

**TABLE 29.1** 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

it is the economy's **investment schedule**. You should not confuse this investment schedule  $I_g$  with the investment demand curve  $ID$  in Figure 29.1a. The investment schedule shows the amount of investment forthcoming at each level of GDP. As indicated in Figure 29.1b, the interest rate and investment demand curve together determine this amount (\$20 billion). Table 29.1 shows the investment schedule in tabular form. Note that investment ( $I_g$ ) in column 2 is \$20 billion at all levels of real GDP.

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

**LO29.3** 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).

Now let's combine the consumption schedule of Chapter 28 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 29.2 repeat the consumption and saving schedules of Table 28.1 and the investment schedule of Table 29.1.

**Real Domestic Output** Column 2 in Table 29.2 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 29.2, aggregate expenditures consist of consumption (column 3) plus investment (column 5). Their

**TABLE 29.2** 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 ( $I_g$ ), Billions	(6) Aggregate Expenditures ( $C + I_g$ ), 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.

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.

At this point we are working with *planned investment*—the data in column 5, Table 29.2. 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.

**Equilibrium GDP** Of the 10 possible levels of GDP in Table 29.2, 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 29.2), 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).

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.

### WORKED PROBLEMS

W29.1  
Equilibrium  
GDP



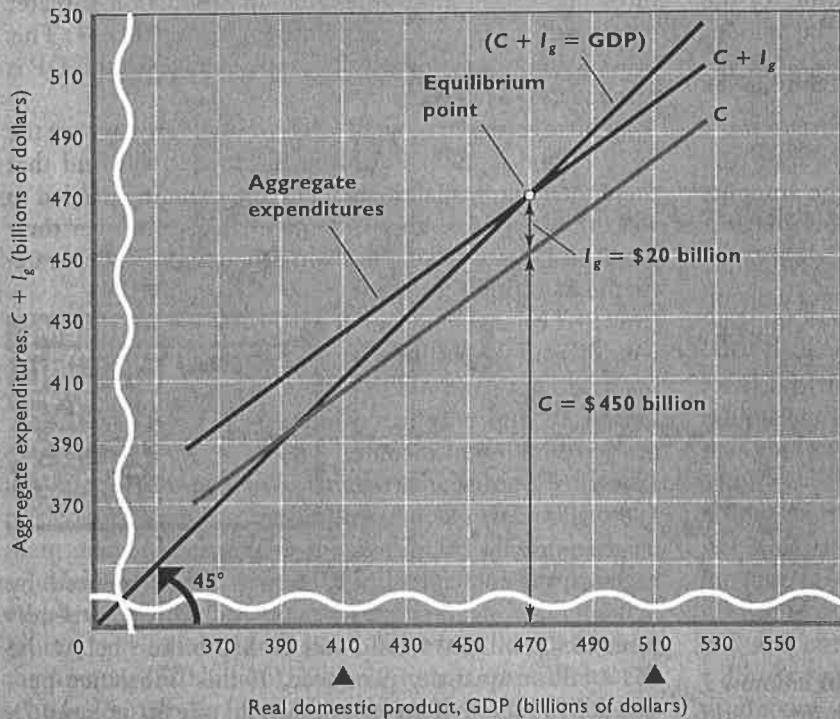
### Graphical Analysis

We can demonstrate the same analysis graphically. In **Figure 29.2 (Key Graph)** the 45° line developed in Chapter 28 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 29.2 is a graphical statement of that equilibrium condition.

Now we must graph the aggregate expenditures schedule onto Figure 29.2. To do this, we duplicate the consumption schedule  $C$  in Figure 28.2a and add to it vertically the constant \$20 billion amount of investment  $I_g$  from Figure 29.1b. 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 29.2.

Observe in Figure 29.2 that the aggregate expenditures line  $C + I_g$  shows that total spending rises with income and

# KEY GRAPH



**FIGURE 29.2** 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  $45^\circ$  line, in this case at \$470 billion.

## QUICK QUIZ FOR FIGURE 29.2

- 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  $45^\circ$  line:
  - equilibrium GDP is possible.
  - aggregate expenditures exceed real GDP.
  - consumption exceeds investment.
  - aggregate expenditures are less than real GDP.
- The \$490 billion level of real GDP is not at equilibrium because:
  - investment exceeds consumption.
  - consumption exceeds investment.
  - planned  $C + I_g$  exceeds real GDP.
  - planned  $C + I_g$  is less than real GDP.
- The \$430 billion level of real GDP is not at equilibrium because:
  - investment exceeds consumption.
  - consumption exceeds investment.
  - planned  $C + I_g$  exceeds real GDP.
  - planned  $C + I_g$  is less than real GDP.

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

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  $0.75 (= \Delta\$15/\Delta\$20)$ .

The equilibrium level of GDP is determined by the intersection of the aggregate expenditures schedule and the  $45^\circ$  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 29.2 is based on the data in Table 29.2, 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 29.2 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

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

**LO29.4** 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.

We have seen that  $C + I_g = \text{GDP}$  at equilibrium in the private closed economy. A closer look at Table 29.2 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 29.2, 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 29.2). 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 29.2), 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 29.2, 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 29.2. 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

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 29.2). 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

**LO29.5** 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 28.8 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 29.3 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 29.1b. In Figure 29.3, 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 29.1b and a downward shift of the aggregate expenditures schedule from  $(C + I_g)_0$  to  $(C + I_g)_2$  in Figure 29.3. 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 29.1

- 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.