CHAPTER 2. A TOUR OF THE BOOK

I. MOTIVATING QUESTIONS

1. How do economists define output, the unemployment rate, and the inflation rate, and why do economists care about these variables?

Output and the unemployment rate are defined in the usual fashion; output as the GDP and the unemployment rate as the percentage of the labor force not working. The text defines the inflation rate in two ways: the percentage change in the GDP deflator and the percentage change in the CPI. The link between output and the standard of living is implicit in the chapter. Economists care about the unemployment rate because the unemployed suffer, particularly if they remain unemployed for long periods of time, and because the unemployment rate provides an indicator of whether the economy is growing too fast or too slowly (concepts that will be defined precisely later in the book). Inflation has three main effects: it redistributes real income away from those who receive fixed nominal income, it distorts relative prices to the extent that some nominal variables do not adjust, and it creates uncertainty about relative price levels.

2. What factors affect output in the short run, the medium run, and long run?

This chapter introduces the basic framework of the book in terms of time. In the short run (a time frame of a few years), output is determined primarily by demand. In the medium run (a time frame of a decade or so), output is determined by the level of technology and the size of capital stock, both of which are more or less fixed. In the long run (a time frame of a half century or more), output is determined by technological progress and capital accumulation.

II. WHY THE ANSWERS MATTER

Students need a formal definition of the basic macroeconomic variables before they can analyze them. The discussion in this chapter provides enough information for students to begin looking at macroeconomic data. Moreover, some discussion of why economists care about these variables, particularly inflation, is useful to orient students.

III. KEY TOOLS, CONCEPTS, AND ASSUMPTIONS

1. Tools and Concepts

i. Chapter 2 introduces **index numbers**.

ii. The chapter defines formally the basic macroeconomic concepts of **nominal** and **real gross domestic product (GDP)**, **GDP growth**, the **GDP deflator**, the **unemployment rate**, the **consumer price index (CPI)**, and the **inflation rate**, as well as associated concepts such as **valued added**, **intermediate inputs**, the **labor force**, and the **participation rate**. All of these concepts are defined in the usual manner.

iii. The chapter distinguishes the **short run**, the **medium run**, and the **long run** in the manner described above in Part I. The distinction establishes the basic theoretical framework for the book.

IV. SUMMARY OF THE MATERIAL

1. Aggregate Output

The text considers a closed economy until Chapter 17, so output is equated with gross domestic product (GDP). Output has three equivalent definitions: (1) the value of final goods and services produced during a given period, (2) the sum of value added during a given period, and (3) the sum of labor and capital income and indirect taxes.

Using the first definition, nominal GDP is output valued at current prices. Real GDP is output valued at constant prices. If the economy produced only one good—say, SUVs—and this good were unchanged over time, one could measure real GDP by simply counting the number of SUVs produced each year. Alternatively, one could multiply the number of SUVs by some constant price—say, the price in some base year. Thus, in the base year, real and nominal GDP would be the same. In practice, the construction of real GDP involves two complications. First, since the economy produces many goods, one must decide how to weight the value of the output of each good to produce aggregate real GDP. The text notes that the United States has adopted a technique—chain weighting—that allows the relative price of goods to change over time. The appendix to Chapter 2 discusses the construction of GDP and chained indexes in more detail. Second, the quality of similar goods changes over time. Economists who construct GDP try to account for quality change in goods through hedonic pricing, an econometric technique that estimates the market value of a good's characteristics—speed, durability, and so on.

The growth rate of real (nominal) GDP is the rate of change of real (nominal) GDP. Periods of positive GDP growth are called expansions; periods of negative growth, recessions.

2. Unemployment and Inflation

i. The Unemployment Rate. An unemployed person is someone who does not have a job, but is looking for one. The labor force is the sum of those who have jobs—the employed—and the unemployed. The unemployment rate is the ratio of unemployed persons to the labor force. Those persons of working age who do not have a job and are not looking for one are classified as out of the labor force. The participation rate is the ratio of the labor force to the size of the working age population.

Economists care about unemployment for two reasons. First, the unemployed suffer. Exactly how much depends on a number of factors, including the generosity of unemployment benefits and the duration of unemployment. In the United States, the average duration of unemployment is relatively low, but some groups (e.g., ethnic minorities, the young, and the less skilled) tend to be more susceptible to unemployment and to remain unemployed much longer than average. Second, the unemployment rate helps policymakers assess how well the economy is utilizing its resources. A high rate of unemployment rate means that labor resources are idle. A low rate of unemployment can also be a problem, if the economy develops labor shortages. A more precise discussion of what constitutes an unemployment rate that is too high or too low is offered later in the book.

ii. The Inflation Rate. The inflation rate is the growth rate of the aggregate price level. Since there are many goods produced and consumed in an economy, constructing the aggregate price level is not trivial. Macroeconomists use two primary measures of the aggregate price level. The first, the GDP deflator, is the ratio of nominal to real GDP. Since nominal and real GDP differ only because prices in any given year differ from the base year, the GDP deflator provides some measure of the average price level in the economy, relative to the base year. By construction, the GDP deflator equals one in the base year. Since the choice of base year is arbitrary, the level of the GDP deflator is meaningless. The rate of change of the GDP deflator, however, is meaningful; it is one measure of inflation.
Measures with arbitrary levels but well-defined rates of change are called index numbers. The GDP deflator is an index number.

An alternative measure of the price level is the Consumer Price Index (CPI)—another index number. In the United States, this measure is based on price surveys across U.S. cities. The prices of various goods are weighted according to average consumer expenditure shares in the United States. The construction of

the CPI and the construction of real GDP involve similar problems. One can also measure inflation as the rate of change in the CPI.

The relationship between inflation measured from the GDP deflator and inflation measured from the CPI is very close, but not perfect. The differences arise because the two price indexes apply to different baskets of goods. GDP measures production of final goods, so inflation calculated from the GDP deflator provides a measure of the percentage change in the aggregate price of final goods produced in an economy. The CPI, on the other hand, measures the price of a representative basket of private consumption, so inflation calculated from the CPI provides a measure of the percentage change in the price of the domestic consumption basket. Domestic consumption includes goods imported from abroad, and domestic production includes final goods used for purposes other than domestic consumption.

Economists care about inflation because it can distort relative prices, produce uncertainty about relative prices, and redistribute income. Inflation distorts relative prices because some nominal variables do not adjust immediately to the rise in the aggregate price level. Inflation redistributes income because some transactions involve fixed nominal payments. For example, some retirees receive fixed nominal incomes (although the text notes that U.S. Social Security payments rise with the CPI).

Inflation may be costly, but there are also economic problems associated with deflation (negative inflation). For example, some of the costs of inflation would also apply to deflation. Moreover, deflation limits the ability of monetary policy to affect output. Consideration of the costs of inflation and the costs of deflation seems to suggest that there is an optimal rate of inflation. Most economists favor a stable inflation rate somewhere between 1 and 4%.

There are two relationships that connect the three main dimensions of economic activity. The relationship between unemployment and output is described by Okun's law. American economist Arthur Okun found that when output increases unemployment falls and vice versa. Intuitively this relationship makes sense because higher output in general requires employing more workers. Figure 2-5 highlights this relationship. The second relationship was identified by economist A.W. Phillips and is shown graphically as the Phillips curve (see Figure 2-6). Phillips discovered that inflation tends to increase as unemployment falls. This finding also seems intuitive given that as economic activity increases, and most people are working, the remaining potential workers must be paid higher wages to get them off the couch. In addition, firms will begin sniping employees from other firms by paying higher wages. The net result is an increase in inflation while unemployment falls.

3. The Basic Macroeconomic Framework and a Road Map for the Book

Macroeconomists view the economy in terms of three time frames. In the short run—a few years or so—demand for goods and services determines output. In the medium run—a decade or so—the level of technology and the size of the capital stock determine output. Since these variables change slowly, it is a useful simplification to assume that they are fixed in the medium run. Finally, in the long run, technological progress and capital accumulation are the primary determinants of output growth.

The remainder of the book can be divided into three sections: "Core" material (Chapters 3-13), extensions to the Core, and concluding chapters on macroeconomic policy and the state of macroeconomic thinking. The Core is organized around the three time frames. It discusses the short run in terms of the *IS-LM* model, the medium run in terms of the *AS-AD* model (which incorporates *IS-LM*), and the long run in terms of the Solow growth model, with some additional discussion of other approaches. After the Core, there are three extensions: expectations (Chapters 14-16), the open economy (Chapters 178-20), and monetary and fiscal policy issues (Chapters 21-23). The final chapter (Chapter 24) focuses on the history of thought in macroeconomics.

The book is constructed so that the three extensions can be addressed in any order after the Core. Indeed, most of the material in the extension chapters can be discussed without covering the growth section of the Core. In addition, much of the material in the policy chapters can be discussed immediately after the Core, without any of the extensions. Thus, there are a number of options for constructing a course around the text.

V. PEDAGOGY

1. Points of Clarification

The use of subscripts to index time will be new for many students. A few minutes of clarification may be worthwhile at the outset.

2. Alternative Sequencing

The chapter does not discuss national income accounting in any detail. Instead the relevant accounting identities are presented in the main text as they become relevant for the development of the analytical model. For example, Chapter 3 presents the expenditure side of the accounts in the course of explaining the composition of aggregate demand. A complete treatment of the real GDP and chain-type indexes is also presented in Appendix 1. Instructors may prefer to introduce the material from Appendix 1 immediately after Section 1 of this chapter.

3. Enlivening the Lecture

It is difficult to add much life to the definitions chapter of macroeconomics. One way to reduce the number of definitions is to focus only on output at this point. The unemployment and inflation definitions could be postponed until Chapter 7, which introduces the labor market and aggregate supply. A benefit of this approach is a more rapid advance to the Keynesian cross in Chapter 3. A cost is the need to say something about the aggregate price level in the *LM* curve in Chapter 6.

VI. EXTENSIONS

1. GDP as a Measure of Welfare

The chapter discusses briefly why economists care about inflation and unemployment, but does not do the same for GDP. It is probably obvious that economists use GDP as a gross measure of aggregate welfare, but instructors may wish to point out that there are (at least) three limitations on GDP as a welfare measure.

i. Measured GDP values goods and services at market prices, since these reflect the relative values placed on them by consumers. However, some valuable things are not sold on markets, and their values thus have to be imputed, a process that undoubtedly introduces some errors. Two important services that do not have a market price are government services and owner-occupied housing.

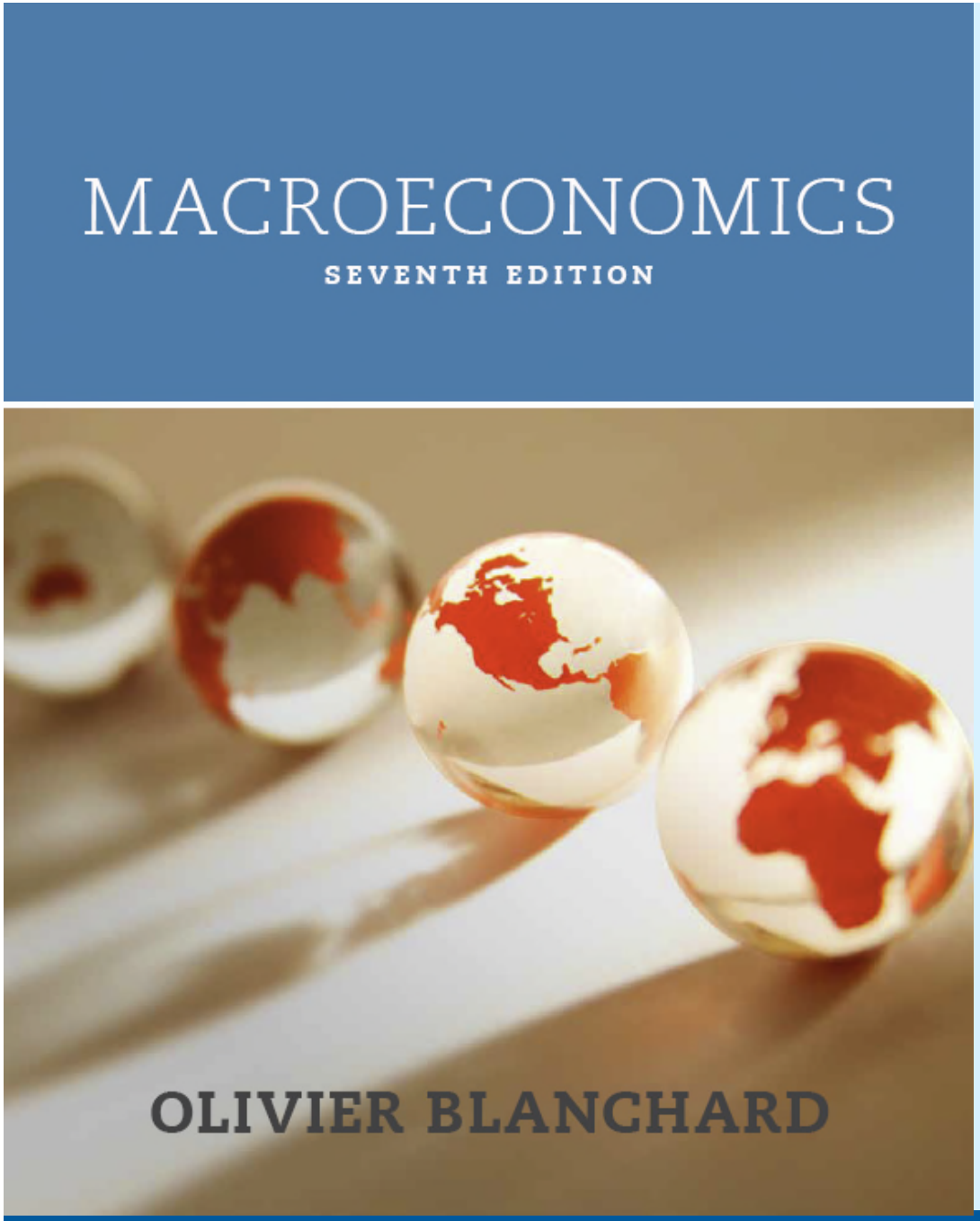
ii. Some goods and services not traded in markets are omitted altogether from the GDP calculation. For example, the value of leisure and the value of services performed in the household are not included in GDP. From a broader perspective, one might also cite civil liberties and other political "goods" as nonmarket goods produced by a nation, but not included in GDP.

iii. GDP does not account for the fact that some of a nation's wealth is depleted in the process of producing it. NDP corrects this to some extent by subtracting the value of depreciated physical capital, but depletion of natural and environmental resources is still omitted. The Department of

Commerce and others have experimented with adjustments to GDP to account for resource and environmental depletion, but there is no consensus among economists about the proper methodology.

2. Stocks and Flows: Wealth and GDP

The text does not introduce the concepts of stocks and flows until Chapter 4 (Financial Markets). Instructors could introduce these concepts in this chapter by distinguishing national wealth (a stock) from GDP (a flow). A natural definition of national wealth is the value of the nation's land (including natural resources), physical and human capital, and claims on foreigners at a given point in time.



A Tour of the Book

Chapter 2

ALWAYS LEARNING
PEARSON

Chapter 2 Outline

A Tour of the Book

2-1	Aggregate Output
2-2	The Unemployment Rate
2-3	The Inflation Rate
2-4	Output, Unemployment, and the Inflation Rate: Okun's Law and the Phillips Curve
2-5	The Short Run, the Medium Run, and the Long Run
APPENDIX	The Construction of Real GDP and Chain-Type Indexes

A Tour of the Book

- The words *output*, *unemployment*, and *inflation* appear daily in newspapers and on the evening news.
- In this chapter, we define these words more precisely.
- The chapter also introduces concepts around which the book is organized: the *short run*, the *medium ran*, and the *long run*.

2-1 Aggregate Output

- **National income and product accounts** were developed at the end of World War II as measures of aggregate output.
- The measure of **aggregate output** is called gross domestic product (**GDP**).
- How would you define aggregate output in the economy?

2-1 Aggregate Output

Steel Company (Firm 1)		
Revenues from sales		$100
Expenses		$80
Wages	$80	
Profit		$20

Car Company (Firm 2)		
Revenues from sales		$200
Expenses		$170
Wages	$70	
Steel purchases	$100	
Profit		$30

- Consider an economy with two firms, Firm 1 and Firm 2.
- Is aggregate output the sum of the values of all goods produced, i.e., $300? Or just the value of cars, i.e., $200?
- Steel is an **intermediate good**, which is a good used in the production of another good.

2-1 Aggregate Output

1. **GDP is the value of final goods and services produced in the economy during a given period.**
   - We want to count only **final goods**, not intermediate goods.
   - If we merge the two firms in the previous example, the revenues of the new firm equal $200.

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

2-1 Aggregate Output

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

- The **value added** by a firm is the value of its production minus the value of the intermediate goods used in production.
- In the two-firm example, the value added equals $100 + $100 = $200.

- So far, we have looked at GDP from the *production side*.

2-1 Aggregate Output

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

- Aggregate production and aggregate income are always equal.
- From the *income side*, valued added in the two-firm example is equal to the sum of *labor income* ($150) and *capital* or *profit* income ($50), i.e., $200.

2-1 Aggregate Output

- **Nominal GDP** is the sum of the quantities of final goods produced times their current price.
- Nominal GDP increases for two reasons:
  - The production of most goods increases
  - The price of most goods increases
- Our goal is to measure production and its change over time.
- **Real GDP** is the sum of quantities of final goods times *constant* (not *current*) prices.

2-1 Aggregate Output

- **Example:**

Year	Quantity of Cars	Price of Cars	Nominal GDP	Real GDP (in 2009 dollars)
2008	10	$20,000	$200,000	$240,000
2009	12	$24,000	$288,000	$288,000
2010	13	$26,000	$338,000	$312,000

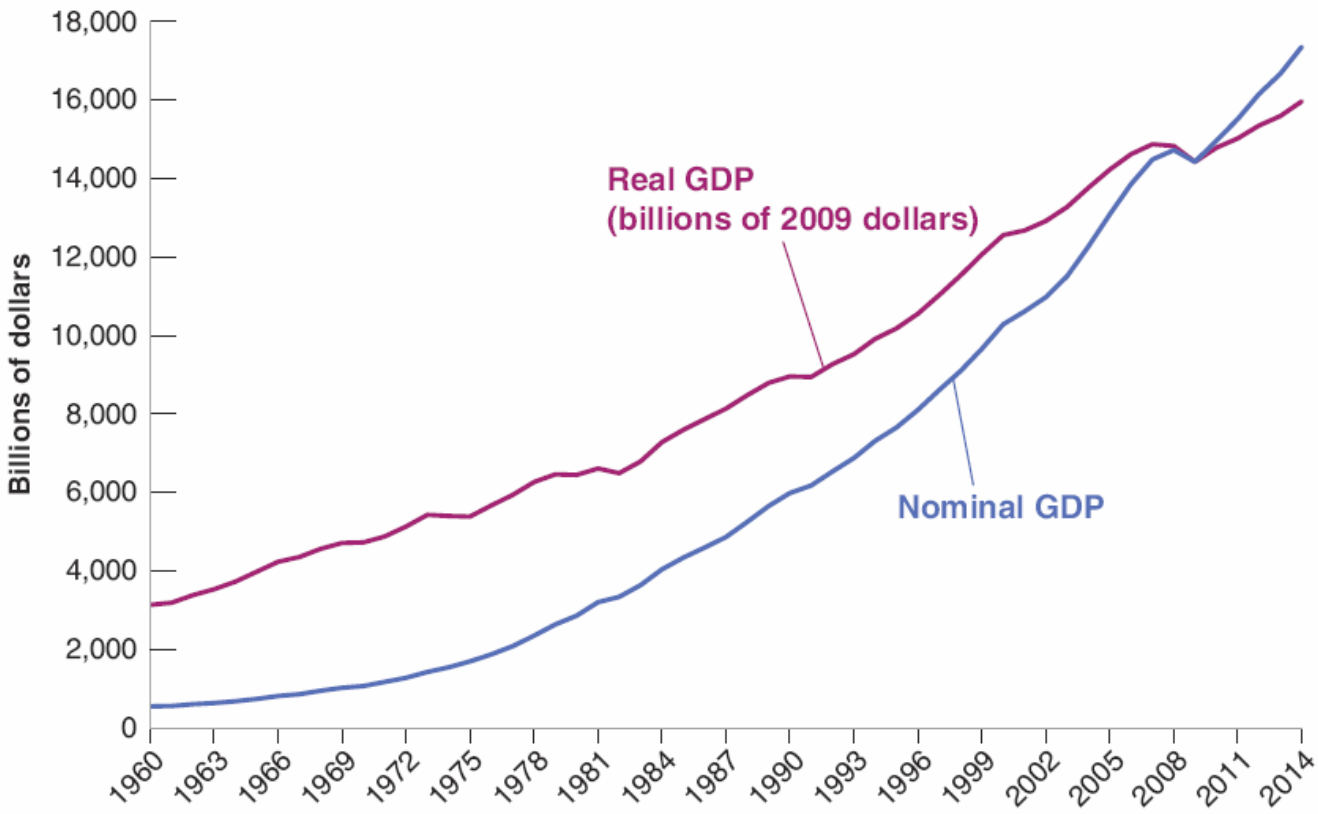
- Real GDP in 2008 (in 2009 dollars) = 10 cars x $24,000 per car = $240,000.
- Real GDP in 2009 (in 2009 dollars) = 12 cars x $24,000 per car = $288,000.
- Real GDP in 2010 (in 2009 dollars) = 13 cars x $24,000 per car = $312,000.

2-1 Aggregate Output

- For more than one good, relative prices of the goods are natural weights for constructed the weighted average of the output of all final goods.
- **Real GDP in chained (2009) dollars** reflects relative prices that change over time.
- The year used to construct prices is called the *base year*.

2-1 Aggregate Output

Figure 2-1 Nominal and Real U.S. GDP, 1960–2014



Source: Series GDPCA, GDPA: Federal Reserve Economic Data (FRED) http://research.stlouisfed.org/fred2/.

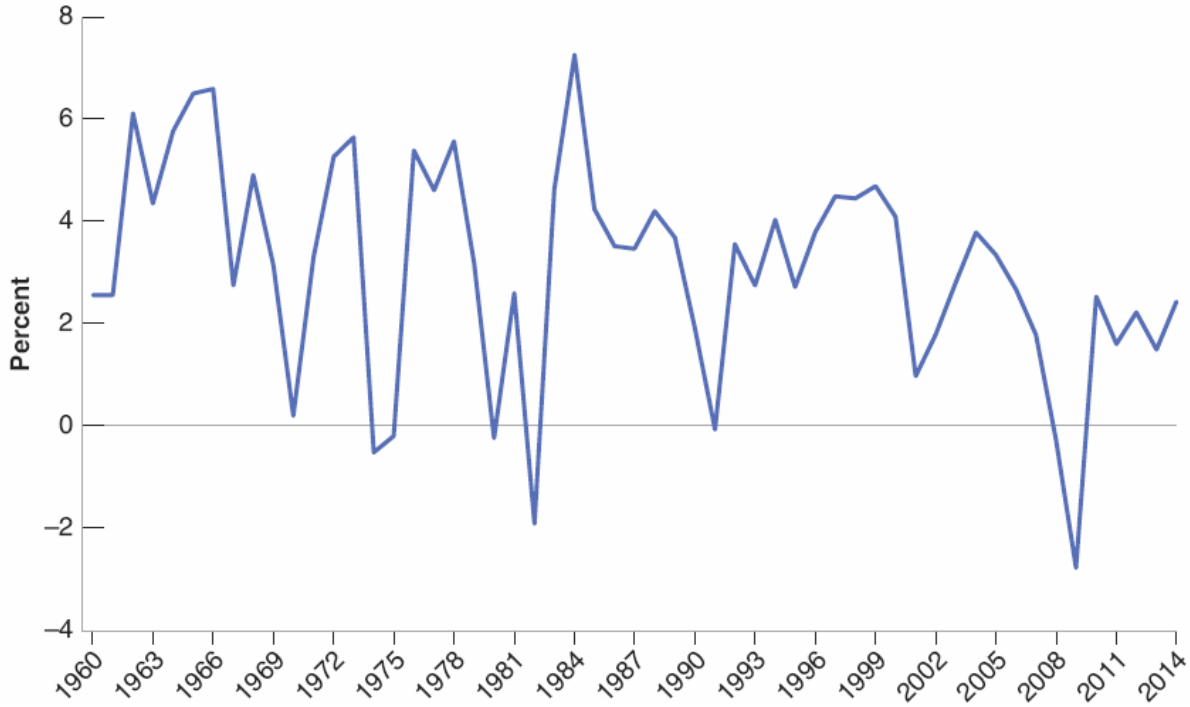
From 1960 and 2014, nominal GDP increased by a factor of 32. Real GDP increased by a factor of about 5.

2-1 Aggregate Output

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

2-1 Aggregate Output

Figure 2-2 Growth Rate of U.S. GDP, 1960–2014



Source: Calculated using series GDPCA in Figure 2-1.

GDP growth in year t is $(Y_t - Y_{t-1})/Y_{t-1}$.

Since 1960, the U.S. economy has gone through a series of expansions, interrupted by short recessions. The 2008–2009 recession was the most severe recession in the period from 1960 to 2014.

FOCUS: Real GDP, Technological Progress, and the Price of Computers

- The Department of Commerce deals with changes in the quality of existing goods like computers with an approach called **hedonic pricing**, which treats goods as providing a collection of characteristics.
- The quality of new laptops (computing services) has increased on average by 18% a year since 1995.
- The dollar price of a typical laptop has also declined by about 7% a year since 1995.
- This implies that laptops' quality-adjusted price has fallen at an average rate of 18% + 7% = 25% per year.

2-2 The Unemployment Rate

- **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 **labor force** is the sum of employment and unemployment.

$$L = N + U$$

$$\text{labor force} = \text{employment} + \text{unemployment}$$

2-2 The Unemployment Rate

- The **unemployment rate** is the ratio of the number of people who are unemployed to the number of people in the labor force.

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

$$\text{unemployment rate} = \text{unemployment} / \text{labor force}$$

2-2 The Unemployment Rate

- Most rich countries rely on large surveys of households to compute the unemployment rate.
- The U.S. **Current Population Survey (CPS)** relies on interviews of 60,000 households every month.
- A person is unemployed if he or she does not have a job *and has been looking for a job in the last four weeks*.
- Those who do not have a job and are not looking for one are counted as **not in the labor force**.

2-2 The Unemployment Rate

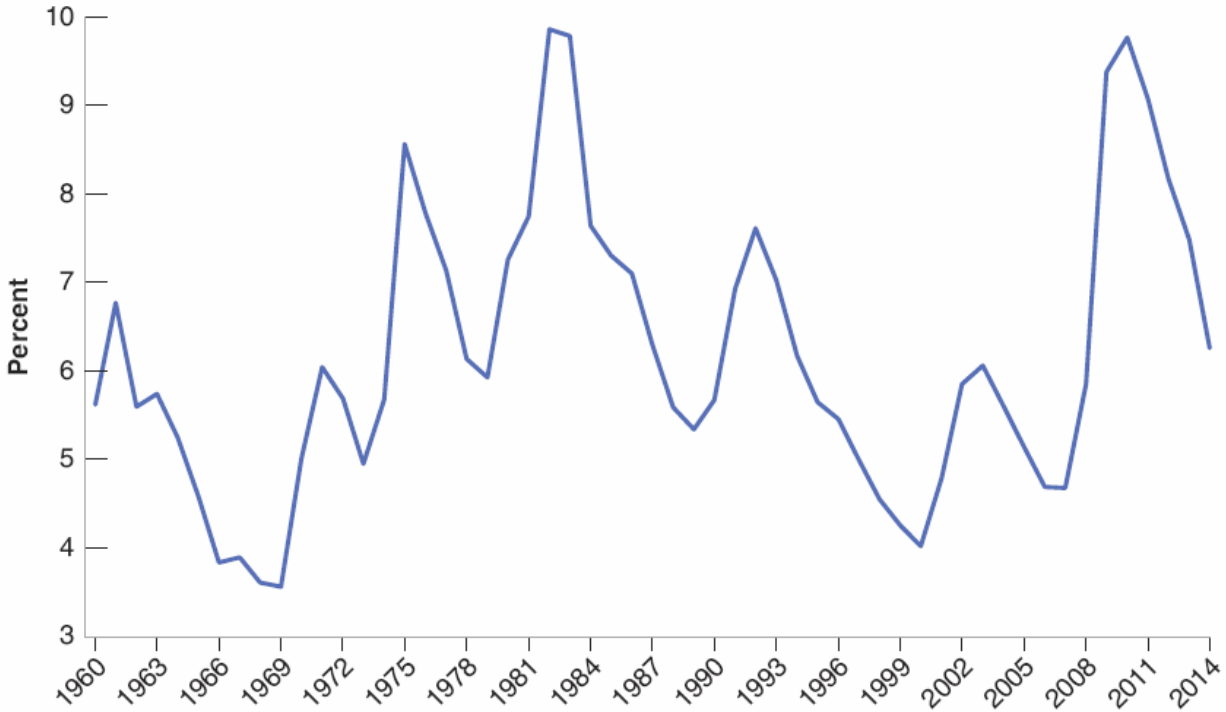
- **Discourage workers** are those who give up looking for a job and so no longer counted as unemployed.
- The **participation rate** is the ratio of the labor force to the total population of working age.
- Because of discourage workers, a higher unemployment rate is typically associated with a lower participation rate.

2-2 The Unemployment Rate

- Why Do Economists Care about Unemployment?
  1. Direct effect on the welfare of the unemployed, especially those remaining unemployed for long periods of time.
  2. A signal that the economy is not using its human resources efficiently.
- Very low unemployment can also be a problem as the economy runs into labor shortages.

2-2 The Unemployment Rate

Figure 2-3 U.S. Unemployment Rate, 1960–2014



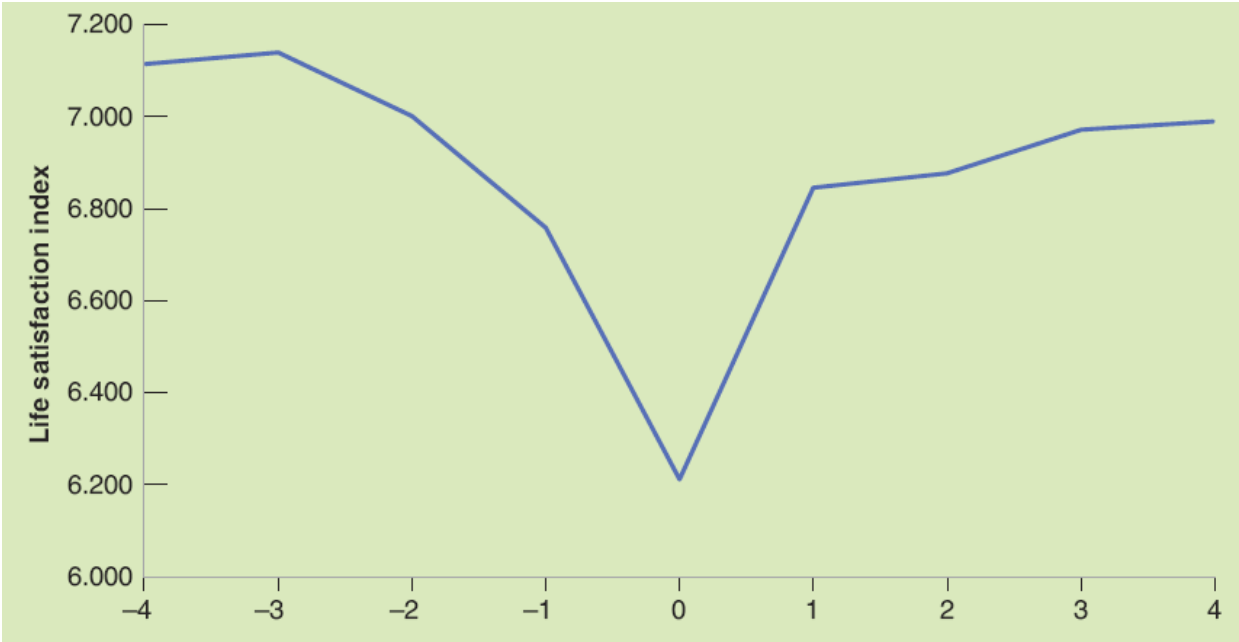
Source: Series LRUN64TTUSA156N: Federal-Reserve Economic Data (FRED) http://research.stlouisfed.org/fred2/.

- Since 1960, the U.S. unemployment rate has fluctuated between 3 and 10%, going down during expansions and going up during recessions.
- The effect of the recent crisis is highly visible, with the unemployment rate reaching close to 10% in 2010, the highest such rate since the early 1980s.

FOCUS: Unemployment and Happiness

- Results of the German Socio-Economic Panel survey suggest that (1) becoming unemployed leads to a large decrease in happiness, (2) happiness declines before the actual unemployment spell, and (3) happiness does not fully recover even four years later.

Figure 1 Effects of Unemployment on Happiness



Source: Winkelmann 2014.

2-3 The Inflation Rate

- **Inflation** is a sustained rise in the general level of prices—the **price level**.
- The **inflation rate** is the rate at which the price level increases.
- **Deflation** is a sustained decline in the price level (negative inflation rate).

2-3 The Inflation Rate

- The **GDP deflator** in year t (P_t) is the ratio of nominal GDP to real GDP in year t:

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

- It is called an **index number** (1 in 2009), which has no economic interpretation.
- The rate of change has a clear interpretation: the rate of inflation.

$$\pi_t = (P_t - P_{t\text{-}1})/P_{t\text{-}1}$$

2-3 The Inflation Rate

- Defining the price level as the GDP deflator implies a simple relation between nominal GP, real GDP, and the GDP deflator:

$$\$Y_t = P_t Y_t$$

- *Nominal GDP is equal to the GDP deflator times real GDP*.
- The rate of growth of nominal GDP is equal to the rate of inflation plus the rate of growth of real GDP.

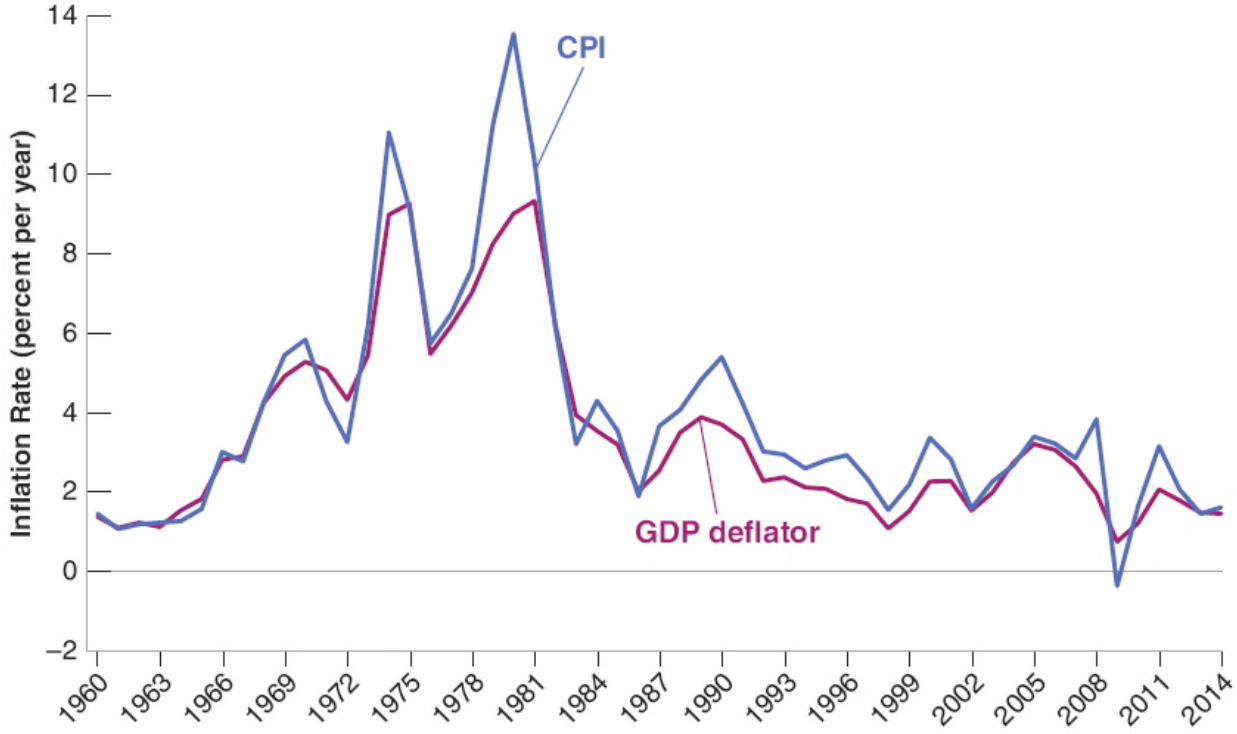
2-3 The Inflation Rate

- The set of goods produced in the economy is not the same as the set of goods purchased by consumers because:
  - Some of the goods in GDP are sold not to consumers but to firms, to the government, or to foreigners.
  - Some of the goods bought by consumers are not produced domestically but are imported from abroad.
- The **Consumer Price Index** (**CPI**) is a measure of the **cost of living**.
- The CPI is published monthly by the Bureau of Labor Statistics (BLS), which collects price data for 211 items in 38 cities.
- The CPI gives the cost in dollars of a specific list of goods and services over time.

2-3 The Inflation Rate

Figure 2-4 Inflation Rate, Using the CPI and the GDP Deflator, 1960–2014

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



Source: Calculated using series USAGDPDEFAISMEI, CPALTT01USA659N Federal Reserve Economic Data (FRED) http://research.stlouisfed.org/fred2/.

2-3 The Inflation Rate

- The CPI and GDP deflator moved together most of the time.
- Exception: In 1979 and 1980, the increase in the CPI was significantly larger than the increase in the GDP deflator due to the price of imported goods increasing relative to the price of domestically produced goods.

2-3 The Inflation Rate

- *Pure inflation* is proportional increase in all prices and wages.
  - This type of inflation causes only a minor inconvenience as relative prices are unaffected.
  - Real wage (wage measured by goods rather than dollars) would be unaffected.
  - There is no such thing as pure inflation.

2-3 The Inflation Rate

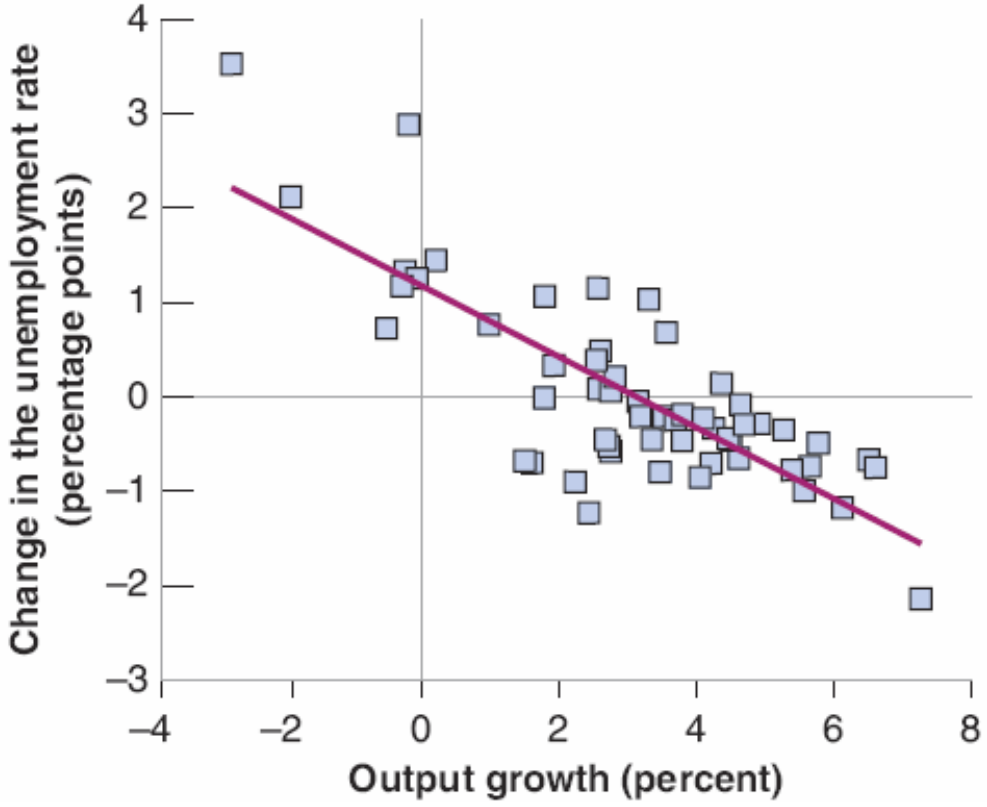
- Why Do Economists Care about Inflation?
  - Inflation affects income distribution when not all prices and wages rise proportionally.
  - Inflation leads to distortions due to uncertainty, some prices that are fixed by law or by regulation, and its interaction with taxation (*bracket creep* in taxes).
- Most economists believe the "best" rate of inflation to be a low and stable rate of inflation between 1 and 4%.

2-4 Output, Unemployment, and the Inflation Rate: Okun's Law and the Phillips Curve

Figure 2-5 Changes in the Unemployment Rate versus Growth in the United States, 1960–2014

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.



Source: See Figures 2-2 and 2-3.

2-4 Output, Unemployment, and the Inflation Rate: Okun's Law and the Phillips Curve

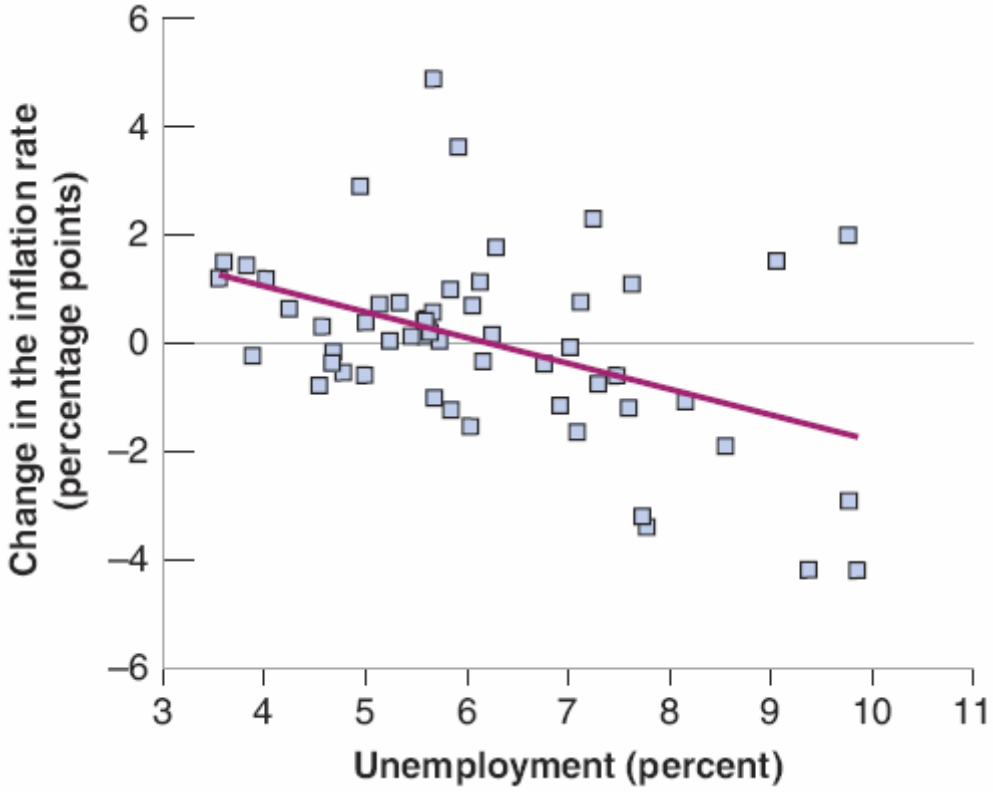
- **Okun's law** is a relation first examined by U.S. economist Arthur Okun.
- In Figure 2-5, the line that best fits the points is downward sloping.
- The slope of the line is –0.4, which imples that, on average, an increase in the growth rate of 1% decreases the unemployment rate by –0.4%.
- The line crosses the horizontal axis where output growth is 3%, meaning that it takes a growth rate of 3% to keep unemployment constant.

2-4 Output, Unemployment, and the Inflation Rate: Okun's Law and the Phillips Curve

Figure 2-6 Changes in the Inflation Rate versus the Unemployment Rate in the United States, 1960–2014

A low unemployment rate leads to an increase in the inflation rate.

A high unemployment rate leads to a decrease in the inflation rate.



Source: See Figures 2-3 and 2-4.

2-4 Output, Unemployment, and the Inflation Rate: Okun's Law and the Phillips Curve

- The Phillips curve is a relation first explored in 1958 by New Zealand economist A.W. Phillips.
- Figure 2-6 plots the change in the inflation rate against the unemployment rate, along with the line that best fits the points.
- The line is downward sloping, meaning that higher unemployment leads, on average, to a decrease in inflation, and vice versa.
- The line crosses the horizontal axis where the unemployment rate is equal to about 6%, meaning that inflation typically increased when unemployment was below 6%.

2-5 The Short Run, the Medium Run, and the Long Run

- In the **short run** (e.g., a few years), year-to-year movements in output are primarily driven by movements in demand.
- In the **medium run** (e.g., a decade), the economy tends to return to the level of output determined by supply factors, such as the capital stock, the level of technology, and the size of the labor force.
- In the **long run** (e.g., a few decades or more), the economy depends on its ability to innovate and introduce new technologies, and how much people save, the quality of the county's education system, the quality of the government, and so on.

2-6 A Tour of the Book

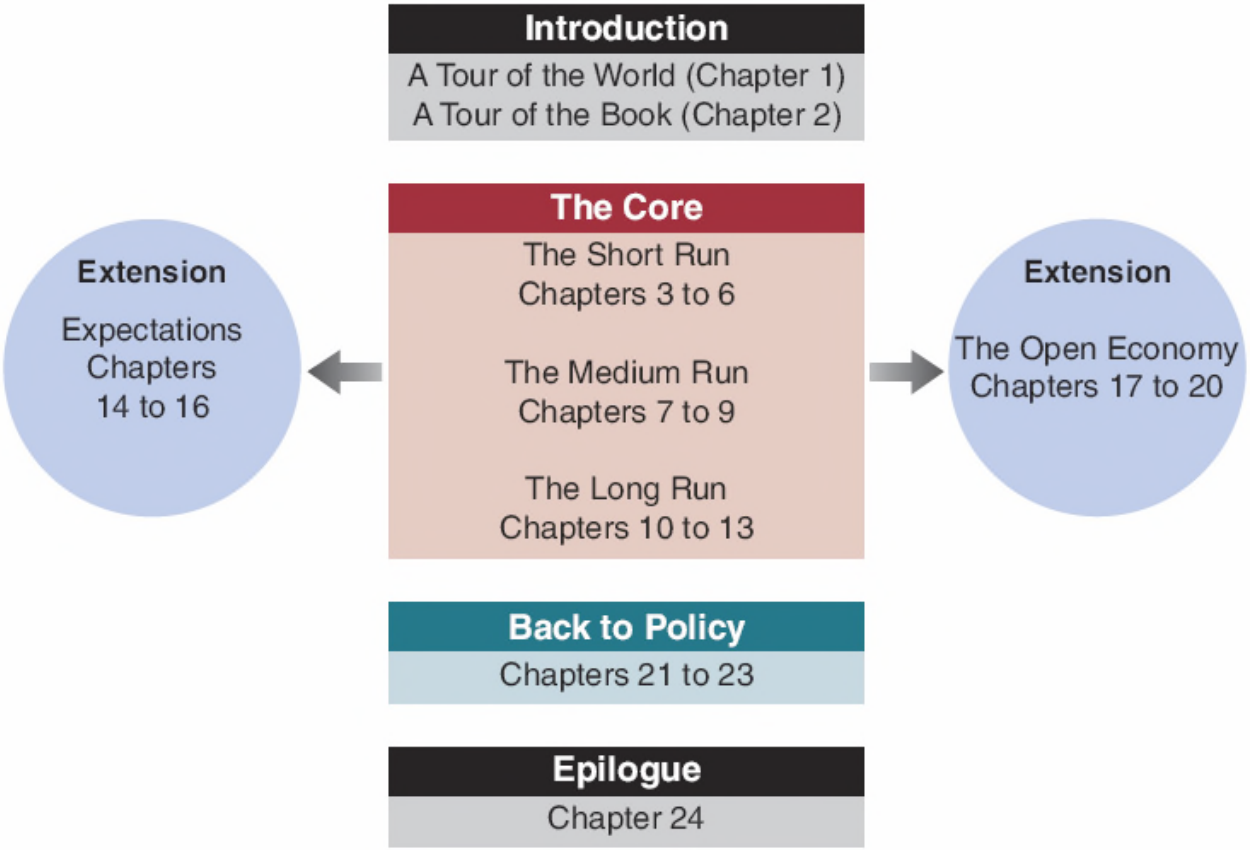
- The Core
  - Chapters 3 to 6: The short run and the role of demand
  - Chapters 7 to 9: The medium run and the supply side
  - Chapters 10 to 13: The long run
- Extensions
  - Chapters 14 to 16: Expectations and implications for fiscal and monetary policy
  - Chapters 17 to 20: Open economy and implications for fiscal and monetary policy

2-6 A Tour of the Book

- Back to Policy
  - Chapter 21: General issues of policy
  - Chapters 22 & 23: The role of fiscal and monetary policies.
- Epilogue
  - Chapter 24: History of macroeconomics and how macroeconomists have come to believe what they believe today

2-6 A Tour of the Book

Figure 2-7 The Organization of the Book



APPENDIX: The Construction of Real GDP and Chain-Type Indexes

- Suppose that an economy produces two final goods, wine and potatoes:

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 or nominal GDP from year o to year 1 is ($30 – $20)/$20 = 50%.

APPENDIX: The Construction of Real GDP and Chain-Type Indexes

- Suppose year 0 is the **base year:**
  - Real GDP in year 0: (10 x $1) + (5 x $2) = $20
  - Real GDP in year 1: (15 x $1) + (5 x $2) = $25
  - The rate of growth of real GDP from year 0 to year 1 is ($25 – $20)/$20 = 25%.
- Suppose year 1 is the base year:
  - Real GDP in year 0: (10 x $1) + (5 x $3) = $25
  - Real GDP in year 1: (15 x $1) + (5 x $3) = $30
  - The rate of growth of real GDP from year 0 to year 1 is ($30 – $25)/$25 = 20%.
- Problem: Which base year should one choose?

APPENDIX: The Construction of Real GDP and Chain-Type Indexes

- In December 1995, the U.S. Bureau of Economic Analysis shifted to a new method with four steps:
  1. Construct the rate of change of real GDP between two years in two different ways:
     - Using the price from year t as the set of common prices
     - Using the price from year t+1 as the set of common prices
  2. Construct the rate of change of real GDP as the average of the these two rates of change
  3. Construct an index of the level of real GDP by *linking* or *chaining* the constructed rates of change for each year
  4. Multiply this index by nominal GDP to derive *real GDP in chained dollars*