added in the single firm would simply be equal to the value of cars, \$200.)

This definition gives us a second way of thinking about GDP. Put together, the two definitions imply that the value of final goods and services—the first definition of GDP—can also be thought of as the sum of the value added by all the firms in the economy—the second definition of GDP.

So far, we have looked at GDP from the *production side*. The other way of looking at GDP is from the *income side*. Go back to our example and think about the revenues left to a firm after it has paid for its intermediate goods.

Some of the revenues go to pay workers—this component is called *labour income*. The rest goes to the firm—that component is called *capital income* or *profit income*.

Of the \$100 of value added by the steel manufacturer, \$80 goes to workers (labour income) and the remaining \$20 goes to the firm (capital income). Of the \$100 of value added by the car manufacturer, \$70 goes to labour income and \$30 to capital income. For the economy as a whole, labour income is equal to \$150 (\$80 + \$70), capital income is equal to \$50 (\$20 + \$30). Value added is equal to the sum of labour income and capital income is equal to \$200 (\$150 + \$50).

The labour share in the example is thus 75 per cent. In advanced countries, the share of labour is indeed typically between 55 and 75 per cent. For Australia, the labour share was 71 per cent in 1960 but fell to 55 per cent in 2011, while capital's share has increased.

This motivates the third definition of GDP:

3. *GDP is the sum of incomes in the economy during a given period.*

To summarise: You can think about aggregate output—*GDP*—in three different but equivalent ways.

- From the *production side*: GDP equals the value of the final goods and services produced in the economy during a given period.
- Also from the *production side*: GDP is the sum of value added in the economy during a given period.
- From the *income side*: GDP is the sum of incomes in the economy during a given period.

Two lessons to remember:
i. GDP is the measure of aggregate output, which we can look at from the production side (aggregate production), or the income side (aggregate income); and
ii. Aggregate production and aggregate income are always equal.

Nominal and real GDP

In the 12 months to December 2011, Australian GDP was \$1442 billion, compared with \$17.3 billion in 1960. Was Australian output really eighty three times higher in 2011 than in 1960? Obviously not: much of the increase reflected an increase in prices, rather than an increase in quantities produced. This leads to the distinction between nominal GDP and real GDP.

Nominal GDP is the sum of the quantities of final goods produced times their current price. This definition makes clear that nominal GDP increases over time for two reasons:

Warning! People often use 'nominal' to denote small amounts. Economists use nominal for variables expressed in current prices. And they surely do not refer to small amounts: the numbers typically run in the billions or trillions of dollars.

- First, the production of most goods increases over time.
- Second, the prices of most goods also increase over time.

If our goal is to measure production and its change over time, we need to eliminate the effect of increasing prices on our measure of GDP. That's why **real GDP** is constructed as the sum of the quantities of final goods times *constant* (rather than *current*) prices.

If the economy produced only one final good, say, a particular car model, constructing real GDP would be easy. We would use the price of the car in a given year, and then use it to multiply the quantity of cars produced in each year. An example will help here. Consider an economy that only produces cars—and to avoid issues we will tackle later, assume the same model is produced every year. Suppose the number and the price of cars in three successive years are given by:

Year	Quantity of cars	Price of cars	Nominal GDP	Real GDP (in 2010 dollars)
2009	10	$20 000	$200 000	$240 000
2010	12	$24 000	$288 000	$288 000
2011	13	$26 000	$338 000	$312 000

Nominal GDP, which is equal to the quantity of cars times their price, goes up from $200 000 in 2009 to $288 000 in 2010—a 44 per cent increase—and from $288 000 in 2010 to $338 000 in 2011—a 16 per cent increase.

- To construct real GDP, we need to multiply the number of cars in each year by a *common* price. Suppose we use the price of a car in 2010 as the common price. This approach gives us in effect *real GDP in 2010 dollars*.
- Using this approach, real GDP in 2009 (in 2010 dollars) equals 10 cars × $24 000 per car = $240 000. Real GDP in 2010 (in 2010 dollars) equals 12 cars × $24 000 per car = $288 000, the same as nominal GDP in 2010. Real GDP in 2011 (in 2010 dollars) is equal to 13 × $24 000 = $312 000.

  So real GDP goes up from $240 000 in 2009 to $288 000 in 2010—a 20 per cent increase—and from $288 000 in 2010 to $312 000 in 2011—an 8 per cent increase.
- How different would our results have been if we had decided to construct real GDP using the price of a car in, say, 2011 rather than 2010? Obviously, the level of real GDP in each year would be different (because the prices are not the same in 2011 as in 2010); but its rate of change from year to year would be the same as above.

To be sure, compute real GDP in 2010 dollars, and compute the rate of growth from 2009 to 2010, and from 2010 to 2011.

The problem in constructing real GDP in practice is that there is obviously more than one final good. Real GDP must be defined as a weighted average of the output of all final goods, and this brings us to what the weights should be.

The *relative prices* of the goods would appear to be the natural weights. If one good costs twice as much per unit as another, then that good should count for twice as much as the other in the construction of real output. But this raises the question: What if, as is typically the case, relative prices change over time? Should we choose the relative prices of a particular year as weights, or should we change the weights over time? More discussion of these issues, and of the way real GDP is constructed in Australia, is left to an appendix to this chapter. Here, what you should know is that the measure of real GDP in Australian national income accounts uses weights that reflect relative prices and that change over time. The measure is called **real GDP in chained (2009–10) dollars**. ('2009–10' because, as in our example above, 2009–10 is the year when, by construction, real GDP is equal to nominal GDP.) It is our best measure of the output of the Australian economy, and its evolution shows how Australian output has increased over time.

Suppose real GDP was measured in 2000 dollars rather than 2009 dollars. Where would the nominal GDP and real GDP lines on the graph intersect?

Figure 2.1 plots the evolution of both nominal GDP and real GDP since 1960. By construction, the two are equal in 2009. The figure shows that real GDP in 2011 was about 5.9 times its level of 1960—a considerable increase, but clearly much less than the 83–fold increase in nominal GDP over the same period. The difference between the two results comes from the increase in prices over the period.

The terms *nominal GDP* and *real GDP* each have many synonyms, and you are likely to encounter them in your readings:

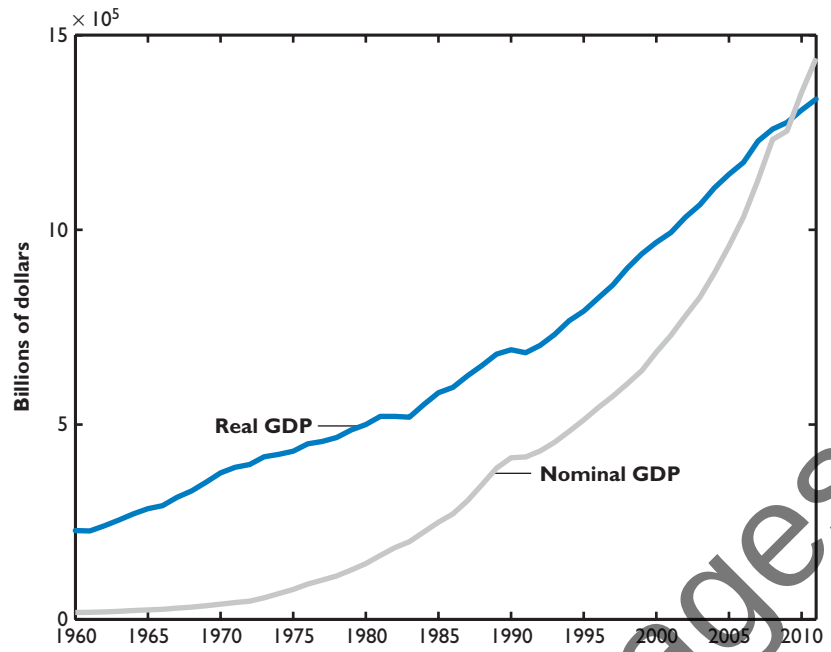


Figure 2.1 Nominal and real Australian GDP, 1960–2011

From 1960 to 2011, nominal GDP increased by a factor of 83. Real GDP increased by a factor of about 6.

SOURCE: RBA *Bulletin*, Table G11. © Reserve Bank of Australia, 2001–10. All rights reserved.

- Nominal GDP is also called **dollar GDP** or **GDP in current dollars**.
- Real GDP is also called **GDP in terms of goods**, **GDP in constant dollars**, **GDP adjusted for inflation**, or **GDP in (chained) 2009 dollars** or **GDP in 2009 dollars**—if the year in which real GDP is set equal to nominal GDP is 2009, as is the case in Australia at this time.

In the chapters that follow, unless we indicate otherwise,

- GDP will refer to *real GDP* and Y_t will denote *real GDP in year t*.
- Nominal GDP, and variables measured in current dollars, will be denoted by a dollar sign in front of them—for example, $\$Y_t$ for nominal GDP in year t.

GDP: Level versus growth rate

We have focused so far on the level of real GDP. This is an important number, which gives the economic size of a country. A country with twice the GDP of another country is economically twice as big. Equally important is the level of **real GDP per capita**, the ratio of real GDP to the population of the country. It gives us the average standard of living of the country.

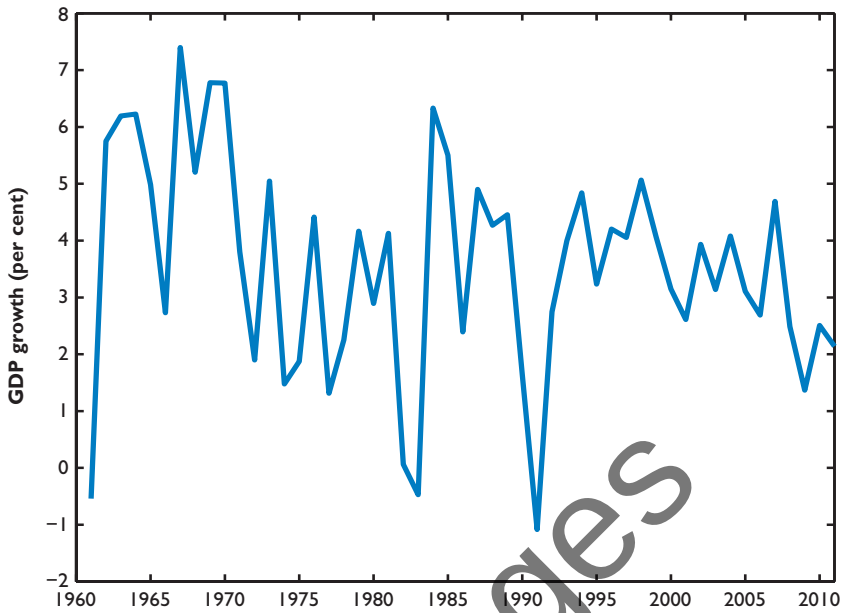
Warning! One must be careful about how one does the comparison. Recall the discussion in Chapter 1 about the standard of living in China. This is discussed further in Chapter 10.

In assessing the performance of the economy from year to year, economists focus on the rate of growth of real GDP, on **GDP growth**. Periods of positive GDP growth are called **expansions**. Periods of negative GDP growth are called **recessions**.

There is no official definition of what constitutes a recession, but to avoid calling just one quarter of negative growth a recession, macroeconomists usually refer to a 'recession' only if the economy undergoes at least two consecutive quarters of negative growth.

The evolution of GDP growth in Australia since 1960 is given in Figure 2.2. GDP growth in year t is constructed as $(Y_t - Y_{t-1})/Y_{t-1}$ and expressed as a percentage. The figure shows how the Australian economy has gone through a series of expansions, interrupted by short recessions. The average growth rate over the 50-year period was about 3.5 per cent. There were three Australian recessions (1960–61, 1982–83 and 1990–91) and the worst was the last. Australia hadn't experienced another recession up until the time of writing (mid-2012), an unusually long period of expansion. Again, you can see the relatively mild effects of the 2008 crisis: a low point of 1.4 per cent growth in 2009, and a slow recovery since.

Figure 2.2
Growth rate of Australian GDP, 1960–2011



Since 1960, the Australian economy has gone through a series of expansions, interrupted by short recessions. The most recent recession in 1990–91 was the most severe recession in the period from 1960 to 2011.

SOURCE: Calculated from RBA *Bulletin*, Table G10.

Focus Box

REAL GDP, TECHNOLOGICAL PROGRESS AND THE PRICE OF COMPUTERS

A tough problem in computing real GDP is how to deal with changes in quality of existing goods. One of the most difficult cases is computers. It would clearly be absurd to assume that a personal computer in 2012 is the same good as a personal computer produced in 1981 (the year in which the IBM PC was introduced). The same amount of money can clearly buy much more computing in 2012 than it could in 1981. But how much more? Does a 2012 computer provide 10 times, 100 times, or 1000 times the computing services of a 1981 computer? How should we take into account the improvements in internal speed, the size of the RAM or of the hard disk, the fact that computers can wirelessly access the Internet, and so on?

The approach used by economists to adjust for these improvements is to look at the market for computers and how it values computers with different characteristics in a given year. Example: Suppose the evidence from prices of different models on the market show that people are willing to pay 10 per cent more for a computer with a speed of 3 GHz (3000 megahertz) rather than 2 GHz. (The first edition of this book, published in 1996, compared two computers with speeds of 50 and 16 megahertz respectively—this change is a good indication of technological progress. A further indication is that, for the past few years, progress has not been made by increasing the speed of processors, but rather by using multi-core processors. We will leave this aspect aside, but people in charge of national income accounts cannot; they must take all factors into account.) Suppose new computers this year have a speed of 3 GHz compared to a speed of 2 GHz for new computers last year. And suppose the dollar price of new computers this year is the same as the dollar price of new computers last year. Then, economists in charge of computing the adjusted price of computers will conclude that new computers are in fact 10 per cent cheaper than last year.

This approach, which treats goods as providing a collection of characteristics—for computers, speed, memory, and so on—each with an implicit price, is called **hedonic pricing** ('hedone' means pleasure in Greek). It is used by

the US Department of Commerce—which constructs real GDP—to estimate changes in the price of complex and fast-changing goods, such as motor vehicles and computers. Using this approach, the US Department of Commerce estimates that, for a given price, the quality of new computers has increased on average by 18 per cent a year since 1981. Put another way, a typical personal computer in 2012 delivers $1.18^{31} = 169$ times the computing services a typical personal computer delivered in 1981.

Not only do computers deliver more services, they have become cheaper as well. Their dollar price has declined by about 10 per cent a year since 1981. Putting this together with the information in the previous paragraph, this implies that their quality-adjusted price has fallen at an average rate of 18 per cent + 10 per cent = 28 per cent per year. Put another way, a dollar spent on a computer today buys $1.28^{31} = 2106$ times more computing services than a dollar spent on a computer in 1981.

In Australia, the ABS has used the US hedonic price measures adjusted for the exchange rate to compute Australian price indices. Since 2005, it has constructed its own hedonic estimates using Australian computer sales data.

2.2 THE UNEMPLOYMENT RATE

Because it is a measure of aggregate activity, GDP is obviously the most important macroeconomic variable. But two other variables, unemployment and inflation, tell us about other important aspects of how an economy is performing. This section focuses on the unemployment rate.

Start with two definitions: **employment** is the number of people who have a job; **unemployment** is the number of people who do not have a job but are looking for one. The **labour force** is the sum of employment and unemployment:

$$L = N + U$$

labour force = employment + unemployment

The **unemployment rate** is the ratio of the number of people who are unemployed to the number of people in the labour force:

$$u = \frac{U}{L}$$

unemployment rate = unemployment/labour force

Constructing the unemployment rate is less obvious than you might have thought. Determining whether somebody is employed is straightforward. But how do we assess whether somebody is unemployed or just not looking for work?

Until the 1950s in Australia, the number of unemployed people could be obtained only from the annual reports by trade unions of their unemployed members. When the Commonwealth Employment Service (CES) was set up in 1947 to assist people to find appropriate jobs, it counted the number of unemployed as those seeking unemployment benefits. As in many other countries, this became the official source of data on unemployment until the 1970s. This system led to a poor measure of unemployment. The number of the truly unemployed who were actually registered at the unemployment offices varied both across countries and across time. Those who had no incentive to register—for example, those who had exhausted their unemployment benefits—were unlikely to take the time to come to the unemployment office, so they weren't counted. Countries with less generous benefit systems were likely to have fewer unemployed registering, and therefore smaller measured unemployment rates.

Today, most rich countries rely on large surveys of households to calculate the unemployment rate. In Australia, this survey is called the **Labour Force Survey** (**LFS**). It has relied on interviews of 55 000 households every month, but this figure was cut to 42 000 in July 2008 because of government budget cuts. The survey classifies a person as employed if he or she has a job at the time of the interview; it classifies a person as unemployed if he or she doesn't have a job and has been looking for work in the last four weeks. Most other countries use a similar definition of unemployment. In Australia, estimates based on the LFS survey show that, in March 2012, on average 11.48 million people were employed,

and 0.63 million people were unemployed, so the unemployment rate was 0.63/(11.48 + 0.63) = 5.2 per cent.

Note that only those *looking for a job* are counted as unemployed; those who do not have a job and are not looking for one are counted as **not in the labour force**. When unemployment is high, some of the unemployed give up looking for a job and therefore are no longer counted as unemployed. These people are known as **discouraged workers.** Take an extreme example: If all workers without a job gave up looking for one, the unemployment rate would equal zero. This would make the unemployment rate a very poor indicator of what is happening in the labour market. This example is too extreme; in practice, when the economy slows down, we typically observe both an increase in unemployment and an increase in the number of people who drop out of the labour force. Equivalently, a higher unemployment rate is typically associated with a lower **participation rate**, defined as the ratio of the labour force to the total population of working age.

At the start of economic reform in Eastern Europe in the early 1990s, unemployment increased dramatically. But equally dramatic was the fall in the participation rate. In Poland in 1990, 70 per cent of the decrease in employment was reflected in early retirements—by people dropping out of the labour force rather than becoming unemployed.

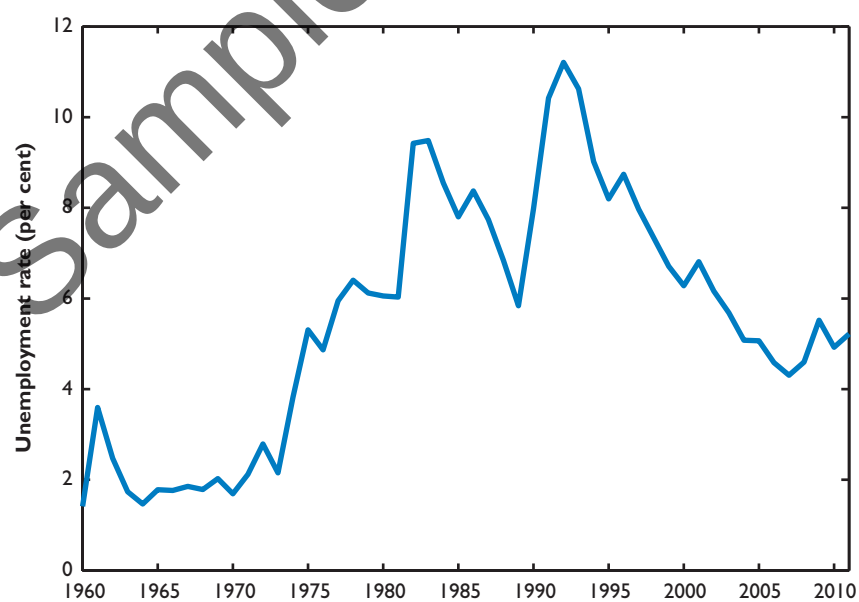
Figure 2.3 shows the evolution of unemployment in Australia since 1960. It has fluctuated between about 2 per cent and 11 per cent, going up in recessions and going down during expansions. Note how much it went up during the recession of 1990–91, and how much it has come down in the long expansion until 2008. Again, you can see the effect of the crisis in 2008, with the unemployment rate reaching a peak at nearly 5.8 per cent in 2009, the highest since 2003.

Why do economists care about unemployment?

Economists care about unemployment for two reasons.

They care about unemployment because of its direct effect on the welfare of the unemployed. Although unemployment benefits are more generous today than they were during the Great Depression, unemployment is still often associated with financial and psychological suffering. How much suffering depends on the nature of the unemployment. One image of unemployment is that of a stagnant pool, of people remaining unemployed for long periods of time. In normal times, in Australia, this image does not

Figure 2.3 Australian unemployment rate, 1960–2012



Since 1960 the Australian unemployment rate has fluctuated between about 2 per cent and 11 per cent, going down during expansions and going up during recessions. The effect of the recent crisis is highly visible, with the unemployment rate peaking in 2009 close to 5.8 per cent, the highest such rate since 2003.

SOURCE: RBA *Bulletin*, Table G7.

apply: every month, many people become unemployed, and many of the unemployed find jobs. When unemployment increases, however, as is the case now in countries like the US where the rate is 8.3 per cent (February 2012), the image becomes more accurate. Not only are more people unemployed, but also many of them are unemployed for a long time. For example, the mean duration of unemployment in the US, which was 9 weeks on average during 2000–07, increased to 33 weeks in 2010. In short, when unemployment increases, it becomes both more widespread and more painful.

In Australia, the mean duration of unemployment in 2011 was 35 weeks, only a little higher than in the previous eight years. Also the unemployment rate was not very different. This is because the 2008–09 global financial crisis had relatively mild effects in Australia.

Economists also care about the unemployment rate because it provides a signal that the economy may not be using some of its resources efficiently. Many workers who want to work do not find jobs; the economy is not utilising its human resources efficiently. From this viewpoint, can very low unemployment also be a problem? The answer is yes. Like an engine running at too high a speed, an economy in which unemployment is very low may be overutilising its resources and run into labour shortages. How low is 'too low'? This is a difficult question, a question we will take up at more length later in the book. The question came up in 2000 in the United States. At the end of 2000, some economists worried that the unemployment rate, 4 per cent at the time, was indeed too low. So, while they did not advocate triggering a recession, they favoured lower (but positive) output growth for some time, so as to allow the unemployment rate to increase to a somewhat higher level. It turned out that they got more than they had asked for: a recession, rather than a slowdown.

It is probably because of statements like this that economics is known as the 'dismal science'.

DID SPAIN REALLY HAVE A 24 PER CENT UNEMPLOYMENT RATE IN 1994?

Focus Box

In 1994, the official unemployment rate in Spain reached 24 per cent. (It then decreased steadily, reaching a low of 8 per cent in 2007, only to increase dramatically again since the beginning of the crisis. In April 2012, it had reached 24 per cent again and may increase further if economic conditions continue to worsen in Europe. Thus, many of the issues in this box are becoming very relevant again.) This was roughly the same unemployment rate as in Australia and the United States in 1933, the worst year of the Great Depression. Yet Spain in 1994 looked nothing like Australia or the United States in 1933: There were few homeless, and most cities looked prosperous. Can we really believe that nearly one-fifth of the Spanish labour force was looking for work?

To answer this question, we must first examine how the Spanish unemployment number is put together. Just like the Labour Force Survey in Australia and the **Current Population Survey (CPS)** in the United States, unemployment is measured using a large survey of 60 000 households. People are classified as unemployed if they indicate that they are not working but are seeking work.

Can we be sure that people tell the truth? No. Although there is no obvious incentive to lie—answers to the survey are confidential and are not used to determine whether people are eligible for unemployment benefits—those who are working in the underground economy may prefer to play it safe and report that they are unemployed instead.

The size of the **underground economy**—that part of economic activity that is not measured in official statistics, either because the activity is illegal, or because firms and workers would rather not report it and thus not pay taxes—is an old issue in Spain. And because of that, we actually know more about the underground economy in Spain than in many other countries. In 1985, the Spanish government tried to find out more and organised a detailed survey of 60 000 individuals. To try to elicit the truth from those interviewed, the questionnaire asked interviewees for an extremely precise account of the use of their time, making it more difficult to misreport. The answers were interesting. The underground economy in Spain—defined as the number of people working without declaring it to the social security administration—accounted for between 10 and 15 per cent of employment. But it was composed mostly of people who already had a job and were taking a second or even a third job. The best estimate from the survey was that only about 15 per cent of the unemployed were in fact working. This implied that the unemployment rate, which was officially 21 per cent at the time, was in fact closer to 18 per cent, still a very high number. In short, the Spanish underground economy was significant, but it just was not the case that most of the Spanish unemployed work in the underground economy.

How did the unemployed survive? Did they survive because unemployment benefits were unusually generous in Spain? No. Except for very generous unemployment benefits in two regions, Andalusia and Extremadura—which, not surprisingly, had even higher unemployment than the rest of the country—unemployment benefits were roughly in line with unemployment benefits in other OECD countries. Benefits were typically 70 per cent of the wage for the first six months, and 60 per cent thereafter. They were given for a period of 4 to 24 months, depending on how long people had worked before becoming unemployed. The 30 per cent of the unemployed who had been unemployed for more than two years did not receive unemployment benefits.

So how did they survive? A key to the answer lies with the Spanish family structure. The unemployment rate was highest among the young: in 1994, it was close to 50 per cent for those between 16 and 19, and around 40 per cent for those between 20 and 24. The young typically stay at home until their late 20s, and have increasingly done so as unemployment increased. Looking at households rather than at individuals, the proportion of households where nobody was employed was less than 10 per cent in 1994; the proportion of households that received neither wage income nor unemployment benefits was around 3 per cent. In short, the family structure, and transfers from the rest of the family, were the factors that allowed many of the unemployed to survive.

2.3 THE INFLATION RATE

Deflation is rare, but it happens. Japan has had deflation, off and on, since the late 1990s. Australia, like many other countries, experienced deflation in the 1930s during the Great Depression.

Inflation is a sustained rise in the the general level of prices—the **price level**. The **inflation rate** is the rate at which the price level increases. Symmetrically, **deflation** is a sustained decline in the price level. It corresponds to a negative inflation rate.

The practical issue is how to define the price level so the inflation rate can be measured. Macroeconomists typically look at two measures of the price level, at two *price indexes*: the GDP deflator and the consumer price index.

The GDP deflator

We saw earlier how increases in nominal GDP can come either from an increase in real GDP, or from an increase in prices. Put another way, if we see nominal GDP increase faster than real GDP, the difference must come from an increase in prices.

This remark motivates the definition of the GDP deflator. The **GDP deflator** in year t, P_t, is defined as the ratio of nominal GDP to real GDP in year t:

$$P_t = \frac{\text{Nominal GDP}_t}{\text{Real GDP}_t} = \frac{\$Y_t}{Y_t}$$

Index numbers are often set equal to 100 (in the base year) rather than to 1.

Note that, in the year in which, by construction, real GDP is equal to nominal GDP (2009 at this point in Australia), this definition implies that the price level is equal to 1. This is worth emphasising: The GDP deflator is what is called an **index number**. Its level is chosen arbitrarily—here it is equal to 1 in 2009—and has no economic interpretation. But its rate of change, $(P_t - P_{t-1})/P_{t-1}$ (which we shall denote by π_t in the rest of the book), has a clear economic interpretation: it gives the rate at which the general level of prices increases over time—the rate of inflation.

Compute the GDP deflator and the associated rate of inflation from 2009 to 2010 and from 2010 to 2011 in our car example in Section 2.1, when real GDP is constructed using the 2010 price of cars as the common price.

One advantage to defining the price level as the GDP deflator is that it implies a simple relation between *nominal GDP*, *real GDP* and the *GDP deflator*. To see this, reorganise the previous equation to get:

$$\$Y_t = P_t Y_t$$

Nominal GDP is equal to the GDP deflator times real GDP. Or, putting it in terms of rates of change: the rate of growth of nominal GDP is equal to the rate of inflation plus the rate of growth of real GDP.

For a refresher, see Appendix 2, Proposition 7.

The consumer price index

The GDP deflator gives the average price of output—the final goods *produced* in the economy. But consumers care about the average price of consumption—the goods they *consume*. The two prices need not be the same—the set of goods produced in the economy is not the same as the set of goods purchased by consumers, for two reasons:

- Some of the goods in GDP are sold not to consumers but to firms (machine tools, for example), to the government or to foreigners.
- Some of the goods bought by consumers are not produced domestically, but are imported from abroad.

To measure the average price of consumption, or equivalently, the **cost of living**, macroeconomists look at another index, the **consumer price index**, **or CPI**. The CPI was first produced in Australia in 1960 with values calculated back to 1948 (though a retail price index was compiled back to 1914). The CPI is published quarterly in Australia, in contrast to the monthly publication in most other rich countries.

Do not confuse the CPI with the PPI, or *producer price index*, which is an index of prices of domestically produced goods in manufacturing, mining, agriculture, fishing, forestry and electric utility industries.

The CPI gives the cost in dollars of a specific list of goods and services over time. The list, which is based on a detailed study of consumer spending—the Household Expenditure Survey—attempts to represent the consumption basket of a typical urban consumer. The list is updated roughly once every six years, and is now based on 2011 weights. These weights have changed significantly—for example, back in 1960 a 30 per cent weight was given to food; now it is half that.

Each quarter, Australian Bureau of Statistics field staff visit stores to find out what has happened to the price of the goods on the list; prices are collected in the eight capital cities, from about 8000 retail stores, car dealerships, garages, hospitals, and so on. These prices are then used to construct the consumer price index.

Like the GDP deflator (the price level associated with aggregate output, GDP), the CPI is an index. It is set equal to 100 in the period chosen as the base period and so its level has no particular significance. The current base period is 1989–90, so the average for the period 1989–90 is equal to 100. In December 2011, the CPI was 179.4; thus, it cost 79.4 per cent more in dollars to purchase the same consumption basket than it did in 1989–90.

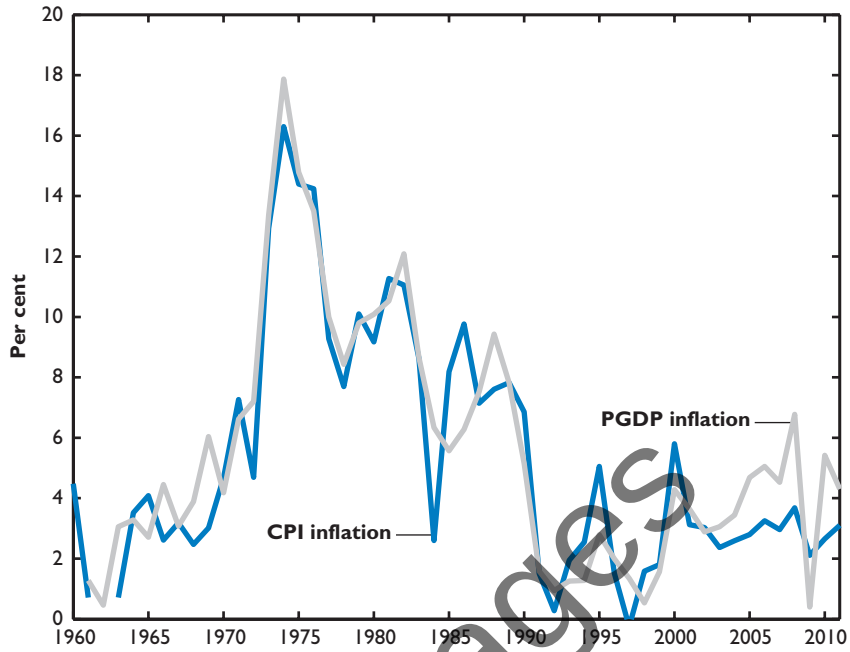
Do not ask why such a strange base period was chosen. Nobody seems to remember.

You may wonder how the rate of inflation differs depending on whether the GDP deflator or the CPI is used to measure it. The answer is given in Figure 2.4, which plots the two inflation rates since 1960 for Australia. The figure yields two conclusions:

- The CPI and the GDP deflator move together most of the time. In most years, the two inflation rates differ by less than 1 per cent.
- But there are clear exceptions. For example, in 1974 the increase in the CPI was significantly less than the increase in the GDP deflator. The reason isn't hard to find. Recall that the GDP deflator is the price of goods produced in Australia, whereas the CPI is the price of goods consumed in Australia. This means that when the price of imported goods decreases relative to the price of goods produced in Australia, the GDP deflator increases faster than the CPI. This is precisely what happened in 1974, when the price of oil doubled and the price of most other commodities went up as well. And although Australia is a consumer of all commodities, it produces much more than it consumes: it was, and still is, a major commodity exporter. Thus, the exchange rate appreciated, which meant you could get more foreign currency for an Australian dollar. In turn, this implied that imports were cheaper, and so there was a smaller increase in the CPI compared with the GDP deflator. A similar story can be told for 2004–11, as oil and other commodity prices increased substantially. The RBA produces an index measure for commodity prices, and from 2004 to 2011, it doubled! This has had major implications for a commodity-exporting country like Australia, pushing up the exchange rate, making imports cheaper and inflation of the CPI lower relative to the GDP deflator.

In what follows, we will typically assume that the two indexes move together so we do not need to distinguish between them. We shall simply talk about *the price level* and denote it by P_t, without indicating whether we have the CPI or the GDP deflator in mind.

Figure 2.4 Inflation rate, using the CPI and the GDP deflator, 1960–2011



The inflation rates, computed using either the CPI or the GDP deflator, are largely similar.

SOURCES: ABS, cat. no. 6401.0, Table 1 (col. J); RBA Bulletin, Table G11 (cols L and W). © Commonwealth of Australia.

Why do economists care about inflation?

If a higher inflation rate meant just a faster but proportional increase in all prices and wages—a case called *pure inflation*—inflation would be only a minor inconvenience, as relative prices would be unaffected.

Take, for example, the workers' *real wage*—the wage measured in terms of goods rather than in dollars. In an economy with 10 per cent more inflation, prices would increase by 10 per cent more a year. But wages would also increase by 10 per cent more a year, so real wages would be unaffected by inflation. Inflation would not be entirely irrelevant; people would have to keep track of the increase in prices and wages when making decisions. But this would be a small burden, hardly justifying making control of the inflation rate one of the major goals of macroeconomic policy.

So, why do economists care about inflation? Precisely because there is no such thing as pure inflation:

- During periods of inflation, not all prices and wages rise proportionately. Because they don't, inflation affects income distribution. For example, retirees in many countries receive payments that do not keep up with the price level, so they lose in relation to other groups when inflation is high. In Australia, only some social security and welfare benefits are automatically indexed for inflation. This is not the case in the United States, where Social Security benefits automatically rise with the CPI, protecting retirees from inflation. But during the very high inflation that took place in Russia in the 1990s, retirement pensions did not keep up with inflation, and many retirees were pushed to near starvation.
- Inflation leads to other distortions. Variations in relative prices also lead to more uncertainty, making it harder for firms to take decisions about the future, such as investment decisions. Some prices, which are fixed by law or by regulation, lag behind the others, leading to changes in relative prices. Taxation interacts with inflation to create more distortions. If tax brackets are not adjusted for inflation, for example, people move into higher and higher tax brackets as their nominal income increases, even if their real income remains the same.

If inflation is so bad, does this imply that deflation (negative inflation) is good?

In Australia now, tax brackets are not indexed to inflation. This is known as *bracket creep*. They were indexed for a brief period in the 1970s. In the United States, the tax brackets are adjusted automatically for inflation: if inflation is 5 per cent, all tax brackets also go up by 5 per cent—in other words, there is no bracket creep in the United States.

Newspapers sometimes confuse deflation and recession. They may happen together but they are not the same. Deflation is a decrease in the price level. A recession is a decrease in real output.

The answer is no. First, high deflation (a large negative rate of inflation) would create many of the same problems as high inflation, from distortions to increased uncertainty. Second, as we will see later in the book, even a low rate of deflation limits the ability of monetary policy to affect output. So what is the 'best' rate of inflation? Most macroeconomists believe that the best (or optimal) rate of inflation is a low and stable rate of inflation, somewhere between 1 and 4 per cent. We will look at the pros and cons of different rates of inflation later in the book.

2.4 OUTPUT, UNEMPLOYMENT AND THE INFLATION RATE: OKUN'S LAW AND THE PHILLIPS CURVE

We have looked separately at the three main dimensions of aggregate economic activity: output growth, the unemployment rate, and the inflation rate. Clearly, they are not independent, and much of the book will be spent looking at the relations between them in detail. But it is useful to have a first look now.

Okun's law

Arthur Okun was an adviser to President Kennedy in the 1960s. Okun's law is, of course, not a law, but an empirical regularity.

Intuition suggests that if output growth is high, unemployment will decrease, and this is indeed true. This relation was first examined by an American economist called Arthur Okun, and for this reason, has become known as **Okun's law**. Figure 2.5 plots the change in the unemployment rate on the vertical axis against the rate of growth of output on the horizontal axis for Australia since 1960. It also draws the line that best fits the cloud of points in the figure. Looking at the figure and the line suggest two conclusions:

Such a graph, plotting one variable against another, is called a scatter plot. The line is called a regression line. For more on regressions, look at Appendix 3.

- The line is downward sloping and fits the cloud of points quite well. Put in economic terms: There is a tight relation between the two variables: Higher output growth leads to a decrease in unemployment. The slope of the line is –0.36. This implies that, on average, an increase in the growth rate of 1 per cent

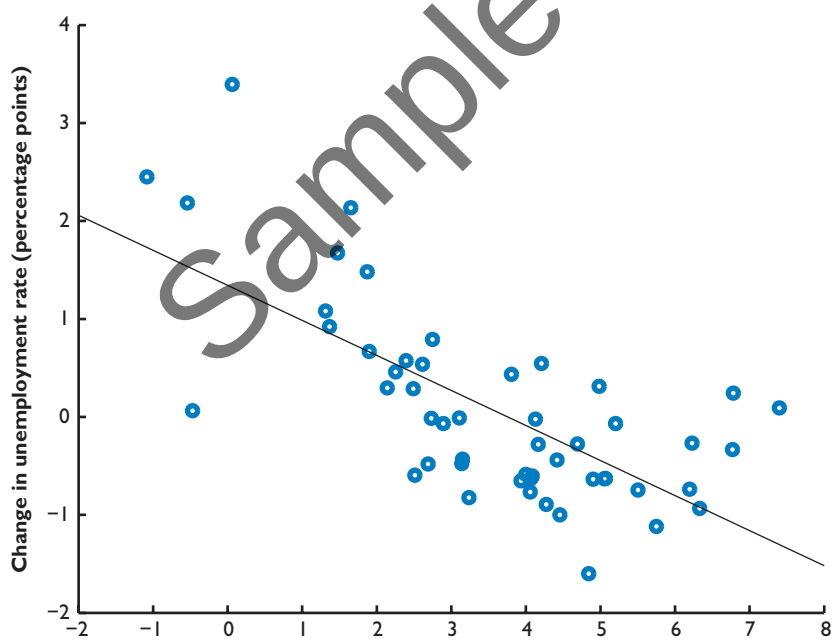


Figure 2.5 Changes in the unemployment rate versus output growth in Australia, 1960–2011

Output growth that is higher than usual is associated with a reduction in the unemployment rate; output growth that is lower than usual is associated with an increase in the unemployment rate.

SOURCES: RBA *Bulletin*, Table G7 and Table G10.

decreases the unemployment rate by roughly –0.36 per cent. This is why unemployment goes up in recessions, and down in expansions. This relation has a simple but important implication: The key to decreasing unemployment is a high enough rate of growth.

- The line crosses the horizontal axis at the point where output growth is roughly equal to 3.75 per cent. In economic terms: It takes a growth rate of about 3.75 per cent to keep unemployment constant. This is for two reasons. The first is that population, and thus the labour force, increases over time, so employment must grow over time just to keep the unemployment rate constant. The second is that output per worker is also increasing with time, which implies that output growth is higher than employment growth. Suppose, for example, that the labour force grows at 1 per cent, and that output per worker grows at 2.75 per cent. Then output growth must be equal to 3.75 per cent (1% + 2.75%) just to keep the unemployment rate constant.

The Phillips curve

Okun's law implies that, with strong enough growth, one can decrease the unemployment rate to very low levels. But intuition suggests that, when unemployment becomes very low, the economy is likely to overheat, and that this will lead to upward pressure on inflation. And, to a large extent, this is true. This relation was first explored in 1958 by a New Zealand economist, A.W. Phillips, and has become known as the **Phillips curve**. Phillips plotted the rate of inflation against the unemployment rate. Since then, the Phillips curve has been redefined as a relation between the *change in the rate of inflation* and the unemployment rate. Figure 2.6 plots the change in the inflation rate (measured using the CPI) on the vertical axis against the unemployment rate on the horizontal axis, together with the line that fits the cloud of points best, for Australia since 1960. Looking at the figure again suggests two conclusions:

It should probably be known as the Phillips relation, but it is too late to change that.

- The line is downward sloping (with a slope of –0.26), although the fit is not as tight as it was for Okun's law: higher unemployment leads, on average, to a decrease in inflation; lower unemployment leads to an increase in inflation. But this is only true on average. Sometimes, high unemployment is associated with an increase in inflation.

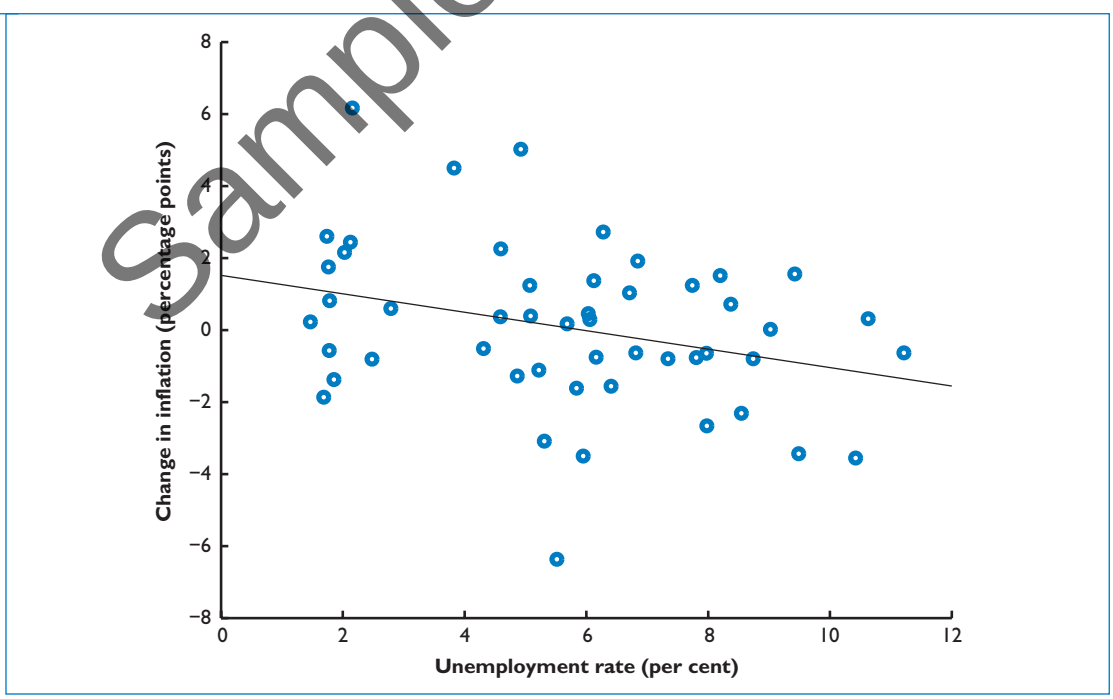


Figure 2.6 Changes in the inflation rate versus the unemployment rate in Australia, 1960–2011

A low unemployment rate leads to an increase in the inflation rate; a high unemployment rate, to a decrease in the inflation rate.

SOURCE: RBA *Bulletin*, Table G7 and Table G11 (cols L and W); ABS, cat no. 6401, Table 1 (col. J).

- The line crosses the horizontal axis at the point where the unemployment rate is roughly equal to 5.9 per cent. In economic terms: when unemployment has been below 5.9 per cent, inflation has typically increased, suggesting that the economy was overheating, operating above its potential. When unemployment has been above 5.9 per cent, inflation has typically decreased, suggesting that the economy was operating below potential. But, again here, the relation is not tight enough that the unemployment rate at which the economy overheats can be pinned down very precisely. This explains why some economists believe that we should try to maintain a lower unemployment rate, say 4 or 5 per cent, and others believe that it may be dangerous, leading to overheating and increasing inflation.

Clearly, a successful economy is an economy which combines high output growth, low unemployment, and low inflation. Can all these objectives be achieved simultaneously? Is low unemployment compatible with low and stable inflation? Do policy-makers have the tools to sustain growth, to achieve low unemployment while maintaining low inflation? These are the questions we will take up as we go through the book. The next two sections give you the road map.

2.5 THE SHORT RUN, THE MEDIUM RUN, THE LONG RUN

What determines the level of aggregate output in an economy?

- Reading newspapers suggests a first answer: movements in output come from movements in the demand for goods. You probably have read news stories that begin like this: 'Production and sales of automobiles were higher last month, due to a surge in consumer confidence, which drove consumers to showrooms in record numbers.' Stories like these highlight the role demand plays in determining aggregate output; they point to factors that affect demand, ranging from consumer confidence to interest rates.
- But, surely, no amount of Indian consumers rushing to Indian showrooms can increase India's output to the level of output in Australia. This suggests a second answer: what matters when it comes to aggregate output is the supply side—how much the economy can produce. How much can be produced depends on how advanced the technology of the country is, how much capital it is using, and the size and the skills of its labour force. These factors—not consumer confidence—are the fundamental determinants of a country's level of output.
- The previous argument can be taken one step further: neither technology, nor capital, nor skills are given. The technological sophistication of a country depends on its ability to innovate and introduce new technologies. The size of its capital stock depends on how much people save. The skills of workers depend on the quality of the country's education system. Other factors are also important: if firms are to operate efficiently, for example, they need a clear system of laws under which to operate and an honest government to enforce those laws. This suggests a third answer: the true determinants of output are factors like a country's education system, its saving rate and the quality of its government. If we want to understand what determines the level of output, we must look at these factors.

You might be wondering at this point, which of the three answers is right? The fact is all three are right. But each applies over a different time frame:

- In the **short run**, say, a few years, the first answer is the right one. Year-to-year movements in output are primarily driven by movements in demand. Changes in demand, perhaps due to changes in consumer confidence or other factors, can lead to a decrease in output (a recession), or an increase in output (an expansion).
- In the **medium run**, say, a decade, the second answer is the right one. Over the medium run, the economy tends to return to the level of output determined by supply factors: the capital stock, the level of technology and the size of the labour force. And, over a decade or so, these factors move sufficiently slowly that we can take them as given.
- In the **long run**, say, a few decades or more, the third answer is the right one. To understand why China has been able to achieve such a high growth rate since 1980, we must understand why both

the capital stock and the level of technology in China are increasing so fast. To do so, we must look at factors like the education system, the saving rate, and the role of the government.

This way of thinking about the determinants of output underlies macroeconomics, and it underlies the organisation of this book.

2.6 A TOUR OF THE BOOK

The book is organised in three parts: a core; two extensions; and, finally, a comprehensive look at the role of macroeconomic policy. This organisation is shown in Figure 2.7. Let us describe it in more detail.

The core

The core is composed of three parts—the short run, the medium run and the long run.

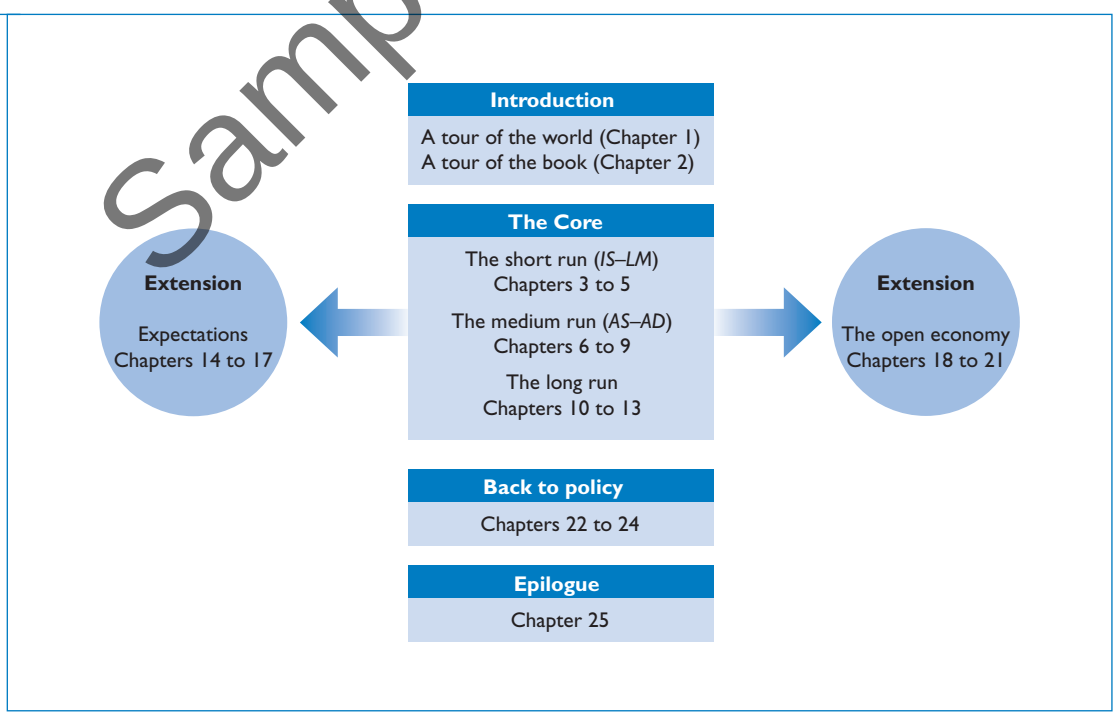
- Chapters 3 to 5 look at how output is determined in the short run.

  To focus on the role of demand, we assume that firms are willing to supply any quantity at a given price. In other words, we ignore supply constraints. Chapter 3 looks at the goods market. Chapter 4 focuses on financial markets. Chapter 5 puts the goods and financial markets together. The resulting framework is known as the *IS–LM* model. Developed in the late 1930s, the *IS–LM* model still provides a simple way of thinking about the determination of output in the short run, and it remains a basic building block of macroeconomics. It also allows for a first pass at studying the effects of fiscal policy and monetary policy on output.

- Chapters 6 to 9 develop the supply side and look at how output is determined in the medium run.

  Chapter 6 introduces the labour market. Chapter 7 puts together goods, financial and labour markets, and shows you how to think about the determination of output both in the short run and in the medium run. The resulting framework is called the aggregate supply–aggregate demand *AS–AD*

Figure 2.7
The organisation of the book



model, and, together with the *IS–LM* is another workhorse of macroeconomics. Chapter 8 focuses on the relation between unemployment and money growth.

By then, we have all the elements we need to take a first detailed look at the crisis that began in 2008. The crisis is unusual in a number of ways. The initial shock is a major one to the financial system in the United States and in Europe. Both monetary and fiscal policies there are facing sharp constraints. As a result, the crisis is much deeper than a standard recession, and the recovery is proving to be very slow. This is the subject of Chapter 9.

- Chapters 10 to 13 focus on the long run.

  Chapter 10 introduces the relevant facts by looking at the growth of output both across countries and over long periods of time. Chapters 11 and 12 then discuss how both capital accumulation and technological progress determine growth. Chapter 13 looks at the interaction between technological progress, wages and unemployment.

Extensions

The core chapters give you a way of thinking about how output (and unemployment and inflation) is determined over the short, medium and long run. However, they leave out several elements, which are explored in two extensions.

- Expectations play an essential role in macroeconomics. Nearly all the economic decisions people and firms make—whether or not to buy a car, whether to buy bonds or to buy stocks, whether or not to build a new plant—depend on their expectations about future income, future profits, future interest rates, and so on. Fiscal and monetary policy affect economic activity not only through their direct effects, but also through their effects on people's and firms' expectations. While we touch on these issues in the core, Chapters 14 to 17 offer a more detailed treatment, and draw the implications for fiscal and monetary policy.
- The core chapters treat the economy as *closed*, ignoring its interactions with the rest of the world. But the fact is, economies are increasingly *open*, trading goods and services and financial assets with one another. As a result, countries are becoming more and more interdependent.

  The nature of this interdependence and the implications for fiscal and monetary policy are the topics of Chapters 18 to 21.

Back to policy

Monetary policy and fiscal policy are discussed in nearly every chapter of this book. But once the core and the extensions have been covered, it is useful to go back and put things together in order to assess the role of policy.

- Chapter 22 focuses on general issues of policy, whether macroeconomists really know enough about how the economy works to use policy as a stabilisation tool at all, and whether policy-makers can be trusted to do what is right.
- Chapters 23 and 24 then return to the role of fiscal and monetary policy.

Epilogue

Macroeconomics is not a fixed body of knowledge. It evolves over time. The final chapter, Chapter 25, looks at the history of macroeconomics and how macroeconomists have come to believe what they believe today. From the outside, macroeconomics sometimes looks like a field divided between schools—'Keynesians', 'monetarists', 'new classicals', 'supply-siders', and so on—hurling arguments at each other. The actual process of research is more orderly and more productive than this image suggests. We identify what we see as the main differences among macroeconomists, the set of propositions that define the core of macroeconomics today, and the challenges posed to macroeconomists by the crisis.

SUMMARY

- We can think of GDP, the measure of aggregate output, in three equivalent ways: (1) GDP is the value of the final goods and services produced in the economy during a given period; (2) GDP is the sum of value added in the economy during a given period; and (3) GDP is the sum of incomes in the economy during a given period.
- Nominal GDP is the sum of the quantities of final goods produced times their current prices. This implies that changes in nominal GDP reflect both changes in quantities and changes in prices. Real GDP is a measure of output. Changes in real GDP reflect changes in quantities only.
- A person is classified as unemployed if he or she doesn't have a job and is looking for one. The unemployment rate is the ratio of the number of people unemployed to the number of people in the labour force. The labour force is the sum of those employed and those unemployed.
- Economists care about unemployment because of the human cost it represents. They also look at unemployment because it sends a signal about how efficiently the economy is using its resources. High unemployment indicates that the economy is not utilising its human resources efficiently.
- Inflation is a rise in the general level of prices—the price level. The inflation rate is the rate at which the price level increases. Macroeconomists look at two measures of the price level. The first is the GDP deflator, which is the average price of the goods produced in the economy. The second is the consumer price index (CPI), which is the average price of goods consumed in the economy.
- Inflation leads to changes in income distribution, to distortions and to increased uncertainty.
- There are two important relations between output, unemployment and inflation. The first, called Okun's law, is a relation between output growth and the change in unemployment: high output growth typically leads to a decrease in the unemployment rate. The second, called the Phillips curve, is a relation between unemployment and inflation: a low unemployment rate typically leads to an increase in the inflation rate.
- Macroeconomists distinguish between the short run (a few years), the medium run (a decade), and the long run (a few decades or more). They think of output as being determined by demand in the short run. They think of output as being determined by the level of technology, the capital stock, and the labour force in the medium run. Finally, they think of output as being determined by factors like education, research, saving and the quality of government in the long run.

KEY TERMS

- national income and product accounts 23
- aggregate output 24
- gross domestic product, GDP 24
- gross national product, GNP 24
- intermediate good 24
- final good 24
- value added 25
- nominal GDP 25
- real GDP 25
- real GDP in chained (2009–10) dollars 26
- dollar GDP, GDP in current dollars 27
- GDP in terms of goods, GDP in constant dollars, GDP adjusted for inflation, GDP in 2009 dollars 27
- real GDP per capita 27
- GDP growth, expansions, recessions 27
- hedonic pricing 28
- employment 29
- unemployment 29
- labour force 29
- unemployment rate 29
- Labour Force Survey (LFS) 29
- not in the labour force 30
- discouraged workers 30
- participation rate 30
- Current Population Survey 31
- underground economy 31
- inflation 32

- price level 32
- inflation rate 32
- deflation 32
- GDP deflator 32
- index number 32
- cost of living 33
- consumer price index (CPI) 33
- Okun's law 35
- Phillips curve 36
- short run, medium run and long run 37

QUESTIONS AND PROBLEMS

Quick check

1. *Using the information in this chapter, label each of the following statements true, false or uncertain. Explain briefly.*
   a. The share of labour income in GDP is much larger than the share of capital income.
   b. Australian GDP was 83 times higher in 2012 than it was in 1960.
   c. When the unemployment rate is high, the participation rate is also likely to be high.
   d. Unemployment tends to fall (rise) during expansions (recessions).
   e. If the Japanese CPI is currently at 108 and the Australian CPI is at 104, then the Japanese rate of inflation is higher than the Australian rate of inflation.
   f. The rate of inflation calculated using the CPI is a better index of inflation than the rate of inflation calculated using the GDP deflator.
   g. The high unemployment rate in Spain is no mystery; it is primarily the result of workers taking jobs in the underground economy.
2. *Suppose you are measuring annual Australian GDP by adding up the final value of all goods and services produced in the economy. Determine the effect of each of the following transactions on GDP:*
   a. You buy $10 worth of potatoes from a market gardener, which you cook and eat at home.
   b. A restaurant buys $10 worth of potatoes from a market gardener.
   c. Qantas buys a new jet from Boeing.
   d. The Australian government buys a fleet of cars from Holden for $1 million.
   e. The government sells one of these cars to you for $50 000.
3. *During a given year, the following activities occur:*
   i. A silver mining company pays its workers $200 000 to mine 75 kilograms of silver. The silver is then sold to a jewellery manufacturer for $300 000.
   ii. The jewellery manufacturer pays its workers $250 000 to make silver necklaces, which it sells directly to consumers for $1 million.
      a. Using the 'production of final goods' approach, what is GDP in this economy?
      b. What is the value added at each stage of production? Using the value added approach, what is GDP?
      c. What are the total wages and profits earned? Using the income approach, what is GDP?
4. *An economy produces three goods: cars, computers and oranges. Quantities and prices per unit for years 2011, 2012 and 2013 are as follows:*

	2011 Quantity	Price	2012 Quantity	Price	2013 Quantity	Price
Cars	10	$2000	12	$3000	11	$2500
Computers	4	$1000	6	$500	5	$750
Oranges	1000	$1	1000	$1	1000	$1

a. What is nominal GDP in 2011, 2012 and 2013? By what percentage does nominal GDP change from 2011 to 2012, and from 2012 to 2013?

b. Using the prices for 2011 as the set of common prices, what is real GDP in 2011, 2012 and 2013? By what percentage does real GDP change from 2011 to 2012, and from 2012 to 2013?

c. Using the prices for 2012 as the set of common prices, what is real GDP in 2011 and in 2012? By what percentage does real GDP change from 2011 to 2012, and from 2012 to 2013?

d. Why are the two output growth rates constructed in (b) and (c) different? Which one is correct? Explain your answer.

5. *Use the data from problem 4 to answer the following:*

a. Suppose we use the prices for 2011 as the set of common prices to calculate real GDP in 2011, 2012 and 2013. Calculate the GDP deflator for each year, and the rate of inflation from 2011 to 2012, and from 2012 to 2013.

b. Suppose we use the prices for 2008 as the set of common prices to calculate real GDP in 2011, 2012 and 2013. Calculate the GDP deflator for each year, and the rates of inflation.

c. Why are the rates of inflation from (a) and (b) different? Which one is correct? Explain your answer.

6. *Chain measures.*

Use the economy described in problem 4.

a. Construct real GDP for years 2011 and 2012 using the average price of each good in 2011 and 2012.

b. By what percentage does real GDP change from 2011 to 2012?

c. What is the GDP deflator in 2011 and 2012? What is the rate of inflation from 2011 to 2012, using the GDP deflator?

d. Repeat (a), (b) and (c) for years 2012 and 2013.

e. Set the real GDP index in 2011 to nominal GDP in 2011. Construct the chain volume of real GDP in 2012, by multiplying the 2011 index by (1+ the growth rate obtained in (b)/100). Repeat this process for 2013 using the growth rate obtained in (d).

f. Is this an attractive solution to the problems pointed out in problems 4 and 5 (that is, two different growth rates, and two different inflation rates, depending on what set of prices was used)? (The answer is 'yes', and is the basis for the construction of chained-type deflators.)

Dig deeper

7. *Hedonic pricing*

As the first focus box of Chapter 2 explains, it is hard to measure the true increase in prices of goods whose characteristics change over time. Hedonic pricing offers a method of calculating the quality-adjusted increase in prices.

a. Consider the case of a routine medical check-up. List some reasons why you may want to use hedonic pricing to measure the change in the price of this service.

Now consider the case of a medical check-up for a pregnant woman. Suppose that the year a new ultrasound method is introduced, the price of this check-up increases by 20 per cent, and all doctors adopt the ultrasound simultaneously.

b. What information do you need in order to determine the quality-adjusted increase in pregnancy check-ups?

c. Is that information available? Explain. What can you say about the quality-adjusted price increase of pregnancy check-ups?

8. *Measured and true GDP*

Suppose that instead of spending an hour cooking dinner, you decide to work an extra hour, earning an additional $12. You then buy some take-away Chinese food, which costs you $10.

a. By how much does measured GDP increase?

b. Should true GDP increase by more or less? Explain.

Explore further

9. *To answer this question, you will need quarterly data on Australian unemployment rates and real GDP growth rates. The basic data can be found at RBA's website (www.rba.gov.au), Statistics, Statistical Tables, Table G10 for real GDP and Table G07 for unemployment data. However, feel free to use any data source you wish. (See the appendix to Chapter 1.)*

Calculate the real GDP growth rate from 'GGDPCVGDP' from Table G10, and obtain the unemployment data from 'GLFSURSA'.

a. Plot the quarterly real GDP growth rates since 2001.

b. Plot the quarterly change in the unemployment rate.

c. Do a scatter plot of the two. Does there appear to be a negative relation between the two? If you know how, check it with a regression of the two.

d. Suppose that Australian policy-makers want to reduce the unemployment rate by one percentage point in one year. Using the answer to (c), try to estimate the growth rate needed to achieve this reduction in the unemployment rate.

FURTHER READING

- If you want to learn more about the definition and the construction of the many economic indicators that are regularly reported on the news—from the help-wanted index to the retail sales index—two easy-to-read references are:
  - The *Guide to Economic Indicators*, 4th edn, by Norman Frumkin (New York: M. E. Sharpe, 2005).
  - *The Economist Guide to Economic Indicators*, 6th edn, by the staff of *The Economist* (New York: Bloomberg, 2007).
- In 1995, the US Senate set up a commission to study the construction of the CPI and to make recommendations about potential changes. The commission concluded that the rate of inflation computed using the CPI was on average about 1 per cent too high. If this conclusion is correct, this implies, in particular, that real wages (nominal wages divided by the CPI) have grown at 1 per cent more per year than is currently being reported. For more on the conclusions of the commission and some of the exchanges that followed, read '*consumer prices, the consumer price index, and the cost of living*', Michael Boskin et al, *Journal of Economic Perspectives*, Volume 12, number 1, Winter 1998, pp. 3–26.
- For a short history of the construction of the national income accounts, read Chapter 1 in the ABS publication: *Australian National Accounts: Concepts, Sources and Methods*, cat. no. 5216.0 (available on the ABS website: <www.abs.gov.au>; select in turn Statistics, By Catalogue Number, 5, 52, 5216.0, Downloads).
- For a discussion of some of the problems involved in measuring activity, read 'What we don't know could hurt us; Some reflections on the measurement of economic activity', by Katherine Abraham, *Journal of Economic Perspectives*, 2005, Volume 19, number 3, 3–18.
- To see why it is hard to measure the price level and output correctly, read 'Viagra and the wealth of nations' by Paul Krugman, 1998 (www.pkarchive.org/theory/viagra.html) (Paul Krugman is an economist at Princeton University and a columnist at *The New York Times*. His columns are opinionated, insightful and fun to read.)

APPENDIX: THE CONSTRUCTION OF REAL GDP AND CHAIN-TYPE INDEXES

The example we used in the chapter had only one final good—cars—so constructing real GDP was easy. But how do we construct real GDP when there is more than one final good? This appendix gives the answer.

To understand how real GDP in an economy with many final goods is constructed, all you need to do is look at an economy where there are just two final goods. What works for two goods works just as well for millions of goods.

So, suppose that an economy produces two final goods, say wine and potatoes:

- In year 0, it produces 10 pounds of potatoes at a price of $1 per pound, and 5 bottles of wine at a price of $2 per bottle.
- In year 1, it produces 15 pounds of potatoes at a price of $1 per pound, and 5 bottles of wine at a price of $3 per bottle.
- Nominal GDP in year 0 is therefore equal to $20. Nominal GDP in year 1 is equal to $30.

This information is summarised in the following table.

Nominal GDP in year 0 and in year 1

Year 0			
	Quantity	$ Price	$ value
Potatoes (pounds)	10	1	10
Wine (bottles)	5	2	10
Nominal GDP			20
Year 1			
	Quantity	$ Price	$ value
Potatoes (pounds)	15	1	15
Wine (bottles)	5	3	15
Nominal GDP			30

The rate of growth of nominal GDP from year 0 to year 1 is equal to ($30 – $20)/$20 = 50 per cent. But what is the rate of growth of real GDP?

Answering this question requires consructing real GDP for each of the two years. The basic idea behind constructing real GDP is to evaluate the quantities in each year using the *same set of prices*.

Suppose we choose, for example, the prices in year 0. Year 0 is then called the **base year**. In this case, the computation is as follows:

- Real GDP in year 0 is the sum of the quantity in year 0 times the price in year 0 for both goods: (10 × $1) + (5 × $2) = $20.
- Real GDP in year 1 is the sum of the quantity in year 1 times the price in year 0 for both goods: (15 × $1) + (5 × $2) = $25.
- The rate of growth of real GDP from year 0 to year 1 is then ($25 – $20)/$20, or 25 per cent.

This answer raises, however, an obvious issue: instead of using year 0 as the base year, we could have used year 1, or any other year. If, for example, we had used year 1 as the base year, then:

- Real GDP in year 0 would be equal to (10 × $1 + 5 × $3) = $25.
- Real GDP in year 1 would be equal to (15 × $1 + 5 × $3) = $30.
- The rate of growth of real GDP from year 0 to year 1 would be equal to $5/$25, or 20 per cent.

The answer using year 1 as the base year would therefore be different from the answer using year 0 as the base year. So, if the choice of the base year affects the constructed percentage rate of change in output, which base year should one choose?

Until the mid-1990s in Australia—and still in most countries today—the practice was to choose a base year and change it every five years. For example, in Australia, 1989–90 was the base year used from December 1991 to December 1995. That is, measures of real GDP published, for example, in 1994 for both 1994 and for all earlier years were constructed using 1989–90 prices. In December 1995, national income accounts shifted to 1994–95 as a base year; measures of real GDP for all earlier years were recalculated using 1994–95 prices.

This practice was logically unappealing. Every time the base year was changed and a new set of prices was used, all past real GDP numbers—and all past real GDP growth rates—were recomputed: economic history was, in effect, rewritten every five years! Starting in 1998, the Australian Bureau of Statistics (ABS)—the government office that produces the GDP numbers—shifted to a new method, which doesn't suffer from this problem.

The method requires four steps:

1. Constructing the rate of change of real GDP from year t to year $t+1$ in two different ways. First using the prices from year t as the set of common prices. Second, using the prices from year $t+1$ as the set of common prices.

   For example, the rate of change of GDP from 2010 to 2011 is computed by:

   - constructing real GDP for 2010 and real GDP for 2011 using 2010 prices as the set of common prices, and computing a first measure of the rate of growth of GDP from 2010 to 2011
   - constructing real GDP for 2010 and real GDP for 2011 using 2011 prices as the set of common prices, and computing a second measure of the rate of growth of GDP from 2010 to 2011.

2. Constructing the rate of change of real GDP as the average of these two rates of change.
3. Constructing an index for the level of real GDP by *linking*—or *chaining*—the constructed rates of change for each year.

   The index is set equal to 1 in some arbitrary year. At the time of writing, the arbitrary year is 2009.

   Given that the constructed rate of growth from 2009 to 2010 by the ABS is 2.5 per cent, the index for 2010 equals (1 + 2.5 per cent) = 1.025. The index for 2011 is obtained by multiplying the index for 2010 by the rate of growth from 2010 to 2011, and so on.
4. Multiplying this index by nominal GDP in 2009 to derive real *GDP in chained (2009) dollars*.

   As the index is 1 in 2009, this implies that real GDP in 2009 equals nominal GDP in 2009.

   Chained refers to the chaining of rates of change described above. (*2009*) refers to the year where, by construction, real GDP is equal to nominal GDP. (You will find the value of real GDP in chained (2009) dollars in column B of Table G10 on the RBA's statistics website.)

This index is more complicated to construct than the indexes used before 1995. (To make sure you understand the steps, construct real GDP in chained (year 0) dollars for year 1 in our example.) But it is clearly better conceptually. The prices used to evaluate real GDP in two adjacent years are the right prices, namely the average prices for those two years. And, because the rate of change from one year to the next is constructed using the prices in those two years rather than the set of prices in an arbitrary base year, history will not be rewritten every five years—as it used to be when, under the previous method for constructing real GDP, the base year was changed.

(For more detail, look at ABS5248.0—*Information Paper: Australian National Accounts, Introduction of Chain Volume and Price Indexes*. To find this, search for 5248.0 on www.abs.gov.au.)

KEY TERM

- base year 44