*The Multiplier*

The most important question about fiscal policy is the size of the *multiplier*. **The multiplier** is the ratio between the change in the government budget position and the resulting change in output or GDP. For example, if we think that an increase in government spending of $10 billion will result in GDP rising by $15 billion, then the multiplier would be 1.5. (In this case, there would be $5 billiion of *induced* private spending, on top of the government spending.)

Here is one way to think about the multiplier. Suppose the city of New York spends a bunch of money – on expanding the subway, let's say. The subway expansion itself counts in *G*, government final expenditure, and adds to GDP. But each person who receives an income from the project will spend some of it. Some of the income will be saved, or spent on imported goods, or paid in taxes but some will be spent on local goods and services. The sellers of those goods and services then receive income, some of which will be spent locally in turn. And the people who receive *that* income will spend some of it, and so on.

Because there are *leakages* at each stage, the increase in spending will come to an end eventually. But the total increase will be greater than original spending. The multiplier tells us, if we add up all the additional spending how does it compare to the original government spending that started the process? It is clear that if people spend a lot of their income on locally produced goods and services, the multiplier will be high; if large fractions of income are saved, taxed, and spent on imported goods, the multiplier will be low.[1]

*The algebra of the multiplier*

We can express the logic of the multiplier with algebra. This is useful because it lets us make a *quantitative* estimate of how large the multiplier might be, and what factors will make it larger or smaller.
Start with the national income identity:

$$Y = C + I + G + (X - M)$$

Now we make some additional assumptions. First, we will take government spending, exports and (for the moment) investment to be *exogenous* – that is, fixed or detrmined outside the model.[2]

$$I = I_0$$

[1] Remember, a large multiplier does not mean that GDP will be high. What it means is that GDP will change a lot in response to changes in government spending (and to changes in taxes, and changes in other forsm of autonomous expenditure).

[2] To say something is exogenous means that we are taking it as given – our model does not try to explain it. The variables a model does explain are called *endogeous*. In this case, *Y*, *C* and *M* are endogenous.

$$G = G_0$$

$$X = X_0$$

Consumption, on the other hand, we think depends strongly on current income. There is also an exogenous componenet, $C_0$, but most consumption spending, we thnk, depends on current income.[3]
We write this relationship as

[3] I am writing $c$ for the marginal propensity to consume. The textbook uses $MPC$ instead of $c$. You can use either one.

$$C = C_0 + c(1 - t)Y$$

For example, if $c = 0.75$ then each dollar of additional disposable income would cause 75 cents of additional consumption spending. $t$ is the *marginal tax rate* on income. This is included because consumption is based on **disposable income**, that is income after taxes.

Finally, we think a fixed share of spending goes to imports:

$$M = mY$$

For example, if $m = 0.2$, then 20 cents out of each new dollar spent in the economy goes to imports, leaving the circular flow.

Let's combine the exogenous terms into a single variable, *autonomous* spending:

$$A = G_0 + C_0 + I_0 + X_0$$

And instead of using $c$, the marginal propensity to consume, let's use $s$, the marginal propensity to save. Since all disposable income is either consumed or saved, that means:

$$s = 1 - c$$

Then we have

$$Y = A + (1 - t)(1 - s)Y - mY$$

$$sY + tY - stY + mY = A$$

$$Y(s + t - st + m) = A$$

$$Y = A\left(\frac{1}{s + t - st + m}\right)$$

The term in parentheses is the *multiplier*.

What we can see here is that the larger are the various leakages, the smaller will be the multiplier. If savings, taxes and imports are

low, the multiplier will be large; if savings, taxes and imports are high, the multiplier will be small. It's possible for the multiplier to be less than one.[4] But, in this simple model, it will always be positive. In other words, no matter how high are tax rates, imports and saving, an increase in government spending will always lead to some increase in total output.

[4] If the multiplier is less than one, that means that an increase in government spending will lead to a decrease in total private spending on domestic goods.

Let's fill in some plausible numbers for the US. Imports in the US are about 15% of national income, but we know that the import share reliably rises in booms and falls in recessions. In other words, the marginal import propensity is higher than the average import propensity. Statistical evidence suggests that in the US, a 1% rise in income typically leads to a 2% rise in imports. (In other words, the *income elasticity* of imports seems to be around 2 in the US.) So a reasonable value for $m$ is around 0.3. Savings are quite low in the US, and consumption responds strongly to current income.On the other hand, savings also includes *retained earnings* – corporate profits that are not paid out to shareholders. Overall, $s = 0.2$ is a reasonable first guess. Finally, federal taxes are around 15% of GDP. Some of these taxes, like corporate profit taxes, vary more than proportionately with income, while others, like inheritance taxes, don't vary much with current income at all. Transfers also include payments that vary with income, like Medicaid and unemployment benefits, and payments that don't vary with income, including the two largest transfers, Medicare and Social Security. Overall, a value of 0.2 seems reasonable for $t$ as well.

Put these estimates together and we have:

$$Y = A\left(\frac{1}{0.3 + 0.2 + 0.2 - 0.04}\right) = A\left(\frac{1}{0.66}\right) \approx A \times 1.5$$

As it happens, 1.5 is quite close to many recent *econometric* estimates of the multiplier based on historical data.