

## 1.2.2) Comparative Static analysis in Math framework

Having solved for the equilibrium solution, what economists usually ask is what would happen to the equilibrium if something, previously assumed to be fixed, has changed.

**Example 1.C (cont.): National income model**

HW in class

- From the example 1.B, it is straightforward to solve for all the endogenous equilibrium solutions,  $Y^*$ ,  $C^*$ ,  $Y_d^*$ .

Firstly, suppose  $C = a + bY_d$  (consumption); linear func  
and others are  $Y_d = Y - T$  (disposable income),  
 $T = T_0$  (tax),  $I = I_0$  (investment),  $G = G_0$  (gov.),  
equilibrium condition is  $Y = C + I + G$   
→ substitute or plug these listed macro equations  
into the equilibrium condition  
⇒  $Y = a + bY_d + I_0 + G_0$   
 $= a + b(Y - T_0) + I_0 + G_0$   
 $= bY + a - bT_0 + I_0 + G_0$   
 $= \frac{a - bT_0 + I_0 + G_0}{1 - b}$  → endogenous equilibrium income solution → equilibrium income function  
derivative  $(\frac{dY}{dI})$

- Numerically, if  $a = 1$ ,  $T_0 = \$0$ ,  $I_0 = \$1$ ,  $G_0 = \$1$  and  $b = 0.5$ , this yields us,

$$Y = \frac{a - bT_0 + I_0 + G_0}{1 - b}$$

$I_0$  changes →  $Y$   
so,  $\frac{\Delta Y}{\Delta I} = \frac{1}{1 - b}$

$$= \frac{1 - 0.5(0) + 1 + 1}{1 - 0.5}$$

$$= \frac{3}{0.5}$$

$$= 6$$

$b = mpc$  if  $0 < b = mpc < 1$  and  $0 < 1 - b < 1$   
magnitude or size → if  $b$  is large size of  $\frac{1}{1 - b}$  big / small  
So,  $b$  is the key of size  
large

**Question:** What if G is now changed to \$2, how big is the change in Y\* and C\*?

**Answer:**

$$\text{New } Y^* = \frac{1 - 0.5(0) + 1 + 2}{1 - 0.5} \rightarrow = \frac{4}{0.5} = 8$$

A \$1 increase in G causes an increase in Y\* by 2

	Old	New	Change $\Delta$
G	1	2	$\Delta G = 1$
Y	6	8	$\Delta Y = 2$

In the later part, we will try to figure out the value of *multiplier* when we don't assign any numerical values of exogenous variables.

- The idea is simple. *We just apply the derivative method to the equilibrium solution function.*

- That is, we calculate the value of  $\frac{\partial Y^*}{\partial I_0}$ ,  $\frac{\partial Y^*}{\partial G_0}$ ,  $\frac{\partial Y^*}{\partial a}$ ,  $\frac{\partial Y^*}{\partial b}$ .

$$Y = \frac{a - bT_0 + I_0 + G_0}{1 - b}$$