

## Problem Set 1

### Solution to Question 1

The Goods Market Equilibrium is represented by the IS curve with the following equation:  $Y = c_0 + c_1(Y-T) + I + G$ , where

$Y$  = output

$C$  = consumption,  $C = c_0 + c_1(Y-T)$

$Y_d$  = disposable income,  $Y_d = Y-T$

$T$  = taxes

$I$  = investment

$G$  = government spending

Assumption:  $G$  and  $I$  constant and exogenous.

(a) What will happen to  $Y$  when  $G$  increases by 1?

First solve the IS-equation for  $Y$ :

$$\begin{aligned} Y &= c_0 + c_1(Y-T) + I + G \\ Y &= c_0 + c_1Y - c_1T + I + G \\ Y - c_1Y &= c_0 - c_1T + I + G \\ Y(1-c_1) &= c_0 - c_1T + I + G \\ Y &= \frac{G}{1-c_1} + \frac{c_0 - c_1T + I}{1-c_1} \end{aligned}$$

Then differentiate  $Y$  with respect to  $G$ :

$\frac{dY}{dG} = \frac{1}{1-c_1} > 0$  by assumption  $0 < c_1 < 1$  as people are likely to consume only part of any increase in  $Y_d$  and save the rest.

Summary: if  $G$  increases by 1 unit,  $Y$  increases by  $\frac{1}{1-c_1}$  units.  $\frac{1}{1-c_1}$  is simply the multiplier of government spending based on  $c_1$ , which is the marginal propensity to consume or MPC.

(b) What will happen to  $Y$  when  $T$  increases by 1?

First solve the IS-equation for  $Y$ : see above for (a)

$$Y(1-c_1) = c_0 - c_1T + I + G$$

$$Y = \frac{c_0 + I + G}{1 - c_1} - \frac{c_1 T}{1 - c_1}$$

Then differentiate Y with respect to T:

$$\frac{dY}{dT} = -\frac{c_1}{1 - c_1} < 0 \text{ by assumption } 0 < c_1 < 1$$

Summary: if T increases by 1 unit, Y decreases by  $\frac{c_1}{1 - c_1}$  units.

(c) The answers differ because government spending affects demand and output directly, but taxes affect demand and output indirectly through consumption  $C = c_1(Y - T)$  and propensity to consume  $c_1 < 1$ .

(d) Balanced budget changes: G increases by the same amount as T increases. Balanced budget changes in G and T are only macro-economically neutral if  $dY = 0$ . That means that the output does not change.

According to our case:

$$dY = dG + dT = \frac{1}{1 - c_1} - \frac{c_1}{1 - c_1} = \frac{1 - c_1}{1 - c_1} = 1$$

The change in level of output equals 1.

Summary: Balanced budget changes in G and T are not macro-economically neutral as  $dY \neq 0$ .

(e) The marginal propensity to consume  $c_1$  does not affect Y because  $dY = 1$  and  $dT = 1$ . They both increase by 1 unit, so  $Y_d$  and C do not change:

$$dY_d = dY - dT = 0 \Rightarrow dC = 0 \text{ as } c_1(dY - dT) = 0$$

The balanced budget tax increase aborts the multiplier process of  $c_1$ .