READING

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Aggregate Output, Prices, and Economic Growth

by Paul R. Kutasovic, PhD, CFA, and Richard Fritz, PhD

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LEARNING OUTCOMES

Mastery	*The candidate should be able to:*
☐	**a.** calculate and explain gross domestic product (GDP) using expenditure and income approaches;
☐	**b.** compare the sum-of-value-added and value-of-final-output methods of calculating GDP;
☐	**c.** compare nominal and real GDP and calculate and interpret the GDP deflator;
☐	**d.** compare GDP, national income, personal income, and personal disposable income;
☐	**e.** explain the fundamental relationship among saving, investment, the fiscal balance, and the trade balance;
☐	**f.** explain the IS and LM curves and how they combine to generate the aggregate demand curve;
☐	**g.** explain the aggregate supply curve in the short run and long run;
☐	**h.** explain causes of movements along and shifts in aggregate demand and supply curves;
☐	**i.** describe how fluctuations in aggregate demand and aggregate supply cause short-run changes in the economy and the business cycle;
☐	**j.** distinguish between the following types of macroeconomic equilibria: long-run full employment, short-run recessionary gap, short-run inflationary gap, and short-run stagflation;
☐	**k.** explain how a short-run macroeconomic equilibrium may occur at a level above or below full employment;
☐	**l.** analyze the effect of combined changes in aggregate supply and demand on the economy;

(continued)

LEARNING OUTCOMES

Mastery	*The candidate should be able to:*
☐	**m.** describe sources, measurement, and sustainability of economic growth;
☐	**n.** describe the production function approach to analyzing the sources of economic growth;
☐	**o.** distinguish between input growth and growth of total factor productivity as components of economic growth.

1 INTRODUCTION

In the field of economics, *microeconomics* is the study of the economic activity and behavior of individual economic units, such as a household, a company, or a market for a particular good or service, and *macroeconomics* is the study of the aggregate activities of households, companies, and markets. Macroeconomics focuses on national aggregates, such as total *investment*, the amount spent by all businesses on plant and equipment; total *consumption*, the amount spent by all households on goods and services; the rate of change in the general level of prices; and the overall level of interest rates.

Macroeconomic analysis examines a nation's aggregate output and income, its competitive and comparative advantages, the productivity of its labor force, its price level and inflation rate, and the actions of its national government and central bank. The objective of macroeconomic analysis is to address such fundamental questions as:

- What is an economy's aggregate output, and how is aggregate income measured?
- What factors determine the level of aggregate output/income for an economy?
- What are the levels of aggregate demand and aggregate supply of goods and services within the country?
- Is the level of output increasing or decreasing, and at what rate?
- Is the general price level stable, rising, or falling?
- Is unemployment rising or falling?
- Are households spending or saving more?
- Are workers able to produce more output for a given level of inputs?
- Are businesses investing in and expanding their productive capacity?
- Are exports (imports) rising or falling?

From an investment perspective, investors must be able to evaluate a country's current economic environment and to forecast its future economic environment in order to identify asset classes and securities that will benefit from economic trends occurring within that country. Macroeconomic variables—such as the level of inflation, unemployment, consumption, government spending, and investment—affect the overall level of activity within a country. They also have different impacts on the growth and profitability of industries within a country, the companies within those industries, and the returns of the securities issued by those companies.

This reading is organized as follows: Section 2 describes gross domestic product and related measures of domestic output and income. Section 3 discusses short-run and long-run aggregate demand and supply curves, the causes of shifts and movements

along those curves, and factors that affect equilibrium levels of output, prices, and interest rates. Section 4 discusses sources, sustainability, and measures of economic growth. A summary and practice problems complete the reading.

AGGREGATE OUTPUT AND INCOME

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The **aggregate output** of an economy is the value of all the goods and services produced in a specified period of time. The **aggregate income** of an economy is the value of all the payments earned by the suppliers of factors used in the production of goods and services. Because the value of the output produced must accrue to the factors of production, aggregate output and aggregate income within an economy must be equal.

There are four broad forms of payments (i.e., income): compensation of employees, rent, interest, and profits. Compensation of employees includes wages and benefits (primarily employer contributions to private pension plans and health insurance) that individuals receive in exchange for providing labor. **Rent** is payment for the use of property. **Interest** is payment for lending funds. **Profit** is the return that owners of a company receive for the use of their capital and the assumption of financial risk when making their investments. We can think of the sum of rent, interest, and profit as the *operating surplus* of a company. It represents the return on all capital used by the business.

Although businesses are the direct owners of much of the property and physical capital in the economy, by virtue of owning the businesses, households are the ultimate owners of these assets and hence the ultimate recipients of the profits. In reality, of course, a portion of profits are usually retained within businesses to help finance maintenance and expansion of capacity. Similarly, because the government is viewed as operating on a non-profit basis, any revenue it receives from ownership of companies and/or property may be viewed as being passed back to households in the form of lower taxes. Therefore, for simplicity, it is standard in macroeconomics to attribute all income to the household sector unless the analysis depends on a more precise accounting.

Aggregate *expenditure*, the total amount spent on the goods and services produced in the (domestic) economy during the period, must also be equal to aggregate output and aggregate income. However, some of this expenditure may come from foreigners in the form of net exports.[1] Thus, aggregate output, aggregate income, and aggregate expenditure all refer to different ways of decomposing the same quantity.

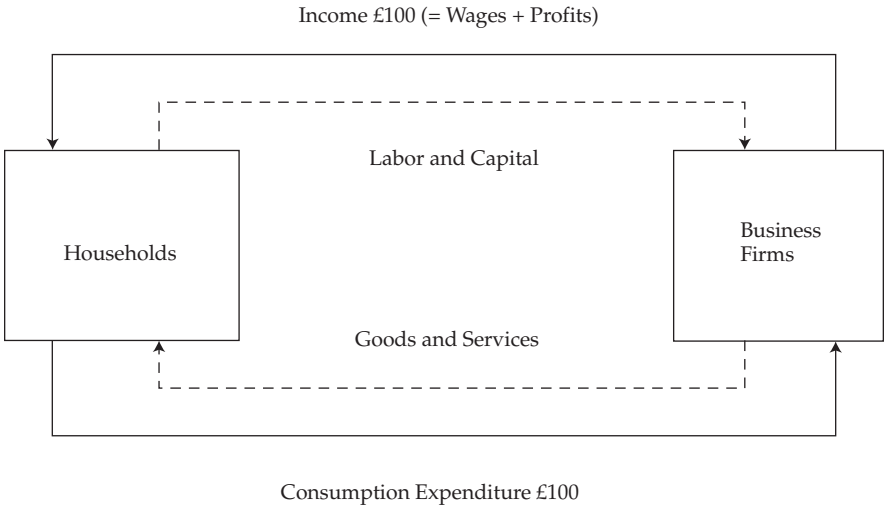
Exhibit 1 illustrates the flow of inputs, output, income, and expenditures in a very simple economy. Households supply the factors of production (labor and capital) to businesses in exchange for wages and profit (aggregate income) totaling £100. These flows are shown by the top two arrows. Companies use the inputs to produce goods and services (aggregate output) which they sell to households (aggregate expenditure) for £100. The output and expenditure flows are shown by the bottom two arrows. Aggregate output, income, and expenditure are all equal to £100.

In this simplified example, households spend all of their income on domestically produced goods and services. They do not buy foreign goods, save for the future, or pay taxes. Similarly, businesses do not sell to foreigners or the government and do

1 Note that "aggregate expenditure" as defined here does *not* equal the amount spent by *domestic* residents on goods and services because it includes exports (purchases of domestic products by foreigners) and excludes imports (purchases of foreign products by domestic residents). Thus, spending by domestic residents does not necessarily equal domestic income/output. Indeed, within any given period, it usually does not. This will be explained in more detail in Section 2.2.3.

not invest to increase their productive capacity. These important components of the economy will be added in Section 2.2. But first we need to discuss how output and income are measured.

Exhibit 1 Output, Income, and Expenditure in a Simple Economy: The Circular Flow



2.1 Gross Domestic Product

Gross domestic product (GDP) measures

- the market value of all final goods and services produced within the economy in a given period of time (output definition) or, equivalently,
- the aggregate income earned by all households, all companies, and the government within the economy in a given period of time (income definition).

Intuitively, GDP measures the flow of output and income in the economy.[2] GDP represents the broadest measure of the value of economic activity occurring within a country during a given period of time.

Therefore, GDP can be determined in two different ways. In the income approach, GDP is calculated as the total amount earned by households and companies in the economy. In the expenditure approach, GDP is calculated as the total amount spent on the goods and services produced within the economy during a given period. For the economy as a whole, total income must equal total expenditures, so the two approaches yield the same result.

Many developed countries use a standardized methodology for measuring GDP. This methodology is described in the official handbook of the Organisation for Economic Co-Operation and Development (Paris: OECD Publishing). The OECD reports the national accounts for many developed nations. In the United States, the National Income and Product Accounts (also called NIPA, or national accounts, for short) is

2 Some textbooks and countries measure flows of income and output by using gross national product (GNP) rather than GDP. The difference is subtle but can be important in some contexts. GDP includes production within national borders regardless of whether the factors of production (labor, capital, and property) are owned domestically or by foreigners. In contrast, GNP measures output produced by domestically owned factors of production regardless of whether the production occurs domestically or overseas.

the official US government accounting of all the income and expenditure flows in the US economy. The national accounts are the responsibility of the US Department of Commerce and are published in its *Survey of Current Business*. In Canada, similar data are available from Statistics Canada, whereas in China, the National Bureau of Statistics of China provides GDP data.

To ensure that GDP is measured consistently over time and across countries, the following three broad criteria are used:

- All goods and services included in the calculation of GDP *must be produced during the measurement period*. Therefore, items produced in previous periods—such as houses, cars, machinery, or equipment—are excluded. In addition, transfer payments from the government sector to individuals, such as unemployment compensation or welfare benefits, are excluded. Capital gains that accrue to individuals when their assets appreciate in value are also excluded.
- The only goods and services included in the calculation of GDP are those whose value *can be determined by being sold in the market*. This enables the price of goods or services to be objectively determined. For example, a liter of extra virgin olive oil is more valuable than a liter of spring water because the market price of extra virgin olive oil is higher than the market price of spring water. The value of labor used in activities that are not sold on the market, such as commuting, gardening, etc., is also excluded from GDP. By-products of production processes are also excluded if they have no explicit market value, such as air pollution, water pollution, and acid rain.
- Only the market value of final goods and services is included in GDP. Final goods and services are those that are not resold. *Intermediate goods* are goods that are resold or used to produce another good.[3] The value of intermediate goods is excluded from GDP because additional value is added during the production process, and all the value added during the entire production process is reflected in the final sale price of the finished good. An alternative approach to measuring GDP is summing all the value added during the production and distribution processes. The most direct approach, however, is to sum the market value of all the final goods and services produced within the economy in a given time period.

Two distinct, but closely related, measurement methods can be used to calculate GDP based on expenditures: value of final output and sum of value added. These two methods are illustrated in Exhibit 2. In this example, a farmer sells wheat to a miller. The miller grinds the wheat into flour and sells it to a baker who makes bread and sells it to a retailer. Finally, the bread is sold to retail customers. The wheat and flour are both intermediate goods in this example because they are used as inputs to produce another good. Thus, they are not counted (directly) in GDP. For the purposes of GDP, the value of the final product is €1.00, which includes the value added by the bread retailer as a distributor of the bread. If, in contrast, the baker sold directly to the public, the value counted in GDP would be the price at which the baker sold the bread, €0.78. The left column of the exhibit shows the total revenue received at each stage of the process, whereas the right column shows the value added at each stage. Note that the market value of the final product (€1.00) is equal to the sum of the value added at each of the stages. Thus, the contribution to GDP can be measured as either the final sale price or the sum of the value added at each stage.

3 "Final goods" should not be confused with so-called final sales, and "intermediate goods" should not be confused with inventories. GDP includes both final sales to customers and increases in companies' inventories. If sales exceed current production, then GDP is less than final sales by the amount of goods sold out of inventory.

Exhibit 2 Value of Final Product Equals Income Created

	Receipts at Each Stage (€)	Value Added (= Income Created) at Each Stage (€)	
Receipts of farmer from miller	0.15	0.15	Value added by farmer
Receipts of miller from baker	0.46	0.31	Value added by miller
Receipts of baker from retailer	0.78	0.32	Value added by baker
Receipts of retailer from final customer	1.00	0.22	Value added by retailer
	1.00	1.00	
	Value of final output	Total value added = Total income created	

EXAMPLE 1

Contribution of Automobile Production to GDP

Exhibit 3 provides simplified information on the cost of producing an automobile in the United States at various stages of the production process. The example assumes the automobile is produced and sold domestically and assumes no imported material is used. Calculate the contribution of automobile production to GDP using the value-added method, and show that it is equivalent to the expenditure method. What impact would the use of imported steel or plastics have on GDP?

Exhibit 3 Cost of Producing Automobiles

Stage of Production		Sales Value ($)
1	Production of basic materials	
	Steel	1,000
	Plastics	3,000
	Semiconductors	1,000
2	Assembly of automobile (manufacturer price)	15,000
3	Wholesale price for automobile dealer	16,000
4	Retail price	18,000

Solution:

GDP includes only the value of final goods and ignores intermediate goods in order to avoid double counting. Thus, the final sale price of $18,000 and not the total sales value of $54,000 (summing sales at all the levels of production) would be included in GDP. Alternatively, we can avoid double counting by calculating and summing the value added at each stage. At each stage of production, the difference between what a company pays for its inputs and what it receives for the product is its contribution to GDP. The value added for each stage of production is computed as follows:

Stage of Production	Sales Value ($)	Value Added ($)	
1 Production of basic materials			
Steel	1,000	1,000	
Plastics	3,000	3,000	
Semiconductors	1,000	1,000	
Total Inputs		5,000	(sum of 3 inputs)
2 Assembly of car (manufacturer price)	15,000	10,000	= (15,000 – 5,000)
3 Wholesale price for car dealer	16,000	1,000	= (16,000 – 15,000)
4 Retail price	18,000	2,000	= (18,000 – 16,000)
Total expenditures	18,000		
Total value added		18,000	

Thus, the sum of the value added by each stage of production is equal to $18,000, which is equal to the final selling price of the automobile. If some of the inputs (steel, plastics, or semiconductors) are imported, the value added would be reduced by the amount paid for the imports.

2.1.1 *Goods and Services Included at Imputed Values*

As a general rule, only the value of goods and services whose *value can be determined by being sold in the market* are included in the measurement of GDP. Owner-occupied housing and government services, however, are two examples of services that are not sold in the marketplace but are still included in the measurement of GDP.

When a household (individual) rents a place to live, he or she is buying housing services. The household pays the owner of the property rent in exchange for shelter. The income that a property owner receives is included in the calculation of GDP. However, when a household purchases a home, it is implicitly paying itself in exchange for the shelter. As a result, the government must estimate (impute) a value for this owner-occupied rent, which is then added to GDP.

The value of government services provided by police officers, firemen, judges, and other government officials is a key factor that affects the level of economic activity. However, valuing these services is difficult because they are not sold in a market like other services; individual customers cannot decide how much to consume or how much they are willing to pay. Therefore, these services are simply included in GDP at their cost (e.g., wages paid) with no value added attributed to the production process.

For simplicity and global comparability, the number of goods and services with imputed values that are included in the measurement of GDP are limited. In general, non-market activity is excluded from GDP. Thus, activities performed for one's own benefit, such as cooking, cleaning, and home repair, are excluded. Activities in the so-called underground economy are also excluded. The underground economy reflects economic activity that people hide from the government either because it is illegal or because they are attempting to evade taxation. Undocumented laborers who are paid "off the books" are one example. The illegal drug trade is another.[4] Similarly, barter transactions, such as neighbors exchanging services with each other (for example, helping your neighbor repair her fence in exchange for her plowing your garden), are excluded from GDP.

4 Member states of the European Union are expected to measure and include illegal activities for statistical and comparative purposes. Guidelines for what activities to include and how to measure them have been established; member states were required to comply with the guidelines effective September 2014.

Exhibit 4 shows a historical study on the estimated size of the underground economy in various countries as a percentage of nominal GDP. The estimates range from 8 percent in the United States to 60 percent in Peru. Based on these estimates, the US national income accounts fail to account for roughly 7.4 percent (= 8/108) of economic activity, whereas in Peru, the national accounts miss roughly 37.5 percent (= 60/160) of the economy. For most of the countries shown, the national accounts miss 12–20 percent of the economy.

Exhibit 4 Underground Economy as a Percentage of Nominal GDP (2006)

Country	Underground Economy as a Percentage of Nominal GDP (%)
Peru	60.0
Mexico	32.1
South Korea	27.5
Costa Rica	26.8
Greece	26.0
India	24.4
Italy	23.1
Spain	20.2
Sweden	16.3
Germany	15.4
Canada	14.1
China	14.0
France	13.2
Japan	8.9
United States	8.0

Source: Friedrich Schneider and Andreas Buehm, Linz University, 2009.

It should be clear from these estimates of the underground economy that the reliability of official GDP data varies considerably across countries. Failure to capture a significant portion of activity is one problem. Poor data collection practices and unreliable statistical methods within the official accounts are also potential problems.

2.1.2 *Nominal and Real GDP*

In order to evaluate an economy's health, it is often useful to remove the effect of changes in the general price level on GDP because higher (lower) income driven solely by changes in the price level is not indicative of a higher (lower) level of economic activity. To accomplish this, economists use **real GDP**, which indicates what would have been the total expenditures on the output of goods and services if prices were unchanged. **Per capita real GDP** (real GDP divided by the size of the population) has often been used as a measure of the average standard of living in a country.

Suppose we are interested in measuring the GDP of an economy. For the sake of simplicity, suppose that the economy consists of a single automobile maker and that in 2017, 300,000 vehicles are produced with an average market price of €18,750. GDP in 2017 would be €5,625,000,000. Economists define the value of goods and services measured at current prices as **nominal GDP**. Suppose that in 2018, 300,000 vehicles are again produced but that the average market price for a vehicle increases by 7 percent to €20,062.50. GDP in 2018 would be €6,018,750,000. Even though no

more cars were produced in 2018 than in 2017, it appears that the economy grew by (€6,018,750,000/€5,625,000,000) – 1 = 7% between 2017 and 2018, although it actually did not grow at all.

Nominal and real GDP can be expressed as

$$\text{Nominal GDP}_t = P_t \times Q_t$$

where

P_t = Prices in year t
Q_t = Quantity produced in year t

$$\text{Real GDP}_t = P_B \times Q_t$$

where

P_B = Prices in the base year

Taking the base year to be 2017 and putting in the 2017 and 2018 numbers gives:

$$\text{Nominal GDP}_{2017} = (€18{,}750 \times 300{,}000) = €5{,}625{,}000{,}000$$

$$\text{Real GDP}_{2017} = (€18{,}750 \times 300{,}000) = €5{,}625{,}000{,}000$$

$$\text{Nominal GDP}_{2018} = (€20{,}062.50 \times 300{,}000) = €6{,}018{,}750{,}000$$

$$\text{Real GDP}_{2018} = (€18{,}750 \times 300{,}000) = €5{,}625{,}000{,}000$$

In this example, real GDP did not change between 2017 and 2018 because the total output remained the same: 300,000 vehicles. The difference between nominal GDP in 2018 and real GDP in 2018 was the 7 percent inflation rate.

Now suppose that the auto manufacturer produced 3 percent more vehicles in 2018 than in 2017 (i.e., production in 2018 was 309,000 vehicles). Real GDP would increase by 3 percent from 2017 to 2018. With a 7 percent increase in prices, nominal GDP for 2018 would now be

$$\begin{aligned}\text{Nominal GDP}_{2018} &= (1.03 \times 300{,}000) \times (1.07 \times €18{,}750)\\ &= (309{,}000 \times €20{,}062.50)\\ &= €6{,}199{,}312{,}500\end{aligned}$$

The **implicit price deflator for GDP**, or simply the **GDP deflator**, is defined as

$$\text{GDP deflator} = \frac{\text{Value of current year output at current year prices}}{\text{Value of current year output at base year prices}} \times 100$$

Thus, in the example the GDP deflator for 2018 is [(309,000 × €20,062.50)/ (309,000 × €18,750)](100) = (1.07)(100) = 107. The GDP deflator broadly measures the aggregate changes in prices across the overall economy, and hence changes in the deflator provide a useful gauge of inflation within the economy.

Real GDP is equal to nominal GDP divided by the GDP deflator scaled by 100:

$$\text{Real GDP} = [\text{Nominal GDP}/(\text{GDP deflator}/100)]$$

This relation gives the GDP deflator its name. That is, the measure of GDP in terms of current prices, nominal GDP, is adjusted for inflation by dividing it by the deflator. The expression also shows that the GDP deflator is the ratio of nominal GDP to real GDP scaled by 100:

$$\text{GDP deflator} = (\text{Nominal GDP}/\text{Real GDP}) \times 100$$

Thus, real GDP for 2018 would be

$$\begin{aligned}\text{Real GDP}_{2018} &= [\text{Nominal GDP}/(\text{GDP deflator}/100)]\\ &= [€6{,}199{,}312{,}500/(107/100)]\\ &= €5{,}793{,}750{,}000\end{aligned}$$

Note that €5,793,750,000 represents 3 percent real growth over 2017 GDP and 3 percent higher real GDP for 2018 than under the assumption of no growth in unit car sales in 2018.

What would be the increase in *nominal* GDP for 2018 compared with 2017 with the 3 percent greater automobile production and 7 percent inflation?

$$(\text{Nominal GDP}_{2018}/\text{Nominal GDP}_{2017}) - 1$$

$$= (€6{,}199{,}312{,}500/€5{,}625{,}000{,}000) - 1$$

$$= 0.102$$

So, nominal GDP would increase by 10.2 percent, which equals $[(1.07 \times 1.03) - 1]$ or approximately 7% + 3% = 10%. Which number is more informative about growth in economic activity, 3 percent real growth or 10.2 percent nominal growth? The real growth rate is more informative because it exactly captures increases in output. Nominal growth, by blending price changes with output changes, is less directly informative about output changes. In summary, real economic growth is measured by the percentage change in real GDP. When measuring real economic activity or when comparing one nation's economy to another, real GDP and real GDP growth should be used because they more closely reflect the quantity of output available for consumption and investment.

EXAMPLE 2

Calculating the GDP Deflator

John Lambert is an equity analyst with Equitytrust, a Canadian investment management firm that primarily invests in Canadian stocks and bonds. The investment policy committee for the firm is concerned about the possibility of inflation. The implicit GDP deflator is an important measure of the overall price level in the economy, and changes in the deflator provide an important gauge of inflation within the economy. GDP data have been released by Statistics Canada and are shown in Exhibit 5. Lambert is asked by the committee to use the GDP data to calculate the implicit GDP price deflator from 2012 to 2016 and the inflation rate for 2016.

Exhibit 5 Real and Nominal GDP for Canada

Seasonally adjusted at annual rates (SAAR)					
	2012	**2013**	**2014**	**2015**	**2016**
GDP at market prices (million C$)	1,822,808	1,897,531	1,990,183	1,994,911	2,035,506
Real GDP (million 2007 C$)	1,659,195	1,698,153	1,747,478	1,762,561	1,786,677

Solution:

The implicit GDP price deflator measures inflation across all sectors of the economy, including the consumer, business, government, exports, and imports. It is calculated as the ratio of nominal to real GDP and reported as an index number with the base year deflator equal to 100. The implicit GDP price deflator for the Canadian economy for 2016 is calculated as (2,035,506/1,786,677) × 100 = 113.9. The results for the other years are shown in the following table:

	2012	2013	2014	2015	2016
GDP at market prices (million C$)	1,822,808	1,897,531	1,990,183	1,994,911	2,035,506
Real GDP (million 2007 C$)	1,659,195	1,698,153	1,747,478	1,762,561	1,786,677
Implicit GDP price deflator	109.9	111.7	113.9	113.2	tbd

The inflation rate is calculated as a percentage change in the index. For 2016, the annual inflation rate is equal to [(113.9/113.2) – 1] or 0.66 percent. This shows that Canada experienced a very low rate of deflation in 2016.

2.2 The Components of GDP

Having defined GDP and discussed how it is measured, we can now consider the major components of GDP, the flows among the four major sectors of the economy—the household sector, the business sector, the government sector, and the foreign or external sector (comprising transactions with the "rest of the world")—and the markets through which they interact. An expression for GDP, based on the expenditure approach, is

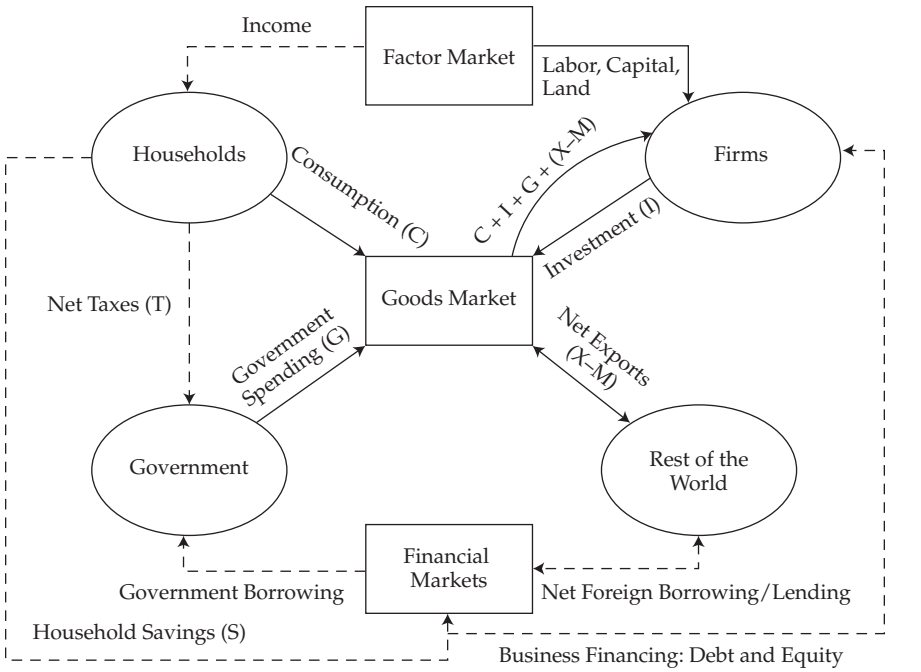
$$\text{GDP} = C + I + G + (X - M) = (C + G^C) + (I + G^I) + (X - M) \quad \textbf{(1)}$$

where

C = Consumer spending on final goods and services
I = Gross private domestic investment, which includes business investment in capital goods (e.g., fixed capital such as plant and equipment) and changes in inventory (**inventory investment**)
G = Government spending on final goods and services for both current consumption and investment in capital goods = $G^C + G^I$
X = Exports
M = Imports

Exhibit 6 shows the flow of expenditures, income, and financing among the four sectors of the economy and the three principal markets. In the exhibit, solid arrows point in the direction of expenditure on final goods and services. For simplicity, corresponding flows of output are not shown separately. The flow of factors of production is also shown with a solid arrow. Financial flows, including income and net taxes, are shown with dashed arrows pointing to the recipient of funds.

Exhibit 6 Output, Income, and Expenditure Flows



2.2.1 *The Household and Business Sectors*

The very top portion of Exhibit 6 shows the services of labor, land, and capital flowing through the *factor market* to business firms and the flow of income back from firms to households. Households spend part of their income on consumption (*C*) and save (*S*) part of their income for future consumption. Current consumption expenditure flows through the *goods market* to the business sector. Household saving flows into the *financial markets* where it provides funding for businesses that need to borrow or raise equity capital. Firms borrow or raise equity primarily to finance investment (*I*) in inventory, property, plant, and equipment. Investment (*I*) is shown flowing from firms through the goods market and back to firms because the business sector both demands and produces the goods needed to build productive capacity (*capital goods*).

In most developed economies, like Italy and the United States, expenditures on capital goods represent a significant portion of GDP. Investments (expenditures) on capital goods accounted for approximately 12.3 percent of Italy's GDP in 2015, while in the United States investments accounted for approximately 16.2 percent of GDP. In some developing countries, notably China (45.4 percent) and India (32.9 percent), investment spending accounts for a substantially larger share of the economy.[5] As we will examine in greater detail later, investment spending is an important determinant of an economy's long-term growth rate. At the same time, investment spending is the most volatile component of the economy, and changes in capital spending, especially spending on inventories, are one of the main factors causing short-run economic fluctuations.

5 See Exhibit 27 later in this reading for investment details for other countries. OECD.Stat Extracts: Country Statistical Profiles 2017 (stats.oecd.org) and World Development Indicators NE GDI.TOTL.ZS.

2.2.2 *The Government Sector*

The government sector collects taxes from households and businesses. For simplicity, only the taxes collected from the household sector are shown in Exhibit 6. In turn, the government sector purchases goods and services (*G*) for both consumption and investment from the business sector. For example, the government sector hires construction companies to build roads, schools, and other infrastructure goods. Government expenditure (*G*) also reflects spending on the military, police and fire protection, the postal service, and other government services. To keep Exhibit 6 simple, however, we combine consumption and investment expenditures into government expenditure, *G*.

Governments also make transfer payments to households. In general, these are designed to address social objectives such as maintaining minimum living standards, providing health care, and assisting the unemployed with retraining and temporary support. In Exhibit 6, transfer payments are subtracted from taxes and reflected in net taxes (*T*).

Transfer payments are not included in government expenditures on goods and services (*G*) because they represent a monetary transfer by the government of tax revenue back to individuals with no corresponding receipt of goods or services. The household spending facilitated by the transfer payments is, of course, included in consumption (*C*) and, hence, GDP. It is worth noting that transfers do not always take the form of direct payments to beneficiaries. Instead, the government may pay for or even directly provide goods or services to individuals. For example, universal health care programs often work in this way.

If, as is usually the case, government expenditure (*G*) exceeds net taxes (*T*), then the government has a *fiscal deficit* and must borrow in the financial markets. Thus, the government may compete with businesses in the financial markets for the funds generated by household saving. The only other potential source of funds in an economy is capital flows from the rest of the world. These will be discussed in the next section.

In 2015, the ratio of general government spending (which includes central government as well as state, provincial, and local government) to GDP in Italy was 50.4 percent while in the United States it was 37.7 percent. In countries where the government provides more services, such as universal health care in Italy, the government's contribution to GDP is greater. France's government sector represents 57.0 percent of GDP. In other countries, the public sector makes up a smaller share. For example, in Mexico, government spending is 24.5 percent of GDP. Exhibit 7 shows data on tax revenues, general government spending, and transfer payments as a share of nominal GDP.

Exhibit 7 General Government Spending and Taxes as a Percentage of GDP (2015)

Country	General Government Tax Revenues as a Percentage of GDP	General Government Spending as a Percentage of GDP		
		Total	Goods and Services and Debt Service	Transfer Payments
Canada	39.8%	41.1%	n.a.	n.a.
Mexico	23.6	24.5	n.a.	n.a.
United States	33.5	37.7	29.9	7.8
Japan	35.8	39.4	23.3	16.1
South Korea	33.8	32.4	n.a.	n.a.
France	53.4	57.0	32.5	24.5
Germany	44.7	44.0	25.0	19.0
Greece	48.3	54.2	33.7	20.5
Italy	47.7	50.4	29.0	21.4

(continued)

Exhibit 7 (Continued)

Country	General Government Tax Revenues as a Percentage of GDP	General Government Spending as a Percentage of GDP		
		Total	Goods and Services and Debt Service	Transfer Payments
Sweden	50.5	50.2	29.3	20.9
Australia	34.3	37.2	27.0	10.2
OECD – Average	42.2	43.8	27.3	16.5

Sources: Government at a Glance – 2017 edition (stats.oecd.org).

2.2.3 *The External Sector*

Trade and capital flows involving the rest of the world are shown in the bottom right quadrant of Exhibit 6. Net exports ($X - M$) reflects the difference between the value of goods and services sold to foreigners—exports (X)—and the portion of domestic consumption (C), investment (I), and government expenditure (G) that represents purchases of goods and services from the rest of the world—imports (M).

A **balance of trade deficit** means that the domestic economy is spending more on foreign goods and services than foreign economies are spending on domestic goods and services. It also means that the country is spending more than it produces because domestic saving is not sufficient to finance domestic investment plus the government's fiscal balance. A trade deficit must be funded by borrowing from the rest of the world through the financial markets. The rest of the world is able to provide this financing because, by definition, it must be running a corresponding trade surplus and is spending less than it produces.

It bears emphasizing that trade and capital flows between an economy and the rest of the world must balance. One area's deficit is another's surplus, and vice versa. This is an accounting identity that must hold. In effect, having allowed a country to run a trade deficit, foreigners must, in aggregate, finance it. However, the financing terms may or may not be attractive.

Exhibit 8 reports trade balances for the United States with selected countries. Note that in 2016 China was the United States' largest trading partner, in terms of sending goods to the United States (US imports). Mexico and Canada, members of NAFTA along with the United States, were second and third in sending goods to the United Sates but were also important consumers of US goods (US exports). Over all its trading partners the US balance of trade deficit in 2016 was US$734,316.3million.

Exhibit 8 US International Trade in Goods—Selected Countries, 2016 (millions of US dollars)

	Exports	Imports	Balance
Total, all countries	1,454,624.2	2,188,940.5	–734,316.3
Europe	318,447.1	483,454.8	–165,007.7
Euro area	200,166.6	325,880.1	–125,713.4
France	30,941.2	46,764.6	–15,823.4
Germany	49,362.0	114,227.4	–64,865.4
Italy	16,753.6	45,210.1	–28,456.5
Canada	266,826.7	278,066.8	–11,240.1

Exhibit 8 (Continued)

	Exports	Imports	Balance
Mexico	230,969.1	294,151.0	–63,191.9
China	115,775.1	462,813.0	–347,037.9
India	21,689.0	45,998.4	–24,309.5
Japan	63,264.3	132,201.8	–68,937.6

Source: FT-900 Supplement, US International Trade in Goods and Services, December 2016.

2.3 GDP, National Income, Personal Income, and Personal Disposable Income

This section examines the calculation of GDP and other income measures in detail by means of an analysis of data from Statistics Canada.

Exhibit 9a provides data on the level of Canadian GDP and its components measured at market prices (nominal GDP), leaving certain quantities in 2016 to be determined (tbd) as part of Example 3.

Exhibit 9a GDP Measures for the Canadian Economy (millions of C$ at market prices, seasonally adjusted at annual rates)

	2012	2013	2014	2015	2016
Expenditure-based:					
Final consumption expenditure	**1,405,369**	**1,455,081**	**1,514,179**	**1,563,236**	**1,613,915**
Household final consumption expenditure	995,046	1,034,804	1,083,056	1,117,690	1,154,829
Non-profit institutions serving households' final consumption expenditure	25,553	26,429	26,826	28,535	29,492
General governments final consumption expenditure	384,770	393,848	404,297	417,011	429,594
Gross fixed capital formation	**447,559**	**460,101**	**486,542**	**475,988**	**472,419**
Business gross fixed capital formation	368,695	383,839	410,591	398,389	389,592
Non-profit institutions serving households' gross fixed capital formation	2,723	2,913	3,145	2,981	3,065
General governments gross fixed capital formation	76,141	73,349	72,806	74,618	79,762
Investment in inventories	**6,822**	**13,705**	**9,563**	**3,940**	**–487**
Exports to other countries	**550,736**	**572,359**	**627,641**	**628,955**	**630,353**
Less: Imports from other countries	**586,644**	**603,606**	**647,221**	**678,265**	**679,538**
Statistical discrepancy	**–1,034**	**–109**	**–521**	**1,057**	**–1,156**
GDP at market prices	**1,822,808**	**1,897,531**	**1,990,183**	**1,994,911**	**tbd**
Income-based:					
Compensation of employees	**923,413**	**961,179**	**998,463**	**1,026,914**	**1,044,005**

(continued)

Exhibit 9a (Continued)

	2012	2013	2014	2015	2016
Gross operating surplus	**495,996**	**518,267**	**557,281**	**515,737**	**518,979**
Net operating surplus: corporations	252,542	262,648	289,160	231,937	227,625
Consumption of fixed capital: corporations	183,261	192,769	203,080	216,207	222,204
Consumption of fixed capital: general governments and non-profit institutions serving households	60,193	62,850	65,041	67,593	69,150
Gross mixed income	**209,190**	**216,355**	**222,458**	**232,366**	**241,415**
Net mixed income	158,536	162,998	167,371	174,982	180,653
Consumption of fixed capital: unincorporated businesses	50,654	53,357	55,087	57,384	60,762
Taxes less subsidies on production	**76,402**	**81,301**	**84,321**	**87,853**	**90,507**
Taxes less subsidies on products and imports	**116,773**	**120,319**	**127,138**	**133,099**	**139,443**
Statistical discrepancy	**1,034**	**110**	**522**	**–1,058**	**1,157**
Gross domestic income at market prices	**1,822,808**	**1,897,531**	**1,990,183**	**1,994,911**	**tbd**

Source: Statistics Canada. Table 36-10-0222-01 and Table: 36-10-0111-01 GDP, expenditure-based & income-based, annual (x C$1,000,000).

Exhibit 9a shows the two approaches to measuring GDP: 1) expenditures on final output measured as the sum of sales to the final users and 2) the sum of the factor incomes generated in the production of final output. In theory, the two approaches should provide the same estimate of GDP. As shown in the exhibit, however, they differ in practice because of the use of different data sources. The difference is accounted for by a *statistical discrepancy*. Market analysts more closely follow the expenditure approach because the expenditure data are more timely and reliable than data for the income components.[6]

Using the expenditure approach, Statistics Canada measures Canadian GDP as follows:

GDP = Consumer spending on goods and services
+ Business gross fixed investment
+ Change in inventories
+ Government spending on goods and services
+ Government gross fixed investment
+ Exports − Imports
+ Statistical discrepancy

6 As shown in Exhibit 9a, Statistics Canada divides the total statistical discrepancy roughly equally (with opposite signs) between the income- and expenditure-based measures of GDP. In the US national accounts, the statistical discrepancy appears only in the income-based breakdown of GDP because the expenditures data are believed to be more accurate than the income data.

Canadian national income accounts explicitly allocate government expenditures between consumption expenditure and gross fixed capital formation. Not all countries make this distinction. The United States, for example, does not. Also note that the investment in business inventories must be included in expenditures. Otherwise, goods produced but not yet sold would be left out of GDP.

The income-based approach calculates gross domestic income (GDI) as the sum of factor incomes and essentially measures the cost of producing final output. However, two of the costs entering into the gross value of output are not really earned by a factor of production. These items, depreciation and indirect taxes, are discussed below. GDP is estimated in the income approach as follows:[7]

GDP = Gross domestic income (GDI)
= Net domestic income + Consumption of fixed capital (CFC) + Statistical discrepancy

Where gross domestic income is the income received by all factors of production used in the generation of final output:

Gross domestic income = Compensation of employees
+ Gross operating surplus
+ Gross mixed income
+ Taxes less subsidies on production
+ Taxes less subsidies on products and imports

Compensation of employees consists of 1) wages and salaries including direct compensation in cash or in kind plus 2) "employers' social contributions" that supplement wages, which are primarily payments for government-sponsored social security schemes including pensions and health insurance.

Gross operating surplus is related to corporate profits and includes private corporations, non-profit corporations, and government corporations. Gross operating surplus is the surplus arising from operations and does not take out charges for rent, interest, or similar charges on financial assets or natural resources used by the business. As such, gross operating surplus essentially measures the return on capital used by the business as a whole, rather than the return to the owners of the business (profit).

Gross mixed income is the same concept applied to unincorporated business in the economy. It is measured in the same way as gross operating surplus and has three major components: 1) farm income, 2) non-farm income excluding rent, and 3) rental income.

"Indirect business taxes less subsidies" reflects taxes and subsidies included in the final price of the good or service. It is the (net) portion of **national income** that is directly paid to the government. In the Canadian accounts, these are measured in two ways: 1) "taxes less subsidies on products and imports," which includes sales taxes, fuel taxes, and import duties, and 2) "taxes less subsidies on factors of production," which is mainly property taxes and payroll taxes.

The consumption of fixed capital (CFC) is a measure of the wear and tear (depreciation) of the capital stock that occurs in the production of goods and services. This measure acknowledges the fact that some income/output must be allocated to the replacement of the existing capital stock as it wears out. Loosely speaking, one may

7 Construction of the national income accounts varies across countries. In the United States, for example, national income is defined to include income received by US-owned factors of production even if the income is generated outside the United States. To compute US GDP, the national income data must be adjusted for net foreign factor income. No adjustment is required in the Canadian data since the data are measured on a geographic basis equivalent to GDP.

think of Profit + CFC as the gross surplus earned by capital, with the CFC being the amount that must be earned and reinvested to maintain the existing productivity of the capital.

Along with the GDP report, Statistics Canada and other government statistical agencies provide information on personal income (called Primary Household Income in the Canadian accounts) and personal saving (called Household Net Saving) as shown in Exhibit 9b below. **Personal income** is a broad measure of household income and measures the ability of consumers to make purchases. As such, it is one of the key determinants of consumption spending. Primary Household Income includes all income received by households, whether earned or unearned. It includes compensation of employees plus net mixed income from unincorporated businesses plus net property income.

Exhibit 9b Household Income and Saving for the Canadian Economy (millions of C$ at market prices, seasonally adjusted at annual rates)

	2012	2013	2014	2015	2016
Compensation of employees	**923,413**	**961,179**	**998,463**	**1,026,914**	**1,044,005**
Plus: net mixed income	158,536	162,998	167,371	174,982	**fill in**
Plus: net property income	112,815	117,112	123,803	141,010	136,011
Primary Household Income	**1,194,764**	**1,241,289**	**1,289,637**	**1,342,906**	**calc**
Plus: current transfers received	246,062	258,527	266,153	287,928	306,439
Less: current transfers paid	443,969	457,738	478,843	503,579	514,566
Household Disposable Income	**996,857**	**1,042,078**	**1,076,947**	**1,127,255**	**calc**
Less: household final consumption expenditure	995,046	1,034,804	1,083,056	1,117,690	**fill in**
Plus: change in pension entitlements	47,452	44,876	46,439	44,300	42,395
Household Net Saving	**49,263**	**52,150**	**40,330**	**53,865**	**calc**
	Percent				
Household saving rate	**4.9**	**5**	**3.7**	**4.8**	**calc**

Source: Statistics Canada. Table 36-10-0224-01 Household sector, current accounts, provincial and territorial, annual

Household disposable income (HDI) is equal to personal income less personal taxes. In reality, households both pay taxes to the government and receive some income from governments (transfer payments such as social insurance payments, unemployment compensation, and disability payments) that is not earned. Thus HDI is calculated as household primary income less net current transfers paid. This measures the amount of after-tax income that households have to spend on goods and services or to save. Thus, it is the most relevant, and most closely watched, measure of income for household spending and saving decisions.

Finally, household net saving is equal to HDI adjusted for two items: subtracting household final consumption expenditures and adding the net change in pension entitlements.

EXAMPLE 3

Canadian GDP Release and Other Measures of Production and Income

The investment policy committee at Equitytrust asks John Lambert to review the Canadian GDP data shown in Exhibits 9a and 9b.

1. Calculate 2016 GDP using the expenditure approach, and indicate how the expenditures are represented in Exhibit 6.
2. Calculate 2016 GDP using the income approach.
3. Calculate personal income for 2016.
4. Using the Canadian data for 2016, calculate the level of household saving (S), the saving rate, and net payments (T) by the household sector to government.
5. Calculate the impact of foreign trade on the Canadian economy in 2016 and Canada's net foreign borrowing/lending in 2016.
6. Calculate the amount of net fixed capital formation across all sectors in 2016.

Solutions:

(All numbers in millions)

Solution to 1:

In the expenditure approach, nominal GDP is calculated as the sum of spending by the major sectors in the economy:

GDP = Final consumption expenditures + Gross fixed capital formation + Investment in Inventories + Exports – Imports + Statistical discrepancy

Substituting the numbers from Exhibit 9a,

GDP = 1,613,915 + 472,419 – 487 + 630,353 – 679,538 – 1,156
= C$2,035,506

In Exhibit 6, these expenditures are represented by the arrows pointing to the goods market and by the arrow pointing back to firms labeled as $C + I + G + (X - M)$. Note that G in Exhibit 6 is captured here partly in final consumption expenditures and partly in gross fixed capital formation for the Canadian national income accounts.

Solution to 2:

On the income side, nominal GDP is equal to gross domestic income the sum of income received by the factors of production and is given by

Gross domestic income = Compensation of employees + Gross operating surplus + Gross mixed income+ Indirect business taxes – Subsidies + Statistical discrepancy

Substituting in the numbers from Exhibit 9a, we get indirect business taxes as equal to the sum of taxes less subsidies on production plus taxes less subsidies on products and imports = 90,507 + 139,443 = C$229,950. Using this result,

GDP = GDI = 1,044,005 + 518,979 + 241,415 + 229,950 + 1,157 = C$2,035,506

Solution to 3:

Personal income (household primary income) is calculated as

Household Primary Income = Compensation of employees + Net mixed income + Net property income

Substituting in the numbers from Exhibit 9b,

Household primary income = 1,044,005 + 180,653 + 136,011
= C$1,360,669

Solution to 4:

Household saving is equal to **personal disposable income** less household final consumption expenditures plus the change in pension entitlements. Household final consumption (*C*) is given in Exhibit 9a as C$1,154,829. Substituting in the appropriate numbers, Household net saving = Household primary income – Net current transfers paid – Household final consumption expenditure + Net change in pension entitlements = 1,360,669 – (514,556 -306,439) – 1,154,829 + 42,395 = C$40,108.

The Canadian saving rate for 2016 = (40,108/1,152,542) = 3.48%

Net "taxes" paid by the household sector consists of two components: 1) transfers paid by households to the government minus 2) government transfer payments received by households. From Exhibit 9b, government transfer payments to households for 2016 were C$306,439. The transfer payments by households to government in 2016 was C$514,566. Thus the net payments *to* government by households in 2016 was:

514,566 – 306,439 = C$208,127

Solution to 5:

It is clear from Exhibit 9a that the international sector generally has a large impact each year on the Canadian economy. In 2016, exports were C$630,353 or roughly 31% of Canadian GDP. Imports were higher than exports at C$679,538 in 2016, indicating that Canada had a trade deficit of 630,353 – 679, 538 = C$49,185. This was roughly the same size as the trade deficit in 2015.

Canada funds its trade deficit by borrowing from the rest of the world through the financial markets. In 2016, this involved borrowing C$49,185 from the rest of the world. As discussed in Section 2.2.3, trade and capital flows between an economy and the rest of the world must balance. A trade deficit must be funded by a capital inflow.

Solution to 6:

Net fixed capital formation is equal to gross fixed capital formation found in the expenditure accounts less consumption of fixed capital (CFC) by corporations, government and non-profits, and unincorporated businesses found in the income accounts. In 2016, gross fixed capital formation was C$472,419, and CFC was (222, 204 + 69,150 + 60,762) for corporations, government and non-profits, and unincorporated businesses, respectively.

Thus net fixed capital formation in the Canadian economy for 2016 was 472,419 – 352,116 = C$120,303.

AGGREGATE DEMAND, AGGREGATE SUPPLY, AND EQUILIBRIUM

3

In this section, we will build a model of aggregate demand and aggregate supply and use it to discuss how aggregate output and the level of prices are determined in the economy. **Aggregate demand** (AD) represents the quantity of goods and services that households, businesses, government, and foreign customers want to buy at any given level of prices. **Aggregate supply** (AS) represents the quantity of goods and services producers are willing to supply at any given level of prices. It also reflects the amount of labor and capital that households are willing to offer into the marketplace at given real wage rates and cost of capital.

3.1 Aggregate Demand

As we will see, the aggregate demand curve looks like the ordinary demand curves that we encounter in microeconomics: quantity demanded increases as the price level declines. But our intuitive understanding of that relationship—lower price allows us to buy more of a good *with a given level of income*—does not apply here because income is not fixed. Instead, aggregate income/expenditure is to be determined within the model along with the price level. Thus, we will need to explain the relationship between price and quantity demanded somewhat differently.

The aggregate demand curve represents the combinations of aggregate income and the price level at which two conditions are satisfied. First, aggregate expenditure equals aggregate income. As indicated in our discussion of GDP accounting, this must always be true after the fact. The new aspect here is the requirement that *planned* expenditure equal *actual* (or realized) income. To understand the distinction, consider business inventories. If businesses end up with more inventory than they planned, then the difference represents unplanned (or unintended) business investment and actual output in the economy exceeded *planned* expenditure by that amount. Second, the available real money supply is willingly held by households and businesses.

The first condition—equality of planned expenditures and actual income/output—gives rise to what is called the *IS curve*. The second condition—equilibrium in the money market—is embodied in what is called the *LM curve*. When we put them together, we get the aggregate demand curve.

3.1.1 *Balancing Aggregate Income and Expenditure: The IS Curve*

Total expenditure on domestically produced output comes from four sources: household consumption (C), investments (I), government spending (G), and net exports ($X - M$). This can be expressed as

$$\text{Expenditure} = C + I + G + (X - M)$$

Personal disposable income is equal to GDP (Y) plus transfer payments (F) minus retained earnings and depreciation (= business saving, S_B) minus direct and indirect taxes (R). Households allocate disposable income between consumption of goods and services (C) and household saving (S_H). Therefore,

$$Y + F - S_B - R = C + S_H$$

Rearranging this equation, we get

$$Y = C + S + T$$

where $T = (R - F)$ denotes net taxes and $S = (S_B + S_H)$ denotes total private sector saving.

Because total expenditures must be identical to aggregate income (Y), we have the following relationship:

$$C + S + T = C + I + G + (X - M)$$

By rearranging this equation, we get the following fundamental relationship among domestic saving, investment, the fiscal balance, and the trade balance:

$$S = I + (G - T) + (X - M) \quad \textbf{(2)}$$

This equation shows that domestic private saving is used or absorbed in one of three ways: investment spending (I), financing government deficits ($G - T$), and building up financial claims against overseas economies [positive trade balance, $(X - M) > 0$]. If there is a trade deficit [$(X - M) < 0$], then domestic private saving is being supplemented by inflows of foreign saving and overseas economies are building up financial claims against the domestic economy.

By rearranging the identity, we can examine the implications of government deficits and surpluses:

$$G - T = (S - I) - (X - M)$$

A fiscal deficit [$(G - T) > 0$] implies that the private sector must save more than it invests [$(S - I) > 0$] or the country must run a trade deficit [$(X - M) < 0$] with corresponding inflow of foreign saving, or both.

EXAMPLE 4

Foreign Capital Inflows Help Finance Government Deficits

The budgetary situation changed dramatically in Canada during 2009, the first year of the financial crisis. The Department of Finance Canada reported that in 2009 the combined federal–provincial governments had a deficit of 84,249 (million C$). Thus, the government sector operated at a deficit that needed to be financed. How was this deficit financed?

Solution:

Using the formula $G - T = (S - I) - (X - M)$ shows that a budget deficit is financed through either higher domestic saving (S), lower business investment (I), or borrowing from foreigners ($X - M$).

In 2009, private sector saving exceeded investment spending by C$58,588 (319,802 – 277,574). Thus, domestic private saving financed over 69.5 percent of the 2009 government deficit (58,588/84,249).

To finance the rest of the government deficit, foreign imports (M) would have to exceed exports (X) by C$25,661. The actual trade deficit (amount of foreign borrowing) in 2009 was C$26,169, slightly greater than the amount required. This difference is largely due to the statistical discrepancy caused by different data sources being used for expenditure-based and income-based estimates of GDP.

Equation 2 is the key relationship that must hold in order for aggregate income and aggregate expenditure to be equal. Up to this point, we have treated it as simply an accounting identity. We now need to think of it as the outcome of explicit decisions on the part of households, businesses, government, and foreigners. When we do so, we are faced with the question of what underlies these decisions and how the requisite balance is established.

Economists have found that the dominant determinant of consumption spending is disposable income ($Y - S_B - T$). This can be expressed formally by indicating that consumption is a function $\boldsymbol{C}(\cdot)$ of disposable income,

$$C = \boldsymbol{C}(Y - S_B - T)$$

or, dropping the technically correct but practically insignificant adjustment for retained earnings and depreciation (S_B), a function of GDP minus net taxes,

$$C = \boldsymbol{C}(Y - T)$$

When households receive an additional unit of income, some proportion of this additional income is spent and the remainder is saved. The **marginal propensity to consume** (MPC) represents the proportion of an additional unit of disposable income that is consumed or spent. Because the amount that is not spent is saved, the **marginal propensity to save** (MPS) is MPS = 1 – MPC.

According to the consumption function, either an increase in real income or a decrease in taxes will increase aggregate consumption. Somewhat more sophisticated models of consumption recognize that consumption depends not only on current disposable income but also on wealth. Except for the very rich, individuals tend to spend a higher fraction of their current income as their wealth increases because with higher current wealth, there is less need to save to provide for future consumption.

Exhibit 10 shows household consumption expenditures as a percentage of GDP for selected countries.

Exhibit 10 Household Final Consumption Expenditures as a Percentage of GDP, average 2011–2015[8]

United States	68.3%
Mexico	67.8
Italy	61.2
Japan	58.2
Canada	56.3
France	55.4
Germany	55.0

These figures reflect the *average propensity to consume* (APC)—that is, the ratio C/Y—rather than a measure of how the next unit of income would be divided between spending and saving, the MPC. However, they are reasonable proxies for the MPC in each country. Comparing Germany's 55.0 percent APC with Mexico's 67.8 percent, the implication is that the Mexican economy is more sensitive to changes in disposable household income than the German economy. All other things being equal, macroeconomic policies that increase disposable household income, such as lowering government taxes, would have a larger impact on the economies of Mexico (67.8 percent) and the United States (68.3 percent) than similar policies would have in Germany (55.0 percent) or France (55.4 percent).

Companies are the primary source of investment spending (I). They make investment decisions in order to expand their stock of physical capital, such as building new factories or adding new equipment to existing facilities. A definition of physical capital is *any manmade aid to production*. Companies also buy investment goods, such

8 Source: OECD (2017), "Aggregate National Accounts, SNA 2008 (or SNA 1993): Gross domestic product", OECD National Accounts Statistics (database). http://dx.doi.org/10.1787/data-00001-en.

as manufacturing plants and equipment to replace existing facilities and equipment that wear out. Total investment, including replacement of worn-out capital, is called *gross investment*, as opposed to *net investment*, which reflects only the addition of new capacity. GDP includes gross investment; hence the name *gross* domestic product. Total investment spending in such developed countries as Italy, Germany, the United Kingdom, and the United States ranged between 12 and 16 percent of GDP in 2015.[9]

Investment decisions depend primarily on two factors: the level of interest rates and aggregate output/income. The level of interest rates reflects the cost of financing investment. The level of aggregate output serves as a proxy for the expected profitability of new investments. When an economy is underutilizing its resources, interest rates are typically very low and yet investment spending often remains dormant because the expected return on new investments is also low. Conversely, when output is high and companies have little spare capacity, the expected return on new investments is high. Thus, investment decisions may be modeled as a decreasing function $\boldsymbol{I}(\cdot,\cdot)$ of the **real interest rate** (nominal interest rate minus the expected rate of inflation) and an increasing function of the level of aggregate output. Formally,

$$I = \boldsymbol{I}(r, Y)$$

where I is investment spending, r is the real interest rate, and Y is, as usual, aggregate income. This investment function leaves out some important drivers of investment decisions, such as the availability of new and better technology. Nonetheless, it reflects the two most important considerations: the cost of funding (represented by the real interest rate) and the expected profitability of the new capital (proxied by the level of aggregate output).

Many government spending decisions are insensitive to the current level of economic activity, the level of interest rates, the currency exchange rate, and other economic factors. Thus, economists often treat the level of government spending on goods and services (G) as an *exogenous* policy variable determined outside the macroeconomic model. In essence, this means that the adjustments required to maintain the balance among aggregate spending, income, and output must occur primarily within the private sector.

Tax policy may also be viewed as an exogenous policy tool. However, the actual amount of net taxes (T) collected is closely tied to the level of economic activity. Most countries impose income taxes or value-added taxes (VAT) or both that increase with the level of income or expenditure. Similarly, at least some transfer payments to the household sector are usually based on economic need and are hence inversely related to aggregate income. Each of these factors makes net taxes (T) rise and fall with aggregate income, Y. The government's fiscal balance can be represented as

$$G - T = \bar{\boldsymbol{G}} - t(Y)$$

where $\bar{\boldsymbol{G}}$ is the exogenous level of government expenditure and $t(Y)$ indicates that net taxes are an (increasing) function of aggregate income, Y. The fiscal balance decreases (smaller deficit or larger surplus) as aggregate income (Y) increases and increases as income declines. This effect is called an *automatic stabilizer* because it tends to mitigate changes in aggregate output.

Net exports ($X - M$) are primarily a function of income in the domestic country and in the rest of the world and the relative prices of domestic and foreign goods and services. As domestic income rises, some of the additional demand that is induced will be for imported goods. Thus, net exports will decline. An increase in income in the rest of the world will lead to an increase in demand for the domestic country's products

9 OECD.Stat Extracts: Country Statistical Profiles 2017 (stats.oecd.org). See Exhibit 27 in this reading for investment details on other countries.

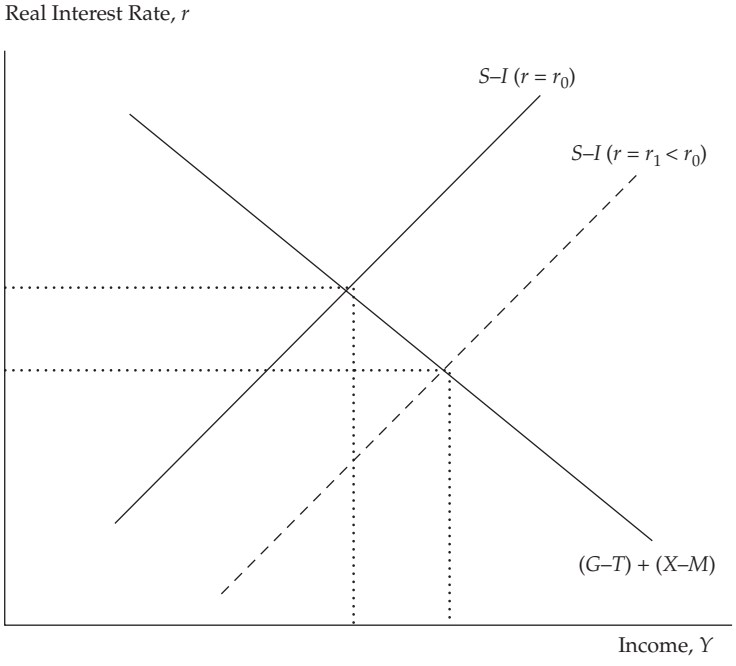
and hence an increase net exports. A decrease in the relative price of domestically produced goods and services, perhaps because of a depreciation of the currency, will shift demand toward these products and hence increase net exports.

We are now in a position to describe how aggregate expenditure and income are brought into balance. Slightly rearranging Equation 2, equality of expenditure and income implies

$$S - I = (G - T) + (X - M)$$

Based on the discussion above, we know that both the government's fiscal balance and the trade balance decrease as income rises because of net taxes and imports, respectively. Hence, the right-hand side of this equation declines with income. This is shown by the downward-sloping line in Exhibit 11. Assuming the direct effect of higher income on saving is larger than the impact on investment, the left-hand side of the equation increases as income rises. This is shown by the solid upward-sloping line in Exhibit 11. Note that this line is drawn for a given level of the real interest rate, r_0. The intersection of these curves shows the level of income at which expenditure and income balance. At higher levels of income, the saving–investment differential ($S - I$) exceeds the combined fiscal and trade balances, implying "excess saving" or insufficient expenditure. At lower levels of income, the saving–investment differential is smaller than the combined fiscal and trade balances, implying planned expenditure exceeds output (= income).

Exhibit 11 Balancing Aggregate Income and Expenditure



The dashed, upward-sloping line in the exhibit reflects a lower real interest rate, $r_1 < r_0$. This line lies to the right of the solid line because for any value of the saving–investment differential ($S - I$), the higher level of investment induced by a lower real interest rate requires a higher level of income to induce higher saving. With a lower real interest rate, the curves intersect at a higher level of income. Thus, we see that *equilibrating income and expenditure entails an inverse relationship between income and the real interest rate*. Economists refer to this relationship as the *IS curve* because

investment (I) and saving (S) are the primary components that adjust to maintain the balance between aggregate expenditure and income. The IS curve is illustrated in Exhibit 12 in the next section.

EXAMPLE 5

The IS Curve

The following equations are given for a hypothetical economy:

C	=	$2{,}000 + 0.7(Y - T)$	Consumption function
I	=	$400 + 0.2Y - 30r$	Investment function
G	=	1,500	Government spending
$(X - M)$	=	$1{,}000 - 0.1Y$	Net export function
T	=	$-200 + 0.3Y$	Tax function

1. Based on these equations, determine the combinations of aggregate income (Y) and the real interest rate (r) that are consistent with equating income and expenditure. That is, find the equation that describes the IS curve.
2. Given a real interest rate of 4 percent, find the level of GDP, consumption spending, investment spending, net exports, and tax receipts.
3. Suppose the government increased expenditure from 1,500 to 2,000. Find the new IS curve. Does the increase in government spending result in an equal increase in equilibrium income for any given level of the real interest rate? Why or why not?
4. Given a real interest rate of 4 percent, determine how the increased government spending is funded.
5. Suppose that the output/income level calculated in Question 2 is the most that can be produced with the economy's resources. If the economy is operating at that level when the government increases expenditure from 1,500 to 2,000, what must happen to maintain the balance between expenditure and income?

Solution to 1:

Starting with the basic GDP identity $Y = C + I + G + (X - M)$ and substituting for each expenditure component using the equations above gives

$$Y = 2{,}000 + 0.7(Y - T) + 400 + 0.2Y - 30r + 1{,}500 + 1{,}000 - 0.1Y$$

Substituting in the tax equation and solving for Y, we get

$$\begin{aligned} Y &= 2{,}000 + 0.7(Y + 200 - 0.3Y) + 400 + 0.2Y - 30r + 1{,}500 + 1{,}000 - 0.1Y \\ &= 5{,}040 + 0.59Y - 30r \\ Y &= 12{,}292.7 - 73.2r \end{aligned}$$

The final equation is the IS curve. It summarizes combinations of income and the real interest rate at which income and expenditure are equal. Equivalently, it reflects equilibrium in the goods market.

Solution to 2:

If the real interest rate is 4 percent, then GDP and the components of GDP are

$$Y = 12{,}292.7 - 73.2(4) = 11{,}999.9$$
$$T = -200 + 0.3(11{,}999.9) = 3{,}399.9$$
$$C = 2{,}000 + 0.7(11{,}999.9 - 3{,}399.9) = 8{,}020$$
$$I = 400 + 0.2(11{,}999.9) - 30(4) = 2{,}680.0$$
$$(X - M) = 1{,}000 - 0.10(11{,}999.9) = -200.0$$

Solution to 3:

Following the steps above but with $G = 2{,}000$, the IS curve is

$$Y = 13{,}512.2 - 73.2r$$

At any given level of the interest rate, aggregate income increases by 1,219.5 = (13,512.2 – 12,292.7). This is 2.44 (= 1,219.5/500) times the increase in government spending. The increase in government spending has a "multiplier" effect on equilibrium income because as income rises, both consumption and investment spending also rise, leading to an even greater increase in income, which leads to even more spending, etc. However, some of the increased private spending goes for imports, and higher income also induces higher taxes and saving. The condition for equality of income and expenditure can be written as

$$G = (S - I) + T + (M - X)$$

So the increase in government spending must be balanced by some combination of 1) an increase in saving relative to investment, 2) an increase in taxes, and 3) a rise in imports relative to exports. Given the interest rate, each of these will be induced by an increase in aggregate income. Because saving (S) equals $Y - C - T$,

$$\begin{aligned}\Delta S &= \Delta Y - \Delta C - \Delta T = \Delta Y - \left[0.7(\Delta Y - \Delta T)\right] - \Delta T \\ &= \Delta Y(1 - 0.7) + \Delta T(0.7 - 1) \\ &= 0.3\Delta Y - 0.3\Delta T = 0.3\Delta Y - 0.3(0.3)\Delta Y \\ &= 0.3(1 - 0.3)\Delta Y = 0.21\Delta Y\end{aligned}$$

Using this result along with the investment, tax, and trade balance functions gives

$$\Delta G = (0.21 - 0.2)\Delta Y + 0.3\Delta Y + 0.1\Delta Y = 0.41\Delta Y$$

So, $\Delta Y = (1 / 0.41)\Delta G = 2.44\Delta G$.

Note that an extra unit of income increases saving by 0.21 but also increases investment spending by 0.20. So, in this hypothetical economy, the saving–investment differential ($S - I$) is very insensitive to the level of aggregate income. All else the same, this implies that relatively large changes in income are required to restore the expenditure/income balance whenever there is a change in spending behavior.

Solution to 4:

Using the results above,

$$\begin{aligned}\text{Change in fiscal balance} &= \Delta G - \Delta T = \Delta G\left[1 - 0.3(2.44)\right] \\ &= 0.268(500) = 134 \\ \text{Change in trade balance} &= \Delta(X - M) = 2.44\Delta G(-0.1) \\ &= -0.244(500) = -122 \\ \text{Change in } (S - I) &= \Delta(S - I) = 2.44\Delta G(0.21 - 0.20) \\ &= 0.0244(5) = 12\end{aligned}$$

So, the increase in government spending (500) is ultimately financed by a large increase in taxes (500 – 134 = 366), a very small increase in private sector excess saving (12), and an increase in capital flows from abroad (122).

Solution to 5:

If the economy is operating at maximum output, then an increase in government expenditure must "crowd out" an equal amount of private expenditure in order to keep total expenditure equal to output/income. In this simple model, this implies that the real interest rate must rise enough that investment spending falls by the amount of the increase in government spending. Using the new IS curve equation from Question 3 and the original level of income from Question 2, we need the interest rate such that

$Y = 13{,}512.2 - 73.2r = 11{,}999.9 \Rightarrow r = 20.66\%$

So the real interest rate would soar from 4 percent to 20.66 percent to choke off investment spending.

3.1.2 *Equilibrium in the Money Market: The LM Curve*

The IS curve tells us what level of income is consistent with a given level of the real interest rate but does not address the appropriate level of interest rates, nor does it depend on the price level. In order to determine the interest rate and introduce a connection between output and the price level, we must consider supply and demand in the financial markets. To keep the model as simple as possible, we will deal explicitly with demand and supply for only one financial asset: money. All other assets (e.g., stocks and bonds) are implicitly treated as a composite alternative to holding money. In some of the subsequent discussion, however, we will note differential impacts on equity and fixed-income securities.

The *quantity theory of money* equation provides a straightforward connection among the nominal money supply (M), the price level (P), and real income/expenditure (Y):

$MV = PY$

In this equation, V is the *velocity of money*, the average rate at which money circulates through the economy to facilitate expenditure. This equation essentially defines V. The equation begins to have economic content only when we make assumptions about how velocity is related to such economic variables as the interest rate. In the simplest case, if velocity is assumed to be constant, then the quantity theory of money equation implies that the money supply determines the nominal value of output (PY). Therefore, an increase in the money supply will increase the nominal value of output. However, this equation alone cannot tell us how that increase would be split between price and quantity.

The quantity theory equation can be rewritten in terms of the supply and demand for real money balances:

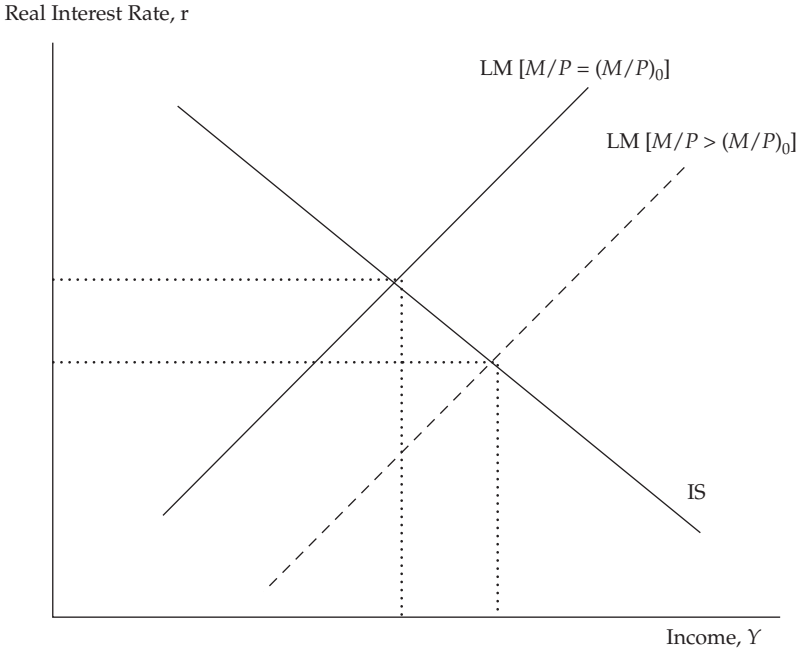
$$M/P = (M/P)_D = kY$$

where $k = 1/V$ reflects how much money people want to hold for every currency unit of real income. The demand for real money balances is typically assumed to depend inversely on the interest rate because a higher interest rate encourages investors to shift their assets out of money (bank deposits) into higher-yielding securities. Although the quantity theory of money suggests that the demand for real money balances is proportional to real income, this need not be the case. The important point is that money demand increases with income. Thus, demand for real money balances is an increasing function $\boldsymbol{M}(\cdot,\cdot)$ of real income and a decreasing function of the interest rate. Equilibrium in the money market requires

$$M/P = \boldsymbol{M}(r,Y)$$

Holding the real money supply (M/P) constant, this equation implies a positive relationship between real income (Y) and the real interest rate (r). Given the real money supply, an increase in real income must be accompanied by an increase in the interest rate in order to keep the demand for real money balances equal to the supply. This relationship, which economists refer to as the *LM curve*, is shown by the upward-sloping curve in Exhibit 12.

Exhibit 12 The IS and LM Curves

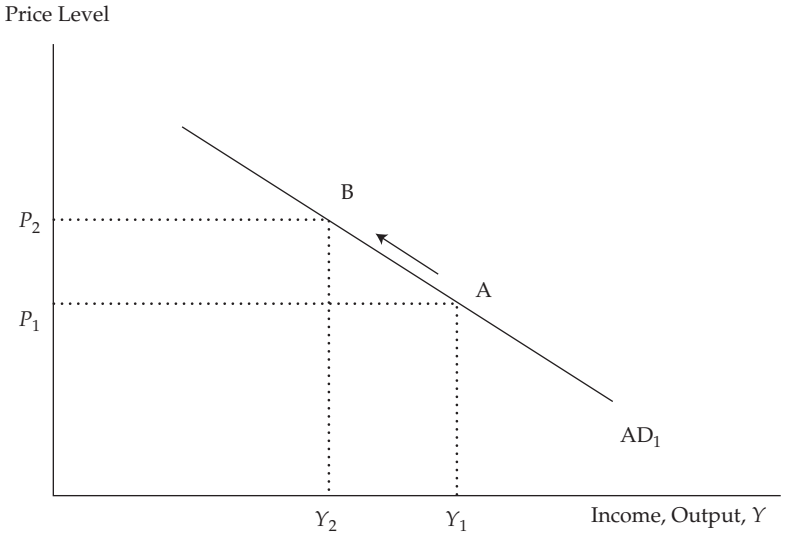


The intersection of the IS and LM curves determines the combination of real income and the real interest rate that is consistent with both the equality of income and (planned) expenditure (the IS curve) and equilibrium in the money market (the LM curve). In Exhibit 12, the dashed LM curve reflects a higher real money supply than the solid LM curve. With a higher real money supply, the intersection of the IS and LM curves occurs at a higher level of real income and a lower level of the real interest rate.

3.1.3 *The Aggregate Demand Curve*

If the nominal money supply (M) is held constant, then a higher or lower real money supply (M/P) arises because of changes in the price level. If the price level declines, the real money supply increases and, as shown in Exhibit 12, real income increases while the real interest rate declines. Conversely, an increase in the price level leads to a decline in real income and an increase in the real interest rate. This inverse relationship between the price level and real income is illustrated in Exhibit 13. This is the **aggregate demand curve** (AD curve).

Exhibit 13 The Aggregate Demand Curve



As shown in Exhibit 13, an increase in the price level from P_1 to P_2 reduces income from Y_1 to Y_2. Our development of the AD curve emphasized only one channel through which prices affect the quantity of output demanded (i.e., planned real expenditure)—the interest rate. There are, however, other mechanisms. Higher prices erode the purchasing power of retirees and others whose income is fixed in nominal terms. Similarly, higher prices reduce the real value of nominal assets (e.g., stocks and bonds) and may reduce consumption relative to current income as people seek to rebuild the real purchasing power of their wealth. Higher domestic prices also make domestically produced goods more expensive relative to imports (assuming a constant currency exchange rate). In each case, lower prices have the opposite effect, increasing aggregate expenditure and income.

It should be clear that many interesting and important aspects of the economy are subsumed into the AD curve: saving, investment, trade and capital flows, interest rates, asset prices, fiscal and monetary policy, and more. All of these disappear behind a deceptively simple relationship between price and output/income.

Before moving on to consider aggregate supply, let's look more closely at the interaction of interest rates and income implicit in movements along the AD curve. For simplicity, we assume there are no changes in the fiscal or trade balances so that maintaining the balance between aggregate expenditure and aggregate income requires that changes in investment spending equal changes in private saving. As the price level increases, the real money supply (M/P) declines. To induce a corresponding decline in money demand, the interest rate must rise so that other assets are more attractive, and income must fall to reduce the transactional need for money balances. The higher interest rate induces companies to reduce investment spending. The decline in

income reduces household saving. *The slope of the AD curve depends on the relative sensitivities of investment, saving, and money demand to income and the interest rate.* The AD curve will be flatter if

- investment expenditure is highly sensitive to the interest rate;
- saving is insensitive to income;
- money demand is insensitive to interest rates; and
- money demand is insensitive to income.

The first two conditions directly imply that income will have to move more to induce a large enough change in saving to match the change in investment spending. All else equal, each of the last two conditions implies that a larger change in the interest rate is required to bring money demand in line with money supply. This, in turn, implies a larger change in investment spending and a correspondingly larger change in saving and income.

EXAMPLE 6

Aggregate Demand

The money demand and supply equations for our hypothetical economy are

$$M_d/P = -300 + 0.5Y - 30r \quad \text{(real money demand)}$$
$$M/P = 5{,}200/P \quad \text{(real money supply)}$$

1. Find the equation for the LM curve.
2. Using the IS curve from Question 1 of Example 5, find the equation of the AD curve.
3. Find the levels of GDP and the interest rate if $P = 1$.
4. What will happen to GDP and the interest rate if the price level rises to 1.1 or falls to 0.9?
5. Suppose investment spending were more sensitive to the interest rate so that the IS becomes ($Y = 12{,}292.7 - 150r$). What happens to the slope of the AD curve? What does this imply about the effectiveness of monetary policy?

Solution to 1:

Setting the real money supply equal to real money demand and rearranging, we get the LM equation:

$$Y = 600 + 2(M/P) + 60r$$

Or with $M = 5{,}200$,

$$Y = 600 + 10{,}400/P + 60r \text{ (LM equation)}$$

Solution to 2:

From Question 1 of Example 5, the IS equation is $Y = 12{,}292.7 - 73.2\,r$. We now have two equations and two unknowns. The easiest way to solve this problem is to multiply the LM curve by 1.22 (= 73.2/60.0) and then add the equations:

$$1.22Y = 732 + 2.44(M/P) + 73.2r \quad \text{(LM equation)}$$
$$Y = 12{,}292.7 - 73.2r \quad \text{(IS equation)}$$

Adding the two equations and solving for Y,

$$Y = 5{,}867.0 + 1.099(M/P) \quad \text{(AD curve)}$$
$$= 5{,}867.0 + 5{,}715.3/P \quad \text{(with } M = 5{,}200\text{)}$$

Solution to 3:

If $P = 1$, the AD curve gives GDP as $Y = 5{,}867.0 + 5{,}715.3 = 11{,}582.3$. From the money demand and supply equation, the equilibrium interest rate is

$$5{,}200/1 = -300 + 0.5(11{,}582.3) - 30r \Rightarrow r = 9.7\%$$

Solution to 4:

If the price level increases to 1.1, GDP declines to $Y = 5{,}867.0 + 5{,}715.3/1.1 = 11{,}062.7$. If the price level falls to 0.9, GDP increases to $Y = 5{,}867.0 + 5{,}715.3/0.9 = 12{,}217.3$. To find the interest rate in each case, we plug these values for Y into the IS curve.

$$\text{If } P = 1.1\text{: } Y = 11{,}062.7 = 12{,}292.7 - 73.2\,r \Rightarrow r = 16.8\%$$
$$\text{If } P = 0.9\text{: } Y = 12{,}217.3 = 12{,}292.7 - 73.2\,r \Rightarrow r = 1.0\%$$

Thus, we have the following relationship among the price level, GDP, and the interest rate:

Price Level	GDP	Interest Rate
0.9	12,217.3	1.0
1.0	11,582.3	9.7
1.1	11,062.7	16.8

The inverse relationship between GDP and the price level is the AD curve. The inverse relationship between GDP and the interest rate reflects the IS curve.

Solution to 5:

If the interest rate parameter in the IS curve is 150 instead of 73.2, we can multiply the LM equation by 2.5 (= 150/60) instead of 1.22 (= 73.2/60) to get the system of equations:

$$2.5Y = 1{,}500 + 5(M/P) + 150r \quad \text{(LM equation)}$$
$$Y = 12{,}292.7 - 150r \quad \text{(IS equation)}$$

Adding these equations and solving for Y gives

$$Y = 3{,}940.77 + 1.429(M/P) \quad \text{(new AD curve)}$$
$$= 3{,}940.77 + 7{,}428.6/P \quad \text{(with } M = 5{,}200\text{)}$$

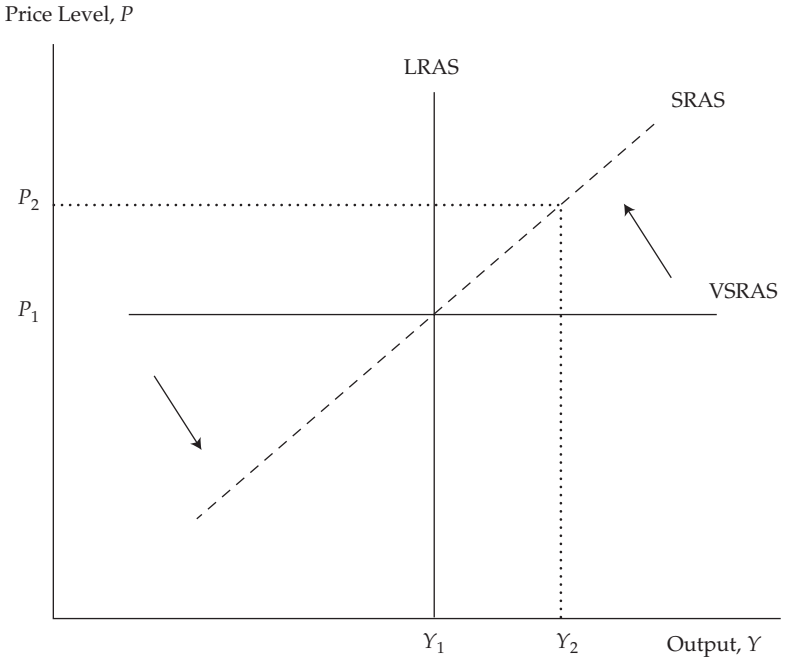
Comparing the new AD curve to the original AD curve indicates that output (Y) is now more sensitive to the price level. That is, the AD curve is flatter. Monetary policy is now more effective because, at any given price level, an increase in M has a greater impact on Y. This can be understood as follows: As the real money supply increases, the interest rate must fall and/or expenditure must increase in order to induce households to hold the increased money supply. With investment spending now more sensitive to the interest rate, income will have to rise by more in order to increase saving by a corresponding amount.

3.2 Aggregate Supply

Aggregate demand only tells us the relationship between the price level and the amount of output demanded at those prices. To understand what price and output level will prevail in the economy, we need to add aggregate supply, the amount of output producers are willing to provide at various prices. The **aggregate supply curve** (AS curve) represents the level of domestic output that companies will produce at each price level. Unlike the demand side, we must distinguish between the short- and long-run AS curves, which differ with respect to how wages and other input prices respond to changes in final output prices. "Long run" and "short run" are relative terms and are necessarily imprecise with respect to calendar time. The "long run" is long enough that wages, prices, and expectations can adjust but not long enough that physical capital is a variable input. Capital and the available technology to use that capital remain fixed. This condition implies a period of at least a few years and perhaps a decade. The truly long run in which even the capital stock is variable may be thought of as covering multiple decades. Consideration of the very long run is postponed to our discussion of economic growth in Section 4.

In the very short run, perhaps a few months or quarters, companies will increase or decrease output to some degree without changing price. This is shown in Exhibit 14 by the horizontal line labeled VSRAS. If demand is somewhat stronger than expected, companies earn higher profit by increasing output as long as they can cover their variable costs. So they will run their plant and equipment more intensively, demand more effort from their salaried employees, and increase the hours of employees who are paid on the basis of hours worked. If demand is somewhat weaker than projected, companies can run their plants less intensively, cut labor hours, and utilize staff to perform maintenance and carry out efficiency-enhancing projects that are often postponed during busier periods.

Exhibit 14 Aggregate Supply Curve



Over somewhat longer periods, the AS curve is upward sloping because more costs become variable. This is represented by the short-run aggregate supply (SRAS) curve in Exhibit 14. In most businesses, wages are adjusted once a year, but for companies with union contracts, several years may pass before the contracts expire. The prices for raw materials and other inputs may also be established under long-term contracts. Hence, wages and other input costs are relatively inflexible in the short run and do not fully adjust to changes in output prices. As the price level rises, most companies enjoy higher profit margins and hence expand production. In Exhibit 14, when prices move from P_1 to P_2, the quantity of aggregate output supplied increases from Y_1 to Y_2. Conversely, a reduction in the price level squeezes profit margins and causes companies to reduce production.

Over time, however, wages and other input prices tend to "catch up" with the prices of final goods and services. In other words, wages and prices that are inflexible or slow to adjust in the short run adjust to changes in the price level over the long run. Thus, over the long run, when the aggregate price level changes, wages and other input prices change proportionately so that the higher aggregate price level has no impact on aggregate supply. This is illustrated by the vertical long-run aggregate supply (LRAS) curve in Exhibit 14. As prices move from P_1 to P_2, the quantity of output supplied remains at Q_1 in the long run. The only change that occurs is that prices shift to a higher level (from P_1 to P_2).

The position of the LRAS curve is determined by the potential output of the economy. The amount of output produced depends on the fixed amount of capital and labor and the available technology. This classical model of aggregate supply can be expressed as

$$Y = \boldsymbol{F}\left(\overline{K},\overline{L}\right) = \overline{Y}$$

where $\overline{K}$ is the fixed amount of capital and $\overline{L}$ is the available labor supply. The stock of capital is assumed to incorporate the existing technological base.[10] The available labor supply is also held constant, and workers are assumed to have a given set of skills. The long-run equilibrium level of output, Y_1 in Exhibit 14, is referred to as the *full employment*, or *natural*, level of output. At this level of output, the economy's resources are deemed to be fully employed and (labor) *unemployment is at its natural rate*. This concept of a natural rate of unemployment assumes the macroeconomy is currently operating at an efficient and unconstrained level of production. Companies have enough spare capacity to avoid bottlenecks, and there is a modest, stable pool of unemployed workers (job seekers equal job vacancies) looking for and transitioning into new jobs.

3.3 Shifts in Aggregate Demand and Supply

In the next two sections, the aggregate demand (AD) and aggregate supply (AS) models are used to address three critical macroeconomic questions:

1. What causes an economy to expand or contract?
2. What causes inflation and changes in the level of unemployment?
3. What determines an economy's rate of sustainable growth, and how can it be measured?

10 Note that investment, *I*, reflects replacement of worn-out capital plus the change in capital, ΔK. Over short periods of time, net investment is assumed to have a negligible effect on aggregate supply. The cumulative effect of investment on economic growth is discussed in Section 4.

Before addressing these questions, we need to distinguish between 1) the long-run growth rate of real GDP and 2) short-run fluctuations in real GDP around this long-run trend.

The business cycle is a direct result of short-term fluctuations of real GDP. It consists of periods of economic expansion and contraction. In an expansion, real GDP is increasing, the unemployment rate is declining, and capacity utilization is rising. In a contraction, real GDP is decreasing, the unemployment rate is rising, and capacity utilization is declining. Shifts in the AD and AS curves determine the short-run changes in the economy associated with the business cycle. In addition, the AD–AS model provides a framework for estimating the sustainable growth rate of an economy, which is addressed in Section 4.

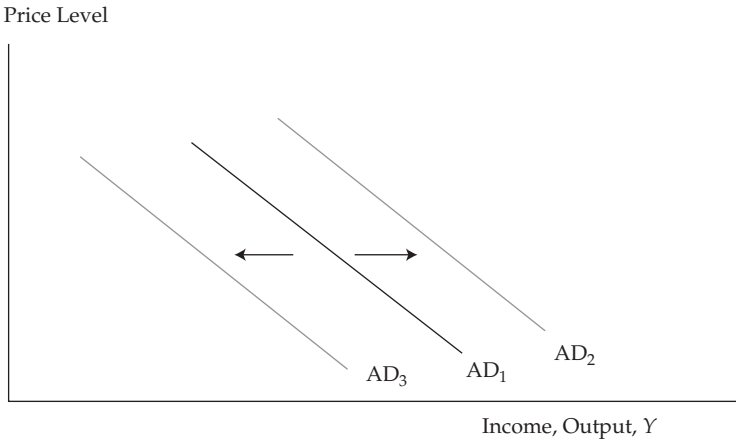
From an asset allocation perspective, it is important to determine the current phase of the business cycle as well as how fast the economy is growing relative to its sustainable growth rate. The expected rate of return on equities and fixed-income securities, for example, depends on estimates of the growth rate of GDP and inflation. For equities, GDP growth is the primary determinant of aggregate corporate profits. For fixed-income securities, the expected rate of inflation determines the spread between real and nominal rates of return. In order to use the AD and AS model to analyze the economy and to make investment decisions, we need to first understand what factors cause the curves to shift.

3.3.1 *Shifts in Aggregate Demand*

In addition to price, factors that influence the level of spending by households, companies, governments, and foreigners (i.e., the aggregate level of expenditures) will cause the AD curve to shift. A shift to the right represents an increase in aggregate demand at any price level. Exhibit 15 shows this as a shift from AD_1 to AD_2. A shift to the left represents a decrease in aggregate demand at any price level. This is indicated by a move from AD_1 to AD_3. Key factors that directly or indirectly influence the level of aggregate expenditures and cause the aggregate demand curve to shift include changes in

- household wealth;
- consumer and business expectations;
- capacity utilization;
- monetary policy;
- the exchange rate;
- growth in global economy; and
- fiscal policy (government spending and taxes).

Exhibit 15 Shifts in the Aggregate Demand Curve



Household Wealth Household wealth includes the value of both financial assets (e.g., cash, savings accounts, investment securities, and pensions) and real assets (e.g., real estate). The primary reason households save a portion of their current income is to accumulate wealth for consumption in the future. The proportion of disposable income that households save depends partly on the value of the financial and real assets that they have already accumulated. If these assets increase in value, households will tend to save less and spend a greater proportion of their income because they will still be able to meet their wealth accumulation goals. As a result, an increase in household wealth increases consumer spending and shifts the aggregate demand curve to the right. In contrast, a decline in wealth will reduce consumer spending and shift the AD curve to the left. This is often referred to as the **wealth effect** and is one explanation for how changes in equity prices affect economic activity. Higher equity prices increase household wealth, which increases consumer spending and reduces the amount saved out of current income. Economic studies estimate that an increase or decrease in wealth in developed countries increases or decreases annual consumer spending by 3–7 percent of the change in wealth.[11] A smaller but still statistically significant wealth effect has been found in a number of emerging markets (developing countries).[12]

Exhibit 16 Historical Example: Housing Prices and the Saving Rate in the United Kingdom

Year	Housing Prices (first quarter of each year) (Index 2000 Q1 = 100)	Saving Rate (%)
2000	100	4.7
2002	122.7	5.8
2004	180.5	3.7
2006	206.3	2.9
2007	225.9	2.1

11 See, for example, Case, Quigley, and Shiller (2005).
12 See Funke (2004).

Exhibit 16 (Continued)

Year	Housing Prices (first quarter of each year) (Index 2000 Q1 = 100)	Saving Rate (%)
2008	220.5	1.2
2009	192.7	7.0

Source: Office of National Statistics, United Kingdom.

EXAMPLE 7

The Wealth Effect on Saving and Consumption

The importance of the wealth effect on consumption, and its relationship to housing prices, was evident in the recession that began in late 2007. During this period, global GDP declined by the steepest amount in the post–World War II period. A major factor associated with the economic downturn was the sharp fall in housing prices, especially in countries that experienced a housing boom earlier in the decade, such as the United States, the United Kingdom, Spain, and Ireland. In each of these countries, consumers reduced spending sharply and raised the level of saving in response to the decline in wealth. Do the data in Exhibit 16 provide support for the wealth effect?

Solution:

Housing prices in the United Kingdom rose by nearly 126 percent [(225.9 – 100)/100] between 2000 and 2007. As predicted, the saving rate declined (with a lag), going from an average of 5.3 percent of income in 2000 and 2002 to 1.2 percent in 2008. Then, as housing prices fell by 14.7 percent between 2007 and 2009, the saving rate rose dramatically from 1.2 percent in 2008 to 7 percent in 2009. Of course, the decline in housing prices was not the only factor contributing to the increase in the saving rate. Stock prices also declined in this period, further reducing wealth in the United Kingdom, and the recession raised uncertainty over future jobs and income.

Consumer and Business Expectations Psychology has an important impact on consumer and business spending. When consumers are confident about their future income and the stability/safety of their jobs, they tend to spend a higher portion of their disposable income. This shifts the AD curve to the right. Consumer spending declines and the AD curve shifts to the left when consumers become less confident. Similarly, when businesses are optimistic about their future growth and profitability, they spend (invest) more on capital projects, which also shifts the AD curve to the right.

Capacity Utilization Capacity utilization is a measure of how fully an economy's production capacity is being used. Companies with excess capacity have little incentive to invest in new property, plant, and equipment. In contrast, when companies are operating at or near full capacity, they will need to increase investment spending in order to expand production. Data from the OECD and the US Federal Reserve indicate that when aggregate capacity utilization reaches 82 to 85 percent, production blockages arise, prompting companies to increase their level of investment spending. This shifts the AD curve to the right.

Fiscal Policy **Fiscal policy** is the use of taxes and government spending to affect the level of aggregate expenditures.[13] An increase in government spending, one of the direct components of AD, shifts the AD curve to the right, whereas a decrease in government spending shifts the AD curve to the left. Taxes affect GDP indirectly through their effect on consumer spending and business investment. Lower taxes will increase the proportion of personal income and corporate pre-tax profits that consumers and businesses have available to spend and will shift the AD curve to the right. In contrast, higher taxes will shift the AD curve to the left.

Monetary Policy *Money* is generally defined as currency in circulation plus deposits at commercial banks. **Monetary policy** refers to action taken by a nation's central bank to affect aggregate output and prices through changes in bank reserves, reserve requirements, or its target interest rate.

Most countries have fractional reserve banking systems in which each bank must hold reserves (vault cash plus deposits at the central bank) at least equal to the required reserve ratio times its customer deposits. Banks with excess reserves can lend them to banks that need reserves to meet their reserve requirements. The central bank can increase the money supply by 1) buying securities from banks, 2) lowering the required reserve ratio, and/or 3) reducing its target for the interest rate at which banks borrow and lend reserves among themselves. In each case, the opposite action would decrease the money supply.

When the central bank buys securities from banks in an open-market operation, it pays for them with a corresponding increase in bank reserves. This increases the amount of deposits banks can accept from their customers—that is, the money supply. Similarly, cutting the required reserve ratio increases the level of deposits (i.e., money) consistent with a given level of reserves in the system. If the central bank chooses to target an interbank lending rate, as the Federal Reserve targets the federal funds rate in the United States, then it must add or drain reserves via open-market operations to maintain the target interest rate. If it raises (lowers) its target interest rate, it will have to drain (add) reserves in order to make reserves more (less) expensive in the interbank market. Thus, open-market operations and interest rate targeting are very closely related. The main distinction is whether the central bank chooses to target a level of reserves and let the market determine the interest rate or chooses to target the interest rate and let the market (banks) determine the level of reserves they desire to hold at that rate.

An increase in the money supply shifts the AD curve to the right so that each price level corresponds to a higher level of income and expenditure.[14] There are various channels through which the additional expenditures may be induced. For example, the interest rate reduction required to induce investors to hold the additional money balances will encourage companies to investment more and households to borrow to purchase durable goods, such as cars. In addition, banks may facilitate greater expenditure by raising credit limits and loosening credit standards. Conversely, a reduction in the money supply shifts the AD curve to the left.

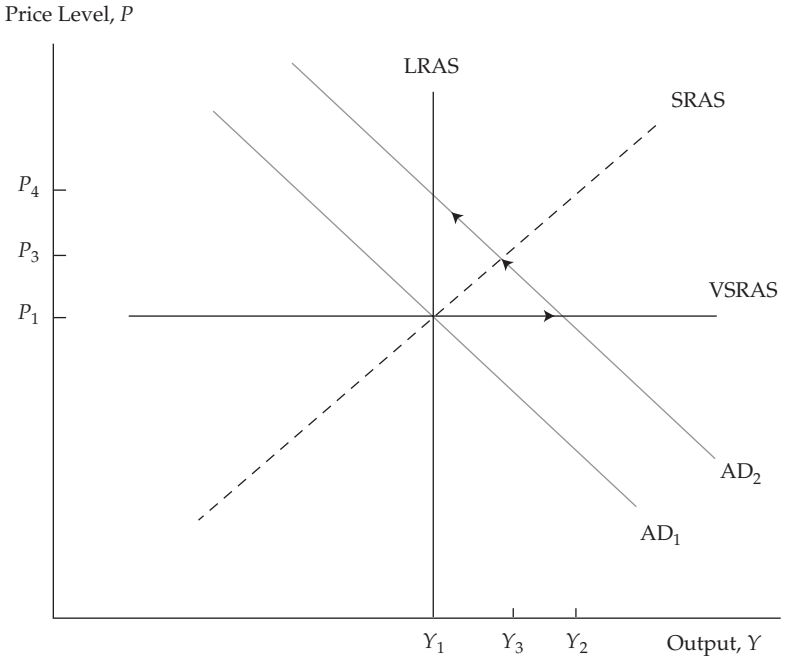
Exhibit 17 illustrates the short-run and long-run effect of expansionary monetary policy. Suppose the central bank expands the money supply in an attempt to stimulate demand when the economy is already in long-run equilibrium. The expansionary policy will shift the AD curve to the right, from AD_1 to AD_2. In the very short run, output

13 Government spending and taxes may be adjusted for other purposes too. In macroeconomics, however, the term "fiscal policy" is usually reserved for actions intended to affect the overall level of expenditure.

14 An unusual but important special case known as a *liquidity trap* occurs if a) banks are willing to hold virtually unlimited excess reserves rather than expand their balance sheets by taking deposits and making loans and/or b) demand for money balances by households and companies is insensitive to the level of income. In a liquidity trap, monetary policy will be ineffective and the AD curve will not shift despite the central bank's efforts. Some have argued that this was a reasonable description of the US situation in 2010.

will expand from Y_1 to Y_2 without an increase in the price level. After operating at higher-than-normal production rates for a few months or quarters, companies will begin to push for price increases and input prices will begin to rise as well. The aggregate supply curve will steepen, and prices will increase to P_3 while output declines to Y_3. As input prices become more flexible, the AS curve will steepen until, in the long run, it is vertical and output has returned to the long-run natural level, Y_1, with prices rising to P_4. Thus, expanding the money supply increases output in the short run, but in the long run it affects only the price level.

Exhibit 17 Short-Run and Long-Run Effect of Monetary Expansion



Exchange Rate An exchange rate is the price of one currency relative to another. Changes in the exchange rate affect the price of exports and imports and thus aggregate demand. For example, a lower euro relative to other currencies makes European exports cheaper in world markets and foreign products sold in Europe (European imports) more expensive. Therefore, a lower euro should cause European exports to increase and imports to decline, causing the AD curve to shift to the right. Conversely, a stronger euro reduces exports and raises imports, and the AD curve shifts to the left.

Growth in the Global Economy International trade is what links countries together and creates a global economy. Faster economic growth in foreign markets encourages foreigners to buy more products from domestic producers and increases exports. For example, rapid GDP growth in ASEAN member countries has increased their demand for foreign products. Japan has benefited from this rapid growth because it has exported more products to them. In terms of the AD and AS model, the AD curve for Japan has shifted to the right because of increased demand for Japanese products in ASEAN countries, resulting in higher exports. A decline in the growth rates of ASEAN members' economies would have a negative effect on the Japanese economy because exports would be lower. This would cause the Japanese AD curve to shift to the left.

What happens to interest rates when the AD curve shifts? In the case of an increase in the money supply, the interest rate declines at each price level because the increase in income (Y) increases saving and rates must decline to induce a corresponding increase in investment spending (I). In each of the other cases considered above, a rightward shift in the AD curve will increase the interest rate at each price level. With the real money supply held constant, the interest rate must rise as income increases. The increase in the interest rate reduces the demand for money at each level of expenditure/income and, therefore, allows expenditure/income to increase without an increase in the money supply. In terms of the quantity theory of money equation, this corresponds to a higher velocity of money, V.

The main factors that shift the AD curve are summarized in Exhibit 18. In each case, the impact of the factor is considered in isolation. In practice, however, various factors may be at work simultaneously and there may be interaction among them. This is especially true with regard to expectational factors—consumer and business confidence—which are likely to be influenced by other developments.

Exhibit 18 Impact of Factors Shifting Aggregate Demand

An Increase in the Following Factors:	Shifts the AD Curve:	Reason:
Stock prices	Rightward: Increase in AD	Higher consumption
Housing prices	Rightward: Increase in AD	Higher consumption
Consumer confidence	Rightward: Increase in AD	Higher consumption
Business confidence	Rightward: Increase in AD	Higher investment
Capacity utilization	Rightward: Increase in AD	Higher investment
Government spending	Rightward: Increase in AD	Government spending a component of AD
Taxes	Leftward: Decrease in AD	Lower consumption and investment
Bank reserves	Rightward: Increase in AD	Lower interest rate, higher investment and possibly higher consumption
Exchange rate (foreign currency per unit domestic currency)	Leftward: Decrease in AD	Lower exports and higher imports
Global growth	Rightward: Increase in AD	Higher exports

EXAMPLE 8

Shifts in Aggregate Demand

Francois Ubert is a portfolio manager with EuroWorld, a French investment management firm. Ubert is considering increasing his clients' portfolio exposure to Brazilian equities. Before doing so, he asks you to prepare a report on the following recent economic events in Brazil and to summarize the impact of each event on the Brazilian economy and on Brazilian equity and fixed-income securities.

1. The Brazilian central bank reduced bank reserves, resulting in a lower money supply.
2. The capacity utilization rate in Brazil is currently estimated to be 86.4 percent, a 2.7 percent increase from the previous year.

3 Corporate profits reported by Brazilian companies increased by 30 percent over last year's levels, and corporations have revised their forecasts of future profitability upward.

4 The government recently announced that it plans to start construction on a number of hydroelectric projects to reduce Brazil's reliance on imported oil.

5 Forecasts by private sector economists project that the European economy will enter a recession in the next year.

Solution to 1:

This monetary policy action is designed to reduce consumption and business investment spending. The reduction in real money balances will increase interest rates and discourage lending within the banking system. Higher interest rates and tighter credit will reduce both investment and consumption expenditures and shift the AD curve to the left. The prices of fixed-income securities will fall because of the rise in interest rates. The reduction in aggregate output should lower corporate profits, and it is likely that equity prices will also fall.

Solution to 2:

Capacity utilization is a key factor determining the level of investment spending. A current utilization rate of over 86 percent and an increase from the previous year indicate a growing lack of spare capacity in the Brazilian economy. As a result, businesses will probably increase their level of capital spending. This will increase AD and shift the AD curve to the right. Higher economic activity (income/output) will cause upward pressure on interest rates and may have a negative impact on fixed-income securities. Higher income/output should increase corporate profits and is likely to have a positive impact on equity securities.

Solution to 3:

Expected corporate profits are an important determinant of the level of investment spending. The large increase in expected profits will raise the level of investment spending and increase aggregate demand. This will shift the AD curve to the right. The increase in corporate profits and the resulting increase in economic output should have a positive impact on equities. The increase in output will put upward pressure on interest rates and downward pressure on the prices of fixed-income securities.

Solution to 4:

Fiscal policy uses government spending to influence the level and growth rate of economic activity. The announcement indicates an increase in government spending, which is a direct component of AD. Therefore, higher spending on the projects will increase AD and shift the AD curve to the right. The increase in output and expenditure should be positive for equities. But it will be negative for existing fixed-income investments because higher interest rates will be required to induce investors to buy and hold the government debt issued to fund the new projects.

Solution to 5:

A recession in Europe will decrease the demand for Brazilian exports by European households and businesses and shift the AD curve to the left. The resulting decline in income and downward pressure on prices will be positive for fixed-income securities but negative for equities.

3.3.2 *Shifts in Short-Run Aggregate Supply*

Factors that change the cost of production or expected profit margins will cause the SRAS curve to shift. These factors include changes in

- nominal wages;
- input prices, including the price of natural resources;
- expectations about future output prices and the overall price level;
- business taxes and subsidies; and
- the exchange rate.

In addition, factors that shift the long-run AS curve (see Section 3.3.3) will also shift the SRAS curve by a corresponding amount because the SRAS and LRAS reflect the same underlying resources and technology. As the economy's resources and technology change, the full employment (or natural) level of output changes, and both the LRAS and SRAS shift accordingly.

Change in Nominal Wages Changes in nominal wages shift the short-run AS curve because wages are often the largest component of a company's costs. An increase in nominal wages raises production costs, resulting in a decrease in AS and a leftward shift in the SRAS curve. Lower wages shift the AS curve to the right. It is important to note that changes in nominal wages have no impact on the LRAS curve.

A better way to measure the impact of labor costs on the AS curve is to measure the change in unit labor cost. We define the change in unit labor cost as

$$\%\ \text{Change in unit labor cost} = \%\ \text{Change in nominal wages} - \%\ \text{Change in productivity}$$

EXAMPLE 9

Unit Labor Cost and Short-Run Aggregate Supply

Suppose Finnish workers are paid €20 an hour and are able to produce 100 cell phones in an hour. The labor cost per cell phone is €0.20 (€20 divided by 100 units). If the wages per hour for Finnish workers rise by 10 percent from €20 to €22 and they are able to raise their productivity by 10 percent, what is the impact on unit labor cost and the short-run aggregate supply curve?

Solution:

The workers can now produce 110 cell phones per hour, and unit labor cost will not change (22/110 = 0.20). In this case, the SRAS curve will remain in its original position. If wages had increased by 20 percent instead of 10 percent, then unit labor cost would have increased and the SRAS would shift to the left. Conversely, if the wage increase were only 5 percent, then unit labor cost would have decreased and the SRAS would shift to the right.

Change in Input Prices The price of raw materials is an important component of cost for many businesses. Lower input prices reduce the cost of production, which, in turn, makes companies willing to produce more at any output price. This is reflected in a rightward shift of the SRAS curve. Conversely, higher input prices increase production costs, which, in turn, causes companies to reduce production at any output price. This shifts the SRAS curve to the left. During the 1970s, high oil prices caused the SRAS curve in most countries to shift to the left. In contrast, in the mid-1980s, declining oil prices lowered the cost of production and shifted the SRAS curve in most countries

to the right. Oil prices currently have a smaller impact on the global economy than in the 1970s and 1980s because most countries have reduced their reliance on oil and improved their energy efficiency so that they now use less energy per unit of GDP.

Change in Expectations about Future Prices The impact of expected future prices on current output decisions is not as straightforward as it might seem. First, each company is primarily concerned about the price of its own output rather than the general price level. The latter may be more reflective of its costs. If it expects its own output price to rise (fall) relative to the general price level, then it may increase (decrease) production in response to the perceived change in its profit margin. As more and more companies become optimistic (pessimistic) about their ability to raise the relative price of their product, the SRAS will shift to the right (left). In the aggregate, of course, companies can neither raise nor lower their prices relative to the general price level. Hence, shifts in the SRAS driven by such price expectations are likely to be modest and temporary. Second, considering future prices introduces a temporal aspect into decision making. If the future price level is expected to be higher, companies may decide to produce more today in order to expand inventory available for future sale. But they will only do so if the cost of carrying inventory (financing, storage, and spoilage) is less than they expect to save on production costs by producing more today and less in the future. Conversely, they may cut current production and sell out of existing inventory if they expect future prices (and costs) to be lower.

The upshot is that expectations of higher (lower) future prices are likely to shift the SRAS curve to the right (left), but the impact may be modest and/or temporary.

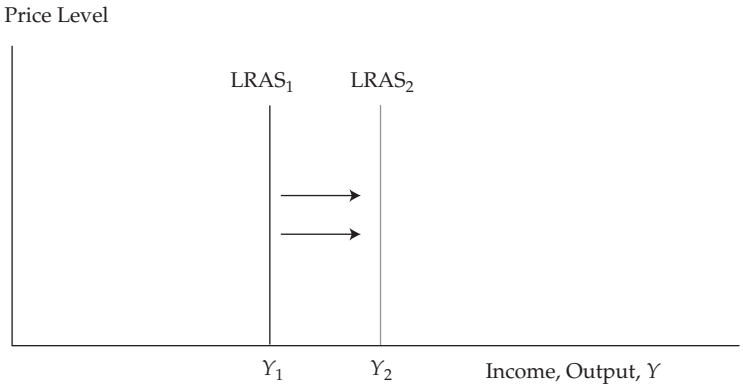
Change in Business Taxes and Subsidies Higher business taxes increase production costs per unit and shift the short-run AS curve to the left. Business subsidies are a payment from the government to the producer. Subsidies for businesses lower their production costs and shift the SRAS curve to the right.

Change in the Exchange Rate Many countries import raw materials, including energy and intermediate goods. As a result, changes in the exchange rate can affect the cost of production and, therefore, aggregate supply. A higher Yen relative to the Euro will lower the cost of raw materials and intermediate goods imported to Japan from Europe. This, in turn, will lower the production costs of Japanese producers and shift the AS curve in Japan to the right. A lower Yen will have the opposite effect.

3.3.3 *Shifts in Long-Run Aggregate Supply*

As discussed above, the position of the LRAS curve is determined by the potential output of the economy. **Potential GDP** measures the productive capacity of the economy and is the level of real GDP that can be produced at full employment. Potential GDP is not a static concept but can increase each year at a steady rate as the economy's resource capacity grows. Therefore, any factor increasing the resource base of an economy causes the LRAS curve to shift as shown in Exhibit 19.

Exhibit 19 Shift in Long-Run Aggregate Supply (LRAS) Curve



These factors include changes in

- supply of labor and quality of labor forces (human capital);
- supply of natural resources;
- supply of physical capital; and
- productivity and technology.

Supply of Labor The larger the supply of labor, the more output the economy can produce. The labor supply depends on growth in the population, the labor force participation rate (the percentage of the population working or looking for work), and net immigration. The determinants of the labor supply are discussed in more detail in Section 4. Increases in the labor supply shift the LRAS curve to the right. Decreases shift the curve to the left.

Supply of Natural Resources Natural resources are essential inputs to the production process and include everything from available land to oil to water. Increased availability of natural resources shifts the LRAS curve to the right.

Supply of Physical Capital Investment in new property, plant, equipment, and software is an essential ingredient for growth. An increase in the stock of physical capital will increase the capacity of the economy to produce goods and services. Simply put, if workers are provided with more and better equipment to use, they should be able to produce more output than they could with the older equipment. Thus, strong growth in business investment, which increases the supply of physical capital, shifts the LRAS curve to the right.

Supply of Human Capital Another way to raise the productive capacity of a country is to increase human capital—the quality of the labor force—through training, skills development, and education. Improvement in the quality of the labor force shifts the LRAS curve to the right.

Labor Productivity and Technology Another important factor affecting the productive capacity of an economy is how efficient labor is in transforming inputs into final goods and services. **Productivity** measures the efficiency of labor and is the amount of output produced by workers in a given period of time—for example, output per hour worked. An increase in productivity decreases labor cost, improves profitability, and results in higher output. Two of the main drivers of labor productivity—physical

capital per worker and the quality of the workforce—have been discussed above. The third key determinant of productivity is technology. Advances in technology shift the LRAS curve to the right.

EXAMPLE 10

Unit Labor Cost and Long-Run Aggregate Supply

Finnish workers are paid €20 per hour and are able to produce 100 cell phones in an hour. If workers develop a new technique for assembly and are able to produce 200 cell phones per hour, what is the impact on the long-run aggregate supply curve?

Solution:

Labor cost per unit will decline to €0.10 (20/200 = €0.10 per cell phone). As a result, profit per unit will rise and companies will have an incentive to increase production. Thus, the LRAS curve shifts to the right.

The factors shifting the AS curve are summarized in Exhibit 20. Rightward shifts in the SRAS or LRAS curves are defined as an increase in supply. Leftward shifts in the SRAS or LRAS curves represent a decrease in supply.

Exhibit 20 Impact of Factors Shifting Aggregate Supply

An Increase in	Shifts SRAS	Shifts LRAS	Reason
Supply of labor	Rightward	Rightward	Increases resource base
Supply of natural resources	Rightward	Rightward	Increases resource base
Supply of human capital	Rightward	Rightward	Increases resource base
Supply of physical capital	Rightward	Rightward	Increases resource base
Productivity and technology	Rightward	Rightward	Improves efficiency of inputs
Nominal wages	Leftward	No impact	Increases labor cost
Input prices (e.g., energy)	Leftward	No impact	Increases cost of production
Expectation of future prices	Rightward	No impact	Anticipation of higher costs and/or perception of improved pricing power
Business taxes	Leftward	No impact	Increases cost of production
Subsidy	Rightward	No impact	Lowers cost of production
Exchange rate	Rightward	No impact	Lowers cost of production

As with our summary of factors that shift the AD curve, Exhibit 20 considers each of the factors affecting aggregate supply in isolation. In practice, various factors will be at work simultaneously, and there may be interaction among them. This is especially important with respect to interaction between factors listed as affecting only SRAS and those that also impact LRAS.

For example, consider an increase in the cost of natural resource inputs (e.g., energy). This shifts the SRAS curve to the left, but according to Exhibit 20, it has no effect on LRAS. This presumes that there has not been a permanent change in the relative prices of the factors of production. If there has been a permanent change, companies will be forced to conserve on the now more expensive input and will not be able to produce as efficiently. The LRAS curve would, therefore, shift to the left,

just as it would if the available supply of natural resources had declined relative to the supply of other inputs. Indeed, that is the most likely cause of a permanent change in relative input prices.

EXAMPLE 11

Shifts in Aggregate Supply

John Donovan is a portfolio manager for a global mutual fund. Currently, his fund has 10 percent of its assets invested in Chinese equities. He is considering increasing the fund's allocation to the Chinese equity market. His decision will be based on an analysis of the following economic developments and their impact on the Chinese economy and equity market. What is the impact on SRAS and LRAS from the following factors?

1. Global oil prices, currently near their longer-run trend at $75 a barrel, have increased from $35 a barrel over the last three years because of strong demand from emerging markets.
2. The number of students studying engineering has dramatically increased at Chinese universities over the last decade.
3. Wages for China's workers are rising, leading some multinational companies to consider shifting their investments to Vietnam or Cambodia.
4. Recent data show that business investment as a share of GDP is over 40 percent in China.
5. The People's Bank of China is likely to permit the yuan to appreciate by 10 percent over the next year.

Solution to 1:

Higher energy prices cause a decrease in short-run AS and shift the SRAS curve to the left. Because oil prices are back to their longer-run trend, the leftward shift in SRAS essentially reverses a previous shift that occurred when oil prices fell to $35, and it is likely that there will be no impact on the LRAS curve. Lower output and profit are likely to have a negative effect on Chinese equity prices.

Solution to 2:

More students studying engineering indicates an improvement in the quality of the labor force—an increase in human capital. As a result, AS increases and the AS curve shifts to the right. Both short-run and long-run curves are affected. Higher output and profits may be expected to have a positive effect on Chinese equity prices.

Solution to 3:

The increase in wages increases labor costs for businesses, causes short-run aggregate supply to decline, and shifts the SRAS curve to the left. Lower output and profit should have a negative effect on Chinese equity prices.

Solution to 4:

The high level of business investment indicates that the capital stock in China is growing at a fast rate. This means that workers have more capital to use, which increases their productivity. Thus, AS increases and the AS curve shifts to the right. Both short-run AS and long-run AS are affected. Higher output should have a positive effect on Chinese equity prices.

Solution to 5:

The probable appreciation of the yuan means that the cost of imported raw materials, such as iron ore, coal, and oil, will be lower for Chinese companies. As a result, short-run AS increases and the SRAS curve shifts to the right. The LRAS curve may also shift to the right if the appreciation of the yuan is permanent and global commodity prices do not fully adjust. Higher output and profit should have a positive effect on Chinese equity prices.[15]

The implications of the above factors for equity investment in China are ambiguous. If the long-run effects dominate, however, then the net impact should be positive. The positive factors—the high level of investment and the growing pool of engineering students—have a lasting impact on output and profit. The negative factors—higher wages and oil prices—should be temporary because wages will realign with the price level and the increase in oil prices appears to offset a previous temporary decline. The reduction in raw material prices due to the stronger currency is positive for output, profit, and equities in the short run and perhaps in the long run as well.

3.4 Equilibrium GDP and Prices

Now that we have discussed the components of the AD and AS model, we can combine them to determine the real level of GDP and the price level. Equilibrium occurs where the AD and AS curves intersect. At this point, the quantity of aggregate output demanded (or the level of aggregate expenditures) is equal to the quantity of aggregate output supplied. In Exhibit 21, equilibrium price and GDP occur at P_1 and Y_1. If the price level is above P_1, then the quantity of output supplied exceeds the amount demanded. This situation would result in unsold inventories and would require a reduction in production and in prices. If the price level is below P_1, then the quantity of aggregate output demanded exceeds the quantity of aggregate output supplied. This situation would result in a shortage of goods that would put upward pressure on prices.

It is important to understand that short-run macroeconomic equilibrium may occur at a level above or below full employment. We consider four possible types of macroeconomic equilibrium:

1. Long-run full employment
2. Short-run recessionary gap
3. Short-run inflationary gap
4. Short-run stagflation

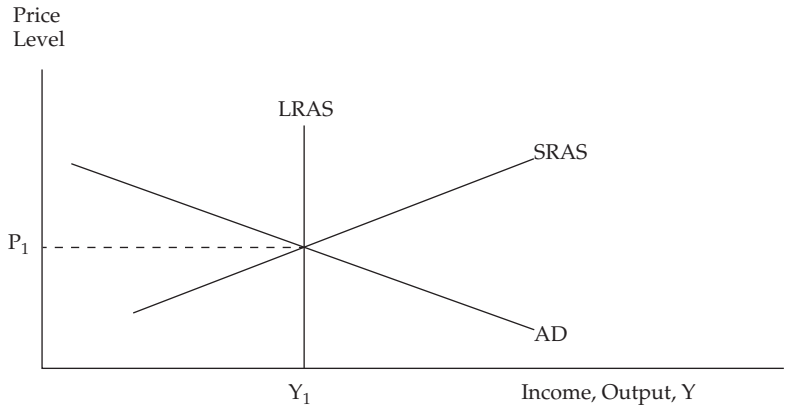
From an investment perspective, the performance of asset classes and financial markets will differ in each of the above cases as the economy makes the adjustment toward the macroeconomic equilibrium. We look at these differences later in the reading.

3.4.1 *Long-Run Equilibrium*

Exhibit 21 shows the long-run full employment equilibrium for an economy. In this case, equilibrium occurs where the AD curve intersects the SRAS curve at a point on the LRAS curve. Because equilibrium occurs at a point on the LRAS curve, the economy is at potential real GDP. Both labor and capital are fully employed, and everyone who wants a job has one. *In the long run, equilibrium GDP is equal to potential GDP.*

15 Note that the stronger yuan will also reduce export demand and shift the AD curve to the left. The combined impact of the AD and AS shifts on output, profit, and equity prices is ambiguous.

Exhibit 21 Long-Run Macroeconomic Equilibrium



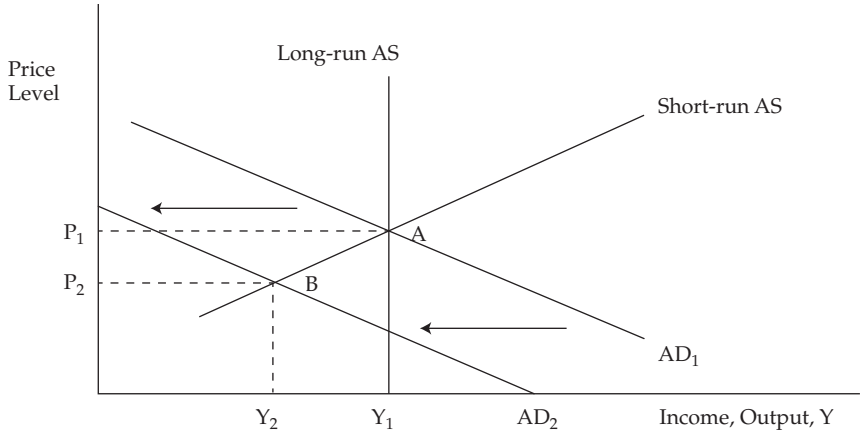
In practice, the level of potential GDP is difficult to measure with precision. Because of fluctuations arising from shifts in the AD and SRAS curves, the economy rarely operates at potential GDP. Thus, potential GDP is not observable from the data on actual GDP. In addition, potential GDP is determined by factors that are themselves difficult to measure (see Section 4.2). Thus, "bottom-up" estimates of the *level* of potential output are also quite imprecise. However, as will be discussed in Section 4, economists have confidence that the long-run *growth rate* of potential GDP can be estimated well enough to provide meaningful guidance for analysts and policymakers. Hence, in the short run, economists generally focus on factors that cause actual GDP to grow faster or slower than their estimate of the long-run growth rate of potential output. In addition, they focus on measures that indicate, albeit imprecisely, the extent to which the economy is operating above or below its productive capacity, such as unemployment and capacity utilization.

3.4.2 *Recessionary Gap*

Cyclical fluctuations in real GDP and prices are caused by shifts in both the AD and SRAS curves. A decline in AD or a leftward shift in the AD curve results in lower GDP and lower prices. Such declines in AD lead to economic contractions, and if such declines drive demand below the economy's potential GDP, the economy goes into a recession. In Exhibit 22, when aggregate demand falls, the equilibrium shifts from Point A to Point B. Real GDP contracts from Y_1 to Y_2, and the aggregate price level falls from P_1 to P_2. Because of the decline in demand, companies reduce their workforce and the unemployment rate rises. The economy is in recession,[16] and the recessionary gap is measured as the difference between Y_2 and Y_1 or the amount by which equilibrium output is below potential GDP. Thus, a recessionary gap occurs when the AD curve intersects the short-run AS curve at a short-run equilibrium level of GDP below potential GDP. *Most importantly, in contrast to full employment, equilibrium GDP is below potential GDP.*

16 A **recession** is defined as a period during which real GDP decreases (i.e., "negative growth") for at least two successive quarters or a period of significant decline in total output, income, employment, and sales usually lasting from six months to a year.

Exhibit 22 Recessionary Gap



Any of the factors discussed in Section 3.3.1 could cause the shift in the AD curve. Tightening of monetary policy, higher taxes, more pessimistic consumers and businesses, and lower equity and housing prices all reduce AD and are all possible causes of a recession.

The question is, How does the economy return to full employment? There is considerable debate among economists about the answer to this question. Some economists argue that an automatic, self-correcting mechanism will push the economy back to its potential, without the need for government action. The idea is that because of the decline in prices and higher unemployment, workers will be willing to accept lower nominal wages. Workers will do this because each currency unit of wages now buys more goods and services because of their lower price. As a result, lower wages and input prices will cause the SRAS curve to shift to the right (see Exhibit 20) and push the economy back to full employment and potential GDP.

The problem is that this price mechanism can take several years to work. As an alternative, government can use the tools of fiscal and monetary policy to shift the AD curve to the right (from Point B to Point A in Exhibit 22) and move the economy back to full employment. On the fiscal side, policymakers can reduce taxes or increase government spending. On the monetary side, the central bank can lower interest rates or increase the money supply. The problem, however, is that variable lags in the effectiveness of these policy measures imply that policy adjustments may end up reinforcing rather than counteracting underlying shifts in the economy.

Investment Implications of a Decrease in AD Aggregate demand and aggregate supply are theoretical measures that are very hard to measure directly. Most governments, however, publish statistics that provide an indication of the direction that aggregate demand and supply are moving over time. For example, statistics on consumer sentiment, factory orders for durable and nondurable goods, the value of unfilled orders, the number of new housing starts, the number of hours worked, and changes in inventories provide an indication of the direction of aggregate demand. If these statistics suggest that a recession is caused by a decline in AD, the following conditions are likely to occur:

- Corporate profits will decline.
- Commodity prices will decline.
- Interest rates will decline.
- Demand for credit will decline.

This suggests the following investment strategy:

- Reduce investments in **cyclical companies**[17] because their earnings are likely to decline the most in an economic slowdown.
- Reduce investments in commodities and/or commodity-oriented companies because the decline in commodity prices will slow revenue growth and reduce profit margins.
- Increase investments in **defensive companies**[18] because they are likely to experience only modest earnings declines in an economic slowdown.
- Increase investments in investment-grade or government-issued fixed-income securities. The prices of these securities should increase as interest rates decline.
- Increase investments in long-maturity fixed-income securities because their prices will be more responsive to the decline in interest rates than the prices of shorter-maturity securities.
- Reduce investments in speculative equity securities and in fixed-income securities with low credit quality ratings.

As with most investment strategies, this strategy will be most successful if it is implemented before other market participants recognize the opportunities and asset prices adjust.

EXAMPLE 12

Using AD and AS: A Historical Example: 2007–2009

Many Asian economies were more adversely affected than the United States by the global recession that began in late 2007. In the first quarter of 2009, real GDP fell at an annualized rate of 16 percent in Japan and 11 percent in Singapore, compared with a 6 percent annualized decline in the United States. Using the data on exports as a share of GDP shown in Exhibit 23, explain how the following economic factors contributed to the recession in the Asian economies:

1. Collapse of house prices and home construction in the United States.
2. Oil prices rising from around $30 a barrel in 2004 to nearly $150 a barrel in 2008. (*Note*: Most Asian economies rely on imports for almost all of their oil and energy needs. In contrast, the United States has a large domestic energy industry and imports about one-half of its oil.)
3. The dramatic reduction in credit availability following the collapse or near collapse of major financial institutions in 2008.

17 Cyclical companies are companies with sales and profits that regularly expand and contract with the business cycle or state of economy (for example, automobile and chemical companies).
18 Defensive companies are companies with sales and profits that have little sensitivity to the business cycle or state of the economy (for example, food and pharmaceutical companies).

Exhibit 23 Exports as a Share of GDP, 2007 and 2016

	2007		2016	
Economy	Exports as a Percentage of GDP	Percentage of Exports Going to United States	Exports as a Percentage of GDP	Percentage of Exports Going to United States
Hong Kong SAR	186	11.2	192	8.3
Singapore	166	11.5	175	6.5
Thailand	62	11.6	69	11.2
Germany	53	10.9	47	9
South Korea	47	7.1	44	12
Mexico	37	26.4	37	81.2
Canada	28	80.2	31	76.2
Chinese mainland	27	19	21	19
India	17	20.1	20	16
Japan	14	17	17	20.2
Kenya	12	—	16	6.7
United States	12	—	12	—
Ethiopia	11	6.7	9	9.9

Sources: World Bank: World Development Indicators NE.EXP.GNFS.ZS and atlas.media.mit.edu/en/profile/country.

Solution to 1:

The collapse in housing prices caused housing construction spending, a component of business investment, to decline in the United States. The decline in housing prices also caused a sharp fall in household wealth. As a result, consumption spending in the United States declined because of the wealth effect. The decline in both consumption and housing construction shifted the AD curve for the United States to the left, resulting in a US recession. The link to the Asian economies was through global trade because exports represented such a large share of the Asian economies' GDP (Exhibit 23). In turn, these economies exported a significant amount of goods and services to the United States. Thus, the recession in the United States and especially the decline in US consumption spending caused a sharp fall in exports among Asian economies. This lowered their AD and caused the AD curve to shift to the left, resulting in a recessionary gap in these economies.

Solution to 2:

The rise in oil prices increased input cost and shifted the short-run AS curve to the left. Because the eastern Asian economies are heavily dependent on imported oil, their economies were more adversely affected than the economy of the United States.

Solution to 3:

The decline in housing prices caused financial institutions in the United States to suffer large losses on housing-related loans and securities. Several large lenders collapsed, and the US Treasury and the Federal Reserve had to intervene to prevent a wave of bankruptcies among large financial institutions. As a result of the crisis, it became difficult for households and businesses to obtain credit to finance their spending. This caused AD to fall and increased the severity of the

recession in the United States, resulting in a significant decline in US imports and thus exports from the Asian economies. In addition, the financial crisis made it more difficult to get trade finance, further reducing exports from Asia.

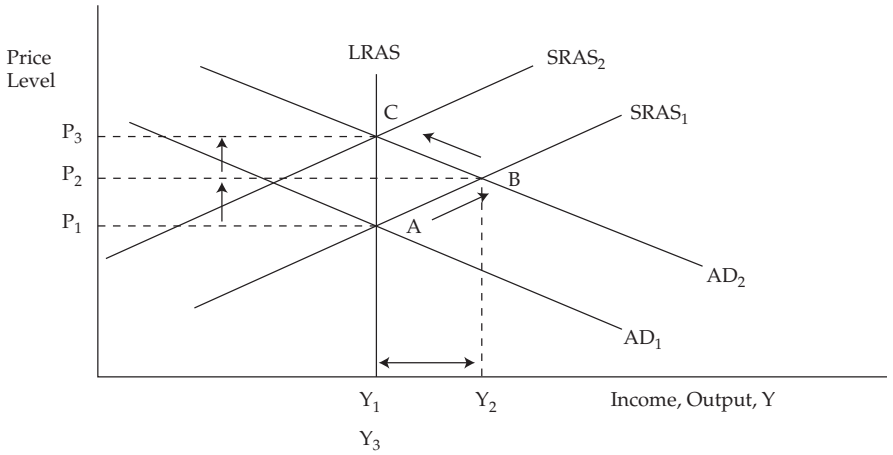
In summary, global investors need to be aware of the growing linkages among economies and the extent that one economy's growth depends on demand from within as well as from outside of that economy. Data on exports as a percentage of an economy's GDP provide an indication of this dependence. Although Japan is often viewed as an export-driven economy, Exhibit 23 shows that in 2016 exports were only 17 percent of its GDP. Similarly, the economy of India depends largely on domestic spending for growth because in 2016 exports accounted for only 20 percent of GDP.

3.4.3 *Inflationary Gap*

Increases in AD lead to economic expansions as real GDP and employment increase. If the expansion drives the economy beyond its production capacity, however, **inflation**[19] will occur. As summarized in Exhibit 18, higher government spending, lower taxes, a more optimistic outlook among consumers and businesses, a weaker domestic currency, rising equity and housing prices, and an increase in the money supply would each stimulate aggregate demand and shift the AD curve to the right. If aggregate supply does not increase to match the increase in AD, a rise in the overall level of prices will result.

In Exhibit 24, an increase in AD will shift the equilibrium level of GDP from Point A to Point B. Real output increases from Y_1 to Y_2, and the aggregate price level rises from P_1 to P_2. As a result of the increase in aggregate demand, companies increase their production and hire more workers. The unemployment rate declines. Once an economy reaches its potential GDP, however, companies must pay higher wages and other input prices to further increase production. The economy now faces an inflationary gap, measured by the difference between Y_2 and Y_1 in Exhibit 24. *An inflationary gap occurs when the economy's short-run level of equilibrium GDP is above potential GDP, resulting in upward pressure on prices.*

Exhibit 24 Inflationary Gap



19 The inflation rate is defined as the increase in the general price level from one period to the next.

GDP cannot remain at Y_2 for long because the economy is over-utilizing its resources—i.e., extra shifts of workers are hired and plant and equipment are operating at their maximum capacity. Eventually, workers become tired and plant and equipment wear out. The increase in the general price level and input prices will set in motion the process of returning the economy back to potential GDP. Higher wages and input prices shift the SRAS curve to the left (from $SRAS_1$ to $SRAS_2$), moving the economy to Point C in Exhibit 24. Again, this self-correcting mechanism may work slowly.

A nation's government and/or its central bank can attempt to use the tools of fiscal and monetary policy to control inflation by shifting the AD curve to the left (AD_2 to AD_1 in Exhibit 24) so that the return to full employment occurs without the price increase. From a fiscal perspective, policymakers can raise taxes or cut government spending. From a monetary perspective, the central bank can reduce bank reserves, resulting in a decrease in the growth of the money supply and higher interest rates.

Investment Implications of an Increase in AD Resulting in an Inflationary Gap If economic statistics (consumer sentiment, factory orders for durable and nondurable goods, etc.) suggest that there is an expansion caused by an increase in AD, the following conditions are likely to occur:

- Corporate profits will rise.
- Commodity prices will increase.
- Interest rates will rise.
- Inflationary pressures will build.

This suggests the following investment strategy:

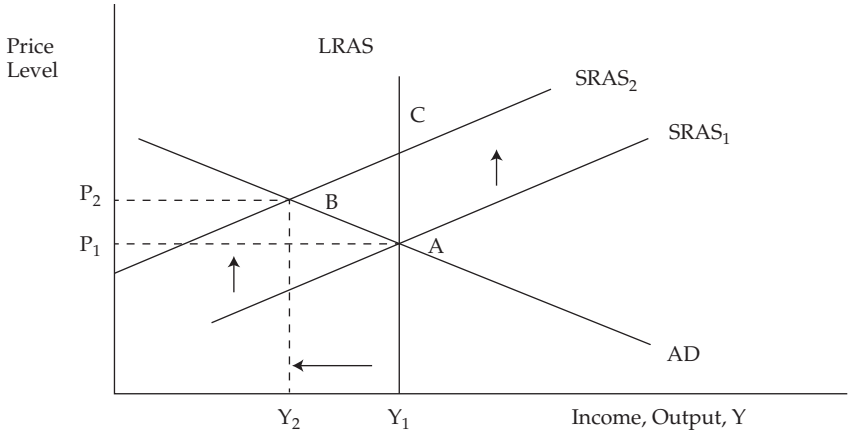
- Increase investment in cyclical companies because they are expected to have the largest increase in earnings.
- Reduce investments in defensive companies because they are expected to have only a modest increase in earnings.
- Increase investments in commodities and commodity-oriented equities because they will benefit from higher production and output.
- Reduce investments in fixed-income securities, especially longer-maturity securities, because they will decline in price as interest rates rise. Raise exposure to speculative fixed-income securities (junk bonds) because default risks decrease in an economic expansion.

3.4.4 *Stagflation: Both High Inflation and High Unemployment*

Structural fluctuations in real GDP are caused by fluctuations in SRAS. Declines in aggregate supply bring about **stagflation**—high unemployment and increased inflation. Increases in aggregate supply conversely give rise to high economic growth and low inflation.

Exhibit 25 shows the case of a decline in aggregate supply, perhaps caused by an unexpected increase in basic material and oil prices. The equilibrium level of GDP shifts from Point A to B. The economy experiences a recession as GDP falls from Y_1 to Y_2, but the price level, instead of falling, rises from P_1 to P_2. Over time, the reduction in output and employment should put downward pressure on wages and input prices and shift the SRAS curve back to the right, re-establishing full employment equilibrium at Point A. However, this mechanism may be painfully slow. Policymakers may use fiscal and monetary policy to shift the AD curve to the right, as previously discussed, but at the cost of a permanently higher price level at Point C.

Exhibit 25 Stagflation



The global economy experienced stagflation in the mid-1970s and early 1980s. Both unemployment and inflation soared. The problem was caused by a sharp decline in aggregate supply fueled by higher input prices, especially the price of oil. In 1973, the price of oil quadrupled. A steep global recession began in late 1973 and lasted through early 1975. The recession was unusual because prices rose rather than declined as would be expected in a typical demand-caused downturn. In 1979–1980, the price of oil doubled. Higher energy prices shifted the SRAS curve to the left, as shown in Exhibit 25, leading to a global recession in 1980–1982. In the United States, the contraction in output was reinforced by the Federal Reserve's decision to tighten monetary policy to fight the supply-induced inflation.

Investment Implications of Shift in AS Labor and raw material costs, including energy prices, determine the direction of shifts in short-run aggregate supply: Higher costs for labor, raw materials, and energy lead to a decrease in aggregate supply, resulting in lower economic growth and higher prices. Conversely, lower labor costs, raw material prices, and energy prices lead to an increase in aggregate supply, resulting in higher economic growth and a lower aggregate price level. Productivity is also an important factor. Higher rates of productivity growth shift the AS to the right, resulting in higher output and lower unit input prices. Lower rates of productivity growth do the opposite and shift the AS curve to the left.

From an investment perspective, a decline in AS (leftward shift of the SRAS curve) suggests

- reducing investment in fixed income because rising output prices (i.e., inflation) put upward pressure on nominal interest rates;
- reducing investment in most equity securities because profit margins are squeezed and output declines; and
- increasing investment in commodities or commodity-based companies because prices and profits are likely to rise.

On the other hand, an increase in AS (rightward shift of the SRAS curve) due to higher productivity growth or lower labor, raw material, and energy costs is favorable for most asset classes other than commodities.

3.4.5 *Conclusions on AD and AS*

The business cycle and the resulting fluctuations in real GDP are caused by shifts in the AD and AS curves. The impact of these shifts can be summarized as follows:

- An increase in AD raises real GDP, lowers the unemployment rate, and increases the aggregate level of prices.
- A decrease in AD lowers real GDP, increases the unemployment rate, and decreases the aggregate level of prices.
- An increase in AS raises real GDP, lowers the unemployment rate, and lowers the aggregate level of prices.
- A decrease in AS lowers real GDP, raises the unemployment rate, and raises the aggregate level of prices.

If both curves shift, the effect is a combination of the above individual effects. We can look at four possible cases:

1. *Both AD and AS increase.* If both AD and AS increase, real GDP will increase but the impact on inflation is not clear unless we know the magnitude of the changes because an increase in AD will increase the price level, whereas an increase in AS will decrease the price level. If AD increases more than AS, the price level will increase. If AS increases more than AD, however, the price level will decline.
2. *Both AD and AS decrease.* If both AD and AS decrease, real GDP and employment will decline, but the impact on the price level is not clear unless we know the magnitude of the changes because a decrease in AD decreases the price level, whereas a decrease in AS increases the price level. If AD decreases more than AS, the price level will fall. If AS decreases more than AD, the price level will rise.
3. *AD increases and AS decreases.* If AD increases and AS declines, the price level will rise, but the effect on real GDP is not clear unless we know the magnitude of the changes because an increase in AD increases real GDP, whereas a decrease in AS decreases real GDP. If AD increases more than AS declines, GDP will rise. If AS decreases more than AD increases, real GDP will fall.
4. *AD decreases and AS increases.* If AD decreases and AS increases, the price level will decline but the impact on real GDP is not clear unless we know the magnitudes of the changes because a decrease in AD decreases real GDP, whereas an increase in AS increases real GDP. If AD decreases more than AS increases, real GDP will fall. If AS increases more than AD declines, real GDP will rise.

Exhibit 26 summarizes these four cases.

Exhibit 26 Effect of Combined Changes in AS and AD

Change in AS	Change in AD	Effect on Real GDP	Effect on Aggregate Price Level
Increase	Increase	Increase	Indeterminate
Decrease	Decrease	Decrease	Indeterminate
Increase	Decrease	Indeterminate	Decrease
Decrease	Increase	Indeterminate	Increase

Whether the growth of the economy is demand- or supply-driven has an impact on asset prices. Demand-driven expansions are normally associated with rising interest rates and inflation, whereas contractions are associated with lower inflation and interest rates. Supply-driven expansions are associated with lower inflation and interest rates, whereas supply-driven contractions are associated with rising inflation and interest rates.

EXAMPLE 13

Investment Strategy Based on AD and AS Curves

An analyst is evaluating the possibility of investing in China, Italy, Mexico, or Brazil. What are the equity and fixed-income investment opportunities in these countries based on the following events?

1. The Chinese government announced a spending plan of $1.2 trillion or 13 percent of GDP. In addition, the central bank of China eased monetary policy, resulting in a surge of lending.
2. The Italian government announced a decline in labor productivity, and it expects this trend to continue into the future.
3. In response to rising inflationary pressure, the Mexican central bank tightened monetary policy, and the government announced tax increases and spending cuts to balance the budget.
4. A major discovery of oil off the coast of Brazil lowered oil prices, while the Brazilian government announced a major increase in spending on public infrastructure to stimulate the economy.

Solution to 1:

Stimulative fiscal and monetary policies should result in a demand-driven expansion. Investors should reduce investments in fixed-income securities and defensive companies and invest in cyclical companies and commodities. As a result, the prospects for growth-oriented equity investments look favorable in China.

Solution to 2:

A decline in labor productivity will result in a decline in AS; i.e., the AS curve will shift to the left. This is typically a poor investment environment. Investors should reduce investments in both fixed-income and equity securities and invest in commodities. Entry into Italian stocks and bonds does not look attractive.

Solution to 3:

The policy measures put in place by the Mexican government and central bank will cause a drop in AD and likely result in a recession. Investors should increase their investments in fixed-income securities because interest rates will most likely decline as the recession deepens. This is a poor environment for equity securities.

Solution to 4:

This is a situation where both the AD and AS curves will shift. The increase in spending on public infrastructure will shift the AD curve to the right, resulting in higher aggregate expenditures and prices. Lower oil prices will shift the AS curve to the right, resulting in higher GDP but lower prices. Thus, GDP will clearly increase, but the impact on prices and inflation is indeterminate. As a result, investors should increase their investment in equity securities; however, the impact on fixed-income securities is unclear.

EXAMPLE 14

Historical Example: Using AD and AS to Explain Japan's Economic Problem

Japan has experienced sluggish growth in real GDP for nearly two decades following the bursting of an asset and investment bubble in the late 1980s. At the same time, Japan has experienced deflation (declining prices) over this period. The reasons for this protracted period of stagnation continue to be debated among economists. Failure to recognize a change in the Japanese growth rate has hurt many investors, especially those taking a long-term perspective. From their peak in 1989, Japanese equity prices, as measured by the Nikkei index, fell by over 60 percent before bottoming out in mid-1992. Since that time, the market has been essentially flat despite considerable volatility.

The performance of the Japanese economy can be explained using the AD and AS model. The protracted slowdown of growth in Japan beginning in the early 1990s can be linked to the effect of the collapse of the equity and commercial real estate markets in the late 1980s and to excessive investment in capital goods (new factories and equipment) in the 1980s. These problems were compounded by persistent weakness in the banking sector, a profound lack of confidence among businesses and consumers, and negative demographics with slow growth in the working age population.

The sum of these developments caused a decline in both the AD and AS curves. Aggregate demand declined, causing the AD curve to shift to the left for the following reasons:

- The wealth effect due to the decline in equity and real estate prices sharply reduced consumption spending. Asset prices have yet to recover from the fall.
- Excessive investment in capital goods caused a sharp decline in business investment.
- Lack of confidence among businesses and consumers.
- Problems in the banking sector made monetary policy ineffective because banks were unable to lend, which negatively affected both consumer and business spending.

AS declined for the following reasons:

- Marked slowing in private investment spending reduced the capital stock. This also reduced potential GDP.
- Slow population growth limited the growth in the labor supply. This also reduced potential GDP.
- Higher energy prices slowed growth because of Japan's heavy dependence on imported energy.

As would be expected, the declines in both AD and AS resulted in slow GDP growth. The fact that prices fell indicates that the AD curve shifted more than the AS curve.

4 ECONOMIC GROWTH AND SUSTAINABILITY

We now shift focus from the short-run cyclical movement of the economy to its long-term growth rate. Economic growth is calculated as the annual percentage change in real GDP or the annual change in real per capita GDP:

- Growth in real GDP measures how rapidly the total economy is expanding.
- Per capita GDP, defined as real GDP divided by population, determines the standard of living in each country and the ability of the average person to buy goods and services.

Economic growth is important because rapid growth in per capita real GDP can transform a poor nation into a wealthy one. Even small differences in the growth rate of per capita GDP, if sustained over time, have a large impact on an economy's standard of living. One should think of the growth rate of GDP as the equivalent of a rate of return on a portfolio. Small differences in return compounded over many years make a big difference. Nevertheless, there is a limit to how fast an economy can grow. Faster growth is not always better for an economy because there are costs associated with excess growth, such as higher inflation, potential environmental damage, and the lower consumption and higher savings needed to finance the growth.

This raises the issue of sustainable growth, which requires an understanding of the concept of potential GDP. Recall that potential GDP measures the productive capacity of the economy and is the level of real GDP that an economy could produce if capital and labor are fully employed. In order to grow over time, an economy must add to its productive capacity. Thus, the **sustainable rate of economic growth** is measured by the rate of increase in the economy's productive capacity or potential GDP. It is important to note that economists cannot directly measure potential output. Instead, they estimate it using a variety of techniques discussed later in this reading.

For global investors, estimating the sustainable rate of economic growth for an economy is important for both asset allocation and security selection decisions. Investors need to understand how the rate of economic growth differs among countries and whether these growth rates are sustainable. When examining the GDP data, global investors need to address a number of questions, including the following:

1. What are the underlying determinants or sources of growth for the country?
2. Are these sources of growth likely to remain stable or change over time?
3. How can we measure and forecast sustainable growth for different countries?

4.1 The Production Function and Potential GDP

The neoclassical or Solow growth model is the framework used to determine the underlying sources of growth for an economy. The model shows that the economy's productive capacity and potential GDP increase for two reasons:

1. accumulation of such inputs as capital, labor, and raw materials used in production, and
2. discovery and application of new technologies that make the inputs in the production process more productive—that is, able to produce more goods and services for the same amount of input.

The model is based on a **production function** that provides the quantitative link between the levels of output that the economy can produce and the inputs used in the production process, given the state of technology. A two-factor production function with labor and capital as the inputs is expressed mathematically as

$$Y = A\boldsymbol{F}(L,K)$$

where Y denotes the level of aggregate output in the economy, L is the quantity of labor or number of workers in the economy, K is the capital stock or the equipment and structures used to produce goods and services, and A represents technological knowledge or **total factor productivity** (TFP). TFP is a scale factor that reflects the portion of growth that is not accounted for by the capital and labor inputs. The main factor influencing TFP is technological change. Like potential GDP, TFP is not directly observed in the economy and must be estimated.

The production function shows that output in the economy depends on inputs and the level of technology. The economy's capacity to produce goods grows when these inputs increase and/or technology advances. The more technologically advanced an economy is, the more output it is able to produce from a given amount of inputs.

Two assumptions about the production function provide a link to microeconomics. First, we assume that the production function has constant returns to scale. This means that if all the inputs in the production process are increased by the same percentage, then output will rise by that percentage. Thus, doubling all inputs would double output. Second, we assume that the production function exhibits **diminishing marginal productivity** with respect to any individual input. This property plays an important role in assessing the contribution of labor and capital to economic growth. Marginal productivity looks at the extra output that is produced from a one-unit increase in an input if the other inputs are unchanged. It applies to any input as long as the other inputs are held constant. For example, if we have a factory of a fixed size and we add more workers to the factory, the marginal productivity of labor measures how much additional output each additional worker will produce.

Diminishing marginal productivity means that at some point the extra output obtained from each additional unit of the input will decline. In the above example, if we hire more workers at the existing factory (fixed capital input in this case), output will rise by a smaller and smaller amount with each additional worker. Traditionally, economists focused on the labor input and how the productivity of labor would decline given a fixed amount of land. The traditional growth theory, where labor is the only (variable) input, was developed by Thomas Malthus in his 1798 publication, *Essay on the Principle of Population*. Malthus argued that as the population and labor force grew, the additional output produced by an additional worker would decline essentially to zero and there would be no long-term economic growth. This gloomy forecast caused others to label economics the "dismal science."

The dire prediction implied by declining marginal productivity of labor never materialized, and economists changed the focus of the analysis away from labor to capital. In this case, if we add more and more capital to a fixed number of workers, the amount of additional output contributed by each additional amount of capital

will fall. Thus, if capital grows faster than labor, capital will become less productive, resulting in slower and slower growth. Diminishing marginal productivity of capital has two major implications for potential GDP:

1 Long-term sustainable growth cannot rely solely on **capital deepening investment** that increases the stock of capital relative to labor. More generally, increasing the supply of some input(s) relative to other inputs will lead to diminishing returns and cannot be the basis for sustainable growth.
2 Given the relative scarcity and hence high productivity of capital in developing countries, the growth rates of developing countries should exceed those of developed countries. As a result, there should be a **convergence** of incomes between developed and developing countries over time.

Because of diminishing returns to capital, the only way to sustain growth in potential GDP per capita is through technological change or growth in total factor productivity. This results in an upward shift in the production function: The economy produces more goods and services using the same level of labor and capital inputs. In terms of the formal production function shown above, this is reflected by an increase in the technology parameter, A.

Using the production function, Robert Solow developed a model that explained the contribution of labor, capital, and technology (total factor productivity) to economic growth. The growth accounting equation shows that the rate of growth of potential output equals growth in technology plus the weighted average growth rate of labor and capital.

$$\text{Growth in potential GDP} = \text{Growth in technology} + W_L\,(\text{Growth in labor}) + W_C\,(\text{Growth in capital})$$

where W_L and W_C are the relative shares of capital and labor in national income. The capital share is the sum of corporate profits, net interest income, net rental income, and depreciation divided by GDP. The labor share is employee compensation divided by GDP. For the United States, W_L and W_C are roughly 0.7 and 0.3, respectively.

The growth accounting equation highlights a key point: The contribution of labor and capital to long-term growth depends on their respective shares of national income. For the United States, because labor's share is higher, an increase in the growth rate of labor will have a significantly larger impact (roughly double) on potential GDP growth than will an equivalent increase in the growth rate of capital.

The growth accounting equation can be further modified to explain growth in per capita GDP. Because it measures the standard of living and purchasing power of the average person in an economy, per capita GDP is more relevant than the absolute level of GDP in comparing economic performance among countries. Transforming the growth accounting equation into per capita terms results in the following equation:

$$\text{Growth in per capita potential GDP} = \text{Growth in technology} + W_C\,(\text{Growth in capital-to-labor ratio})$$

The capital-to-labor ratio measures the amount of capital available per worker and is weighted by the share of capital in national income. Because capital's share in national income in the US economy is 0.3, a 1 percent increase in the amount of capital available for each worker increases per capita output by only 0.3 percent. The equation shows that improvements in technology are more important than capital in raising an economy's standard of living.

4.2 Sources of Economic Growth

The growth accounting equation focuses on the main determinants of growth—capital, labor and technology—and omits a number of other sources of growth to simplify the analysis. For many countries, however, natural resource and human capital inputs play an important role in explaining economic growth. Therefore, there are five important sources of growth for an economy:

- Labor supply;
- Human capital;
- Physical capital;
- Technology; and
- Natural resources.

These sources of growth determine the capacity of the economy to supply goods and services.

Labor Supply Growth in the number of people available for work (quantity of workforce) is an important source of economic growth and partially accounts for the superior growth performance, among the advanced economies, of the US economy versus the European and Japanese economies. Most developing countries, such as China, India, and Mexico, have a large potential labor supply. We can measure the potential size of the labor input as the total number of hours available for work, which is given by

Total hours worked = Labor force × Average hours worked per worker

The **labor force** is defined as the portion of the working age population (over the age of 16) that is employed or available for work but not working (unemployed). The contribution of labor to overall output is also affected by changes in the average hours worked per worker. Average hours worked is highly sensitive to the business cycle. However, the long-term trend has been toward a shorter workweek in the advanced countries. This development is the result of legislation, collective bargaining agreements, and the growth of part-time and temporary work.

Human Capital In addition to the quantity of labor, the quality of the labor force is important. Human capital is the accumulated knowledge and skill that workers acquire from education, training, and life experience. It measures the quality of the workforce. In general, better-educated and skilled workers will be more productive and more adaptable to changes in technology.

An economy's human capital is increased through investment in education and on-the-job training. Like physical capital, investment in education is costly. Studies show that there is a significant return on education. That is, people with more education earn higher wages. Moreover, education may also have a spillover or externality impact: Increasing the educational level of one person not only raises the output of that person but also the output of those around him or her. The spillover effect operates through the link between education and advances in technology. Education not only improves the quality of the labor force but also encourages growth through innovation. Investment in health is also a major contributor to human capital, especially in developing countries.

Physical Capital Stock The physical **capital stock** (accumulated amount of buildings, machinery, and equipment used to produce goods and services) increases from year to year as long as net investment (gross investment less depreciation of capital) is positive. Thus, countries with a higher rate of investment should have a growing physical capital

stock and a higher rate of GDP growth. Exhibit 27 shows the level of business investment as a share of GDP. The exhibit shows significant variation across countries. Japan and South Korea have a higher investment-to-GDP ratio than other developed countries.

As is evident in Exhibit 27, the correlation between economic growth and investment is high. Economies that devote a large share of GDP to investment, such as China, India, and South Korea, have high growth rates. Ireland, the fastest-growing economy in Europe from 2009–2015, has among the highest investment-to-GDP ratios. Economies that devote a smaller share of GDP to investment, such as Brazil and Mexico, have slower growth rates. The data show why the Chinese economy has expanded at such a rapid rate, achieving an annual GDP growth rate of roughly 10 percent over the last two decades. Investment spending in China on new factories, equipment, and infrastructure as a percentage of GDP is the highest in the world.

Exhibit 27 Business Investment as a Percentage of GDP

	Non-residential gross fixed capital formation as a share of GDP				Average Annual Real GDP Growth	
Developed Economies	**1995**	**2001**	**2007**	**2015**	**2009–2015**	**1991–2009**
United States	16.6	17.6	17.4	16.2	2.2	2.2
Japan	24.3	22.5	20.6	20.3	1.5	1.1
Germany	15.8	15.6	15.0	14.0	2.0	1.4
France	14.6	16.2	16.4	15.7	1.1	1.5
Italy	14.0	15.8	15.8	12.3	–0.2	1.0
United Kingdom	15.7	14.8	14.4	13.3	2.0	2.2
Canada	14.0	15.4	16.3	16.3	2.3	2.1
Ireland	12.9	15.6	17.6	19.3	5.7	5.1
Spain	16.0	17.1	19.3	15.3	–0.2	2.6
Australia	19.1	18.8	23.1	19.6	2.7	3.2
South Korea	30.9	26.3	25.6	24.5	3.5	4.9
New Zealand	17.0	17.0	17.5	15.9	2.4	2.7
Developing Economies	**1995**	**2001**	**2007**	**2015**	**2009–2015**	**2001–2009**
Brazil	19.2	18.7	19.8	17.6	2.1	3.9
China	39.7	36.4	41.5	45.4	8.3	11.3
India	28.2	27.0	42.5	32.9	7.4	8.0
Indonesia	30.0	21.2	23.4	34.2	5.7	5.3
Mexico	16.9	20.9	23.4	22.9	3.2	2.9
Turkey	25.5	18.1	28.7	28.4	7.3	7.1

Sources: GDP: OECD National Accounts Statistics (database), April 2017. Gross fixed capital: World Development Indicator, NE.GDI.TOTL.ZS

Technology The most important factor affecting economic growth is technology, especially in developed countries such as the United States. **Technology** refers to the process a company uses to transform inputs into outputs. Technological advances are discoveries that make it possible to produce more or higher-quality goods and services

with the same resources or inputs. At the same time, technological progress results in the creation of new goods and services. Finally, technological progress improves how efficiently businesses are organized and managed.

Technological advances are very important because they allow an economy to overcome the limits imposed by diminishing marginal returns. Thus, an economy will face limits to growth if it relies exclusively on expanding the inputs or factors of production.

Because most technological change is embodied in new machinery, equipment, and software, physical capital must be replaced, and perhaps expanded, in order to take advantage of changes in technology. One of the key drivers of growth in developed countries over the last decade has been the information technology (IT) sector. Growth in the IT sector has been driven by technological innovation that has caused the price of key technologies, such as semiconductors, to fall dramatically. The steep declines in prices have encouraged investment in IT at the expense of other assets. The sector has grown very fast and has made a significant contribution to economic growth, employment, and exports.

Countries can innovate through expenditures, both public and private, on research and development (R&D). Thus, expenditures on R&D and the number of patents issued, although not directly measuring innovation, provide some useful insight into innovative performance. Countries can also acquire new technology through imitation or copying the technology developed elsewhere. The embodiment of technology in capital goods can also enable relatively poor countries to jump ahead of the technology leaders.

Total factor productivity (TFP) is the component of productivity that proxies technological progress and organizational innovation. TFP is the amount by which output would rise because of improvements in the production process. It is calculated as a residual, the difference between the growth rate of potential output and the weighted average growth rate of capital and labor. Specifically,

$$\text{TFP growth} = \text{Growth in potential GDP} - [W_L\,(\text{Growth in labor}) + W_C\,(\text{Growth in capital})]$$

Natural Resources Raw materials are an essential input to growth and include everything from available land to oil to water. Historically, consumption of raw materials has increased as economies have grown. There are two categories of natural resources:

1. **Renewable resources** are those that can be replenished, such as a forest. For example, if a tree is cut, a seedling can be planted and a new forest harvested in the future.
2. **Non-renewable resources** are finite resources that are depleted once they are consumed. Oil and coal are examples.

Natural resources account for some of the differences in growth among countries. Today, such countries as Brazil and Australia, as well as those in the Middle East, have relatively high per capita incomes because of their resource base. Countries in the Middle East have large pools of oil. Brazil has an abundance of land suitable for large-scale agricultural production, making it a major exporter of coffee, soybeans, and beef.

Even though natural resources are important, they are not necessary for a country to achieve a high level of income provided it can acquire the requisite inputs through trade. Countries in eastern Asia, such as Japan and South Korea, have experienced rapid economic growth but own few natural resources.

4.3 Measures of Sustainable Growth

Measuring how fast an economy can grow is an important exercise. Economists project potential GDP into the future to forecast the sustainable growth path for the economy. An economy's potential GDP is an unobserved concept that is approximated using a number of alternative methods. It is important to note that estimates of the economy's potential growth can change as new data become available. Being able to understand such a change is critical for financial analysts because equity returns are highly dependent on the sustainable rate of economic growth.

We discussed in the previous section that the growth rate of potential GDP depends on the rate of technological progress as well as the growth rate of

- the labor force;
- physical and human capital; and
- natural resources.

How can we summarize all of these forces driving economic growth and develop a method to measure/estimate the growth rate of potential GDP? One way is to use the growth accounting equation discussed in Section 4.1.

$$\text{Growth in potential GDP} = \text{Growth in technology} + W_L\,(\text{Growth in labor}) + W_C\,(\text{Growth in capital})$$

The problem with this approach is that there are no observed data on potential GDP or on total factor productivity and both must be estimated. In addition, data on the capital stock and the labor and capital shares of national income are not available for many countries, especially the developing countries.

As an alternative, we can focus on the productivity of the labor force, where we generally have more reliable data. **Labor productivity** is defined as the quantity of goods and services (real GDP) that a worker can produce in one hour of work. Our standard of living improves if we produce more goods and services for each hour of work. Labor productivity is calculated as real GDP for a given year divided by the total number of hours worked in that year, counting all workers. We use total hours, rather than the number of workers, to adjust for the fact that not everyone works the same number of hours.

$$\text{Labor productivity} = \text{Real GDP}/\text{Aggregate hours}$$

Therefore, we need to understand the forces that make labor more productive. Productivity is determined by the factors that we examined in the preceding section: education and skill of workers (human capital), investments in physical capital, and improvements in technology. An increase in any of these factors will increase the productivity of the labor force. The factors determining labor productivity can be derived from the production functions under the assumption of constant returns to scale, where a doubling of inputs causes output to double as well. Dividing the production function by L, we get the following:

$$Y/L = A\boldsymbol{F}(1, K/L)$$

where Y/L is output per worker, which is a measure of labor productivity. The equation states that labor productivity depends on physical capital per worker (K/L) and technology (A). Recall that "A" can also be interpreted as total factor productivity. As this equation indicates, labor productivity and total factor productivity are related but distinct concepts. TFP is a scale factor that does not depend on the mix of inputs. Changes in TFP are measured as a residual, capturing growth that cannot be attributed to specific inputs. On the other hand, as shown in this equation, labor productivity—output per worker—depends on both the general level of productivity (reflected

in TFP) and the mix of inputs. Increases in either TFP or the capital-to-labor ratio boost labor productivity. Because both output and labor input can be observed, labor productivity can be measured directly.

Labor productivity is a key concept for measuring the health and prosperity of an economy and its sustainable rate of growth. An analyst examining the growth prospects for an economy needs to focus on the labor productivity data for that country. Labor productivity largely explains the differences in the living standards and the long-term sustainable growth rates among countries. The distinction between the level and growth rate of productivity is important to understand. Exhibit 28 provides such a comparison for selected countries.

Exhibit 28 Labor Productivity: Level vs. Growth Rate in Select Countries

	Level of Labor Productivity	Average Annual Growth Rate in Labor Productivity		
Country	2015 GDP per hour worked	1995–2015	2001–2007	2009–2015
United States	68.3	1.7	2.0	0.7
Ireland	91.8	4.2	2.2	6.2
France	67.6	1.3	1.5	1.0
Germany	66.6	1.2	1.3	1.2
Sweden	60.5	1.8	2.8	1.4
United Kingdom	52.4	1.3	2.0	0.6
Canada	50.8	1.2	1.0	1.0
Spain	51.3	0.7	0.5	1.3
Italy	53.6	0.3	0.0	0.5
Japan	45.5	1.4	1.4	1.3
Greece	34.9	1.1	2.2	–0.9
Korea	31.9	4.2	4.9	2.8
Turkey	38.6	2.9	6.3	3.3
Mexico	20.1	0.8	1.0	0.1

Source: OECD Productivity Statistics (database), April 2017.

Level of Labor Productivity The higher the level of labor productivity, the more goods and services the economy can produce with the same number of workers. The level of labor productivity depends on the accumulated stock of human and physical capital and is much higher in the developed countries. For example, India has a population of more than 1.3 billion people, compared with more than 82 million people in Germany (UNDESA July 2017). Because of its much larger population, India has significantly more workers than Germany; however, the German economy, as measured by real GDP, is much larger. As shown in Exhibit 28, Germany has among the highest level of productivity in the world, producing nearly $67 of GDP per hour worked. Similarly, workers in France, the United States, and Ireland have high levels of productivity. In comparison, Mexican workers produce only $20.1 worth of GDP per hour worked. Thus, German workers are more than three times more productive than Mexican workers.

Growth Rate of Labor Productivity The growth rate of labor productivity is the percentage increase in productivity over a year. It is among the economic statistics that economists and financial analysts watch most closely. In contrast to the level of productivity, the growth rate of productivity is typically higher in the developing countries where human and physical capital is scarce but growing rapidly.

If productivity growth is rapid, it means the same number of workers can produce more and more goods and services. In this case, companies can afford to pay higher wages and still make a profit. Thus, high rates of productivity growth will translate into rising profits and higher stock prices.

In contrast, persistently low productivity growth suggests the economy is in bad shape. Without productivity gains, businesses have to either cut wages or boost prices in order to increase profit margins. Low rates of productivity growth should be associated with slow growth in profits and flat or declining stock prices.

EXAMPLE 15

Prospects for Equity Returns in Mexico

John Todd, CFA, manages a global mutual fund with nearly 30 percent of its assets invested in Europe. Because of the low population growth rate, he is concerned about the long-term outlook for the European economies. With potentially slower economic growth in Europe, the environment for equities may be less attractive. Therefore, he is considering reallocating some of the assets from Europe to Mexico. Based on the data in Exhibits 27 and 28, do you think that investment opportunities are favorable in Mexico? According to the OECD, the Mexican population increased by 1.34 percent in 2016, compared with a 0.3 percent increase in the European Union (27 countries).

Solution:

Other than the higher population growth rate, the potential sources of growth for Mexico are not favorable. The level of business investment (Exhibit 27) in Mexico is quite low, especially in comparison to China, and not much higher than that of many of the advanced economies in Europe. The level of labor productivity in Mexico is well below that in most European countries. This is not surprising given that the amount of capital per worker in Mexico is much lower than that in Europe. What is surprising and of concern is the rate of labor productivity growth in Mexico. Labor productivity in Mexico is growing at a 1.0 percent annual rate, below that of Germany, France, and the United Kingdom. This means that the rightward shift in the AS curve is greater for the European countries than for Mexico, despite the more favorable demographic trend in Mexico. In addition, it implies that there is more potential for expanding profit margins in Europe than in Mexico. Thus, the analysis of potential growth does not suggest a favorable outlook for equity returns in Mexico. In the absence of more favorable considerations—e.g., compelling equity valuations—John Todd should decide not to reallocate assets from Europe to Mexico.

Measuring Sustainable Growth Labor productivity data can be used to estimate the rate of sustainable growth of the economy. A useful way to describe potential GDP is as a combination of aggregate hours worked and the productivity of those workers:

Potential GDP = Aggregate hours worked × Labor productivity

Transforming the above equation into growth rates, we get the following:

Potential growth rate = Long-term growth rate of labor force +
Long-term labor productivity growth rate

Thus, potential growth is a combination of the long-term growth rate of the labor force and the long-term growth rate of labor productivity. Therefore, if the labor force is growing at 1 percent per year and productivity per worker is rising at 2 percent per year, then potential GDP (adjusted for inflation) is rising at 3 percent per year.

EXAMPLE 16

Estimating the Rate of Growth in Potential GDP

Exhibit 29 provides data on sources of growth for Canada, Germany, Japan, and the United States. Estimate the growth rates of the labor force, labor productivity, and potential GDP for each country by averaging the growth rates for these variables for the last decade and a half.

Exhibit 29 Sources of Growth: Average Annual Growth Rate

	1971–1980	1981–1990	1991–2000	2001–2008	2009–2015
Canada					
Labor force	2.1%	1.8%	1.1%	1.5%	0.9%
Productivity	1.8	1.0	1.8	0.9	1.4
GDP	4.0	2.8	2.9	2.4	2.3
Germany					
Labor force	–0.9%	0.0%	–0.4%	–0.4%	0.6%
Productivity	3.7	2.3	2.5	1.5	1.4
GDP	2.9	2.3	2.1	1.0	2.0
Japan					
Labor force	0.3%	0.5%	–0.9%	–0.7%	0.1%
Productivity	4.2	3.4	2.2	2.1	1.4
GDP	4.5	3.9	1.2	1.4	1.5
United States					
Labor force	1.6%	1.8%	1.5%	0.3%	1.0%
Productivity	1.6	1.4	1.8	2.0	2.1
GDP	3.2	3.2	3.3	2.2	2.1

Solution:

Potential GDP is calculated as the sum of the trend growth rate in the labor force and the trend growth rate in labor productivity. The growth in the labor force can differ from the population growth rate because of changes in the labor force participation rate and changes in hours worked per person. Estimating based on the average for the period from 2001-2015 gives:

	Projected Growth in Labor Force	Projected Growth in Labor Productivity	Projected Growth in Potential GDP
Canada	1.2%	1.2%	2.4%
Germany	0.1	1.5	1.6
Japan	–0.3	1.8	1.5
United States	0.7	2.1	2.7

The most striking result is the difference in labor force growth in Germany and Japan in contrast to that in the United States and Canada. Most of the difference between the growth rates in potential GDP among these countries can be explained by the demographic factor. The results suggest that Japan's sluggish growth over the last two decades is likely to continue. The weak productivity growth in Canada is of concern and is indicative of a low rate of innovation among Canadian companies.

EXAMPLE 17

Prospects for Fixed-Income Investments

As a fixed-income analyst for a large Canadian bank, you have just received the latest GDP forecast from the OECD for Canada, Germany, Japan, and the United States. The forecast is given below:

Exhibit 30 OECD GDP Forecast

	Projected Average Annual GDP Growth (2018–2020)
Canada	4.0%
Germany	1.5
Japan	0.5
United States	3.8

To evaluate the future prospects for fixed-income investments, analysts must estimate the future rate of inflation and assess the possibility of changes in monetary policy by the central bank. An important indicator for both of these factors is the degree of slack in the economy. One way to measure the degree of slack in the economy is to compare the growth rates of actual GDP and potential GDP.

Based on the estimates of potential GDP from the previous example and the information in Exhibit 30, evaluate the prospects for fixed-income investments in each of the countries.

Solution:

In comparing the OECD forecast for GDP growth with the estimated growth rate in potential GDP, there are two cases to consider:

1 If actual GDP is growing at a faster rate than potential GDP, it signals growing inflationary pressures and an increased likelihood that the central bank will raise interest rates.

2 If actual GDP is growing at a slower rate than potential GDP, it signals growing resource slack, less inflationary pressures, and an increased likelihood that the central bank will reduce rates or leave them unchanged.

Exhibit 31 provides a comparison of actual and potential GDP for the above countries.

Exhibit 31 Actual vs. Potential GDP

	Projected Average Annual GDP Growth (2018–2020)	Potential GDP Growth (Example 16)
Canada	4.0%	2.4%
Germany	1.5	1.6
Japan	0.5	1.5
United States	3.8	2.7

The data suggest that inflationary pressure will grow in the United States and Canada and that both the Federal Reserve and the Bank of Canada will eventually raise interest rates. Thus, the environment for bond investing is not favorable in the United States and Canada, because bond prices are likely to decline.

With Germany growing at its potential rate of GDP growth, the rate of inflation should neither rise nor fall. Monetary policy is set by the European Central Bank (ECB), but data on the German economy play a big role in the ECB's decision. Based on the above data, no change in ECB policy is likely. For bond investors, little change in bond prices is likely in Germany, so investors need to focus on the interest (coupon) income received from the bond.

Finally, growing resource slack in Japan will put downward pressure on inflation and may force the Bank of Japan to keep rates low. Bond prices should rise in this environment.

SUMMARY

This reading introduces important macroeconomic concepts and principles for macroeconomic forecasting and related investment decision making. Macroeconomics examines the economy as a whole by focusing on a country's aggregate output of final goods and services, total income, aggregate expenditures, and the general price level. The first step in macroeconomic analysis is to measure the size of an economy. Gross domestic product enables us to assign a monetary value to an economy's level of output or aggregate expenditures. The interaction of aggregate demand and aggregate supply determines the level of GDP as well as the general price level. The business cycle

reflects shifts in aggregate demand and short-run aggregate supply. The long-term sustainable growth rate of the economy depends on growth in the supply and quality of inputs (labor, capital, and natural resources) and advances in technology. From an investment perspective, macroeconomic analysis and forecasting are important because business profits, asset valuations, interest rates, and inflation rates depend on the business cycle in the short to intermediate term and on the drivers of sustainable economic growth in the long term. In addition, it is important to understand fiscal and monetary policies' economic impact on and implications for inflation, household consumption and saving, capital investment, and exports.

- GDP is the market value of all final goods and services produced within a country in a given time period.
- GDP can be valued by looking at either the total amount spent on goods and services produced in the economy or the income generated in producing those goods and services.
- GDP counts only final purchases of newly produced goods and services during the current time period. Transfer payments and capital gains are excluded from GDP.
- With the exception of owner-occupied housing and government services, which are estimated at imputed values, GDP includes only goods and services that are valued by being sold in the market.
- Intermediate goods are excluded from GDP in order to avoid double counting.
- GDP can be measured either from the value of final output or by summing the value added at each stage of the production and distribution process. The sum of the value added by each stage is equal to the final selling price of the good.
- Nominal GDP is the value of production using the prices of the current year. Real GDP measures production using the constant prices of a base year. The GDP deflator equals the ratio of nominal GDP to real GDP.
- Households earn income in exchange for providing—directly or indirectly through ownership of businesses—the factors of production (labor, capital, natural resources including land). From this income, they consume, save, and pay net taxes.
- Businesses produce most of the economy's output/income and invest to maintain and expand productive capacity. Companies retain some earnings but pay out most of their revenue as income to the household sector and as taxes to the government.
- The government sector collects taxes from households and businesses and purchases goods and services, for both consumption and investment, from the private business sector.
- Foreign trade consists of exports and imports. The difference between the two is net exports. If net exports are positive (negative), then the country spends less (more) than it earns. Net exports are balanced by accumulation of either claims on the rest of the world (net exports > 0) or obligations to the rest of the world (net exports < 0).
- Capital markets provide a link between saving and investment in the economy.
- From the expenditure side, GDP includes personal consumption (C), gross private domestic investment (I), government spending (G), and net exports ($X - M$).

- The major categories of expenditure are often broken down into subcategories. Gross private domestic investment includes both investment in fixed assets (plant and equipment) and the change in inventories. In some countries, government spending on investment is separated from other government spending.
- National income is the income received by all factors of production used in the generation of final output. It equals GDP minus the **capital consumption allowance** (depreciation) and a statistical discrepancy.
- Personal income reflects pre-tax income received by households. It equals national income plus transfers minus undistributed corporate profits, corporate income taxes, and indirect business taxes.
- Personal disposable income equals personal income minus personal taxes.
- Private saving must equal investment plus the fiscal and trade deficits. That is, $S = I + (G - T) + (X - M)$.
- Consumption spending is a function of disposable income. The marginal propensity to consume represents the fraction of an additional unit of disposable income that is spent.
- Investment spending depends on the average interest rate and the level of aggregate income. Government purchases and tax policy are often considered to be exogenous variables determined outside the macroeconomic model. Actual taxes collected depend on income and are, therefore, endogenous—that is, determined within the model.
- The IS curve reflects combinations of GDP and the real interest rate such that aggregate income/output equals planned expenditures. The LM curve reflects combinations of GDP and the interest rate such that demand and supply of real money balances are equal.
- Combining the IS and LM relationships yields the aggregate demand curve.
- Aggregate demand and aggregate supply determine the level of real GDP and the price level.
- The aggregate demand curve is the relationship between real output (GDP) demanded and the price level, holding underlying factors constant. Movements along the aggregate demand curve reflect the impact of price on demand.
- The aggregate demand curve is downward sloping because a rise in the price level reduces wealth, raises real interest rates, and raises the price of domestically produced goods versus foreign goods. The aggregate demand curve is drawn assuming a constant money supply.
- The aggregate demand curve will shift if there is a change in a factor, other than price, that affects aggregate demand. These factors include household wealth, consumer and business expectations, capacity utilization, monetary policy, fiscal policy, exchange rates, and foreign GDP.
- The aggregate supply curve is the relationship between the quantity of real GDP supplied and the price level, keeping all other factors constant. Movements along the supply curve reflect the impact of price on supply.
- The short-run aggregate supply curve is upward sloping because higher prices result in higher profits and induce businesses to produce more and laborers to work more. In the short run, some prices are sticky, implying that some prices do not adjust to changes in demand.
- In the long run, all prices are assumed to be flexible. The long-run aggregate supply curve is vertical because input costs adjust to changes in output prices, leaving the optimal level of output unchanged. The position of the curve is determined by the economy's level of potential GDP.

- The level of potential output, also called the full employment or natural level of output, is unobservable and difficult to measure precisely. This concept represents an efficient and unconstrained level of production at which companies have enough spare capacity to avoid bottlenecks and there is a balance between the pool of unemployed workers and the pool of job openings.
- The long-run aggregate supply curve will shift because of changes in labor supply, supply of physical and human capital, and productivity/technology.
- The short-run supply curve will shift because of changes in potential GDP, nominal wages, input prices, expectations about future prices, business taxes and subsidies, and the exchange rate.
- The business cycle and short-term fluctuations in GDP are caused by shifts in aggregate demand and aggregate supply.
- When the level of GDP in the economy is below potential GDP, such a recessionary situation exerts downward pressure on the aggregate price level.
- When the level of GDP is above potential GDP, such an overheated situation puts upward pressure on the aggregate price level.
- Stagflation, a combination of high inflation and weak economic growth, is caused by a decline in short-run aggregate supply.
- The sustainable rate of economic growth is measured by the rate of increase in the economy's productive capacity or potential GDP.
- Growth in real GDP measures how rapidly the total economy is expanding. Per capita GDP, defined as real GDP divided by population, reflects the standard of living in a country. Real GDP growth rates and levels of per capita GDP vary widely among countries.
- The sources of economic growth include the supply of labor, the supply of physical and human capital, raw materials, and technological knowledge.
- Output can be described in terms of a production function. For example, $Y = A\boldsymbol{F}(L,K)$ where L is the quantity of labor, K is the capital stock, and A represents technological knowledge or total factor productivity. The function $\boldsymbol{F}(\cdot)$ is assumed to exhibit constant returns to scale but diminishing marginal productivity for each input individually.
- Total factor productivity is a scale factor that reflects the portion of output growth that is not accounted for by changes in the capital and labor inputs. TFP is mainly a reflection of technological change.
- Based on a two-factor production function, Potential GDP growth = Growth in TFP + W_L (Growth in labor) + W_C (Growth in capital), where W_L and W_C (= 1 – W_L) are the shares of labor and capital in GDP.
- Diminishing marginal productivity implies that
  - increasing the supply of some input(s) relative to other inputs will lead to diminishing returns and cannot be the basis for sustainable growth. In particular, long-term sustainable growth cannot rely solely on capital deepening, that is, increasing the stock of capital relative to labor.
  - given the relative scarcity and hence high productivity of capital in developing countries, the growth rate of developing countries should exceed that of developed countries.
- The labor supply is determined by population growth, the labor force participation rate, and net immigration. The capital stock in a country increases with investment. Correlation between long-run economic growth and the rate of investment is high.

- In addition to labor, capital, and technology, human capital—essentially, the quality of the labor force—and natural resources are important determinants of output and growth.
- Technological advances are discoveries that make it possible to produce more and/or higher-quality goods and services with the same resources or inputs. Technology is the main factor affecting economic growth in developed countries.
- The sustainable rate of growth in an economy is determined by the growth rate of the labor supply plus the growth rate of labor productivity.

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PRACTICE PROBLEMS

1 Which of the following statements is the *most* appropriate description of gross domestic product (GDP)?

A The total income earned by all households, firms, and the government whose value can be verified.

B The total amount spent on all final goods and services produced within the economy over a given time period.

C The total market value of resalable and final goods and services produced within the economy over a given time period.

2 The component *least likely* to be included in a measurement of gross domestic product (GDP) is:

A the value of owner occupied rent.

B the annual salary of a local police officer.

C environmental damage caused by production.

3 Which of the following conditions is *least likely* to increase a country's GDP?

A An increase in net exports.

B Increased investment in capital goods.

C Increased government transfer payments.

4 Which of the following would be included in Canadian GDP for a given year? The market value of:

A wine grown in Canada by US citizens.

B electronics made in Japan and sold in Canada.

C movies produced outside Canada by Canadian film makers.

5 Suppose a painting is produced and sold in 2018 for £5,000. The expenses involved in producing the painting amounted to £2,000. According to the sum-of-value-added method of calculating GDP, the value added by the final step of creating the painting was:

A £2,000.

B £3,000.

C £5,000.

6 A GDP deflator less than 1 indicates that an economy has experienced:

A inflation.

B deflation.

C stagflation.

7 The *most* accurate description of nominal GDP is:

A a measure of total expenditures at current prices.

B the value of goods and services at constant prices.

C a measure to compare one nation's economy to another.

8 From the beginning to the ending years of a decade, the annual value of final goods and services for country *X* increased from €100 billion to €300 billion. Over that time period, the GDP deflator increased from 111 to 200. Over the decade, real GDP for country *X* increased by approximately:

A 50%.

B 67%.

C 200%.

9 If the GDP deflator values for year 1 and year 2 were 190 and 212.8, respectively, which of the following *best* describes the annual growth rate of the overall price level?

A 5.8%.

B 6%.

C 12%.

10 The numerator of the GDP price deflator reflects:

A the value of base year output at current prices.

B the value of current year output at current prices.

C the value of current year output at base year prices.

11 Consider the following data for a hypothetical country:

Account name	Amount ($ trillions)
Consumption	15.0
Capital consumption allowance	1.5
Government spending	3.8
Imports	1.7
Gross private domestic investment	4.0
Exports	1.5

Based only on the data given, the gross domestic product and national income are respectively *closest* to:

A 21.1 and 20.6.

B 22.6 and 21.1.

C 22.8 and 20.8.

12 In calculating personal income for a given year, which of the following would *not* be subtracted from national income?

A Indirect business taxes.

B Undistributed corporate profits.

C Unincorporated business net income.

13 Equality between aggregate expenditure and aggregate output implies that the government's fiscal deficit must equal:

A Private saving – Investment – Net exports.

B Private saving – Investment + Net exports.

C Investment – Private saving + Net exports.

14 Because of a sharp decline in real estate values, the household sector has increased the fraction of disposable income that it saves. If output and investment spending remain unchanged, which of the following is *most likely*?

A A decrease in the government deficit.

B A decrease in net exports and increased capital inflow.

C An increase in net exports and increased capital outflow.

15 Which curve represents combinations of income and the real interest rate at which planned expenditure equals income?

A The IS curve.

B The LM curve.

C The aggregate demand curve.

16 An increase in government spending would shift the:

A IS curve and the LM curve.

B IS curve and the aggregate demand curve.

C LM curve and the aggregate demand curve.

17 An increase in the nominal money supply would shift the:

A IS curve and the LM curve.

B IS curve and the aggregate demand curve.

C LM curve and the aggregate demand curve.

18 An increase in the price level would shift the:

A IS curve.

B LM curve.

C aggregate demand curve.

19 As the price level declines along the aggregate demand curve, the interest rate is *most likely* to:

A decline.

B increase.

C remain unchanged.

20 The full employment, or natural, level of output is *best* described as:

A the maximum level obtainable with existing resources.

B the level at which all available workers have jobs consistent with their skills.

C a level with a modest, stable pool of unemployed workers transitioning to new jobs.

21 Which of the following *best* describes the aggregate supply curve in the short-run (e.g., 1 to 2 years)? The short run aggregate supply curve is:

A flat because output is more flexible than prices in the short run.

B vertical because wages and other input prices fully adjust to the price level.

C upward sloping because input prices do not fully adjust to the price level in the short run.

22 If wages were automatically adjusted for changes in the price level, the short-run aggregate supply curve would *most likely* be:

A flatter.

B steeper.

C unchanged.

23 The *least likely* cause of a decrease in aggregate demand is:

A higher taxes.

B a weak domestic currency.

C a fall in capacity utilization.

24 Which of the following is *most likely* to cause the long-run aggregate supply curve to shift to the left?

A Higher nominal wages.

B A decline in productivity.

C An increase in corporate taxes.

25 Increased household wealth will *most likely* cause an increase in:

A household saving.

B investment expenditures.

C consumption expenditures.

26 The *most likely* outcome when both aggregate supply and aggregate demand increase is:

A a rise in inflation.

B higher employment.

C an increase in nominal GDP.

27 Which of the following is *least likely* to be caused by a shift in aggregate demand?

A Stagflation.

B A recessionary gap.

C An inflationary gap.

28 Following a sharp increase in the price of energy, the overall price level is *most likely* to rise in the short run:

A and remain elevated indefinitely unless the central bank tightens.

B but be unchanged in the long run unless the money supply is increased.

C and continue to rise until all prices have increased by the same proportion.

29 Among developed economies, which of the following sources of economic growth is *most likely* to explain superior growth performance?

A Technology.

B Capital stock.

C Labor supply.

30 Which of the following can be measured directly?

A Potential GDP.

B Labor productivity.

C Total factor productivity.

31 The sustainable growth rate is *best* estimated as:

A the weighted average of capital and labor growth rates.

B growth in the labor force plus growth of labor productivity.

C growth in total factor productivity plus growth in the capital-to-labor ratio.

32 In the neoclassical or Solow growth model, an increase in total factor productivity reflects an increase in:

A returns to scale.

B output for given inputs.

C the sustainable growth rate.

The following information relates to Questions 33–34

An economic forecasting firm has estimated the following equation from historical data based on the neoclassical growth model:

$$\text{Potential output growth} = 1.5 + 0.72 \times \text{Growth of labor} + 0.28 \times \text{Growth of capital}$$

33 The intercept (1.5) in this equation is *best* interpreted as:

A the long-run sustainable growth rate.

B the growth rate of total factor productivity.

C above trend historical growth that is unlikely to be sustained.

34 The coefficient on the growth rate of labor (0.72) in this equation is *best* interpreted as:

A the labor force participation rate.

B the marginal productivity of labor.

C the share of income earned by labor.

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35 Convergence of incomes over time between emerging market countries and developed countries is *most likely* due to:

A total factor productivity.

B diminishing marginal productivity of capital.

C the exhaustion of non-renewable resources.

SOLUTIONS

1 B is correct. GDP is the total amount spent on all final goods and services produced within the economy over a specific period of time.

2 C is correct. By-products of production processes that have no explicit market value are not included in GDP.

3 C is correct. Government transfer payments, such as unemployment compensation or welfare benefits, are excluded from GDP.

4 A is correct. Canadian GDP is the total market value of all final goods and services produced in a given time period within Canada. The wine was produced in Canada and counts towards Canadian GDP.

5 B is correct. This is the value added by the artist: £5,000 – £2,000 = £3,000.

6 B is correct. The GDP Deflator = Nominal GDP/Real GDP. To get a ratio less than 1, real GDP exceeds nominal GDP, which indicates that prices have decreased and, accordingly, deflation has occurred.

7 A is correct. Nominal GDP is defined as the value of goods and services measured at current prices. Expenditure is used synonymously with the value of goods and services since aggregate expenditures must equal aggregate output of an economy.

8 B is correct. Real GDP in the first year was €100 billion/1.11 = €90 and in the last year it was €300 billion/2.00 = €150. Thus, (€150 – €90)/€90 = 0.67 or 67%.

9 A is correct: $(212.8/190)^{1/2} - 1 = 0.0583$ or 5.8%.

10 B is correct.

$$\text{GDP deflator} = \frac{\text{Value of current year output at current year prices}}{\text{Value of current year output at base year prices}} \times 100$$

11 B is correct. GDP = Consumption + Gross private domestic investment + Government Spending + Exports – Imports = 15 + 4 + 3.8 + 1.5 – 1.7 = 22.6. National income = GDP – CCA = 22.6 – 1.5 = 21.1

12 C is correct. Unincorporated business net income is also known as proprietor's income and is included in personal income.

13 A is correct. The fundamental relationship among saving, investment, the fiscal balance, and the trade balance is $S = I + (G - T) + (X - M)$. This form of the relationship shows that private saving must fund investment expenditures, the government fiscal balance, and net exports (= net capital outflows). Rearranging gives $G - T = (S - I) - (X - M)$. The government's fiscal deficit $(G - T)$ must be equal to the private sector's saving/investment balance $(S - I)$ minus net exports.

14 C is correct. The fundamental relationship among saving, investment, the fiscal balance, and the trade balance is $S = I + (G - T) + (X - M)$. Given the levels of output and investment spending, an increase in saving (reduction in consumption) must be offset by either an increase in the fiscal deficit or an increase in net exports. Increasing the fiscal deficit is not one of the choices, so an increase in net exports and corresponding increase in net capital outflows (increased lending to foreigners and/or increased purchases of assets from foreigners) is the correct response.

15 A is correct. The IS curve represents combinations of income and the real interest rate at which planned expenditure equals income.

16 B is correct. The IS curve represents combinations of income and the real interest rate at which planned expenditure equals income. Equivalently, it represents combinations such that

$$S(Y) = I(r) + (G - T) + (X - M)$$

where $S(Y)$ indicates that planned saving is a (increasing) function of income and $I(r)$ indicates that planned investment is a (decreasing) function of the real interest rate. To maintain this relationship, an increase in government spending (G) requires an increase in saving at any given level of the interest rate (r). This implies an increase in income (Y) at each interest rate level—a rightward shift of the IS curve. Unless the LM curve is vertical, the IS and LM curves will intersect at a higher level of aggregate expenditure/income. Since the LM curve embodies a constant price level, this implies an increase in aggregate expenditure at each price level—a rightward shift of the Aggregate Demand curve.

17 C is correct. The LM curve represents combinations of income and the interest rate at which the demand for real money balances equals the supply. For a given price level, an increase in the nominal money supply is also an increase in the real money supply. To increase the demand for real money balances, either the interest must decline or income must increase. Therefore, at each level of the interest rate, income (= expenditure) must increase—a rightward shift of the LM curve. Since the IS curve is downward sloping (higher income requires a lower interest rate), a rightward shift in the LM curve means that the IS and LM curves will intersect at a higher level of aggregate expenditure/income. This implies a higher level of aggregate expenditure at each price level—a rightward shift of the Aggregate Demand curve.

18 B is correct. The LM curve represents combinations of income and the interest rate at which the demand for real money balances equals the supply. For a given nominal money supply, an increase in the price level implies a decrease in the real money supply. To decrease the demand for real money balances, either the interest must increase or income must decrease. Therefore, at each level of the interest rate, income (= expenditure) must decrease—a leftward shift of the LM curve.

19 A is correct. A decrease in the price level increases the real money supply and shifts the LM curve to the right. Since the IS curve is downward sloping, the IS and LM curves will intersect at a higher level of income and a lower interest rate.

20 C is correct. At the full employment, or natural, level of output the economy is operating at an efficient and unconstrained level of production. Companies have enough spare capacity to avoid bottlenecks, and there is a modest, stable pool of unemployed workers (job seekers equal job vacancies) looking for and transitioning into new jobs.

21 C is correct. Due to long-term contracts and other rigidities, wages and other input costs do not fully adjust to changes in the price level in the short-run. Given input prices, firms respond to output price changes by expanding or contracting output to maximize profit. Hence, the SRAS is upward sloping.

22 B is correct. The slope of the short-run aggregate supply curve reflects the extent to which wages and other input costs adjust to the overall price level. Automatic adjustment of wages would mitigate the impact of price changes on profitability. Hence, firms would not adjust output as much in response to changing output prices—the SRAS curve would be steeper.

23 B is correct. A weak domestic currency will result in an increase in aggregate demand at each price level—a rightward shift in the AD curve. A weaker currency will cause a country's exports to be cheaper in global markets. Conversely, imports will be more expensive for domestic buyers. Hence, the net exports component of aggregate demand will increase.

24 B is correct. Productivity measures the efficiency of labor and is the amount of output produced by workers in a given period of time. A decline in productivity implies decreased efficiency. A decline in productivity increases labor costs, decreases profitability and results in lower output at each output price level—a leftward shift in both the short-run and long-run aggregate supply curves.

25 C is correct. The wealth effect explains the impact of increases or decreases in household wealth on economic activity. Household wealth includes financial and real assets. As asset values increase, consumers save less and spend more out of current income since they will still be able to meet their wealth accumulation goals. Therefore, an increase in household wealth results in a rightward shift in the aggregate demand curve.

26 B is correct. Higher aggregate demand (AD) and higher aggregate supply (AS) raise real GDP and lower unemployment, meaning employment levels increase.

27 A is correct. Stagflation occurs when output is declining and prices are rising. This is most likely due to a decline in aggregate supply—a leftward shift of the SRAS curve. Depending on the source of the shift, the LRAS may shift too.

28 B is correct. An increase in energy prices will shift the short-run aggregate supply curve (SRAS) to the left, reducing output and increasing prices. If there is no change in the aggregate demand curve, in particular if the central bank does not expand the money supply, slack in the economy will put downward pressure on in input prices, shifting the SRAS back to its original position. In the long run, the price level will be unchanged.

29 A is correct. Technology is the most important factor affecting economic growth for developed countries. Technological advances are very important because they allow an economy to overcome the limits imposed by diminishing marginal returns.

30 B is correct. Labor productivity can be directly measured as output/hour.

31 B is correct. Output growth is equal to the growth rate of the labor force plus the growth rate of labor productivity, i.e. output per worker. Unlike total factor productivity, output per worker is observable, so this is the most practical way to approach estimation of sustainable growth.

32 B is correct. Total factor productivity (TFP) is a scale factor primarily reflecting technology. An increase in TFP means that output increases for any level of factor inputs.

33 B is correct. The estimated equation is the standard Solow growth accounting equation. The intercept is the growth rate of total factor productivity.

34 C is correct. In the standard Solow growth accounting equation, the coefficient on each factor's growth rate is its share of income.

35 B is correct. Diminishing marginal productivity of capital means that as a country accumulates more capital per worker the incremental boost to output declines. Thus, all else the same, economies grow more slowly as they become more capital intensive. Given the relative scarcity and hence high marginal productivity of capital in developing countries, they tend to grow more rapidly than developed countries. This leads to convergence in income levels over time.