18.4 The Government Budget Constraint

In 2012, the amount of federal debt held by the public was equal to \$11.6 trillion, or more than \$37,000 per person. That is, the federal government has borrowed about \$150,000 for every family of four in the United States. Is this a lot or a little? How much *can* the federal government borrow? And how does this borrowing affect the economy?

The starting point for answering these questions is what we can call the **flow version of the government budget constraint**. It is based on a standard accounting identity that says the sources of funds to the government must equal the uses of funds by the government. That is,

$$\underbrace{G_t + Tr_t + iB_t}_{\text{uses}} = \underbrace{T_t + \Delta B_{t+1} + \Delta M_{t+1}}_{\text{sources}}. \qquad (18.1)$$

This equation is called the flow version because it must hold in each period. We first encountered an equation like this in Chapter 8 when we studied the fiscal causes of high inflation. The version here includes a few extra terms, so we'll go through them carefully.

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The left side of the equation says that the government can use its funds to purchase goods and services, denoted G_t; for transfer payments, denoted Tr_t (unemployment insurance, Social Security, and welfare payments); and to pay interest on the debt. The existing stock of government debt is B_t (the B denotes "borrowing" or "bonds"); this is the stock of debt held at the start of period t. For simplicity, we assume the nominal interest rate is constant at i.

The right side of the equation describes the sources of government funds. The government can obtain funds through taxes T_t, which in the United States are the main source. It can also obtain them by borrowing. And since B_t is the total amount borrowed so far, ΔB_{t+1} is the amount of new borrowing; it can also be written as $\Delta B_{t+1} = B_{t+1} - B_t$. In other words, ΔB_{t+1} is the dollar value of the funds obtained by selling government bonds. Finally, the third source of funds is printing money: ΔM_{t+1} is the change in the stock of money—the amount of new money that is printed. To simplify our presentation, we will assume $\Delta M_{t+1} = 0$ for the rest of this chapter. That is, we assume none of the government finance comes about through printing money. As discussed in Chapter 8, this is a reasonable assumption for the United States.

We can simplify this budget constraint further by assuming transfer payments Tr_t are also zero. This is really just to make our notation easier; if you'd like, think of transfer payments as being included in G_t in what follows.

With these simplifications, the government budget constraint can be rearranged in a useful way. Since $\Delta B_{t+1} = B_{t+1} - B_t$, the budget constraint in equation (18.1) can be rewritten as

$$B_{t+1} = (1 + i)B_t + \underbrace{G_t - T_t}_{\text{deficit}}. \tag{18.2}$$

This equation says that the stock of debt at the start of next year is equal to the sum of three terms. The first is the stock of debt this year, including the required interest payments. The last two terms capture the extent to which current spending (G_t) exceeds tax revenues (T_t). That is, it is a measure of the budget deficit. Budget deficits cause the government debt to increase, other things being equal.

An important subtlety is involved here. Standard measures of budget deficits include interest payments on the government debt as a part of spending; this was true, for example, in Table 18.1. In studying the deficit, however, it proves convenient to separate out the interest payments, as we've done in equation (18.2). The measure $G_t - T_t$ is commonly referred to as the **primary deficit**, while $G_t + iB_t - T_t$ is called the **total deficit**. That is, the primary deficit excludes spending on interest, while the total deficit includes it. (A similar distinction—primary versus total—applies to the budget surplus and the budget balance.)

The Intertemporal Budget Constraint

Budget constraints play a central role in economics. Most of the insights to be gained from these constraints can be found by thinking about a simple example. Suppose an economy exists for two periods, period 1 and period 2. The world of this economy begins in period 1 and ends after period 2. What does the government budget constraint look like?

In this short-lived economy, there are actually two flow-version budget constraints, one for each period. If we apply the formula in equation (18.2), the budget constraint for period 1 is

$$B_2 = (1 + i)B_1 + G_1 - T_1. \tag{18.3}$$

All of the terms in this equation should make sense to you, except perhaps for B_1. This variable is the amount of debt that the government has outstanding when the economy starts. Even though our economy can't have accumulated any debt yet, this will prove a useful term. To see why, suppose we employed this model to study the United States. Period 1 could represent the country today, and period 2 could represent it in the future. A value of $B_1 = \$5$ trillion would capture the fact that the U.S. government begins today with a large outstanding debt.

There is a similar budget constraint for period 2:

$$B_3 = (1 + i)B_2 + G_2 - T_2 = 0. \tag{18.4}$$

But why do these terms now equal zero? The reason is that B_3 is the total amount the government owes at the beginning of period 3, but our economy ends after period 2. No one will be willing to make new loans to the government during period 2—they would never be repaid, since the world is coming to an end. Therefore, it must be the case that B_3 is equal to zero. This is simply another way of saying that all debts must be repaid before the world ends.

Now we are ready for an important result. We use the period 2 budget constraint to solve for B_2, and substitute the result back into the period 1 budget constraint. We are left with **the intertemporal budget constraint:**[1]

$$\underbrace{G_1 + \frac{G_2}{1+i}}_{\text{pdv of spending}} + \underbrace{(1+i)B_1}_{\text{initial debt}} = \underbrace{T_1 + \frac{T_2}{1+i}}_{\text{pdv of taxes}} \tag{18.5}$$

To see how this equation gets its name, think about its interpretation. First, suppose $B_1 = 0$: when the economy begins, there is no outstanding government debt. In this case, the left-hand side of the equation is the present discounted value (pdv) of government spending: G_1 is spending today, and $G_2/(1 + i)$ is spending in the future. (We divide by $1 + i$ to compute the present value of the future spending.) So both terms on the left are valued as of period 1.

The right-hand side of the equation is the present discounted value of tax revenues. Therefore, the intertemporal budget constraint says that *the present discounted value of government spending must equal the present discounted value of tax revenues.*

[1] Here are the details of the derivation. If we use the period 2 budget constraint to solve for B_2, we find that $B_2 = (T_2 - G_2)/(1 + i)$. Now substitute this expression for B_2 back into equation (18.3). Collecting the spending terms on one side and the tax terms on the other gives the intertemporal budget constraint.

Now let's consider an economy where B_1 is allowed to differ from zero. Suppose B_1 = \$5 trillion, as is roughly the case in the U.S. economy today. What is the logic of the government budget constraint in this case? Here, the present value of tax revenues must be enough to cover current and future spending and to pay off the debt the economy starts with.[2]

According to this version of the intertemporal budget constraint, the present discounted value of uses of funds (spending plus paying off the initial debt) must equal the present discounted value of the sources of funds (taxes). Like the flow version, the intertemporal budget constraint yields a "uses = sources" interpretation, but now the uses and sources are measured in present discounted value.

An alternate version of the intertemporal budget constraint is also useful. Suppose we collect the tax and spending terms on the same side of the equation. In our two-period example, the intertemporal budget constraint in equation (18.5) can be written as

$$\underbrace{(T_1 - G_1)}_{\text{period 1 balance}} + \underbrace{\frac{(T_2 - G_2)}{1 + i}}_{\text{period 2 balance}} = \underbrace{(1 + i)B_1}_{\text{initial debt}}. \qquad (18.6)$$

If $B_1 = 0$, the intertemporal budget constraint says that the present discounted value of the government's budget balance (the left-hand side of the equation) must equal zero. The government is allowed to borrow or lend in any given period. But what must be true is that any borrowing in period 1 gets offset by a surplus in period 2. If $T_1 - G_1$ is −\$1,000, then $T_2 - G_2$ must equal +\$1,000 in present discounted value. *The government's budget must balance—not period by period, but rather in a present discounted value sense.*

If, again, B_1 = \$5 trillion, the present discounted value of the budget balance going forward from today must be enough to pay off the initial stock of outstanding debt. Not only must future surpluses and deficits offset, but we must run more surpluses in the future in order to pay off the existing debt today. Higher taxes in the future are one implication of borrowing today.

Although our example entailed two periods, the logic of the intertemporal budget constraint applies no matter how many time periods there are. At the end of the chapter, you will get a chance to derive the constraint for a three-period economy.