Otemon Economic Studies, 1 (1968)

FISCAL POLICY AND ECONOMIC GROWTH

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The role of fiscal policy in a growing economy was disscussed by John G. Gurley, Warren L. Smith, E. Carry Brown, Arthur Smithies, Richard A. Musgrave, and David C. Smith.[1] This paper attempts to make a brief review of the treatments of fiscal policy in growth model by these authors.

One of the functions of fiscal policy in a growing economy is to attain balanced growth, that is to say, equality of the required rate of growth and the rate of growth of demand. The required rate of growth is the rate at which national income is required to grow for utilizing the productive capacity of the economy fully, which is independent of the type of investment function used in an economic system. The rate of growth of demand is the rate at which actual aggregate demand grows in an economic system, which varies depending on the nature ofthe investment function. The two rates in one particular economic system do not always correspond to each other. In the short-run Keynesian system in which the productive capacity is given, stabilization means adjusting aggregate demand alone to utilize the given productive capacity; while in the long-run system where potential output grows, stabilization means attaining equality between the required rate of growth and the rate of growth of demand.

First, we shall derive the required rate of growth with fiscal-policy parameters, and then show the effects of the changes in fiscal parameters on such a rate. Next, we shall derive the rates of demand growth in various economic systems and clarify the effects of the changes in fiscal parameters on those rates.

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1) John G. Gurley, "Fiscal Policy in a Growing Economy," *Journal of Political Economy*, Vol. LXI, No. 6, December, 1953, pp. 523–535; Warren L. Smith, "Professor Gurley on Fiscal Policy in a Growing Economy," *Journal of Political Economy*, Vol. LXII, No. 5, October, 1954, pp. 440–442 and "Monetary-Fiscal Policy and Economic Growth," *Quarterly Journal of Economics*, Vol. LXXI, No. 1, February, 1957, pp. 36–55; E. Cary Brown, "Fiscal Policy in a Growing Economy: A Further Word," *Journal of Political Economy*, Vol. LXIV, No. 2, April, 1956, pp. 170–172; Arthur Smithies, "The Control of Inflation," *Review of Economics and Statistics*, Vol. XXXIX, No. 3, August, 1957, pp. 272–283; Richard A. Musgrave, *The Theory of Public Finance*, 1959; and David C. Smith, "Monetary-Fiscal Policy and Economic Growth in an Open Economy," *Quarterly Journal of Economics*, Vol. LXXIV, No. 4, November, 1960, pp. 614–632.

Finally, we shall consider the appropriate alterations of government parameters in equalizing the required rate of growth and the actual rate of demand growth. We shall ignore the monetary effects of fiscal policy on aggregate demand.[2] Our discussion is confined to a closed economy.[3]

I *Required Rate of Growth with Fiscal Parameters*

Domar's required rate of growth was derived on the assumption of a private closed economy. Our task is to obtain the required rate of growth for a mixed closed economy which is analogous to Domar's one. We divide the required growth rate into two kinds, depending on whether we ignore the capacity-creating effects of government expenditures or not.

(a) *The Case of Ignored Capacity-Creating Effects of Government Expenditures*[4]

We begin with the supply side of the problem. In this case, since we ignore the capacity-generating nature of government expenditures, it is only private investment that increases productive capacity. Assuming that an increase in productive capacity in any period, $Y'_t - Y'_{t-1}$, is equal to a certain fraction, σ, of private net investment, I_{t-1}, in the last period, we can write;

$$(1)\quad Y'_t - Y'_{t-1} = \sigma I_{t-1}$$

Turning to the demand side of the picture, we assume the following equation system.

$$(2)\quad Y_t = C_t + I_t + G_t$$
$$(3)\quad C_t = c(Y_t - T_t)$$
$$(4)\quad T_t = tY_t$$
$$(5)\quad G_t = gY_t$$

Here Y is national income, C private consumption, I private investment, G government expenditures for goods and services, c average and marginal propensity to consume from disposable income, t the ratio of taxes to national income, and g the ratio of government expenditures to aggregate demand.

From (2), (3), (4), and (5), we obtain the following equation:

2) R. A. Musgrave, *op. cit.*, pp. 550–553 deals with these effects.

3) D. C. Smith, *op. cit.*, considers the problem in a growth model with international economic relations.

4) The formulations of W. L. Smith, A. Smithies, and D. C. Smith are of this case.

$$(6)\quad \Delta Y_t = \frac{1}{1-c(1-t)-g}\Delta I_t$$

For growth to be balanced, a change in aggregate demand and a change in productive capacity must be equal; that is, it is necessary that $Y'_t - Y'_{t-1} = \Delta Y_t$ $(=Y_t - Y_{t-1})$.

Setting (1) equal to (6), we obtain the following equation which gives the growth rate of investment required for equilibrium growth.

$$(7)\quad \frac{\Delta I^r_t}{I^r_{t-1}} = \sigma[1-c(1-t)-g]$$

On the assumption that the values of c, t and g are constant and average, the right side also shows the rate of growth required to utilize the productive capacity fully. We can rewrite (7) as follows:

$$(8)\quad R = \sigma[1-c(1-t)-g]$$

(b) *The Case of Capacity-Creating Effects of Government Expenditures Allowed for*[5)]

In this case, the productive capacity of the economy is increased by government expenditures as well as private investment. Assuming that increase in output capacity in any period is equal to a fraction, σ, of private investment and capacity-creating government expenditure, H, in the last period, we can write for the supply side:

$$(9)\quad Y'_t - Y'_{t-1} = \sigma(I_{t-1} + H_{t-1})$$

And, assuming that the capacity-creating government expenditures, H, is a certain fraction, γ, of total government expenditures, G, we can rewrite (9) as follows:

$$(10)\quad Y'_t - Y'_{t-1} = \sigma(I_{t-1} + \gamma G_{t-1})$$

Setting (10) equal to (6), we obtain (11)

$$(11)\quad \frac{\Delta I_t}{I_{t-1} + \gamma G_{t-1}} = \frac{\Delta I_t}{I_{t-1} + \gamma g Y_{t-1}} = \sigma[1-c(1-t)-g]$$

On the assumption that c, g and t are constant and average, we obtain

5) This case is adopted by J. G. Gurley and R. A. Musgrave.

$$(12) \quad R=\frac{\Delta I^r_t}{I^r_{t-1}}=\sigma[1-c(1-t)-g(1-\gamma)]$$

for the required rate of income growth.

II *Effects of Changes in Fiscal Parameters on Required Rate of Growth*

Equations (8) and (12) showing the required rate of growth contain fiscal parameters. This implies that changes in such parameters affect the required rate of growth. We can know the effects of fiscal alterations upon the required rate of growth by differentiating it partially with respect to fiscal parameters.

(a) *The Case of the Capacity-Generating Effects of Government Expenditures Ignored*

Differentiating (8) partially with respect to fiscal parameter, g and t, respectively, we obtain the following equations:

$$(13) \quad \frac{\partial R}{\partial g}=-\sigma<0$$

$$(14) \quad \frac{\partial R}{\partial t}=\sigma c>0$$

From (13) and (14), it is seen that a decrease in g or an increase in t lowers the required rate of growth, and *vice versa.*

The Balanced-Budget Case. In the case of balanced budget the required rate of growth can be obtained by setting $g=t$ in (8):

$$(15) \quad R=\sigma(1-c)(1-g)$$

Differentiating (15) partially with respect to g, we obtain the following equation:

$$(16) \quad \frac{\partial R}{\partial g}=-\sigma(1-c)<0$$

From (16) it is seen that an increase in g under the balanced budget lowers the required rate of growth, and *vice versa.*

(b) *The Case of the Capacity-Creating Effects of Government Expenditures Allowed for*

Differentiating (12) partially with respect to g, t and γ respectively, we obtain the following equations:

(17) $\dfrac{\partial R}{\partial g}=-\sigma(1-\gamma)\leqq 0$ according as $\gamma\leqq 1$

(18) $\dfrac{\partial R}{\partial t}=\sigma c>0$

(19) $\dfrac{\partial R}{\partial \gamma}=\sigma g>0$

First, from (17) it is seen that an increase in the fraction of government expenditures in aggregate demand lowers the required rate of growth so long as unproductive expenditures are contained by total government expenditures, and raises the required rate if all government expenditures are productive, and *vice versa*. Second, from (18) we can know that an increase in the tax rate always raises the required rate of growth, and *vice versa*. Finally, apparently from (19), a change in the ratio of capacity-creating government expenditures in total government expenditures has the same directional effects as a change in tax rate.

The Balanced-Budget Case. Setting $g=t$ in (12), we obtain

(20) $R=\sigma[1-c-g(1-c-\gamma)]$

Differentiating (20) partially with respect to g and γ respectively, the following equations are obtained:

(21) $\dfrac{\partial R}{\partial g}=-\sigma[(1-c)-\gamma]\gtreqqless 0$ according as $1-c\gtreqqless\gamma$

(22) $\dfrac{\partial R}{\partial \gamma}=\sigma g>0$

Unlike in the case of the ignored capacity-creating nature of government expenditures, changes in g in this case have different effects on R, depending on the relation of $1-c$ and γ. Changes in γ have the same effects on R as in the other case.

III *Rate of Growth of Demand*

In the previous sections we derived the required rate of growth containing fiscal parameters and clarified the influences of various changes in such parameters on it. What we must do next is to derive the rate at which actual demand grows and the effects changes in government parameters give on this rate.

The actual rate of demand growth varies depending on the nature of investment function in the relevant economic system.

Investment as a Function of the Level of Past Income

We assume that investment depends on the level of income in the last period. The investment of this type in the texts may be subdivided into two cases; one is a function of the disposable income of the last period[6] and the other is a function of the last business profits after tax.[7]

(*1*) *Investment as a Function of the Disposable Income of the Last Period*

The system in this case is written as follows

(2) $Y_t = C_t + I_t + G_t$

(3) $C_t = c(Y_t - T_t)$

(4) $T_t = tY_t$

(5) $G_t = gY_t$

(23) $I_t = b(Y_{t-1} - T_{t-1})$

The equations (2) to (5) are self-explanatory. The equation (23) gives the investment function of this case. This can be rewritten:

$$I_t = b(1-t)Y_{t-1}$$

Substituting among (2), (3), (4), (5) and (23), and solving for Y_t/Y_{t-1}, we obtain

$$\frac{Y_t}{Y_{t-1}} = \frac{b(1-t)}{1-c(1-t)-g}$$

By subtracting 1 from both sides of the above equation, we obtain

$$(24) \quad \frac{Y_t - Y_{t-1}}{Y_{t-1}} = \frac{b(1-t)}{1-c(1-t)-g} - 1 = R^d$$

for the rate of demand growth in the present system. The effects of changes in fiscal parameters on the rate of growth of demand is shown by the following partial derivatives:

$$(25) \quad \frac{\partial R^d}{\partial g} = \frac{b(1-t)}{[1-c(1-t)-g]^2} > 0$$

6) R. A. Musgrave, *op. cit.*, p. 489.

7) W. L. Smith, *op. cit.*, adopts this type of investment function.

$$(26) \quad \frac{\partial R^d}{\partial t} = \frac{-b(1-g)}{[1-c(1-t)-g]^2} < 0$$

The Balanced-Budget Case. Setting $g=t$ in (24), one obtains

$$(27) \quad R^d = \frac{b}{1-c} - 1$$

for the rate of demand growth in the case of a balanced budget. The following partial derivative of R^d with respect to g gives the effect of fiscal change on the demand growth rate in this case.

$$(28) \quad \frac{\partial R^d}{\partial g} = 0$$

(2) *Investment as a Function of the Business Profits after Tax in the Last Period*

This system can be written as follows:

$$(2) \quad Y_t = C_t + I_t + G_t$$
$$(3) \quad C_t = c(Y_t - T_t)$$
$$(4) \quad T_t = tY_t$$
$$(5) \quad G_t = gY_t$$
$$(29) \quad I_t = d(P_{t-1} - T^p_{t-1})$$
$$(30) \quad P_t = pY_t$$
$$(31) \quad T^p_t = wT_t$$

The equations (2), (3), (4) and (5) have already been introduced. The equation (29) gives an investment function in which the investment of any one period depends on the business profits after tax in the last period. Here T^p is the tax on the business profits, P, and therefore $P-T^p$ is the profits after tax. Equation (30) shows the relation between business profits and aggregate income. Equation (31) gives the relation between the tax on business profits and taxes. Substituting among (29), (30) and (31), and solving for I_t, we obtain

$$I_t = d(p-wt)Y_{t-1}$$

Now let us derive the rate of growth of demand for the above system. Substituting among (2), (3), (4), (5), (29), (30), and (31), and solving for Y_t/Y_{t-1}, we obtain

$$\frac{Y_t}{Y_{t-1}}=\frac{d(p-wt)}{1-c(1-t)-g}$$

Subtracting 1 from both sides of the above equation, we obtain

$$(32)\quad R^d=\frac{Y_t-Y_{t-1}}{Y_{t-1}}=\frac{d(p-wt)}{1-c(1-t)-g}-1$$

for the actual rate of growth of demand.

The effects of fiscal changes on the rate of demand growth are given by the following partial derivatives of R^d with respect to each fiscal parameter:

$$(33)\quad \frac{\partial R^d}{\partial g}=\frac{d(p-wt)}{[1-c(1-t)-g]^2}>0$$

$$(34)\quad \frac{\partial R^d}{\partial t}=\frac{-d[w\{1-c(1-t)-g\}+c(p-wt)]}{[1-c(1-t)-g]^2}<0$$

The Balanced-Budget Case. By setting $g=t$ in (32), we obtain

$$(35)\quad R^d=\frac{d(p-wg)}{(1-c)(1-g)}-1$$

for the rate of demand growth in the balanced budget case. It follows from (35) that

$$(36)\quad \frac{\partial R^d}{\partial g}=\frac{d(p-w)}{(1-c)(1-g)^2}\gtreqless 0 \text{ according as } p\gtreqless w$$

System with the Accelerator Type of Investment Function

The role of fiscal policy in a growing economy was treated by some writers with regard to the system with the accelerator type of investment function.[8] Such type investment function may be distinguished between (1) investment which depends on changes in income in the current period,[9] and (2) investment which depends on both the changes in and the level of disposable income in the current period.[10]

(*1*) *Investment Depending on Changes in Income in the Current Period*

The investment function of this case is written:

8) J. G. Gurley, *op. cit.*, E. C. Brown, *op. cit.*, and R. A. Musgrave, *op. cit.*
9) E. C. Brown, *op. cit.*, and R. A. Musgrave, *op. cit.*
10) J. G. Gurley, *op. cit.*

(37) $I_t=\beta(Y_t-Y_{t-1})$

From (2), (3), (4), (5) and (37), we obtain

$$(38)\quad R^d=\frac{-\beta}{1-c(1-t)-g-\beta}-1$$

for the rate of growth of demand of this system.

The effects of alterations in fiscal parameters on the rate of growth of demand are shown by the following partial derivatives:

$$(39)\quad \frac{\partial R^d}{\partial g}=\frac{-\beta}{[1-c(1-t)-g-\beta]^2}<0$$

$$(40)\quad \frac{\partial R^d}{\partial t}=\frac{c\beta}{[1-c(1-t)-g-\beta]^2}>0$$

The Balanced-Budget Case. By setting $g=t$ in (38), we obtain

$$(41)\quad R^d=\frac{-\beta}{(1-c)(1-g)-\beta}-1$$

for the rate of growth of demand in this case. The partial derivative of R^d with respect to g becomes as follows:

$$(42)\quad \frac{\partial R^d}{\partial g}=\frac{\beta(1-c)}{[(1-c)(1-g)-\beta]^2}>0$$

(2) *Investment Depending on Both Changes in Disposable Income and Level of Disposable Income in the Current Period*

The investment function of this case can be written as follows:

(43) $I_t=e(1-t)(Y_t-Y_{t-1})+u(1-t)Y_t$

The rate of growth of demand in this system can be derived in a similar way. That is,

$$(44)\quad R^d=\frac{-e(1-t)}{1-(1-t)(c+e+u)-g}-1$$

It follows from (44) that

$$(45)\quad \frac{\partial R^d}{\partial g}=\frac{-e(1-t)}{[1-(1-t)(c+e+u)-g]^2}<0$$

$$(46)\quad \frac{\partial R^d}{\partial t}=\frac{e(1+g)}{[1-(1-t)(c+e+u)-g]^2}>0$$

The Balanced-Budget Case. The rate of demand growth in this case can be obtained by setting $g=t$ in (44). That is

$$(47)\quad R^d=\frac{-e}{1-c-e-u}-1$$

From (47)

$$(48)\quad \frac{\partial R^d}{\partial g}=0$$

IV *Balanced Growth by Fiscal Policy*

So far we have clarified the effects of changes in fiscal parameters on the required rate of growth and the rate of growth of demand. We are now in a position to know in which direction to alter fiscal parameters in order to prevent the deviation of the two rates.

It is an insoluble question here whether we should take account of the capacity-creating nature of government expenditures in defining the required rate of growth or not. It is also a difficult question to answer which type of investment function is the most realistic one. Setting aside these questions, we shall consider the appropriate fiscal changes in attaining equality between the required growth rate and the actual demand growth rate.

Let us take as an example the system in which investment is a function of the disposable income in the last period. For the time being, we shall ignore the capacity-generating nature of government expenditures. Suppose that the rate of demand growth exceeds the required rate of growth, that is $R^d>R$. In order to attain $R^d=R$, the government should reduce R^d and raise R. We can know the proper changes in g from (13) and (25). In this situation the government should decrease g. The government can also attain the same result by altering t. The proper change in t can be known from (26) and (14). The government must increase t.

Next, we shall allow for the capacity-creating effects of government expenditures. In this case the government could use the alterations of γ as well as g and t in order to attain the desired objective, though the changes in γ affect only the required rate of growth.

In the situation where the rate of growth of demand falls short of the required rate of growth, that is $R^d < R$, the government should raise R^d and lower R. To do so, it must alter the fiscal parameters in the opposite direction to the case of $R^d > R$.

The similar expositions of the proper fiscal policy are possible for the other systems which have different types of investment functions. In whatever case, when we attempt to adjust the required rate of growth, we can know the proper direction of alteration in the fiscal parameters from (13), (14), (16), (17), (18), (19), (21) and (22). We can know the right adjustments of the actual demand growth rates from the partial derivatives of such rates with respect to the fiscal parameters in the relevant system.