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CHAPTER 11

The Aggregate Expenditures Model

Learning Objectives

- LO11.1** Explain how sticky prices relate to the aggregate expenditures model.
- LO11.2** Explain how an economy's investment schedule is derived from the investment demand curve and an interest rate.
- LO11.3** Illustrate how economists combine consumption and investment to depict an aggregate expenditures schedule for a private closed economy and how that schedule can be used to demonstrate the economy's equilibrium level of output (where the total quantity of goods produced equals the total quantity of goods purchased).

- LO11.4** Discuss the two other ways to characterize the equilibrium level of real GDP in a private closed economy: saving = investment, and no unplanned changes in inventories.
- LO11.5** Analyze how changes in equilibrium real GDP can occur in the aggregate expenditures model and describe how those changes relate to the multiplier.
- LO11.6** Explain how economists integrate the international sector (exports and imports) into the aggregate expenditures model.
- LO11.7** Explain how economists integrate the public sector (government expenditures and taxes) into the aggregate expenditures model.
- LO11.8**

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Differentiate between equilibrium GDP and full-employment GDP and identify and describe the nature and causes of “recessionary expenditure gaps” and “inflationary expenditure gaps.” Page 240

ORIGIN OF THE IDEA

LO11.1

Aggregate
expenditures
model



In previous chapters we answered in detail two of the most critical questions in macroeconomics: How is an economy's output measured? Why does an economy grow? But we have been relatively general in addressing two other important questions: What determines the level of GDP, given a nation's production capacity? What causes real GDP to rise in one period and to fall in another? To provide more thorough answers to these two questions, we construct the aggregate expenditures model, which has its origins in 1936 in the writings of British economist John Maynard Keynes (pronounced “Caines”). The basic premise of the aggregate expenditures model—also known as the “Keynesian cross” model—is that the amount of goods and services produced and therefore the level of employment depend directly on the level of aggregate expenditures (total spending). Businesses will produce only a level of output that they think they can profitably sell. They will idle their workers and machinery when there are no markets for their goods and services.

Assumptions and Simplifications

LO11.1 Explain how all the price levels in the aggregate expenditures model.

The simplifying assumptions underpinning the aggregate expenditures model reflect the economic conditions that were prevalent during the Great Depression. As discussed in this chapter's Last Word, Keynes created the model during the middle of the Great Depression in the hopes of understanding both why the Great Depression had happened as well as how it might be ended.

The most fundamental assumption behind the aggregate expenditures model is that prices in the economy are fixed. In the terminology of Chapter 6, the aggregate expenditures model is an extreme version of a sticky price model. In fact, it is a stuck-price model because the price-level cannot change at all.

Keynes made this simplifying assumption because he had observed that prices had not declined sufficiently during the Great Depression to boost spending and maintain output and employment at

their pre-Depression levels. Such price declines had been predicted by macroeconomic theories that were popular before the Great Depression. But actual prices did not fall sufficiently during the Great Depression, and the economy sank far below its potential output. Real GDP in the United States declined by 27 percent from 1929 to 1933, and the unemployment rate rose to 25 percent. Thousands of factories sat idle, gathering dust and producing nothing, because nobody wanted to buy their output.

To Keynes, this massive unemployment of labor and capital resulted from firms reacting to information about how much they should produce. As households and businesses greatly reduced their spending, inventories of unsold goods rocketed. Unable or unwilling to slash their prices, firms could not sell all the goods they had already produced. So they greatly reduced their current production. This meant discharging workers, idling production lines, and even closing entire factories. Keynes thought that a new economic model was needed to show how all this could have happened and how it might be reversed.

The Keynesian aggregate expenditures model is not just of historical interest. It is still insightful even today because many prices in the modern economy are inflexible downward over relatively short periods of time. The

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aggregate expenditures model therefore can help us understand how the modern economy is likely to initially adjust to various economic shocks over shorter periods of time. For example, it clarifies aspects of the severe 2007–2009 recession, such as why unexpected initial declines in spending caused even larger declines in real GDP. It also illuminates the thinking underlying the stimulus programs (tax cuts, government spending increases) enacted by the government during the recession.

We will build up the aggregate expenditures model in simple stages. Let's first look at aggregate expenditures and equilibrium GDP in a *private closed economy*—one without international trade or government. Then we will “open” the “closed” economy to exports and imports and also convert our “private” economy to a more realistic “mixed” economy that includes government purchases (or, more loosely, “government spending”) and taxes.

In addition, until we introduce taxes into the model, we will assume that real GDP equals disposable income (DI). For instance, if \$500 billion of output is produced as GDP, households will receive exactly \$500 billion of disposable income that they can then consume or save. And finally, unless specified otherwise, we will assume (as Keynes did) that the presence of excess production capacity and unemployed labor implies that an increase in aggregate expenditures will increase real output and employment without raising the price level.

Consumption and Investment Schedules

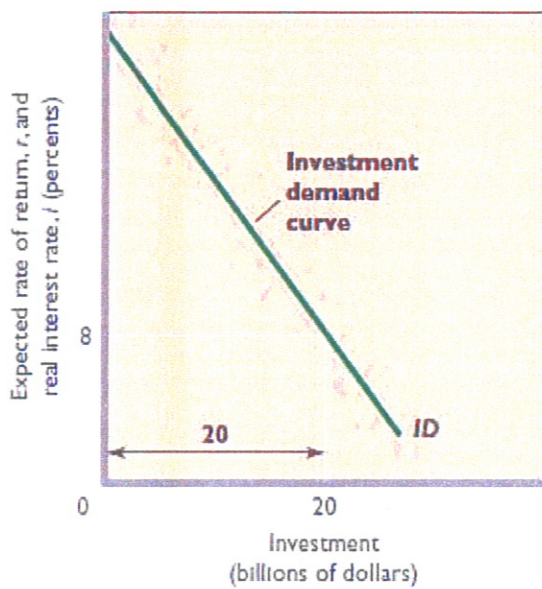
LO 11.1 Explain how an economy's investment schedule is derived from the investment demand curve and the interest rate.

In the private closed economy, the two components of aggregate expenditures are consumption, C , and gross investment, I_g . Because we examined the *consumption schedule* (Figure 10.2a) in the previous chapter, there is no need to repeat that analysis here. But to add the investment decisions of businesses to the consumption plans of households, we need to construct an investment schedule showing the amounts business firms collectively intend to invest—their **planned investment**—at each possible level of GDP. Such a schedule represents the investment plans of businesses in the same way the consumption schedule represents the consumption plans of households. In developing the investment schedule, we will assume that this planned investment is independent of the level of current disposable income or real output.

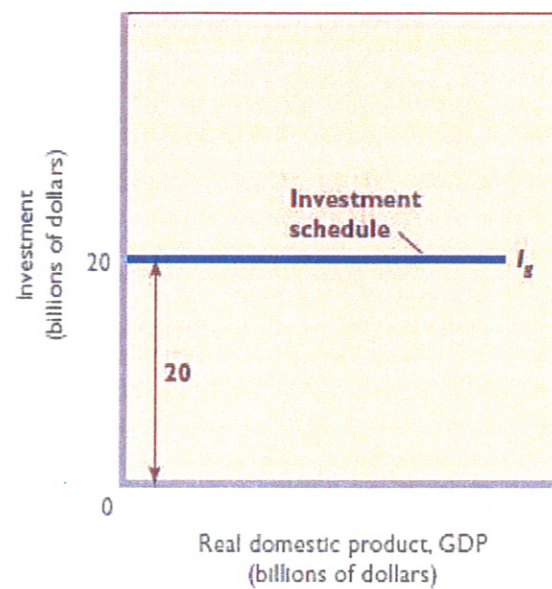
Suppose the investment demand curve is as shown in Figure 11.1a and the current real interest rate is 8 percent. This means that firms will spend \$20 billion on investment goods. Our assumption tells us that this \$20 billion of investment will occur at both low and high levels of GDP. The line I_g in Figure 11.1b shows this graphically; it is the economy's **investment schedule**. You should not confuse this investment schedule I_g with the investment demand curve ID in Figure 11.1a. The investment schedule shows the amount of investment forthcoming at each level of GDP. As indicated in Figure 11.1b, the interest rate and investment demand curve together determine this amount (\$20 billion). Table 11.1 shows the investment schedule in tabular form. Note that investment (I_g) in column 2 is \$20 billion at all levels of real GDP.

FIGURE 11.1 (a) The investment demand curve and (b) the investment schedule. (a) The level of investment spending (here, \$20 billion) is determined by the real interest rate (here, 8 percent) together with the investment

demand curve ID . (b) The investment schedule I_g relates the amount of investment (\$20 billion) determined in (a) to the various levels of GDP.



(a)
Investment demand curve



(b)
Investment schedule

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TABLE 11.1 The Investment Schedule (in Billions)

(1) Level of Real Output and Income	(2) Investment (I_g)
\$370	\$20
390	20
410	20
430	20
450	20
470	20
490	20
510	20
530	20
550	20

Equilibrium GDP: $C + I_g = \text{GDP}$

(11.1.1) Illustrates how a private closed economy's consumption and investment schedules can be used to find the equilibrium level of output, income, and employment. The equilibrium level of output is where the total quantity of goods produced equals the quantity of goods purchased.

Now let's combine the consumption schedule of Chapter 10 and the investment schedule here to explain the equilibrium levels of output, income, and employment in the private closed economy.

Tabular Analysis

Columns 2 through 5 in Table 11.2 repeat the consumption and saving schedules of Table 10.1 and the investment schedule of Table 11.1.

Real Domestic Output Column 2 in Table 11.2 lists the various possible levels of total output—of real GDP—that the private sector might produce. Firms would be willing to produce any one of these 10 levels of output just as long as the revenue that they receive from selling any particular level equals or exceeds the costs they would incur to produce it. Those costs are the factor payments needed to obtain the required amounts of land, labor, capital, and entrepreneurship. For example, firms would be willing to produce \$370 billion of output if the costs of production (wages, rents, interest, and the normal profit needed to attract entrepreneurship) are less than or equal to the \$370 billion in revenue that they would get from selling the output.

Aggregate Expenditures In the private closed economy of Table 11.2, aggregate expenditures consist of consumption (column 3) plus investment (column 5). Their sum is shown in column 6, which along with column 2 makes up the **aggregate expenditures schedule** for the private closed economy. This schedule shows the amount ($C + I_g$) that will be spent at each possible output or income level.

TABLE 11.2 Determination of the Equilibrium Levels of Employment, Output, and Income: A Private Closed Economy

(1) Possible Levels of Employment, Millions	(2) Real Domestic Output (and Income) (GDP = DI),* Billions	(3) Consumption (C), Billions	(4) Saving (S), Billions	(5) Investment (I _p), Billions	(6) Aggregate Expenditures (C + I _p), Billions	(7) Unplanned Changes in Inventories, (+ or -)	(8) Tendency of Employment, Output, and Income
(1) 40	\$370	\$375	\$-5	\$20	\$395	\$-25	Increase
(2) 45	390	390	0	20	410	-20	Increase
(3) 50	410	405	5	20	425	-15	Increase
(4) 55	430	420	10	20	440	-10	Increase
(5) 60	450	435	15	20	455	-5	Increase
(6) 65	470	450	20	20	470	0	Equilibrium
(7) 70	490	465	25	20	485	+5	Decrease
(8) 75	510	480	30	20	500	+10	Decrease
(9) 80	530	495	35	20	515	+15	Decrease
(10) 85	550	510	40	20	530	+20	Decrease

*If depreciation and net foreign factor income are zero, government is ignored, and it is assumed that all saving occurs in the household sector of the economy, then GDP as a measure of domestic output is equal to NI, PI, and DI. This means that households receive a DI equal to the value of total output.

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At this point we are working with *planned investment*—the data in column 5, Table 11.2. These data show the amounts firms plan or intend to invest, not the amounts they actually will invest if there are unplanned changes in inventories. More about that shortly.

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Equilibrium GDP Of the 10 possible levels of GDP in Table 11.2, which is the equilibrium level? Which total output is the economy capable of sustaining?

The equilibrium output is that output whose production creates total spending just sufficient to purchase that output. So the equilibrium level of GDP is the level at which the total quantity of goods produced (GDP) equals the total quantity of goods purchased ($C + I_g$). In the private closed economy, the **equilibrium GDP** is where

$$C + I_g = \text{GDP}$$

If you look at the domestic output levels in column 2 and the aggregate expenditures levels in column 6, you will see that this equality exists only at \$470 billion of GDP (row 6). That is the only output at which economy-wide spending is precisely equal to the amount needed to move that output off the shelves. At \$470 billion of GDP, the annual rates of production and spending are in balance. There is no overproduction, which would result in a piling up of unsold goods and consequently cutbacks in the production rate. Nor is there an excess of total spending, which would draw down inventories of goods and prompt increases in the rate of production. In short, there is no reason for businesses to alter this rate of production; \$470 billion is the equilibrium GDP.

Disequilibrium No level of GDP other than the equilibrium level of GDP can be sustained. At levels of GDP *less than* equilibrium, spending always exceeds GDP. If, for example, firms produced \$410 billion of GDP (row 3 in Table 11.2), they would find it would yield \$405 billion in consumer spending. Supplemented by \$20 billion of planned investment, aggregate expenditures ($C + I_g$) would be \$425 billion, as shown in column 6. The economy would provide an annual rate of spending more than sufficient to purchase the \$410 billion of annual production. Because buyers would be taking goods off the shelves faster than firms could produce them, an unplanned decline in business inventories of \$15 billion would occur (column 7) if this situation continued. But businesses can adjust to such an imbalance between aggregate expenditures and real output by stepping up production. Greater output will increase employment and total income. This process will continue until the equilibrium level of GDP is reached (\$470 billion).

WORKED PROBLEMS**W11.1**Equilibrium
GDP

The reverse is true at all levels of GDP *greater than* the \$470 billion equilibrium level. Businesses will find that these total outputs fail to generate the spending needed to clear the shelves of goods.

Being unable to recover their costs, businesses will cut back on production. To illustrate: At the \$510 billion output (row 8), business managers would find spending is insufficient to permit the sale of all that output. Of the \$510 billion of income that this output creates, \$480 billion would be received back by businesses as consumption spending. Though supplemented by \$20 billion of planned investment spending, total expenditures (\$500 billion) would still be \$10 billion below the \$510 billion quantity produced. If this imbalance persisted, \$10 billion of inventories would pile up (column 7). But businesses can adjust to this unintended accumulation of unsold goods by cutting back on the rate of production. The resulting decline in output would mean fewer jobs and a decline in total income.

Graphical Analysis

We can demonstrate the same analysis graphically. In **Figure 11.2 (Key Graph)** the 45° line developed in Chapter 10 now takes on increased significance. Recall that at any point on this line, the value of what is being measured on the horizontal axis (here, GDP) is equal to the value of what is being measured on the vertical axis (here, aggregate expenditures, or $C + I_g$). Having discovered in our tabular analysis that the equilibrium level of domestic output is determined where $C + I_g$ equals GDP, we can say that the 45° line in Figure 11.2 is a graphical statement of that equilibrium condition.

Now we must graph the aggregate expenditures schedule onto Figure 11.2. To do this, we duplicate the consumption schedule C in Figure 10.2a and add to it vertically the constant \$20 billion amount of investment I_g from Figure 11.1b. This \$20 billion is the amount we assumed firms plan to invest at all levels of GDP. Or, more directly, we can plot the $C + I_g$ data in column 6, Table 11.2.

Observe in Figure 11.2 that the aggregate expenditures line $C + I_g$ shows that total spending rises with income and output (GDP), but not as much as income rises. That is true because the marginal propensity to consume—the slope of line C —is less than 1. A part of any increase in income will be saved rather than spent. And because the aggregate expenditures line $C + I_g$ is parallel to the consumption line C , the slope of the aggregate expenditures line also equals the MPC for the economy and is less than 1. For our particular data, aggregate expenditures rise by \$15 billion for every \$20 billion increase in real output and income because \$5 billion of each \$20 billion increment is saved. Therefore, the slope of the aggregate expenditures line is 0.75 ($= \Delta\$15/\Delta\20).

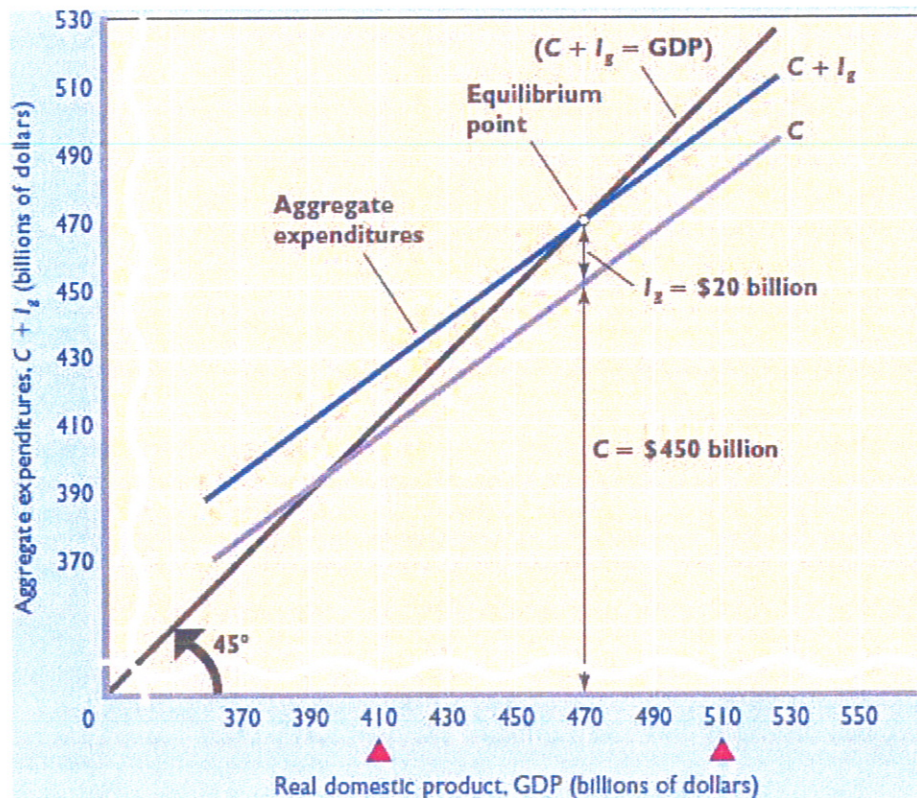
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KEY GRAPH

FIGURE 11.2 Equilibrium GDP in a private closed economy. The aggregate expenditures schedule, $C + I_g$, is determined by adding the investment schedule I_g to the upsloping consumption schedule C . Since investment is assumed to be the same at each level of GDP, the vertical distances between C and $C + I_g$ do not change. Equilibrium GDP is determined where the aggregate expenditures schedule intersects the 45° line, in this case at \$470 billion.



QUICK QUIZ FOR FIGURE 11.2

- In this figure, the slope of the aggregate expenditures schedule $C + I_g$:
 - increases as real GDP increases.
 - falls as real GDP increases.
 - is constant and equals the MPC.
 - is constant and equals the MPS.
- At all points on the 45° line:
 - equilibrium GDP is possible.

- b. aggregate expenditures exceed real GDP.
 - c. consumption exceeds investment.
 - d. aggregate expenditures are less than real GDP.
3. The \$490 billion level of real GDP is not at equilibrium because:
- a. investment exceeds consumption.
 - b. consumption exceeds investment.
 - c. planned $C + I_g$ exceeds real GDP.
 - d. planned $C + I_g$ is less than real GDP.
4. The \$430 billion level of real GDP is not at equilibrium because:
- a. investment exceeds consumption.
 - b. consumption exceeds investment.
 - c. planned $C + I_g$ exceeds real GDP.
 - d. planned $C + I_g$ is less than real GDP.

Answers: 1. c; 2. a; 3. d; 4. c

The equilibrium level of GDP is determined by the intersection of the aggregate expenditures schedule and the 45° line. This intersection locates the only point at which aggregate expenditures (on the vertical axis) are equal to GDP (on the horizontal axis). Because Figure 11.2 is based on the data in Table 11.2, we once again find that equilibrium output is \$470 billion. Observe that consumption at this output is \$450 billion and investment is \$20 billion.

It is evident from Figure 11.2 that no levels of GDP *above* the equilibrium level are sustainable because at those levels $C + I_g$ falls short of GDP. Graphically, the aggregate

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expenditures schedule lies below the 45° line in those situations. At the \$510 billion GDP level, for example, $C + I_g$ is only \$500 billion. This underspending causes inventories to rise, prompting firms to readjust production downward, in the direction of the \$470 billion output level.

Conversely, at levels of GDP *below* \$470 billion, the economy wants to spend in excess of what businesses are producing. Then $C + I_g$ exceeds total output. Graphically, the aggregate expenditures schedule lies above the 45° line. At the \$410 billion GDP level, for example, $C + I_g$ totals \$425 billion. This excess spending causes inventories to fall below their planned level, prompting firms to adjust production upward, in the direction of the \$470 billion output level. Once production reaches that level, it will be sustained there indefinitely unless there is some change in the location of the aggregate expenditures line.

Other Features of Equilibrium GDP

Table 11.2 shows the two other characteristics of the equilibrium level of real GDP in a private closed economy: saving = investment, and no unplanned changes in inventories.

We have seen that $C + I_g = \text{GDP}$ at equilibrium in the private closed economy. A closer look at Table 11.2 reveals two more characteristics of equilibrium GDP:

- Saving and *planned* investment are equal ($S = I_g$).
- There are no *unplanned* changes in inventories.

Saving Equals Planned Investment

As shown by row 6 in Table 11.2, saving and planned investment are both \$20 billion at the \$470 billion equilibrium level of GDP.

Saving is a **leakage** or withdrawal of spending from the economy's circular flow of income and expenditures. Saving is what causes consumption to be less than total output or GDP. Because of saving, consumption by itself is insufficient to remove domestic output from the shelves, apparently setting the stage for a decline in total output.

However, firms do not intend to sell their entire output to consumers. Some of that output will be capital goods sold to other businesses. Investment—the purchases of capital goods—is therefore an **injection** of spending into the income-expenditures stream. As an adjunct to consumption, investment is thus a potential replacement for the leakage of saving.

If the leakage of saving at a certain level of GDP exceeds the injection of investment, then $C + I_g$ will be less than GDP and that level of GDP cannot be sustained. Any GDP for which saving exceeds investment is an above-equilibrium GDP. Consider GDP of \$510 billion (row 8 in Table 11.2). Households will save \$30 billion, but firms will plan to invest only \$20 billion. This \$10 billion excess of saving over planned investment will reduce total spending to \$10 billion below the value of total output. Specifically, aggregate expenditures will be \$500 billion while real GDP is \$510 billion. This spending deficiency will reduce real GDP.

Conversely, if the injection of investment exceeds the leakage of saving, then $C + I_g$ will be greater than GDP and drive GDP upward. Any GDP for which investment exceeds saving is a below-equilibrium GDP. For example, at a GDP of \$410 billion (row 3 in Table 11.2), households will save

only \$5 billion, but firms will invest \$20 billion. So investment exceeds saving by \$15 billion. The small leakage of saving at this relatively low GDP level is more than compensated for by the larger injection of investment spending. That causes $C + I_g$ to exceed GDP and drives GDP higher.

Only where $S = I_g$ —where the leakage of saving of \$20 billion is exactly offset by the injection of planned investment of \$20 billion—will aggregate expenditures ($C + I_g$) equal real output (GDP). That $C + I_g = \text{GDP}$ equality is what defines the equilibrium GDP.

No Unplanned Changes in Inventories

As part of their investment plans, firms may decide to increase or decrease their inventories. But, as confirmed in line 6 of Table 11.2, there are no **unplanned changes in inventories** at equilibrium GDP. This fact, along with $C + I_g = \text{GDP}$, and $S = I_g$ is a characteristic of equilibrium GDP in the private closed economy.

Unplanned changes in inventories play a major role in achieving equilibrium GDP. Consider, as an example, the \$490 billion *above-equilibrium* GDP shown in row 7 of Table 11.2. What happens if firms produce that output, thinking they can sell it? Households save \$25 billion of their \$490 billion DI, so consumption is only \$465 billion. Planned investment—which includes *planned* changes in inventories—is \$20 billion (column 5). So aggregate expenditures ($C + I_g$) are \$485 billion and sales fall short of production by \$5 billion. Firms retain that extra \$5 billion of goods as an *unplanned* increase in inventories (column 7). It results from the failure of total spending to remove total output from the shelves.

Because changes in inventories are a part of investment, we note that *actual investment* is \$25 billion. It consists of \$20 billion of planned investment *plus* the \$5 billion unplanned increase in inventories. Actual investment equals the saving of \$25 billion, even though saving exceeds

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planned investment by \$5 billion. Because firms cannot earn profits by accumulating unwanted inventories, the \$5 billion unplanned increase in inventories will prompt them to cut back employment and production. GDP will fall to its equilibrium level of \$470 billion, at which unplanned changes in inventories are zero.

Now look at the *below-equilibrium* \$450 billion output (row 5, Table 11.2). Because households save only \$15 billion of their \$450 billion DI, consumption is \$435 billion. Planned investment by firms is \$20 billion, so aggregate expenditures are \$455 billion. Sales exceed production by \$5 billion. This is so only because a \$5 billion unplanned decrease in business inventories has occurred. Firms must *disinvest* \$5 billion in inventories (column 7). Note again that actual investment is \$15 billion (\$20 billion planned *minus* the \$5 billion decline in inventory investment) and is equal to saving of \$15 billion, even though planned investment exceeds saving by \$5 billion. The unplanned decline in inventories, resulting from the excess of sales over production, will encourage firms to expand production. GDP will rise to \$470 billion, at which unplanned changes in inventories are zero.

When economists say differences between investment and saving can occur and bring about changes in equilibrium GDP, they are referring to planned investment and saving. Equilibrium occurs only when planned investment and saving are equal. But when unplanned changes in inventories are considered, investment and saving are always equal, regardless of the level of GDP. That is true because actual investment consists of planned investment and unplanned investment (unplanned changes in inventories). Unplanned changes in inventories act as a balancing item that equates the actual amounts saved and invested in any period.

Changes in Equilibrium GDP and the Multiplier

LO11.5 Analyze how changes in equilibrium real GDP can occur in the aggregate expenditures model and describe how those changes relate to the multiplier

In the previous chapter, we established that an initial change in spending can cause a greater change in real output through the multiplier effect. In equation form,

$$\text{Multiplier} = \frac{\text{change in real GDP}}{\text{initial change in spending}}$$

Further, we discovered that the size of the multiplier depends on the size of the MPS in the economy:

$$\text{Multiplier} = \frac{1}{\text{MPS}}$$

(Because the multiplier is such an important element of the aggregate expenditures model, we highly recommend that you quickly review Figure 10.8 at this time.)

In a private closed economy, the equilibrium GDP will change in response to changes in either the investment schedule or the consumption schedule. Because changes in the investment schedule are the main sources of instability, we will direct our attention toward them.

Figure 11.3 shows the effect of changes in investment spending on the equilibrium real GDP. Suppose that the expected rate of return on investment rises or that the real interest rate falls such that

investment spending increases by \$5 billion. That would be shown as an upward shift of the investment schedule in Figure 11.1b. In Figure 11.3, the \$5 billion increase of investment spending will increase aggregate expenditures from $(C + I_g)_0$ to $(C + I_g)_1$ and raise equilibrium real GDP from \$470 billion to \$490 billion.

If the expected rate of return on investment decreases or if the real interest rate rises, investment spending will decline by, say, \$5 billion. That would be shown as a downward shift of the investment schedule in Figure 11.1b and a downward shift of the aggregate expenditures schedule from $(C + I_g)_0$ to $(C + I_g)_2$ in Figure 11.3. Equilibrium GDP will fall from \$470 billion to \$450 billion.

In our examples, a \$5 billion change in investment spending leads to a \$20 billion change in output and income. So the *multiplier* is 4 ($= \$20/\5). The MPS is 0.25, meaning that for every \$1 billion of new income, \$0.25 billion of new saving occurs. Therefore, \$20 billion of new income is needed to generate \$5 billion of new saving. Once that increase in income and saving occurs, the economy is back in equilibrium— $C + I_g = \text{GDP}$; saving and investment are equal; and there are no unplanned changes in inventories. You can see, then, why the multiplier is equal to $1/\text{MPS}$ and that the multiplier process is an integral part of the aggregate expenditures model.

QUICK REVIEW 11.1

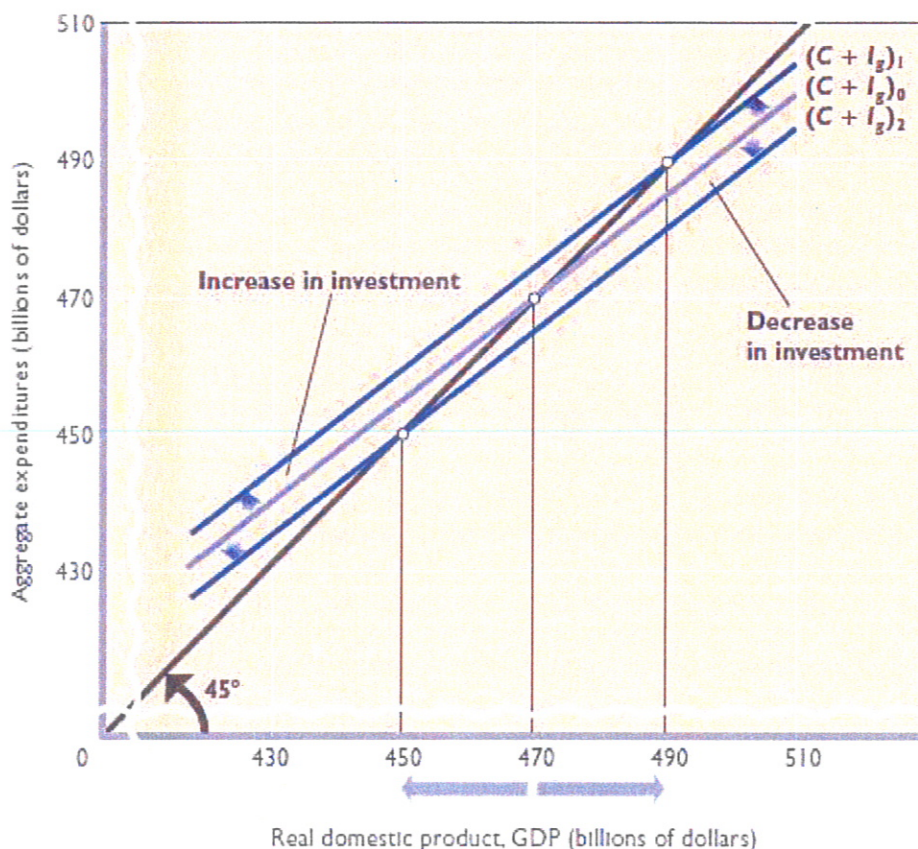
- In a private closed economy, equilibrium GDP occurs where aggregate expenditures equal real domestic output ($C + I_g = \text{GDP}$).
- At equilibrium GDP, saving equals planned investment ($S = I_g$) and unplanned changes in inventories are zero.
- Actual investment consists of planned investment plus unplanned changes in inventories (+ or –) and is always equal to saving in a private closed economy.
- Through the multiplier effect, an initial change in investment spending can cause a magnified change in domestic output and income.

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FIGURE 11.3 Changes in the aggregate expenditures schedule and the multiplier effect. An upward shift of the aggregate expenditures schedule from $(C + I_g)_0$ to $(C + I_g)_1$ will increase the equilibrium GDP. Conversely, a downward shift from $(C + I_g)_0$ to $(C + I_g)_2$ will lower the equilibrium GDP. The extent of the changes in equilibrium GDP will depend on the size of the multiplier, which in this case is 4 ($= 20/5$). The multiplier is equal to $1/\text{MPS}$ (here, $4 = 1/.25$).



Adding International Trade

LO11.6 Explain how economic activity in the international sector affects and is affected by aggregate expenditures model.

We next move from a private closed economy to a private open economy that incorporates exports (X) and imports (M). Our focus will be on **net exports** (exports minus imports), which may be either positive or negative.

Net Exports and Aggregate Expenditures

Like consumption and investment, exports create domestic production, income, and employment for a nation. Although U.S. goods and services produced for export are sent abroad, foreign spending on those goods and services increases production and creates jobs and incomes in the United States. We must therefore include exports as a component of U.S. aggregate expenditures.

Conversely, when an economy is open to international trade, it will spend part of its income on imports—goods and services produced abroad. To avoid overstating the value of domestic production, we must subtract the amount spent on imported goods because such spending generates production and income abroad rather than at home. So, to correctly measure aggregate expenditures for domestic goods and services, we must subtract expenditures on imports from total spending.

In short, for a private closed economy, aggregate expenditures are $C + I_g$. But for an open economy, aggregate expenditures are $C + I_g + (X - M)$. Or, recalling that net exports (X_n) equal $(X - M)$, we can say that aggregate expenditures for a private open economy are $C + I_g + X_n$.

The Net Export Schedule

A net export schedule lists the amount of net exports that will occur at each level of GDP. Table 11.3 shows two possible net export schedules for the hypothetical economy represented in Table 11.2. In net export schedule X_{n1} (columns 1 and 2), exports exceed imports by \$5 billion at each level of GDP. Perhaps exports are \$15 billion while imports are \$10 billion. In schedule X_{n2} (columns 1 and 3), imports are \$5 billion higher than exports. Perhaps imports are \$20 billion while exports are \$15 billion. To simplify our discussion, we assume in both schedules that net exports are independent of GDP.¹

TABLE 11.3 Two Net Export Schedules (in Billions)

(1) Level of GDP	(2) Net Exports, $X_{n1} (X > M)$	(3) Net Exports, $X_{n2} (X < M)$
\$370	\$+5	\$-5
390	+5	-5
410	+5	-5
430	+5	-5
450	+5	-5
470	+5	-5
490	+5	-5
510	+5	-5
530	+5	-5
550	+5	-5

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FIGURE 11.4 Net exports and equilibrium GDP. (a) Net exports can be either positive, as shown by the net export schedule X_{n1} or negative, as depicted by net export schedule X_{n2} . (b) Positive net exports elevate the aggregate expenditure schedule from the closed-economy level of $C + I_g$ to the open-economy level of $C + I_g + X_{n1}$. Negative net exports lower the aggregate expenditures schedule from the closed-economy level of $C + I_g$ to the open-economy level of $C + I_g + X_{n2}$.

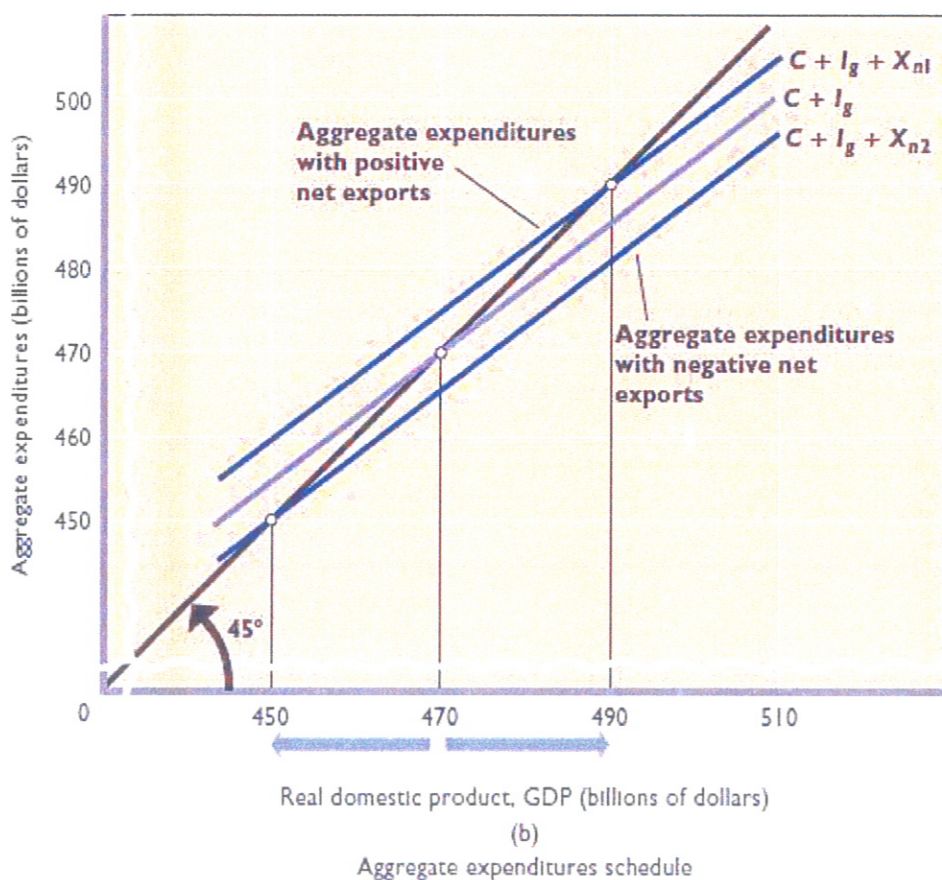
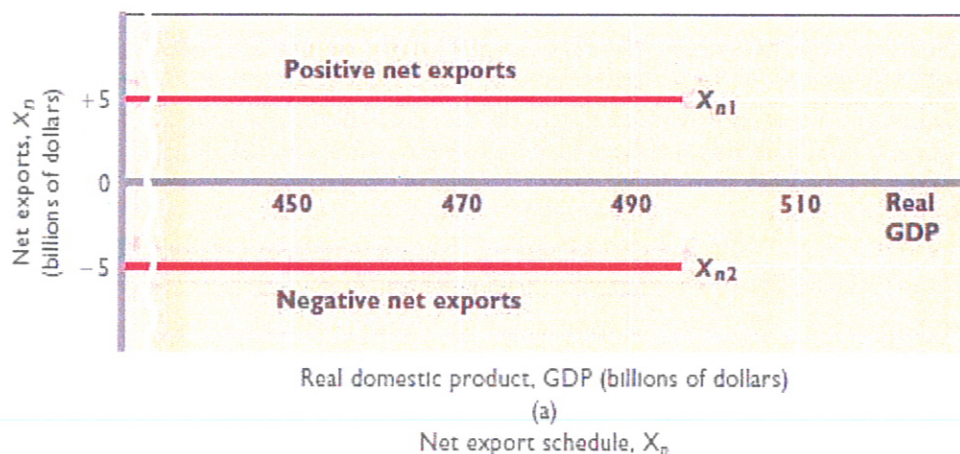


Figure 11.4a represents the two net export schedules in Table 11.3. Schedule X_{n1} is above the horizontal axis and depicts positive net exports of \$5 billion at all levels of GDP. Schedule X_{n2} , which is below the horizontal axis, shows negative net exports of \$5 billion at all levels of GDP.

Net Exports and Equilibrium GDP

The aggregate expenditures schedule labeled $C + I_g$ in Figure 11.4b reflects the private closed economy. It shows the combined consumption and gross investment expenditures occurring at each level of GDP. With no foreign sector, the equilibrium GDP is \$470 billion.

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But in the private open economy, net exports can be either positive or negative. Let's see how each of the net export schedules in Figure 11.4a affects equilibrium GDP.

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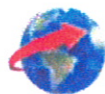
Positive Net Exports Suppose the net export schedule is X_{n1} . The \$5 billion of additional net export expenditures by the rest of the world is accounted for by adding that \$5 billion to the $C + I_g$ schedule in Figure 11.4b. Aggregate expenditures at each level of GDP are then \$5 billion higher than $C + I_g$ alone. The aggregate expenditures schedule for the open economy thus becomes $C + I_g + X_{n1}$. In this case, international trade increases equilibrium GDP from \$470 billion in the private closed economy to \$490 billion in the private open economy. Adding net exports of \$5 billion has increased GDP by \$20 billion, in this case implying a multiplier of 4.

Generalization: Other things equal, positive net exports increase aggregate expenditures and GDP beyond what they would be in a closed economy. Be careful to notice that this increase is the result of exports being larger than imports. This is true because exports and imports have opposite effects on the measurement of domestically produced output. Exports increase real GDP by increasing expenditures on domestically produced output. Imports, by contrast, must be subtracted when calculating real GDP because they are expenditures directed toward output produced abroad. It is only because net exports are positive in this example—so that the expansionary effect of exports outweighs the reductions caused by imports—that we get the overall increase in real GDP. As the next section shows, if net exports are negative, then the reductions caused by imports will outweigh the expansionary effect of exports so that domestic real GDP will decrease.

Negative Net Exports Suppose that net exports are a negative \$5 billion as shown by X_{n2} in Figure 11.4a. This means that our hypothetical economy is importing \$5 billion more of goods than it is exporting. The aggregate expenditures schedule shown as $C + I_g$ in Figure 11.4b therefore overstates the expenditures on domestic output at each level of GDP. We must reduce the sum of expenditures by the \$5 billion net amount spent on imported goods. We do that by subtracting the \$5 billion of net imports from $C + I_g$.

The relevant aggregate expenditures schedule in Figure 11.4b becomes $C + I_g + X_{n2}$ and equilibrium GDP falls from \$470 billion to \$450 billion. Again, a change in net exports of \$5 billion has produced a fourfold change in GDP, reminding us that the multiplier in this example is 4.

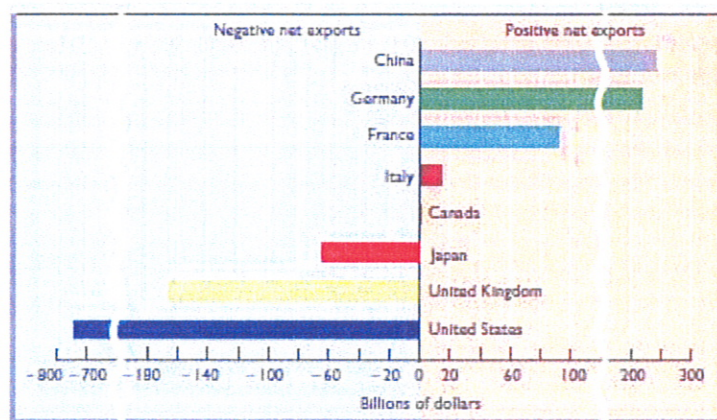
This gives us a corollary to our first generalization: Other things equal, negative net exports reduce aggregate expenditures and GDP below what they would be in a closed economy. When imports exceed exports, the contractionary effect of the larger amount of imports outweighs the expansionary effect of the smaller amount of exports, and equilibrium real GDP decreases.



GLOBAL PERSPECTIVE 11.1

Net Exports of Goods, Selected Nations, 2012

Some nations, such as China and Germany, have positive net exports; other countries, such as the United States and the United Kingdom, have negative net exports.



Source: CIA World Factbook, www.cia.gov.

Our generalizations of the effects of net exports on GDP mean that a decline in X_n —a decrease in exports or an increase in imports—reduces aggregate expenditures and contracts a nation's GDP. Conversely, an increase in X_n —the result of either an increase in exports or a decrease in imports—increases aggregate expenditures and expands GDP.

As is shown in Global Perspective 11.1, net exports vary greatly among the major industrial nations.

International Economic Linkages

Our analysis of net exports and real GDP suggests how circumstances or policies abroad can affect U.S. GDP.

Prosperity Abroad A rising level of real output and income among U.S. foreign trading partners enables the United States to sell more goods abroad, thus raising U.S. net exports and increasing U.S. real GDP (assuming initially there is excess capacity). There is good reason for Americans to be interested in the prosperity of our trading partners. Their good fortune enables them to buy more of our exports, increasing our income and enabling us in turn to buy more foreign imports. These imported goods are the ultimate benefit of international trade. Prosperity abroad transfers some of that prosperity to Americans.

Exchange Rates Depreciation of the dollar relative to other currencies enables people abroad to obtain more

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dollars with each unit of their own currencies. The price of U.S. goods in terms of those currencies will fall, stimulating purchases of U.S. exports. Also, U.S. customers will find they need more dollars to buy foreign goods and, consequently, will reduce their spending on imports. If the economy has available capacity, the increased exports and decreased imports will increase U.S. net exports and expand the nation's GDP.

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This last example has been cast only in terms of depreciation of the dollar. You should think through the impact that appreciation of the dollar would have on net exports and equilibrium GDP.

A Caution on Tariffs and Devaluations Because higher net exports increase real GDP, countries often look for ways to reduce imports and increase exports during recessions or depressions. Thus, a recession might tempt the U.S. federal government to increase tariffs and devalue the international value of the dollar (say, by supplying massive amounts of dollars in the foreign exchange market) to try to increase net exports. Such an increase of net exports would expand domestic production, reduce domestic unemployment, and help the economy recover.

But this interventionist thinking is too simplistic. Suppose that the United States imposes high tariffs on foreign goods to reduce our imports and thus increase our domestic production and employment. Our imports, however, are our trading partners' exports. So when we restrict our imports to stimulate our economy, we depress the economies of our trading partners. They are likely to retaliate against us by imposing tariffs on our products. If so, our exports to them will decline and our net exports may in fact fall. With retaliation in the picture, it is possible that tariffs may decrease, not increase, our net exports.

That unfortunate possibility became a sad reality during the Great Depression of the 1930s, when various nations, including the United States, imposed trade barriers as a way of reducing domestic unemployment. The result was many rounds of retaliation that simply throttled world trade, worsened the depression, and increased unemployment. Abetting the problem were attempts by some nations to increase their net exports by devaluing their currencies. Other nations simply retaliated by devaluing their own currencies. The international exchange rate system collapsed, and world trade spiraled downward. Economic historians agree that tariffs and devaluations during the 1930s were huge policy mistakes!

Nations are tempted to use tariffs and currency devaluations because, *other things equal*, these policies *do* increase net exports and real GDP. But keep in mind that other things aren't likely to stay equal. In particular, other nations will almost certainly retaliate with their own tariffs and devaluations—the final result being lower net exports and lower GDP for those countries and for our own.

QUICK REVIEW 11.2

- Positive net exports increase aggregate expenditures relative to the closed economy and, other things equal, increase equilibrium GDP.
- Negative net exports decrease aggregate expenditures relative to the closed economy and, other things equal, reduce equilibrium GDP.

- In the open economy, changes in (a) prosperity abroad, (b) tariffs, and (c) exchange rates can affect U.S. net exports and therefore U.S. aggregate expenditures and equilibrium GDP.
- Tariffs and deliberate currency depreciations are unlikely to increase net exports because other nations will retaliate.

Adding the Public Sector

LO11* Explain how economists integrate the public sector government expenditures and taxes into the aggregate expenditures model.

Our final step in constructing the full aggregate expenditures model is to move the analysis from a private (no-government) open economy to an economy with a public sector (sometimes called a “mixed economy”). This means adding government purchases and taxes to the model.

For simplicity, we will assume that government purchases are independent of the level of GDP and do not alter the consumption and investment schedules. Also, government's net tax revenues—total tax revenues less “negative taxes” in the form of transfer payments—are derived entirely from personal taxes. Finally, a fixed amount of taxes is collected regardless of the level of GDP.

Government Purchases and Equilibrium GDP

Suppose the government decides to purchase \$20 billion of goods and services regardless of the level of GDP and tax collections.

Tabular Example Table 11.4 shows the impact of this purchase on the equilibrium GDP. Columns 1 through 4 are carried over from Table 11.2 for the private closed economy, in which the equilibrium GDP was \$470 billion. The only new items are exports and imports in column 5 and government purchases in column 6. (Observe in column 5 that net exports are zero.) As shown in column 7, the addition of government purchases to private spending ($C + I_g + X_n$) yields a new, higher level of aggregate expenditures ($C + I_g + X_n + G$). Comparing columns 1 and 7, we find that aggregate expenditures and real output are equal at a higher level of GDP. Without government purchases, equilibrium GDP was \$470 billion (row 6); *with* government purchases, aggregate expenditures and real output are equal at \$550 billion (row 10). Increases in public spending, like increases in private spending, shift the aggregate expenditures schedule upward and produce a higher equilibrium GDP.

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TABLE 11.4 The Impact of Government Purchases on Equilibrium GDP

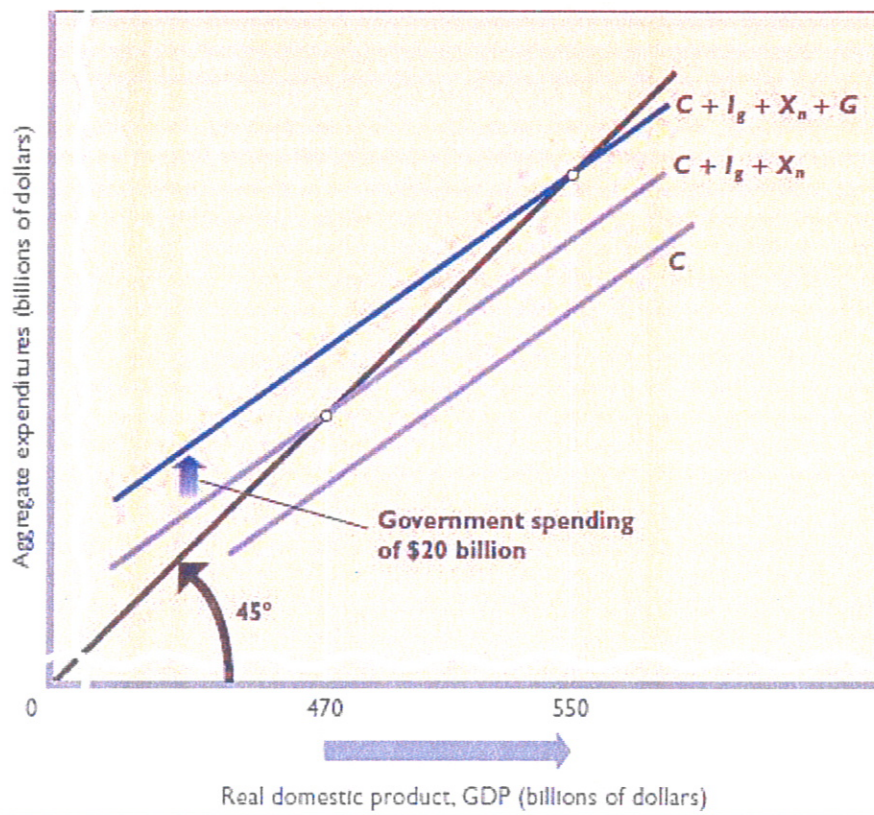
(1) Real Domestic Output and Income (GDP = DI), Billions	(2) Consumption (C), Billions	(3) Savings (S), Billions	(4) Investment (I_g), Billions	(5) Net Exports (X_n), Billions		(6) Government Purchases (G), Billions	(7) Aggregate Expenditures ($C + I_g + X_n + G$), Billions (2) + (4) + (5) + (6)
				Exports (X)	Imports (M)		
(1) \$370	\$375	\$-5	\$20	\$10	\$10	\$20	\$415
(2) 390	390	0	20	10	10	20	430
(3) 410	405	5	20	10	10	20	445
(4) 430	420	10	20	10	10	20	460
(5) 450	435	15	20	10	10	20	475
(6) 470	450	20	20	10	10	20	490
(7) 490	465	25	20	10	10	20	505
(8) 510	480	30	20	10	10	20	520
(9) 530	495	35	20	10	10	20	535
(10) 550	510	40	20	10	10	20	550

Note, too, that government spending is subject to the multiplier. A \$20 billion increase in government purchases has increased equilibrium GDP by \$80 billion (from \$470 billion to \$550 billion). The multiplier in this example is 4.

This \$20 billion increase in government spending is *not* financed by increased taxes. Shortly, we will demonstrate that increased taxes *reduce* equilibrium GDP.

Graphical Analysis In Figure 11.5, we vertically add \$20 billion of government purchases, G , to the level of private spending, $C + I_g + X_n$. That added \$20 billion raises the aggregate expenditures schedule (private plus public) to $C + I_g + X_n + G$, resulting in an \$80 billion increase in equilibrium GDP, from \$470 to \$550 billion.

FIGURE 11.5 Government spending and equilibrium GDP. The addition of government expenditures of G to our analysis raises the aggregate expenditures ($C + I_g + X_n + G$) schedule and increases the equilibrium level of GDP, as would an increase in C , I_g , or X_n .



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TABLE 11.5 Determination of the Equilibrium Levels of Employment, Output, and Income: Private and Public Sectors

(1) Real Domestic Output and Income (GDP = NI = PI), Billions	(2) Taxes (T), Billions	(3) Disposable Income (DI), Billions, (1) – (2)	(4) Consumption (C _a), Billions	(5) Saving (S _a), Billions (3) – (4)	(6) Investment (I _a), Billions	(7) Net Exports (X _n), Billions		(8) Government Purchases (G), Billions	(9) Aggregate Expenditures (C _a + I _a + X _n + G), Billions, (4) + (6) + (7) + (8)
						Exports (X)	Imports (M)		
(1) \$370	\$20	\$350	\$360	\$–10	\$20	\$10	\$10	\$20	\$400
(2) 390	20	370	375	–5	20	10	10	20	415
(3) 410	20	390	390	0	20	10	10	20	430
(4) 430	20	410	405	5	20	10	10	20	445
(5) 450	20	430	420	10	20	10	10	20	460
(6) 470	20	450	435	15	20	10	10	20	475
(7) 490	20	470	450	20	20	10	10	20	490
(8) 510	20	490	465	25	20	10	10	20	505
(9) 530	20	510	480	30	20	10	10	20	520
(10) 550	20	530	495	35	20	10	10	20	535

A decline in government purchases G will lower the aggregate expenditures schedule in Figure 11.5 and result in a multiplied decline in the equilibrium GDP. Verify in Table 11.4 that if government purchases were to decline from \$20 billion to \$10 billion, the equilibrium GDP would fall by \$40 billion.

Taxation and Equilibrium GDP

The government not only spends but also collects taxes. Suppose it imposes a **lump-sum tax**, which is a tax of a constant amount or, more precisely, a tax yielding the same amount of tax revenue at each level of GDP. Let's assume this tax is \$20 billion, so that the government obtains \$20 billion of tax revenue at each level of GDP regardless of the level of government purchases.

Tabular Example In Table 11.5, which continues our example, we find taxes in column 2, and we see in column 3 that disposable (after-tax) income is lower than GDP (column 1) by the \$20 billion amount of the tax. Because households use disposable income both to consume and to save, the tax lowers both consumption and saving. The MPC and MPS tell us how much consumption and saving will decline as a result of the \$20 billion in taxes. Because the MPC is 0.75, the government tax collection of \$20 billion will reduce consumption by \$15 billion ($= 0.75 \times \20 billion). Since the MPS is 0.25, saving will drop by \$5 billion ($= 0.25 \times \20 billion).

Columns 4 and 5 in Table 11.5 list the amounts of consumption and saving *at each level of GDP*. Note they are \$15 billion and \$5 billion smaller than those in Table 11.4. Taxes reduce disposable income relative to GDP by the amount of the taxes. This decline in DI reduces both consumption and saving at each level of GDP. The extent of the C and S reductions depend on the MPC and the MPS.

To find the effect of taxes on equilibrium GDP, we calculate aggregate expenditures again, as shown in column 9, Table 11.5. Aggregate spending is \$15 billion less at each level of GDP than it was in Table 11.4. The reason is that after-tax consumption, designated by C_a , is \$15 billion less at

each level of GDP. A comparison of real output and aggregate expenditures in columns 1 and 9 shows that the aggregate amounts produced and purchased are equal only at \$490 billion of GDP (row 7). The \$20 billion lump-sum tax has reduced equilibrium GDP by \$60 billion, from \$550 billion (row 10, Table 11.3) to \$490 billion (row 7, Table 11.4).

Graphical Analysis In Figure 11.6 the \$20 billion increase in taxes shows up as a \$15 (not \$20) billion decline in the aggregate expenditures ($C_a + I_g + X_n + G$) schedule. This decline in the schedule results solely from a decline in the consumption C component of aggregate expenditures. The equilibrium GDP falls from \$550 billion to \$490 billion because of this tax-caused drop in consumption. With no change in government expenditures, tax increases lower the aggregate expenditures schedule relative to the 45° line and reduce the equilibrium GDP.

In contrast to our previous case, a *decrease* in existing taxes will raise the aggregate expenditures schedule in Figure 11.6 as a result of an increase in consumption at all GDP levels. You should confirm that a tax reduction of \$10 billion (from the present \$20 billion to \$10 billion) would increase the equilibrium GDP from \$490 billion to \$520 billion.

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We will defer discussion and further assessment of these stimulus attempts until Chapter 13, but Figure 11.7a clearly illuminates their purpose. If the government could drive up aggregate expenditures, such as from AE_1 to AE_0 , the recession would come to an end and the recovery phase of the business cycle would begin.

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QUICK REVIEW 11.3

- Government purchases shift the aggregate expenditures schedule upward and raise equilibrium GDP.
- Taxes reduce disposable income, lower consumption spending and saving, shift the aggregate expenditures schedule downward, and reduce equilibrium GDP.
- A recessionary expenditure gap is the amount by which an economy's aggregate expenditures schedule must shift upward to achieve the full-employment GDP; an inflationary expenditure gap is the amount by which the economy's aggregate expenditures schedule must shift downward to achieve full-employment GDP and eliminate demand-pull inflation.

SUMMARY

LO11.1 Explain how sticky prices relate to the aggregate expenditures model.

The aggregate expenditures model views the total amount of spending in the economy as the primary factor determining the level of real GDP that the economy will produce. The model assumes that the price level is fixed. Keynes made this assumption to reflect the general circumstances of the Great Depression, in which declines in output and employment, rather than declines in prices, were the dominant adjustments made by firms when they faced huge declines in their sales.

LO11.2 Explain how an economy's investment schedule is derived from the investment demand curve and an interest rate.

An investment schedule shows how much investment the firms in an economy are collectively planning to make at each possible level of GDP. In this chapter, we utilize a simple investment schedule in which investment is a constant value and therefore the same at all levels of GDP. That constant value is derived from the investment demand curve by determining what quantity of investment will be demanded at the economy's current real interest rate.

LO11.3 Illustrate how economists combine consumption and investment to depict an aggregate expenditures schedule for a private closed economy and how that schedule can be used to

demonstrate the economy's equilibrium level of output (where the total quantity of goods produced equals the total quantity of goods purchased).

For a private closed economy the equilibrium level of GDP occurs when aggregate expenditures and real output are equal or, graphically, where the $C + I_g$ line intersects the 45° line. At any GDP greater than equilibrium GDP, real output will exceed aggregate spending, resulting in unplanned investment in inventories and eventual declines in output and income (GDP). At any below-equilibrium GDP, aggregate expenditures will exceed real output, resulting in unplanned disinvestment in inventories and eventual increases in GDP.

LO11.4 Discuss the two other ways to characterize the equilibrium level of real GDP in a private closed economy: saving = investment, and no unplanned changes in inventories.

At equilibrium GDP, the amount households save (leakages) and the amount businesses plan to invest (injections) are equal. Any excess of saving over planned investment will cause a shortage of total spending, forcing GDP to fall. Any excess of planned investment over saving will cause an excess of total spending, inducing GDP to rise. The change in GDP will in both cases correct the discrepancy between saving and planned investment.

At equilibrium GDP, there are no unplanned changes in inventories. When aggregate expenditures diverge from real GDP, an unplanned change in inventories occurs. Unplanned increases in inventories are followed by a cutback in production and a decline of real GDP. Unplanned decreases in inventories result in an increase in production and a rise of GDP.

Actual investment consists of planned investment plus unplanned changes in inventories and is always equal to saving.

LO11.5 Analyze how changes in equilibrium real GDP can occur in the aggregate expenditures model and describe how those changes relate to the multiplier.

A shift in the investment schedule (caused by changes in expected rates of return or changes in interest rates) shifts the aggregate

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expenditures curve and causes a new equilibrium level of real GDP. Real GDP changes by more than the amount of the initial change in investment. This multiplier effect ($\Delta \text{GDP} / \Delta I_g$) accompanies both increases and decreases in aggregate expenditures and also applies to changes in net exports (X_n) and government purchases (G).

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LO11.6 Explain how economists integrate the international sector (exports and imports) into the aggregate expenditures model.

The net export schedule in the model of the open economy relates net exports (exports minus imports) to levels of real GDP. For simplicity, we assume that the level of net exports is the same at all levels of real GDP.

Positive net exports increase aggregate expenditures to a higher level than they would if the economy were “closed” to international trade. Negative net exports decrease aggregate expenditures relative to those in a closed economy, decreasing equilibrium real GDP by a multiple of their amount. Increases in exports or decreases in imports have an expansionary effect on real GDP, while decreases in exports or increases in imports have a contractionary effect.

LO11.7 Explain how economists integrate the public sector (government expenditures and taxes) into the aggregate expenditures model.

Government purchases in the model of the mixed economy shift the aggregate expenditures schedule upward and raise GDP.

Taxation reduces disposable income, lowers consumption and saving, shifts the aggregate expenditures curve downward, and reduces equilibrium GDP.

In the complete aggregate expenditures model, equilibrium GDP occurs where $C_a + I_g + X_n + G = \text{GDP}$. At the equilibrium GDP, *leakages* of after-tax saving (S_a), imports (M), and taxes (T) equal *injections* of investment (I_g), exports (X), and government purchases (G): $S_a + M + T = I_g + X_n + G$. Also, there are no unplanned changes in inventories.

LO11.8 Differentiate between equilibrium GDP and full-employment GDP and identify and describe the nature and causes of “recessionary expenditure gaps” and “inflationary expenditure gaps.”

The equilibrium GDP and the full-employment GDP may differ. A recessionary expenditure gap is the amount by which aggregate expenditures at the full-employment GDP fall short of those needed to achieve the full-employment GDP. This gap produces a negative GDP gap (actual GDP minus potential GDP). An inflationary expenditure gap is the amount by which aggregate expenditures at the full-employment GDP exceed those just sufficient to achieve the full-employment GDP. This gap causes demand-pull inflation.

Keynes suggested that the solution to the large negative GDP gap that occurred during the Great Depression was for government to increase aggregate expenditures. It could do this by increasing its own expenditures (G) or by lowering taxes (T) to increase after-tax consumption expenditures (C_a) by households. Because the economy had millions of unemployed workers and massive amounts of unused production capacity, government could boost aggregate expenditures without worrying about creating inflation.

The stuck-price assumption of the aggregate expenditures model is not credible when the economy approaches or attains its full-employment output. With unemployment low and excess production capacity small or nonexistent, an increase in aggregate expenditures will cause inflation along with any increase in real GDP.

TERMS AND CONCEPTS

planned investment
 investment schedule
 aggregate expenditures schedule
 equilibrium GDP
 leakage
 injection
 unplanned changes in inventories
 net exports
 lump-sum tax
 recessionary expenditure gap
 inflationary expenditure gap

The following and additional problems can be found in 

DISCUSSION QUESTIONS

1. What is an investment schedule and how does it differ from an investment demand curve?
LO11.2
2. Why does equilibrium real GDP occur where $C + I_g = \text{GDP}$ in a private closed economy? What happens to real GDP when $C + I_g$ exceeds GDP? When $C + I_g$ is less than GDP? What two expenditure components of real GDP are purposely excluded in a private closed economy?
LO11.3
3. Why is saving called a *leakage*? Why is planned investment called an *injection*? Why must saving equal planned investment