The Multiplier Effect of Fiscal Policy

We analyze the multiplier effect of fiscal policy—changes in government expenditure and taxation.

The key result is that an increase in the government budget deficit causes a proportional increase in consumption.

Keynesian Cross Macroeconomic Model

Consider a standard Keynesian cross macroeconomic model, in which production adjusts to equal demand. Consumption demand c plus investment demand i plus government expenditure g equals national income and product y,

$$c + i + g \equiv y. \tag{1}$$

Investment and government expenditure are exogenous.

Government Budget Deficit

The government budget deficit is government expenditure g minus taxes t. Government expenditure refers to spending on goods and services. Transfer payments—social security benefits, unemployment benefits, welfare benefits—together with the interest on government debt are classified as negative taxes.

Disposable Income Versus National Income

Disposable income y_d is after-tax income, national income minus taxes,

$$y_d \equiv y - t. \tag{2}$$

We assume that consumption demand is an increasing function

$$c(y_d) \tag{3}$$

of disposable income.

Marginal Propensity to Consume

Let mpc_d denote the marginal propensity to consume out of disposable income; an increase of disposable income by one dollar raises consumption demand by mpc_d. Let τ denote the marginal tax rate, the increase in taxes when national income rises by one dollar.

Together mpc_d and τ determine mpc, the marginal propensity to consume out of national income, the increase in consumption demand when national income rises by one dollar. If national income rises by one dollar, then disposable income rises by $1-\tau$; consequently consumption demand rises by

$$(1-\tau)mpc_d = mpc.$$

Numerical Example

Consider a numerical model. Suppose that the marginal tax rate is $\tau = 1/3$, and the marginal propensity to consume out of disposable income is $mpc_d = 9/10$. If national income rises by one dollar, then disposable income rises by $2/3$. Consumption then rises by $mpc = 9/10 \times 2/3 = 3/5$, the marginal propensity to consume out of national income.

The Multiplier Effect and the Consumption Function

The results below are derived entirely from (1), (2), and (3). The first two relationships necessarily hold, as they are accounting identities. Consequently the consumption function (3) is the only behavioral relationship. As long as consumption is determined solely by disposable income, the results below must hold.

The Effect of Fiscal Policy on Consumption

We work out the multiplier effect of a change in government expenditure and taxation. Let Δ denote the change in a variable. If government expenditure changes by Δg and taxes change by Δt, then $\Delta g - \Delta t$ is the change in the government budget deficit.

Consumption and the Deficit

Below we derive the fiscal policy multiplier (8): the multiplier effect on consumption of fiscal policy is simply that consumption changes in proportion to the change in the deficit. If fiscal policy changes, but without any change in the deficit, then consumption is unaffected. If fiscal policy changes and the deficit increases, then consumption rises in proportion.

Mathematical Derivation

By (1), the change in consumption plus the change in government expenditure equals the change in national income,

$$\Delta c + \Delta g = \Delta y, \tag{4}$$

since investment is exogenous.

By (2), the change in disposable income equals the change in national income minus the change in taxes,

$$\Delta y_d = \Delta y - \Delta t. \tag{5}$$

By (3), the change in consumption is the marginal propensity to consume out of disposable income multiplied by the change in disposable income,

$$\Delta c = mpc_d \Delta y_d. \tag{6}$$

Substituting from (5) into (4) eliminates y:

$$\Delta c + \Delta g = \Delta y_d + \Delta t. \tag{7}$$

Next, eliminate y_d by substituting from (6):

$$\Delta c + \Delta g = \Delta c / mpc_d + \Delta t.$$

The Fiscal Policy Multiplier

Solving for Δc then gives our key result, the *fiscal policy multiplier*:

$$\Delta c = \frac{mpc_d}{1 - mpc_d}(\Delta g - \Delta t). \tag{8}$$

The change in consumption is proportional to the change in the government deficit.

The Balanced-Budget Multiplier

That the *balance-budget multiplier* equals one is an implication. Suppose that the government expenditure and taxes both rise by one dollar, so that the government deficit is unaffected. By (8), consumption is unaffected. Hence the national income and product rises by only one dollar, but not by more.

Although the extra one-dollar production to meet the additional government demand does increase national income by one dollar, the one-dollar rise in taxes offsets this increase. Disposable income is unaffected, so consumption does not change.

The Multiplier for Government Expenditure

The fiscal multiplier is consistent with the standard Keynesian multiplier theory. In the standard theory, an increase in government expenditure has the multiplier effect

$$\Delta y = \frac{1}{1 - mpc} \Delta g. \tag{9}$$

Since the change in consumption is $\Delta c = \Delta y - \Delta g$, therefore

$$\Delta c = \frac{mpc}{1 - mpc} \Delta g. \tag{10}$$

Numerical Example

Although one can show by algebra that the two alternate expressions (8) and (10) for the multiplier are consistent, here we just show consistency in a numerical example.

We continue with the numerical model above. The marginal tax rate is $\tau = 1/3$, and the marginal propensity to consume out of disposable income is $mpc_d = 9/10$, so the marginal propensity to consume out of national income is

$$mpc = (1-\tau)mpc_d = 3/5.$$

Suppose that government expenditure rises by one dollar.
By (9), national income rises by $\Delta y = 1/(1-3/5) = 2\ 1/2$;
thus consumption rises by $1\ 1/2$.

In the fiscal policy multiplier formula (8), the coefficient multiplying the change in the deficit is

$$mpc_d/(1-mpc_d) = (9/10)/(1-9/10) = 9,$$

so an increase in the government deficit of only one dollar would raise consumption by nine dollars, a large amount.

However, the increase in the deficit is small: as national income rises, taxes rise. The increase in taxes is the marginal tax rate times the change in national income, $\Delta t = (1/3) \times 2\,1/2 = 5/6$, almost as much as the increase in government expenditure.

The increase in the deficit is only $\Delta g - \Delta t = 1 - 5/6 = 1/6$. Using (8), we evaluate

$$\Delta c = \left(\frac{mpc_d}{1 - mpc_d} \right) (\Delta g - \Delta t) = 9 \times \frac{1}{6} = 1\frac{1}{2},$$

which is consistent with the standard multiplier.

The Tax Multiplier

Let us consider the effect of a one-dollar cut in the level of taxes: for any given income, the level of taxes falls by one dollar, but the marginal tax rate stays constant. The tax cut causes a multiplier process that raises national income and product.

Multiplier Process

Initially, the tax cut raises disposable income by one dollar, which raises consumption demand. Firms produce to meet demand, so national product rises. National income equals national product, so national income necessarily rises by the same amount. Since national income is higher, consumption demand increases. Firms produce to meet this additional demand, so national product rises. National income rises by the same amount, which then induces a further increase in consumption demand. More demand causes more product, implying more income, and in turn yet more demand.

The following sequence spells out the exact effects:

taxes down by one,
disposable income up, $\Delta y_d = 1$

consumption demand up because income up, $\Delta c_1 = mpc_d \Delta y_d$
national product up by increase in demand, $\Delta y_1 = \Delta c_1$
national income up same as product, $\Delta y_1 = mpc_d$

consumption demand up because income up, $\Delta c_2 = mpc \Delta y_1$
product up by increase in demand, $\Delta y_2 = \Delta c_2$
income up same as product, $\Delta y_2 = mpc_d mpc$

consumption demand up because income up, $\Delta c_3 = mpc \Delta y_2$
product up by increase in demand, $\Delta y_3 = \Delta c_3$
income up same as product, $\Delta y_3 = mpc_d mpc^2$

etc.

In each round of the multiplier process, the effect on national income and product is less, because the marginal propensity to consume is less than one.

Total Effect

The increase in consumption is the same as the increase in the national income and product. The total increase is sum of the round-by-round increases,

$$\begin{aligned}\Delta c &= \Delta y \\ &= \Delta y_1 + \Delta y_2 + \Delta y_3 + \Delta y_4 + \cdots \\ &= mpc_d + mpc_d mpc + mpc_d mpc^2 + mpc_d mpc^3 + \cdots .\end{aligned}$$

Infinite Geometric Sum

The total increase is an infinite geometric sum, an expression of the form

$$a + ab + ab^2 + ab^3 + \ldots = \frac{a}{1-b}.$$

Here the first term is $a = mpc_d$, and the ratio of successive terms is $b = mpc$, so the overall effect on consumption and income is

$$\Delta c = \Delta y = \frac{mpc_d}{1-mpc}. \tag{11}$$

Numerical Example

Using our numerical model, we show that the fiscal policy multiplier (8) is consistent with the tax multiplier (11).

In the numerical model, $mpc_d = 9/10$ and $mpc = 3/5$, so the tax multiplier is

$$\Delta c = \Delta y = \frac{\frac{9}{10}}{1 - \frac{3}{5}} = 2\frac{1}{4}.$$

Since the tax cut causes national income to increase, taxes rise by the marginal tax rate times the increase in national income, $1/3 \times 9/4 = 3/4$.

The net decrease in taxes is the one-dollar tax cut less the $3/4$-dollar rise in taxes, $1 - 3/4 = 1/4$. Substituting into (8) gives

$$\Delta c = \left(\frac{mpc_d}{1 - mpc_d} \right) (-\Delta t) = 9 \times \frac{1}{4} = 2\frac{1}{4}.$$

Thus the two multiplier formulas are consistent.

The Crowding Out of Investment

Seeing one assumption in this analysis is faulty, some critics have attacked the fiscal policy multiplier theory. They argue one cannot take investment as exogenous. If the government budget deficit increases, this deficit must be financed. Financing the deficit takes saving from the private sector, which causes investment to decrease. Fiscal policy “crowds out” investment.

False Criticism

This criticism is, however, faulty. An increase in the government deficit causes income to rise. As income rises, saving rises.

It turns out that the increase in saving is *exactly* equal to the increase in the deficit. This extra saving finances the higher deficit, so there is no reason why investment must be crowded out.

We demonstrate this relationship. By definition, saving is income minus spending. Private saving is disposable income minus consumption, $s \equiv y_d - c$. Rearranging expression (7) above yields

$$\Delta g - \Delta t = \Delta y_d - \Delta c \equiv \Delta s,$$

Thus the increase in the deficit exactly equals the change in private saving, and this extra saving finances the deficit.