Introductory Macroeconomics

Pre-Tutorial #4
Week Starting 29 March 2021

The Tutorial. This week's tutorial provides more examples of working with the Keynesian model.

Note that your tutor is under no obligation to go through the answers to the pre-tutorial work in detail. The focus in the tutorial will be on the tutorial work itself – the questions here are preparatory.

Reading Guide. You should look carefully over your lecture notes for Weeks 3 and 4. You may also find Chapter 8 of BOFAH useful.

Key Concepts. Fiscal policy. The multiplier. Leakeages and injections.

Problems.

1. Consider a Keynesian model where net taxes collected depend on the state of the economy

$$T = \bar{T} + tY$$

with marginal tax rate t. The rest of the economy is standard

$$\begin{aligned} C &= \bar{C} + c(Y - T) \\ I &= \bar{I} \\ G &= \bar{G} \end{aligned}$$

Suppose the specific numerical values $\bar{C} = 1600$, $\bar{I} = 1000$, $\bar{G} = 1800$, marginal propensity to consume $c = 0.8$, and for the tax system $\bar{T} = 3000$ and marginal tax rate $t = 0.01$ (okay, so this tax rate is not descriptively realistic — just go with it).

   (a) Find a numerical equation relating planned aggregate expenditure to output.

   (b) Solve for short-run equilibrium output.

   (c) Suppose potential output is $Y^* = 10000$. What marginal tax rate t would achieve full employment?

   (d) Show your result graphically using the 45-degree diagram and explain how the change in the marginal tax rate t identified in part (c) has enabled full employment to be achieved.

2. Using the Keynesian model described in Question 1 above, derive an expression for the multiplier

$$\frac{dY}{d\bar{G}}$$

associated with an increase in government purchases $\bar{G}$. Explain how the value of the government purchases multiplier varies depending on the value of the marginal propensity to consume c and the marginal tax rate t.

Solutions to Pre-Tutorial Work.

1. (a) Write planned aggregate expenditure as

$$PAE = C + I + G$$

Substituting in the given equations

$$PAE = \bar{C} + c(Y - \bar{T} - tY) + \bar{I} + \bar{G}$$

where $\bar{C} = 1600, c = 0.8, \bar{T} = 3000, t = 0.01, \bar{I} = 1000$, and $\bar{G} = 1800$. If we plug these values into the right hand side, we get a numerical equation relating PAE to output Y.

(b) If we impose in equilibrium that $PAE = Y$ and collect terms we get

$$(1 - c + ct)Y = \bar{C} - c\bar{T} + \bar{I} + \bar{G}$$

Hence

$$Y = \frac{1}{1 - c + ct}\left(\bar{C} - c\bar{T} + \bar{I} + \bar{G}\right) \qquad (*)$$

Plugging in the given numerical vaues

$$Y = \frac{1}{1 - 0.8 + 0.8(0.01)}(1600 - 0.8(3000) + 1000 + 1800) = 9615.4$$

(c) We can use equation $(*)$ to solve this problem. We look for the value of t that makes $Y = Y^* = 10000$, that is, the value of t that solves

$$10000 == \frac{1}{1 - 0.8 + 0.8t}(1600 - 0.8(3000) + 1000 + 1800)$$

This is equivalent to

$$10000(1 - 0.8 + 0.8t) = 2000$$

which solves for $t = 0$. That is, we need the marginal tax rate to be set to equal zero to achieve a level of output of $Y = Y^* = 10000$.

(d) The first key feature is that PAE is parallel to consumption but higher by the amount of $\bar{I} + \bar{G}$. The second key feature of the diagram is that the reduction in the tax rate makes the PAE curve *steeper*. Looking at our equation for PAE we can see the slope is given by $c(1 - t)$. A decrease in the tax rate increases after-tax disposable income (other things equal). Households now retain a larger amount of disposable income as income increases. This increases consumption for any given level of Y with the marginal propensity to consume, c, unchanged.

2. Following the steps to get equation $(*)$ above, short-run equilibrium output is given by

$$Y = \frac{1}{1 - c + ct}\left(\bar{C} - c\bar{T} + \bar{I} + \bar{G}\right)$$

The government purchases multiplier is given by the derivative of Y with respect to $\bar{G}$, namely

$$\frac{dY}{d\bar{G}} = \frac{1}{1 - c + ct}$$

If c increases (and assuming $t < 1$), then the denominator becomes smaller and hence the multiplier becomes larger. If t increases, then the denominator becomes larger and the multiplier becomes smaller.