One of the central questions in macroeconomics is why output fluctuates around its potential level. Growth is highly uneven. In business cycle booms and recessions, output rises and falls relative to the trend of potential output. Over the last 30 years there have been five recessions, in which output declined relative to trend—even falling in some years, including 1991—and then recoveries, in which output rose relative to trend.

This chapter offers a first theory of these fluctuations in real output relative to trend. The cornerstone of this model is the mutual interaction between output and spending: Spending determines output and income, but output and income also determine spending.

The *Keynesian* model of income determination that we develop in this chapter is very simple; it will be elaborated in later chapters. The central simplification is that we assume for the time being that prices do not change at all and that firms are willing to sell *any* amount of output at the given level of prices. Thus, the aggregate supply curve, shown in Chapter 7, is assumed to be entirely flat. This chapter develops the theory of the aggregate demand schedule.

The key finding in this chapter is that because of the feedback between spending and output, increases in autonomous spending—increased government purchases, for example—generate further increases in aggregate demand. Other chapters introduce dynamic links between spending and output and allow for offsetting effects due to changes in prices and interest rates, but these more sophisticated models of the economy can be seen as elaborations of this chapter's model.

9-1

AGGREGATE DEMAND AND EQUILIBRIUM OUTPUT

***Aggregate demand* is the total amount of goods demanded in the economy.** Distinguishing among goods demanded for consumption (C), for investment (I), by the government (G), and as net exports (NX), aggregate demand (AD) is determined by

$$AD = C + I + G + NX \tag{1}$$

***Output* is at its *equilibrium level* when the quantity of output produced is equal to the quantity demanded.** Thus, an economy is at equilibrium output when

$$Y = AD = C + I + G + NX \tag{2}$$

When aggregate demand—the amount people want to buy—is not equal to output, there is unplanned inventory investment or disinvestment. We summarize this as

$$IU = Y - AD \tag{3}$$

where IU is unplanned additions to inventory. If output is greater than aggregate demand, there is unplanned inventory investment, $IU > 0$. As excess inventory accumulates, firms cut back on production until output and aggregate demand are again in equilibrium. Conversely, if output is below aggregate demand, inventories are drawn down until equilibrium is restored.

9-2

THE CONSUMPTION FUNCTION AND AGGREGATE DEMAND

With the concept of equilibrium output firmly defined, we now focus on the determinants of aggregate demand, and particularly on consumption demand. We focus on consumption in part because the consumption sector is so large and in part because it is easy to see the link between consumption and income. For simplicity, we omit the government and foreign trade, therefore setting both G and NX equal to zero.

In practice, the demand for consumption goods is not constant but, rather, increases with income: Families with higher incomes consume more than families with lower incomes, and countries where income is higher have higher levels of total consumption. The relationship between consumption and income is described by the *consumption function.*

THE CONSUMPTION FUNCTION

We assume that consumption demand increases with the level of income:

$$C = \overline{C} + cY \qquad \overline{C} > 0 \qquad 0 < c < 1 \tag{4}$$

This consumption function is shown by the green line in Figure 9-1. The variable $\overline{C}$, the *intercept*, represents the level of consumption when income is zero.[1] For every dollar increase in income, the level of consumption increases by $\$c$. For example, if c is .90, then for every $1 increase in income, consumption rises by 90 cents. The *slope* of the consumption function is c. Along the consumption function the level of consumption rises with income. Box 9-1 shows that this relationship holds in practice.

The coefficient c is sufficiently important to have a special name, the *marginal propensity to consume.* The marginal propensity to consume is the increase in consumption per unit increase in income. In our case, the marginal propensity to consume is less than 1, which implies that out of a dollar increase in income, only a fraction, c, is spent on consumption.

CONSUMPTION AND SAVING

What happens to the rest of the dollar of income, the fraction $(1 - c)$, that is not spent on consumption? If it is not spent, it must be saved. Income is either spent or saved;

[1]Two points need to be made about the consumption function, equation (4). First, individuals' consumption demands are related to the amount of income they have available to spend, that is, their disposable income (YD), rather than just to the level of output. However, in this section, where we are ignoring the role of government and foreign trade, disposable income is equal to the level of income and output. Second, the real role of the intercept is to represent factors affecting consumption other than income—ownership of assets, such as stocks, bonds, and houses.

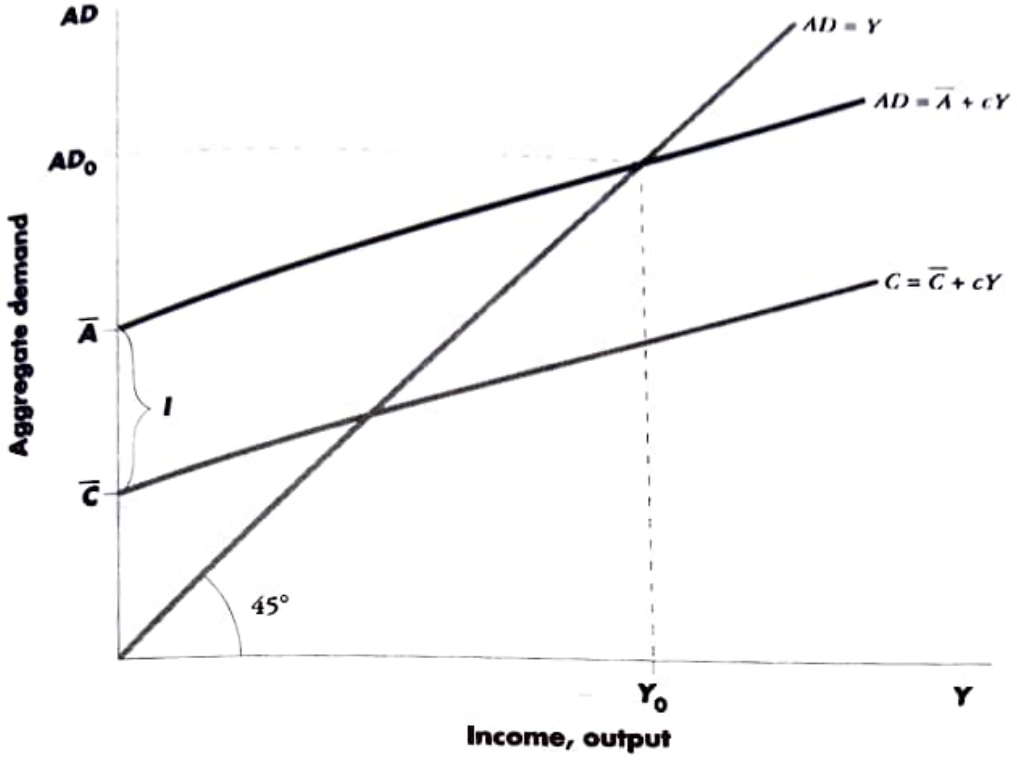

FIGURE 9-1 THE CONSUMPTION FUNCTION AND AGGREGATE DEMAND.

there are no other uses to which it can be put. It follows that any theory that explains consumption is equivalently explaining the behavior of saving.

More formally, look at equation (5), which states that income not spent on consumption is saved:

$$S \equiv Y - C \tag{5}$$

Equation (5) tells us that, by definition, *saving is equal to income minus consumption.*

The consumption function in equation (4), together with equation (5), which we call the *budget constraint,* implies a savings function. The savings function relates the level of saving to the level of income. Substituting the consumption function in equation (4) into the budget constraint in equation (5) yields the savings function:

$$S \equiv Y - C = Y - \overline{C} - cY = -\overline{C} + (1 - c)Y \tag{6}$$

From equation (6), we see that saving is an increasing function of the level of income because the *marginal propensity to save,* $s = 1 - c$, is positive.

In other words, saving increases as income rises. For instance, suppose the marginal propensity to consume, c, is .9, meaning that 90 cents out of each extra dollar of income is consumed. Then the marginal propensity to save, s, is .10, meaning that the remaining 10 cents of each extra dollar of income is saved.

BOX 9-1 The Consumption-Income Relationship

The consumption function of equation (4), $C = \bar{C} + cY$, provides a good initial description of the consumption-income relationship. Annual per capita consumption and disposable personal income data for the United States for the years since 1960 are plotted in Figure 1. Recall from Chapter 2 that disposable personal income is the amount of income households have available for either spending or saving after paying taxes and receiving transfers.

The figure reveals a very close relationship between consumption and disposable income. The actual relationship is

$$C = -818 + .95YD$$

where C and YD are each measured in 1996 dollars per person. Although the relationship between consumption and disposable income is close, not all the points in Figure 1 lie exactly on the line. This means that something other than disposable income is affecting consumption in any given year. We turn our attention to the other factors determining consumption in Chapter 13. Meanwhile, it is reassuring that equation (4) is a quite accurate description of the real world's consumption-income relationship.

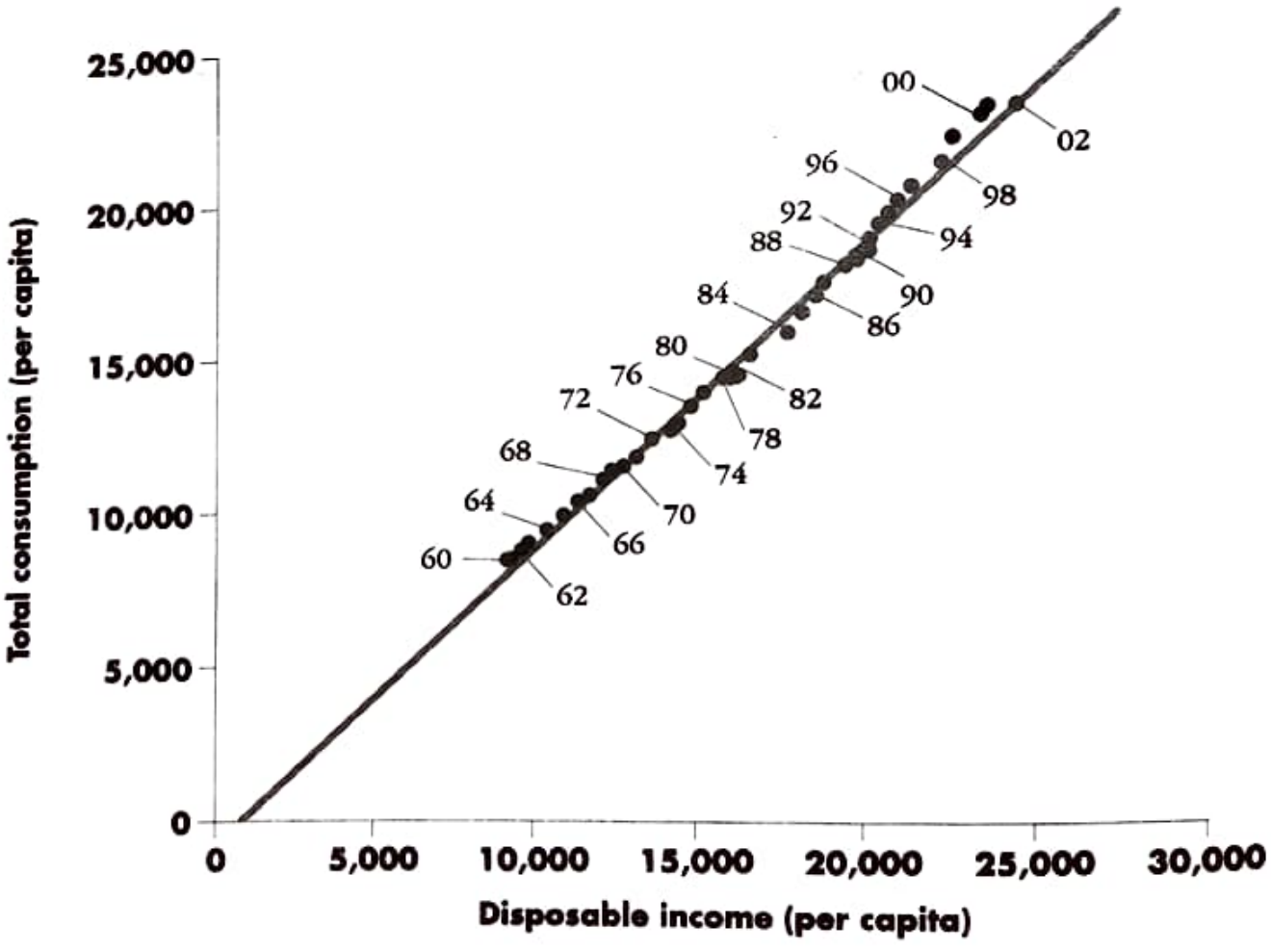

FIGURE 1 RELATIONSHIP BETWEEN CONSUMPTION AND DISPOSABLE INCOME.
(Source: Bureau of Economic Analysis.)

CONSUMPTION, AGGREGATE DEMAND, AND AUTONOMOUS SPENDING

We have specified one component of aggregate demand, consumption demand, and its link to income. Now we add investment, government spending and taxes, and foreign trade to our model, but we assume for the moment that each is *autonomous*, that is, determined outside the model and specifically assumed to be independent of income. Later chapters consider investment, the government, and foreign trade in detail. Here we just assume that investment is $\bar{I}$, government spending is $\bar{G}$, taxes are $\overline{TA}$, transfers are $\overline{TR}$, and net exports are $\overline{NX}$. Consumption now depends on *disposable income*,

$$YD = Y - TA + TR \tag{7}$$

$$C = \bar{C} + cYD = \bar{C} + c(Y + TR - TA) \tag{8}$$

Aggregate demand is the sum of the consumption function, investment, government spending, and net exports. Continuing to assume that the government sector and foreign trade are exogenous,

$$\begin{aligned} AD &= C + I + G + NX \\ &= \bar{C} + c(Y - \overline{TA} + \overline{TR}) + \bar{I} + \bar{G} + \overline{NX} \\ &= [\bar{C} - c(\overline{TA} - \overline{TR}) + \bar{I} + \bar{G} + \overline{NX}] + cY \\ &= \bar{A} + cY \end{aligned} \tag{9}$$

The aggregate demand function, equation (9), is shown in Figure 9-2. Part of aggregate demand, $\bar{A} \equiv \bar{C} - c(\overline{TA} - \overline{TR}) + \bar{I} + \bar{G} + \overline{NX}$, is independent of the level of income, or autonomous. But *aggregate demand also depends on the level of income.* It increases with the level of income because consumption demand increases with income. The aggregate demand schedule is obtained by adding (vertically) the demands for consumption, investment, government spending, and net exports at each level of income. At the income level Y_0 in Figure 9-2, the level of aggregate demand is AD_0.

EQUILIBRIUM INCOME AND OUTPUT

The next step is to use the aggregate demand function, AD, from Figure 9-2 and equation (9) to determine the equilibrium levels of output and income.

Recall the basic point of this chapter: The equilibrium level of income is such that aggregate demand equals output (which in turn equals income). The 45° line, $AD = Y$, in Figure 9-2 shows points at which output and aggregate demand are equal. Only at point E in Figure 9-2, and at the corresponding equilibrium levels of income and output (Y_0), does aggregate demand exactly equal output.[2] At that level of output and income, planned spending precisely matches production.

The arrows in Figure 9-2 indicate how the economy reaches equilibrium. At any income level below Y_0, firms find that demand exceeds output and inventories are declining, and they therefore increase production. Conversely, for output levels above Y_0, firms find inventories piling up and therefore cut production. As the arrows show, this

[2]We frequently use the subscript 0 to denote the equilibrium level of a variable.

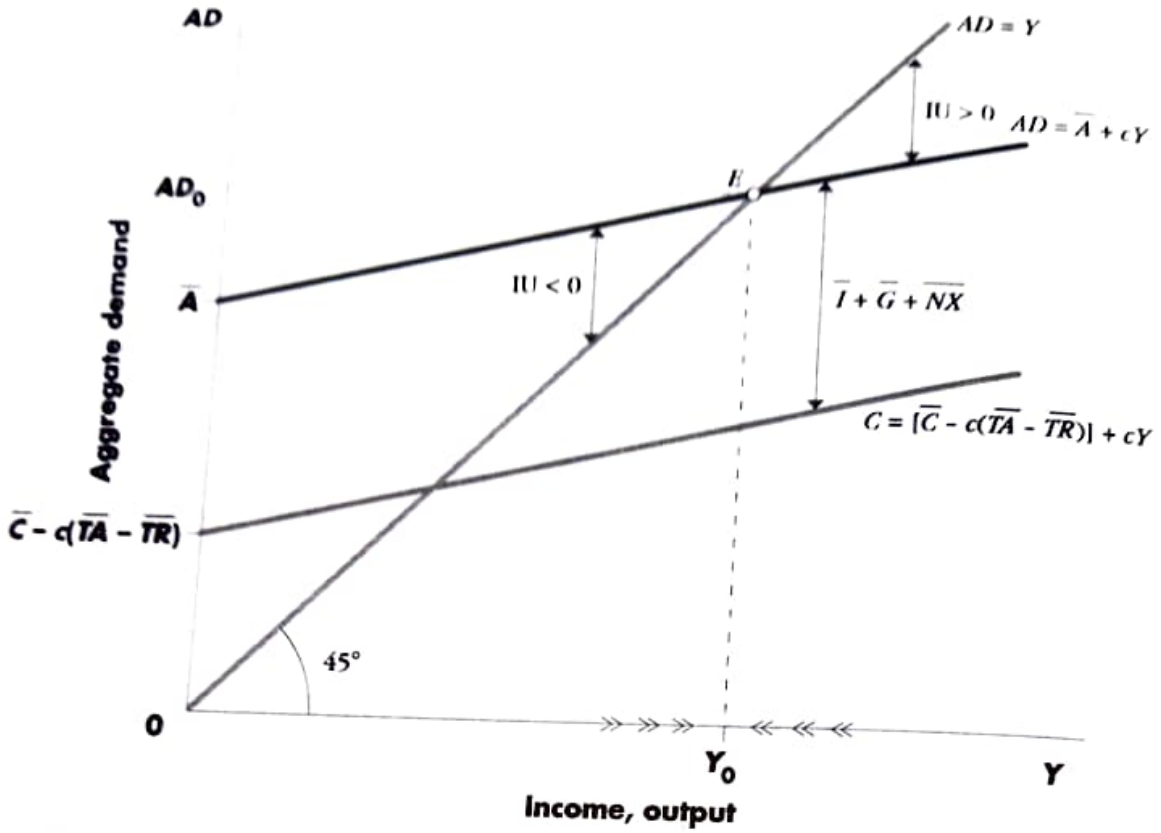

FIGURE 9-2 DETERMINATION OF EQUILIBRIUM INCOME AND OUTPUT.

process leads to the output level Y_0, at which current production exactly matches planned aggregate spending and unintended inventory changes (IU) are therefore equal to zero.

THE FORMULA FOR EQUILIBRIUM OUTPUT

The determination of equilibrium output in Figure 9-2 can also be expressed algebraically by using equation (9) and the equilibrium condition in the goods market, which is that output is equal to aggregate demand:

$$Y = AD \tag{10}$$

The level of aggregate demand, AD, is specified in equation (9). Substituting for AD in equation (10), we have the equilibrium condition:

$$Y = \bar{A} + cY \tag{11}$$

Since we have Y on both sides of the equilibrium condition in equation (11), we can collect the terms and solve for the equilibrium level of income and output, denoted by Y_0:

$$Y_0 = \frac{1}{1 - c}\bar{A} \tag{12}$$

Figure 9-2 sheds light on equation (11). The position of the aggregate demand schedule is characterized by its slope, c (the marginal propensity to consume), and intercept, $\bar{A}$ (autonomous spending). Given the intercept, a steeper aggregate demand function—as would be implied by a higher marginal propensity to consume—implies a higher level of equilibrium income. Similarly, for a given marginal propensity to consume, a higher level of autonomous spending—in terms of Figure 9-2, a larger intercept—implies a higher equilibrium level of income. These results, suggested by Figure 9-2, are easily verified using equation (12), the formula for the equilibrium level of income.

Thus, the equilibrium level of output is higher the larger the marginal propensity to consume, c, and the higher the level of autonomous spending, $\bar{A}$.

Equation (12) shows the *level* of output as a function of the marginal propensity to consume and autonomous spending. Frequently, we are interested in knowing how a change in some component of autonomous spending would *change* output. Starting from equation (12), we can relate changes in output to changes in autonomous spending through

$$\Delta Y = \frac{1}{1 - c}\Delta\bar{A} \tag{13}$$

For example, if the marginal propensity to consume is .9, then $1/(1 - c) = 10$, so a $1 billion increase in government spending increases output by $10 billion, since the recipients of the increased government spending increase their own spending, the recipients of that spending increase theirs, and so on. (We investigate the underpinnings of equation (13) more thoroughly in Section 9-3.) Note that we can compute the change in output without specifying the level of output either before or after the change.

SAVING AND INVESTMENT

There is a useful alternative formulation of the equilibrium condition that aggregate demand is equal to output. *In equilibrium, planned investment equals saving.* This condition applies only to an economy in which there is no government and no foreign trade.

To understand this relationship, return to Figure 9-2. Without government and foreign trade, the vertical distance between the aggregate demand and consumption schedules in the figure is equal to planned investment spending, $\bar{I}$. Note also that the vertical distance between the consumption schedule and the 45° line measures saving ($S = Y - C$) at each level of income.

The equilibrium level of income is found where AD crosses the 45° line, at E. Accordingly, at the equilibrium level of income, and only at that level, the two vertical distances are equal. Thus, at the equilibrium level of income, saving equals (planned) investment. By contrast, above the equilibrium level of income, Y_0, saving (the distance between the 45° line and the consumption schedule) exceeds planned investment, while below Y_0, planned investment exceeds saving.

The equality between saving and investment can be seen directly from national income accounting. Since income is either spent or saved, $Y = C + S$. Without government and foreign trade, aggregate demand equals consumption plus investment, $Y = C + I$. Putting the two together, we have $C + S = C + I$, or $S = I$.

If we include government and foreign trade in the analysis, we get a more complete picture relating investment to saving and also to net exports. Now income can either be spent, saved, or paid in taxes, so $Y = C + S + TA - TR$ and complete aggregate demand is $Y = C + I + G + NX$. Therefore,

$$\begin{aligned} C + I + G + NX &= C + S + TA - TR \\ I &= S + (TA - TR - G) - NX \end{aligned} \tag{14}$$

That is, investment equals private savings (S) plus the government budget surplus ($TA - TR - G$) minus net exports (NX) or plus net imports, if you prefer.

Rather than using algebra, some people prefer to think of equation (14) in terms of a "corn economy": Investment is the leftover corn that will be planted for next year's crop. The sources of corn investment are corn saved by individuals, any corn left over from government tax collections net of government spending, and any net corn imported from abroad.

9-3

THE MULTIPLIER

In this section we develop an answer to the following question: By how much does a $1 increase in autonomous spending raise the equilibrium level of income? There appears to be a simple answer. Since, in equilibrium, income equals aggregate demand, it would seem that a $1 increase in (autonomous) demand or spending should raise equilibrium income by $1. That answer is wrong. Let us now see why.

Suppose first that output increased by $1 to match the increased level of autonomous spending. This increase in output and income would in turn give rise to further *induced* spending as consumption rises because the level of income has risen. How much of the initial $1 increase in income would be spent on consumption? Out of an additional dollar of income, a fraction c is consumed. Assume, then, that production increases further to meet this induced expenditure, that is, that output and thus income increase by $1 + c$. That will still leave us with an excess demand, because the expansion in production and income by $1 + c$ will give rise to further induced spending. This story could clearly take a long time to tell. Does the process have an end?

In Table 9-1 we lay out the steps in the chain more carefully. The first round starts off with an increase in autonomous spending, $\Delta\bar{A}$. Next, we allow an expansion in production to meet exactly that increase in demand. Production accordingly expands by $\Delta\bar{A}$. This increase in production gives rise to an equal increase in income and, therefore, via the marginal propensity to consume, c, gives rise in the second round to increased expenditures of size $c\Delta\bar{A}$. Assume again that production expands to meet this increase in spending. The production adjustment this time is $c\Delta\bar{A}$, and so is the increase in income. This gives rise to a third round of induced spending equal to the marginal propensity to consume times the increase in income, $c(c\Delta\bar{A}) = c^2\Delta\bar{A}$. Since the marginal propensity to consume, c, is less than 1, the term c^2 is less than c,

TABLE 9-1 The Multiplier

ROUND	INCREASE IN DEMAND THIS ROUND	INCREASE IN PRODUCTION THIS ROUND	TOTAL INCREASE IN INCOME (ALL ROUNDS)
1	$\Delta\bar{A}$	ΔA	ΔA
2	$c\Delta\bar{A}$	$c\Delta A$	$(1 + c)\Delta A$
3	$c^2\Delta\bar{A}$	$c^2\Delta\bar{A}$	$(1 + c + c^2)\Delta A$
4	$c^3\Delta\bar{A}$	$c^3\Delta\bar{A}$	$(1 + c + c^2 + c^3)\Delta A$
...	...	...	...
...	...	...	...
...	...	...	...
			$\frac{1}{1 - c}\Delta A$

and therefore induced expenditures in the third round are smaller than those in the second round.

If we write out the successive rounds of increased spending, starting with the initial increase in autonomous demand, we obtain

$$\begin{aligned}\Delta AD &= \Delta\bar{A} + c\Delta\bar{A} + c^2\Delta\bar{A} + c^3\Delta\bar{A} + \dots \\ &= \Delta\bar{A}(1 + c + c^2 + c^3 + \dots)\end{aligned} \tag{15}$$

For a value of $c < 1$, the successive terms in the series become progressively smaller. In fact, we are dealing with a geometric series, so the equation simplifies to

$$\Delta AD = \frac{1}{1 - c}\Delta\bar{A} = \Delta Y_0 \tag{16}$$

From equation (16), therefore, we find that the cumulative change in aggregate spending is equal to a multiple of the increase in autonomous spending—just as we deduced from equation (12). The multiple $1/(1 - c)$ is called the *multiplier*.[3] **The multiplier is the amount by which equilibrium output changes when autonomous aggregate demand increases by 1 unit.**

The concept of the multiplier is sufficiently important to create new notation. The general definition of the multiplier is $\Delta Y/\Delta\bar{A}$, the change in equilibrium output when autonomous demand increases by 1 unit. In this specific case, omitting the government sector and foreign trade, we define the multiplier as α, where

$$\alpha \equiv \frac{1}{1 - c} \tag{17}$$

[3]Table 9-1 and equation (16) derive the multiplier using the mathematics of geometric series. If you are familiar with calculus, you will realize that the multiplier is nothing other than the derivative of the equilibrium level of income, Y_0, in equation (12) with respect to autonomous spending. Use calculus on equation (12) to check the statements in the text.

Inspection of the multiplier in equation (17) shows that the larger the marginal propensity to consume, the larger the multiplier. For a marginal propensity to consume of .6, the multiplier is 2.5; for a marginal propensity to consume of .8, the multiplier is 5. This is because a high marginal propensity to consume implies that a larger fraction of an additional dollar of income will be consumed, and thus added to aggregate demand, thereby causing a larger induced increase in demand.

Why focus on the multiplier? The reason is that we are developing an explanation of fluctuations in output. The multiplier suggests that output changes when autonomous spending (including investment) changes *and* that the change in output can be larger than the change in autonomous spending. The multiplier is the formal way of describing a commonsense idea: If the economy for some reason—for example, a loss in confidence that reduces investment spending—experiences a shock that reduces income, people whose incomes have gone down will spend less, thereby driving equilibrium income down even further. The multiplier is therefore potentially part of the explanation of why output fluctuates.[4]

THE MULTIPLIER IN PICTURES

Figure 9-3 provides a graphical interpretation of the effects of an increase in autonomous spending on the equilibrium level of income. The initial equilibrium is at point E, with an income level Y_0. Now autonomous spending increases from $\bar{A}$ to $\bar{A}'$. This is represented by a parallel upward shift of the aggregate demand schedule to AD'. The upward shift means that now, at each level of income, aggregate demand is higher by an amount $\Delta\bar{A} \equiv \bar{A}' - \bar{A}$.

Aggregate demand now exceeds the initial level of output, Y_0. Consequently, inventories begin to run down. Firms will respond to the increase in demand and declining inventories by expanding production, say, to income level Y'. This expansion in production gives rise to induced expenditure, increasing aggregate demand to level A_G. At the same time, the expansion reduces the gap between aggregate demand and output to the vertical distance FG. The gap between demand and output is reduced because the marginal propensity to consume is less than 1.

Thus, with marginal propensity to consume less than unity, a sufficient expansion in output will restore the balance between aggregate demand and output. In Figure 9-3 the new equilibrium is indicated by point E', and the corresponding level of income is Y_0'. The change in income required is therefore $\Delta Y_0 = Y_0' - Y_0$.

The magnitude of the income change required to restore equilibrium depends on two factors. The larger the increase in autonomous spending, represented in Figure 9-3

[4]Two warnings: (1) The multiplier is necessarily greater than 1 in this very simplified model of the determination of income, but as we shall see in the discussion of "crowding out" in Chap. 10, there may be circumstances in which it is less than 1. (2) The term "multiplier" is used more generally in economics to mean the effect on some endogenous variable (a variable whose level is explained by the theory being studied) of a unit change in an exogenous variable (a variable whose level is not determined within the theory being examined). For instance, one can talk of the multiplier for a change in the money supply on the level of unemployment. However, the classic use of the term is as we are using it here—the effects of a change in autonomous spending on equilibrium output.

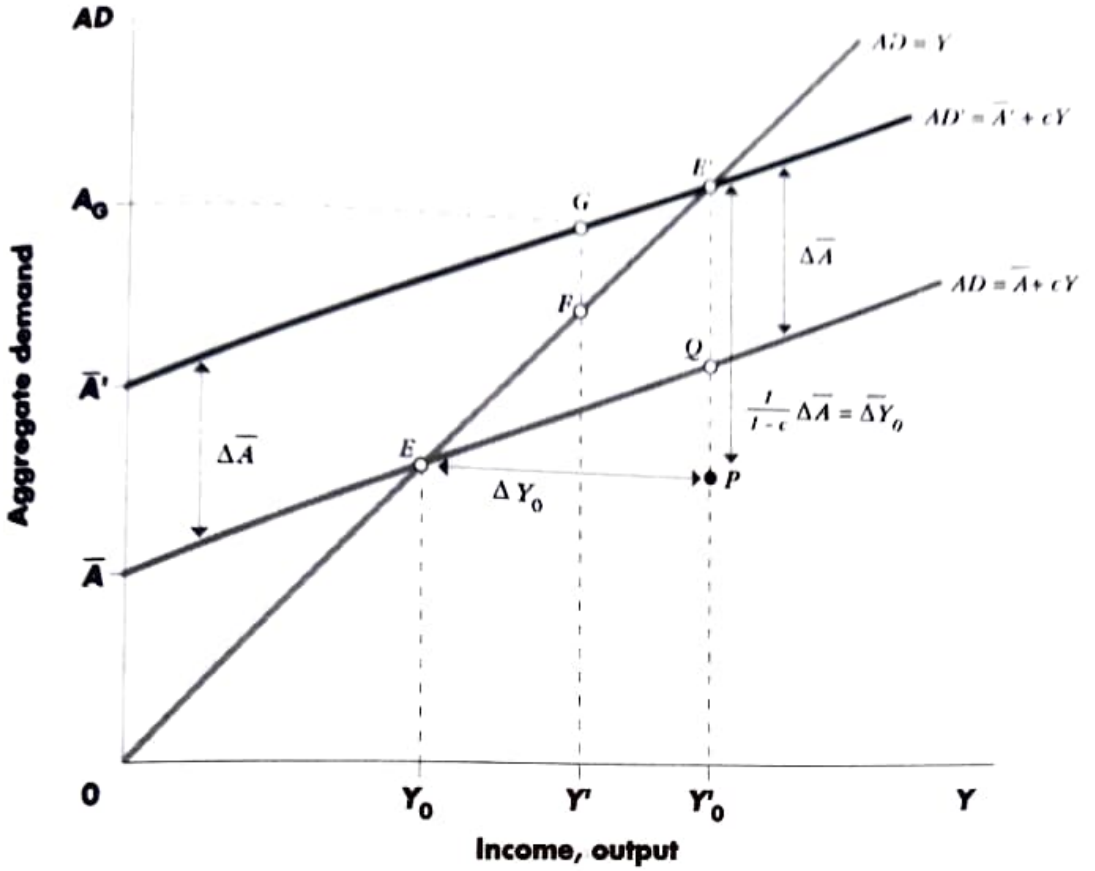

FIGURE 9-3 DERIVATION OF THE MULTIPLIER.

by the parallel shift in the aggregate demand schedule, the larger the income change. Furthermore, the larger the marginal propensity to consume—that is, the steeper the aggregate demand schedule—the larger the income change.

RECAP

There are three points to remember from this discussion of the multiplier:

- An increase in autonomous spending raises the equilibrium level of income.
- The increase in income is a multiple of the increase in autonomous spending.
- The larger the marginal propensity to consume, the larger the multiplier arising from the relation between consumption and income.

9-4 THE GOVERNMENT SECTOR

Whenever there is a recession, people expect and demand that the government do something about it. What can the government do? The government directly affects the level of equilibrium income in two separate ways. First, government purchases of goods and

services, G, are a component of aggregate demand. Second, taxes and transfers affect the relation between output and income, Y, and the *disposable income*—income available for consumption or saving—that accrues to the household, YD. In this section we are concerned with the way in which government purchases, taxes, and transfers affect the equilibrium level of income.

Disposable income (YD) is the net income available for spending by households after they receive transfers from and pay taxes to the government. It thus consists of income plus transfers minus taxes, $Y + TR - TA$. The consumption function is given as in equation (8).

The final step is a specification of *fiscal policy*. **Fiscal policy is the policy of the government with regard to the level of government purchases, the level of transfers, and the tax structure.** We assume that the government purchases a constant amount, $\overline{G}$; that it makes a constant amount of transfers, $\overline{TR}$; and that it imposes a *proportional income tax*, collecting a fraction, t, of income in the form of taxes:

$$G = \overline{G} \qquad TR = \overline{TR} \qquad TA = tY \tag{18}$$

Since tax collections, and therefore YD, C, and AD, depend on the tax rate t, the multiplier depends on the tax rate as we will see below.

With this specification of fiscal policy, we can rewrite the consumption function, after substituting from equation (18) for TR and TA in equation (8), as

$$\begin{aligned} C &= \overline{C} + c(Y + \overline{TR} - tY) \\ &= \overline{C} + c\overline{TR} + c(1 - t)Y \end{aligned} \tag{19}$$

Note in equation (19) that the presence of transfers raises autonomous consumption spending by the marginal propensity to consume out of disposable income, c, times the amount of transfers.[5] Income taxes, by contrast, lower consumption spending at each level of income. That reduction arises because households' consumption is related to *disposable* income rather than income itself, and income taxes reduce disposable income relative to the level of income.

While the marginal propensity to consume out of disposable income remains c, the marginal propensity to consume out of income is now $c(1 - t)$, where $1 - t$ is the fraction of income left after taxes. For example, if the marginal propensity to consume, c, is .8 and the tax rate is .25, the marginal propensity to consume out of income, $c(1 - t)$, is .6 [$= .8 \times (1 - .25)$].

Combining the aggregate demand identity with equations (18) and (19), we have

$$\begin{aligned} AD &= C + I + G + NX \\ &= [\overline{C} + c\overline{TR} + c(1 - t)Y] + \overline{I} + \overline{G} + \overline{NX} \\ &= (\overline{C} + c\overline{TR} + \overline{I} + \overline{G} + \overline{NX}) + c(1 - t)Y \\ &= \overline{A} + c(1 - t)Y \end{aligned} \tag{20}$$

[5]We are assuming no taxes are paid on transfers from the government. As a matter of fact, taxes are paid on some transfers, such as interest payments on the government debt, and not paid on other transfers, such as welfare benefits.

The slope of the AD schedule is flatter because households now have to pay part of every dollar of income in taxes and are left with only $1 - t$ of that dollar. Thus, as equation (20) shows, the marginal propensity to consume out of income is now $c(1 - t)$ instead of c.

EQUILIBRIUM INCOME

We are now set to study income determination when the government is included. We return to the equilibrium condition for the goods market, $Y = AD$, and using equation (19), write the equilibrium condition as

$$Y = \bar{A} + c(1 - t)Y$$

We can solve this equation for Y_0, the equilibrium level of income, by collecting terms in Y:

$$Y[1 - c(1 - t)] = \bar{A}$$

$$Y_0 = \frac{1}{1 - c(1 - t)}(\bar{C} + c\overline{TR} + \bar{I} + \bar{G} + \overline{NX}) \qquad (21)$$

$$Y_0 = \frac{\bar{A}}{1 - c(1 - t)}$$

In comparing equation (21) with equation (12), we see that the government sector makes a substantial difference. It raises autonomous spending by the amount of government purchases, $\bar{G}$, and by the amount of induced spending out of net transfers, $c\overline{TR}$; in addition, the presence of the income tax lowers the multiplier.

INCOME TAXES AND THE MULTIPLIER

Income taxes lower the multiplier, as can be seen from equation (21). If the marginal propensity to consume is .8 and taxes are zero, the multiplier is 5; with the same marginal propensity to consume and a tax rate of .25, the multiplier is cut in half, to $1/[1 - .8(1 - .25)] = 2.5$. Income taxes reduce the multiplier because they reduce the induced increase of consumption out of changes in income. The inclusion of taxes flattens the aggregate demand curve and hence reduces the multiplier.

INCOME TAXES AS AUTOMATIC STABILIZERS

The proportional income tax is one example of the important concept of *automatic stabilizers.* **As you remember, an automatic stabilizer is any mechanism in the economy that automatically—that is, without case-by-case government intervention—reduces the amount by which output changes in response to a change in autonomous demand.**

One explanation of the business cycle is that it is caused by shifts in autonomous demand, especially investment. Sometimes, it is argued, investors are optimistic and investment is high—and so, therefore, is output. But sometimes they are pessimistic, and so both investment and output are low.

Swings in investment demand have a smaller effect on output when automatic stabilizers—such as a proportional income tax, which reduces the multiplier—are in place. This means that in the presence of automatic stabilizers we should expect output to fluctuate less than it would without them.

The proportional income tax is not the only automatic stabilizer.[6] Unemployment benefits enable the unemployed to continue consuming even though they do not have a job, so TR rises when Y falls. This means that demand falls less when someone becomes unemployed and receives benefits than it would if there were no benefits. This, too, makes the multiplier smaller and output more stable. Higher unemployment benefits and income tax rates in the post-World War II period are reasons that the business cycle fluctuations have been less extreme since 1945 than they were earlier.[7]

EFFECTS OF A CHANGE IN FISCAL POLICY

We now consider the effects of changes in fiscal policy on the equilibrium level of income. Consider first a change in government purchases. This case is illustrated in Figure 9-4, where the initial level of income is Y_0. An increase in government purchases is a change in autonomous spending; therefore, the increase shifts the aggregate demand schedule upward by an amount equal to the increase in government purchases. At the initial level of output and income, the demand for goods exceeds output and, accordingly, firms expand production until the new equilibrium, at point E', is reached.

By how much does income expand? Recall that the change in equilibrium income will equal the change in aggregate demand, or

$$\Delta Y_0 = \Delta \bar{G} + c(1 - t)\Delta Y_0$$

where the remaining terms ($\bar{C}$, $\overline{TR}$, $\bar{I}$, and $\overline{NX}$) are constant by assumption. Thus, the change in equilibrium income is

$$\Delta Y_0 = \frac{1}{1 - c(1 - t)}\Delta \bar{G} = \alpha_G \Delta \bar{G} \tag{22}$$

where we have introduced the notation α_G to denote the multiplier in the presence of income taxes:

$$\alpha_G \equiv \frac{1}{1 - c(1 - t)} \tag{23}$$

Thus, a \$1 increase in government purchases will lead to an increase in income in excess of a dollar. With a marginal propensity to consume of $c = .8$ and an income

[6]Automatic stabilizers are discussed by T. Holloway, "The Economy and the Federal Budget: Guide to Automatic Stabilizers," *Survey of Current Business*, July 1984. For a more recent article on automatic stabilizers, see A. Auerbach and D. Feenberg, "The Significance of Federal Taxes as Automatic Stabilizers," *Journal of Economic Perspectives*, Summer 2000.

[7]For a (dissenting) discussion regarding whether U.S. business cycles have become more stable, see C. Romer, "Changes in Business Cycles: Evidence and Explanations," *Journal of Economic Perspectives*, Spring 1999.

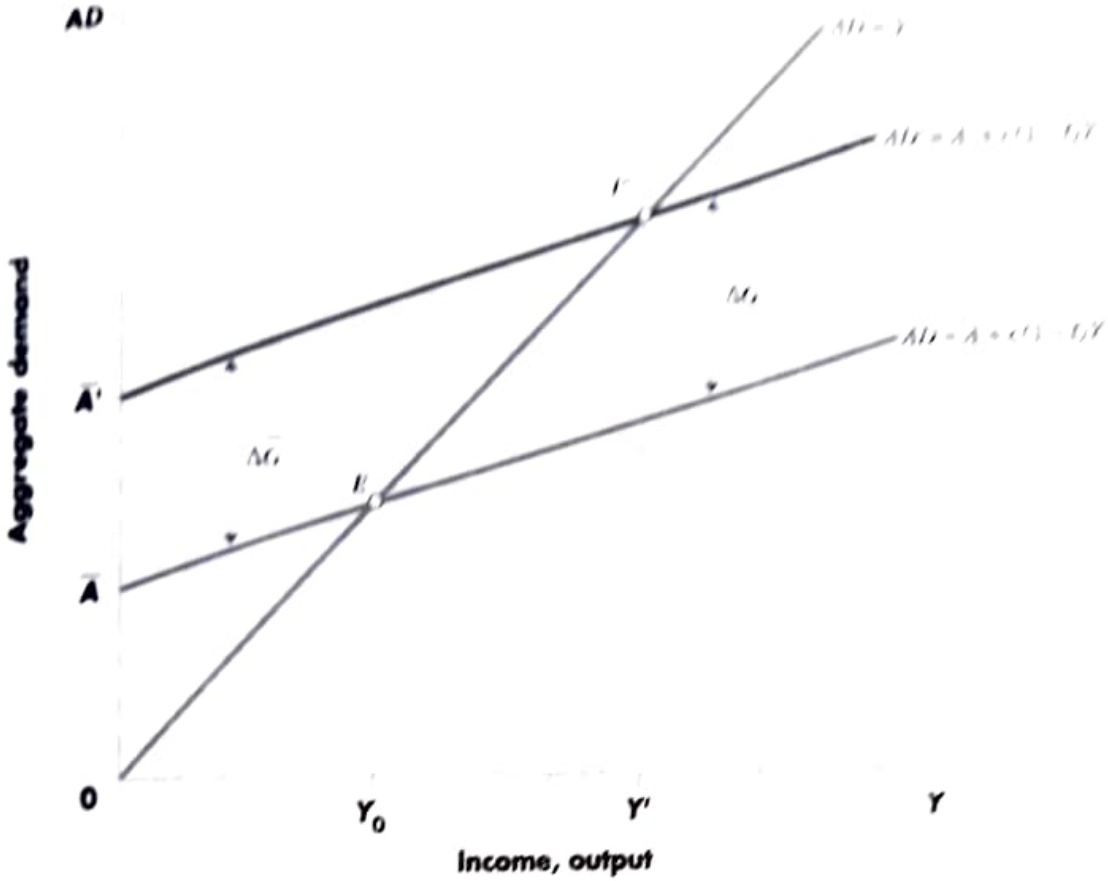

FIGURE 9.4 THE EFFECTS OF AN INCREASE IN GOVERNMENT PURCHASES.

tax rate of $t = .25$, we would have a multiplier of 2.5: A $1 increase in government spending raises equilibrium income by $2.50.

Suppose that instead of raising government spending on goods and services, $\bar{G}$, the government increases transfer payments, $\bar{TR}$. Autonomous spending, $\bar{A}$, will increase by only $c\Delta\bar{TR}$, so output will rise by $\alpha_t \times c\Delta\bar{TR}$. The multiplier for transfer payments is smaller than that for government spending—by a factor c—because part of any increase in $\bar{TR}$ is saved.

If the government raises marginal tax rates, two things happen. The direct effect is that aggregate demand will be reduced since the increased taxes reduce disposable income and therefore consumption. In addition, the multiplier will be smaller, so shocks will have a smaller effect on aggregate demand.

RECAP

- Government purchases and transfer payments act like increases in autonomous spending in their effects on income.
- A proportional income tax reduces the proportion of each extra dollar of output that is received as disposable income by consumers, and thus it has the same effects on income as a reduction in the propensity to consume.
- A proportional income tax is an automatic stabilizer.
- A reduction in transfers lowers output.

IMPLICATIONS

Since the theory we are developing implies that changes in government spending and taxes affect the level of income, it seems that fiscal policy can be used to stabilize the economy. When the economy is in a recession, or growing slowly, perhaps taxes should be cut or spending increased to get output to rise. And when the economy is booming, perhaps taxes should be increased or government spending cut to get back down to full employment. Indeed, fiscal policy is used actively to try to stabilize the economy, as in 2001, when the Bush administration created a short-term stimulus through tax refunds and tax cuts.

9-5 THE BUDGET

Government budget deficits were the norm in the United States in the last quarter of the twentieth century. At the turn of the millennium, the U.S. federal budget moved into surplus. The long period of peacetime deficits may be a historical anomaly; Figure 9-5 shows that the federal government typically ran surpluses in peacetime and deficits during wars, although the cuts in 2001 raised questions about whether the surplus would

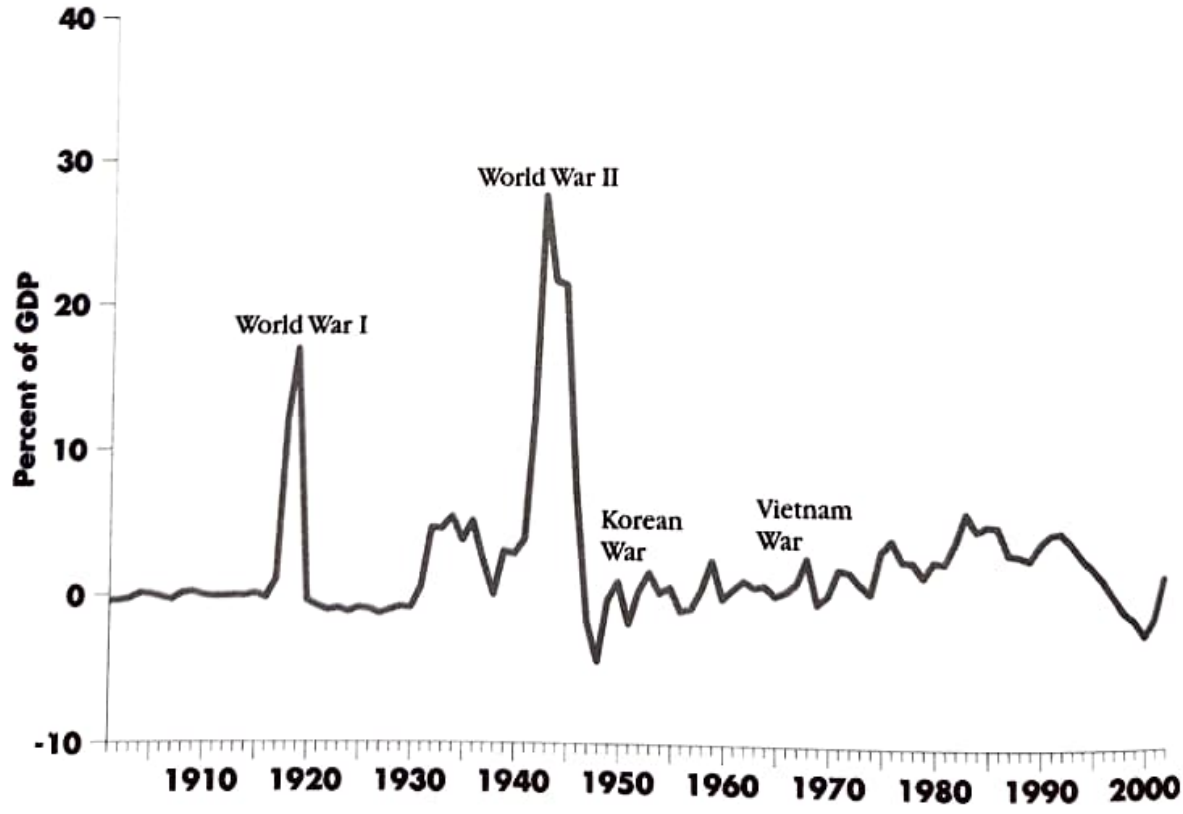

FIGURE 9-5 U.S. GOVERNMENT BUDGET DEFICIT AS A PERCENTAGE OF GDP, 1901–2002. (*Source:* www.economagic.com; *and* Historical Statistics of the United States, Colonial Times to 1957.)

persist. Canada and the United Kingdom have also recently turned from budget deficit to budget surplus.[8]

The budget surplus on which the media and politicians focus is the federal budget surplus, which in 2000 was $206 billion, or around 2.1 percent of GDP.[9] "Government" in the national income accounts consists of all levels of government—federal, state, and local. State and local governments tend to run small (less than 1 percent of GDP) surpluses in boom years and small deficits in recession years. In 2000, the state and local surplus was $18.0 billion, about 0.2 percent of GDP.

Is there a reason for concern over a budget deficit? The fear is that the government's borrowing makes it difficult for private firms to borrow and invest and thus slows the economy's growth. Full understanding of this concern has to wait until later chapters, but this section serves as an introduction, dealing with the government budget, its effects on output, and the effects of output on the budget.

The first important concept is the *budget surplus,* denoted by *BS.* **The budget surplus is the excess of the government's revenues, taxes, over its total expenditures, consisting of purchases of goods and services and transfer payments:**

$$BS \equiv TA - \overline{G} - \overline{TR} \tag{24}$$

A negative budget surplus, an excess of expenditure over revenues, is a *budget deficit.*

Substituting in equation (24) the assumption of a proportional income tax that yields tax revenues $TA = tY$ gives us

$$BS = tY - \overline{G} - \overline{TR} \tag{24a}$$

Figure 9-6 plots the budget surplus as a function of the level of income for given $\overline{G}$, $\overline{TR}$, and income tax rate, t. At low levels of income, the budget is in deficit (the surplus is negative) because government spending, $\overline{G} + \overline{TR}$, exceeds income tax collection. At high levels of income, by contrast, the budget shows a surplus, since income tax collection exceeds expenditures in the form of government purchases and transfers.

Figure 9-6 shows that the budget deficit depends not only on the government's policy choices, reflected in the tax rate (t), purchases ($\overline{G}$), and transfers ($\overline{TR}$), but also on anything else that shifts the level of income. For instance, suppose there is an increase in investment demand that increases the level of output. Then the budget deficit will fall or the surplus will increase because tax revenues have risen. But the government has done nothing that changed the deficit.

We should, accordingly, not be surprised to see budget deficits in recessions, periods when the government's tax receipts are low. And in practice, transfer payments,

[8]Other countries with recent budget surpluses include Bahrain (2.2 percent of GDP in 2000), Denmark (1.59 percent of GDP in 2000), and Singapore (10 percent of GDP in 2000).

[9]The federal budget in the United States is officially divided into "on-budget" and "off-budget" items. When we use the terms "budget deficit" or "surplus" in the text, we're referring to the "unified budget," the sum of on- and off-budget items. The off-budget budget surplus is pretty much the current surplus in the social security program. At the beginning of the twenty-first century, almost all of the unified budget surplus came from the off-budget side. A note on budget measurement: while most of us think in terms of a calendar year, the U.S. federal government uses a fiscal year beginning in October of the previous year for budget calculations.

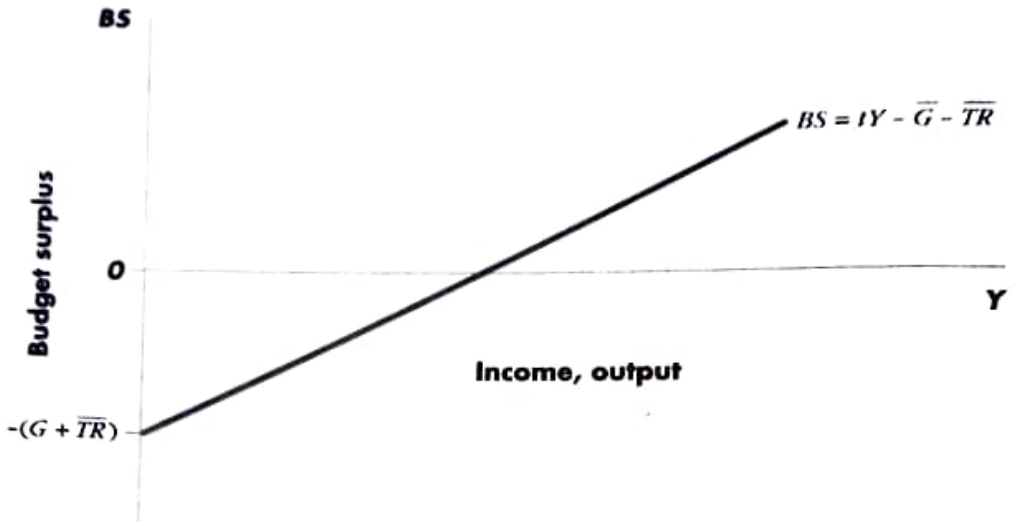

FIGURE 9-6 THE BUDGET SURPLUS.

through unemployment benefits, also increase during recessions, even though we are taking $\overline{TR}$, as autonomous in our model.

EFFECTS OF GOVERNMENT PURCHASES AND TAX CHANGES ON THE BUDGET SURPLUS

Next we show how changes in fiscal policy affect the budget. In particular, we want to find out whether an increase in government purchases must reduce the budget surplus. At first sight, this appears obvious, because increased government purchases, from equation (24), are reflected in a reduced surplus or an increased deficit. On further thought, however, the increased government purchases will cause an increase (multiplied) in income and therefore increased income tax collection. This raises the interesting possibility that tax collection might increase by more than government purchases.

A brief calculation shows that the first guess is right: Increased government purchases reduce the budget surplus. From equation (22) we see that the change in income due to increased government purchases is equal to $\Delta Y_0 \equiv \alpha_G \Delta \overline{G}$. A fraction of that increase in income is collected in the form of taxes, so tax revenue increases by $t\alpha_G \Delta \overline{G}$. The change in the budget surplus, using equation (23) to substitute for α_G, is therefore

$$\begin{aligned} \Delta BS &= \Delta TA - \Delta \overline{G} \\ &= t\alpha_G \Delta \overline{G} - \Delta \overline{G} \\ &= \left[\frac{t}{1 - c(1 - t)} - 1 \right] \Delta \overline{G} \\ &= -\frac{(1 - c)(1 - t)}{1 - c(1 - t)} \Delta \overline{G} \end{aligned} \tag{25}$$

which is unambiguously negative.

We have therefore shown that an increase in government purchases will reduce the budget surplus, although in this model by considerably less than the increase in purchases. For instance, for $t = .8$ and $t = .25$, a $1 increase in government purchases will create a $0.375 reduction in the surplus.

In the same way, we can consider the effects of an increase in the tax rate on the budget surplus. We know that the increase in the tax rate will reduce the level of income. It might thus appear that an increase in the tax rate, keeping the level of government spending constant, could reduce the budget surplus. In fact, an increase in the tax rate increases the budget surplus, despite the reduction in income that it causes, as you are asked to show in the problem set at the end of this chapter.[14]

We signal here another interesting result known as the *balanced budget multiplier*. Suppose government spending and taxes are raised in equal amounts and thus in the new equilibrium the budget surplus is unchanged. By how much will output rise? The answer is that for this special experiment the multiplier is equal to 1—output rises by the increase in government spending and no more.

9-6

THE FULL-EMPLOYMENT BUDGET SURPLUS

The final topic to be treated here is the concept of the full-employment budget surplus.[15] Recall that increases in taxes add to the surplus and that increases in government expenditures reduce the surplus. Increases in taxes have been shown to reduce the level of income; increases in government purchases and transfers, to increase the level of income. It thus seems that the budget surplus is a convenient, simple measure of the overall effects of fiscal policy on the economy. For instance, when the budget is in deficit, we would say that fiscal policy is expansionary, tending to increase GDP.

However, the budget surplus by itself suffers from a serious defect as a measure of the direction of fiscal policy. The defect is that the surplus can change because of changes in autonomous private spending—as can be seen in Figure 9-4. Thus, an increase in the budget deficit does not necessarily mean that the government has changed its policy in an attempt to increase the level of income.

Since we frequently want to measure the way in which fiscal policy is being used to affect the level of income, we require some measure of policy that is independent of the particular position of the business cycle—boom or recession—in which we may find ourselves. Such a measure is provided by the *full-employment budget surplus*, which we denote by BS^*. The full-employment budget surplus measures the budget

[14] The theory that tax rate cuts would increase government revenue (or tax rate increases reduce government revenue) is associated with Arthur Laffer, formerly at the University of Chicago and University of Southern California. Laffer's argument, however, did not depend on the aggregate demand effects of tax cuts but, rather, on the possibility that a tax cut would lead people to work more. This is a strand in supply-side economics, which we examined in Chap. 5.

[15] The concept has a long history; it was first used by E. Cary Brown, "Fiscal Policy in the Thirties: A Reappraisal," *American Economic Review*, December 1956.

surplus at the full-employment level of income or at potential output. Using Y^* to denote the full-employment level of income, we can write

$$BS^* = tY^* - \bar{G} - \overline{TR} \tag{26}$$

There are other names for the full-employment surplus. Among them are the *cyclically adjusted surplus* (or deficit), the *high-employment surplus*, the *standardized budget surplus*, and the *structural surplus*. These new names all refer to the same concept as the full-employment surplus, but they avoid implying that there is a unique level of full-employment output that the economy has not yet reached. They suggest, reasonably, that the concept is merely a convenient measuring rod that fixes a given level of employment as the reference point.

To see the difference between the actual and the full-employment budgets, we subtract the actual budget surplus in equation (24*a*) from the full-employment budget surplus in equation (26) to obtain

$$BS^* - BS = t(Y^* - Y) \tag{27}$$

The only difference arises from income tax collection.[12] Specifically, if output is below full employment, the full-employment surplus exceeds the actual surplus. Conversely, if actual output exceeds full-employment (or potential) output, the full-employment surplus is less than the actual surplus. The difference between the actual and the full-employment budget is the *cyclical* component of the budget. In a recession the cyclical component tends to show a deficit, and in a boom there may even be a surplus.

We next look at the full-employment budget deficit shown in Figure 9-7. Public concern about the deficit mounted in the 1980s. For many economists, the behavior of the deficit during the high-unemployment years 1982 and 1983 was not especially worrisome. The actual budget is usually in deficit during recessions. But the shift toward deficit of the full-employment budget was regarded as an entirely different matter.

Two final words of warning: First, there is no certainty as to the true full-employment level of output. Various assumptions about the level of unemployment that corresponds to full employment are possible. The usual assumptions now are that full employment means an unemployment rate of about 5 to 5.5 percent, although when the actual unemployment rate was higher, there were some estimates as high as 7 percent. Estimates of the full-employment deficit or surplus will differ depending on the assumptions made about the economy at full employment.

Second, the high-employment surplus is not a perfect measure of the thrust of fiscal policy. There are several reasons for this: A change in spending with a matching increase in taxes, leaving the deficit unchanged, will raise income; expectations about future fiscal policy changes can affect current income; and in general, because fiscal

[12]In practice, transfer payments, such as welfare and unemployment benefits, are also affected by the state of the economy, so *TR* also depends on the level of income. But the major cause of differences between the actual surplus and the full-employment surplus is taxes. Automatic movements in taxes caused by a change in income are about five times the size of automatic movements in spending. (See T. M. Holloway and J. C. Wakefield, "Sources of Change in the Federal Government Deficit, 1970–86," *Survey of Current Business*, May 1985.)

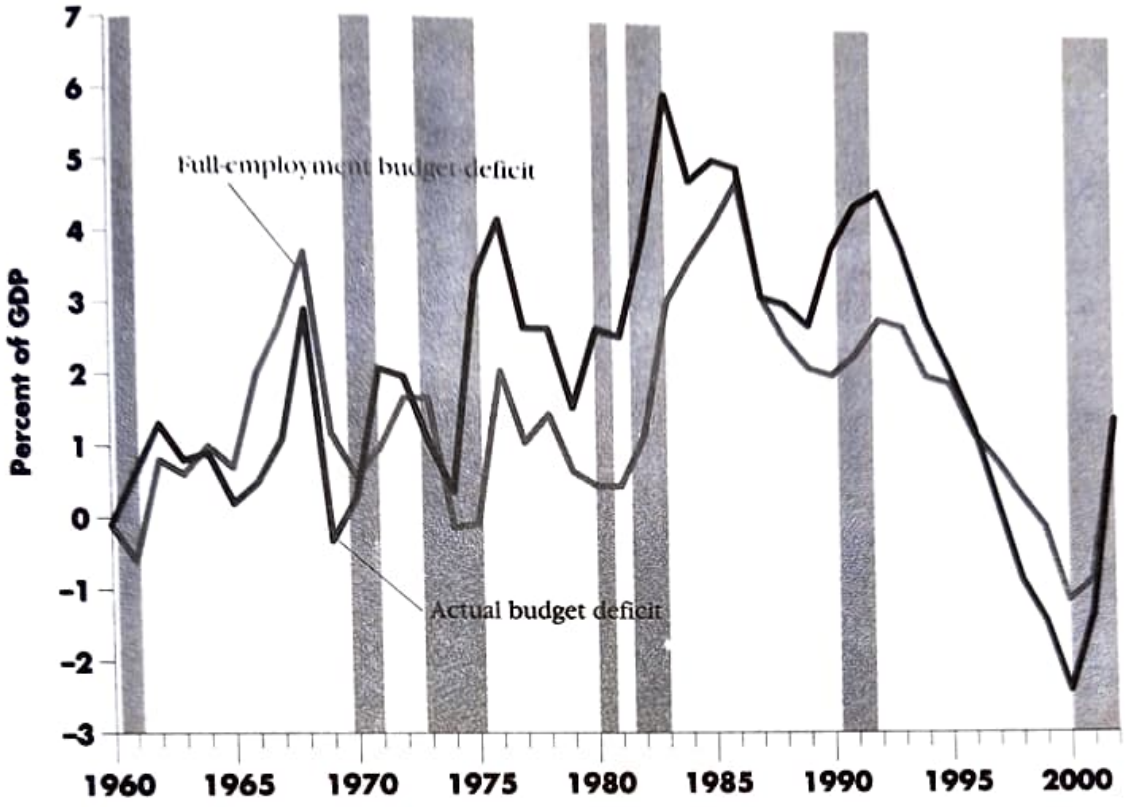

FIGURE 9-7 ACTUAL AND FULL-EMPLOYMENT BUDGET DEFICIT.
(Source: Congressional Budget Office, www.cbo.gov.)

policy involves the setting of a number of variables—the tax rate, transfers, and government purchases—it is difficult to describe the thrust of fiscal policy perfectly with a single number. But the high-employment surplus is nevertheless a useful guide to the direction of fiscal policy.[13]

SUMMARY

1. Output is at its equilibrium level when the aggregate demand for goods is equal to the level of output.
2. Aggregate demand consists of planned spending by households on consumption, by firms on investment goods, and by government on its purchases of goods and services and also includes net exports.
3. When output is at its equilibrium level, there are no unintended changes in inventories and all economic units are making precisely the purchases they had planned

[13]For further discussion of the full-employment deficit and alternative measures of fiscal policy, see Congressional Budget Office, *The Economic Outlook,* February 1984, appendix B; and Darrel Cohen, *A Comparison of Fiscal Measures Using Reduced Form Techniques,* Board of Governors of the Federal Reserve System, 1989. Early each year the Congressional Budget Office publishes *The Economic and Budget Outlook,* which contains an analysis of current fiscal policy and estimates of the full-employment budget. Much information about the budget and budget surplus is available online at www.cbo.gov.

to. An adjustment process for the level of output based on the accumulation or run-down of inventories leads the economy to the equilibrium output level.

4. The level of aggregate demand is itself affected by the level of output (equal to the level of income) because consumption demand depends on the level of income.
5. The consumption function relates consumption spending to income. Consumption rises with income. Income that is not consumed is saved, so the savings function can be derived from the consumption function.
6. The multiplier is the amount by which a $1 change in autonomous spending changes the equilibrium level of output. The greater the propensity to consume, the higher the multiplier.
7. Government purchases and government transfer payments act like increases in autonomous spending in their effects on the equilibrium level of income. A proportional income tax has the same effect on the equilibrium level of income as a reduction in the propensity to consume. A proportional income tax thus reduces the multiplier.
8. The budget surplus is the excess of government receipts over expenditures. When the government is spending more than it receives, the budget is in deficit. The size of the budget surplus (or deficit) is affected by the government's fiscal policy variables—government purchases, transfer payments, and tax rates.
9. The actual budget surplus is also affected by changes in tax collection and transfers resulting from movements in the level of income that occur because of changes in private autonomous spending. The full-employment (high-employment) budget surplus is used as a measure of the active use of fiscal policy. The full-employment surplus measures the budget surplus that would exist if output were at its potential (full-employment) level.

KEY TERMS

aggregate demand
automatic stabilizer
balanced budget multiplier
budget constraint
budget deficit
budget surplus
consumption function
disposable income
equilibrium level of output
fiscal policy
full-employment budget surplus
marginal propensity to consume
marginal propensity to save
multiplier

PROBLEMS

Conceptual

1. We call the model of income determination developed in this chapter a *Keynesian* one. What makes it Keynesian, as opposed to classical?
2. What is an autonomous variable? What components of aggregate demand have we specified, in this chapter, as being autonomous?
3. Using your knowledge of the amount of time required for the many components of the federal government to agree upon and implement changes in policy (i.e., tax codes, the welfare system), can you think of any problems with using fiscal policy to stabilize the economy?