Sessions 08-09

Keynesian Theory of Output Determination

Keynesian Theory of Output Determination

Understanding Business Cycles

- Business cycles occur because of changes in spending on C, I, G or X-M
- Therefore, one needs to understand the mechanism by which changes in spending get translated into changes in output
- A simple approach to understanding business cycles is the ***Keynesian multiplier model***

Equilibrium Output

Aggregate demand is the total amount of goods demanded in the economy

$$AD = C + I + G + NX$$

Output is at its equilibrium level when the quantity of output produced is equal to the quantity demanded:

$$Y = AD = C + I + G + NX$$

When aggregate demand – the amount people want to buy – is not equal to output (Y), there are **unplanned** additions (IU) to **inventory**

i.e. $IU = Y - AD$

So macroeconomic equilibrium occurs when **IU = 0**

The Consumption Function

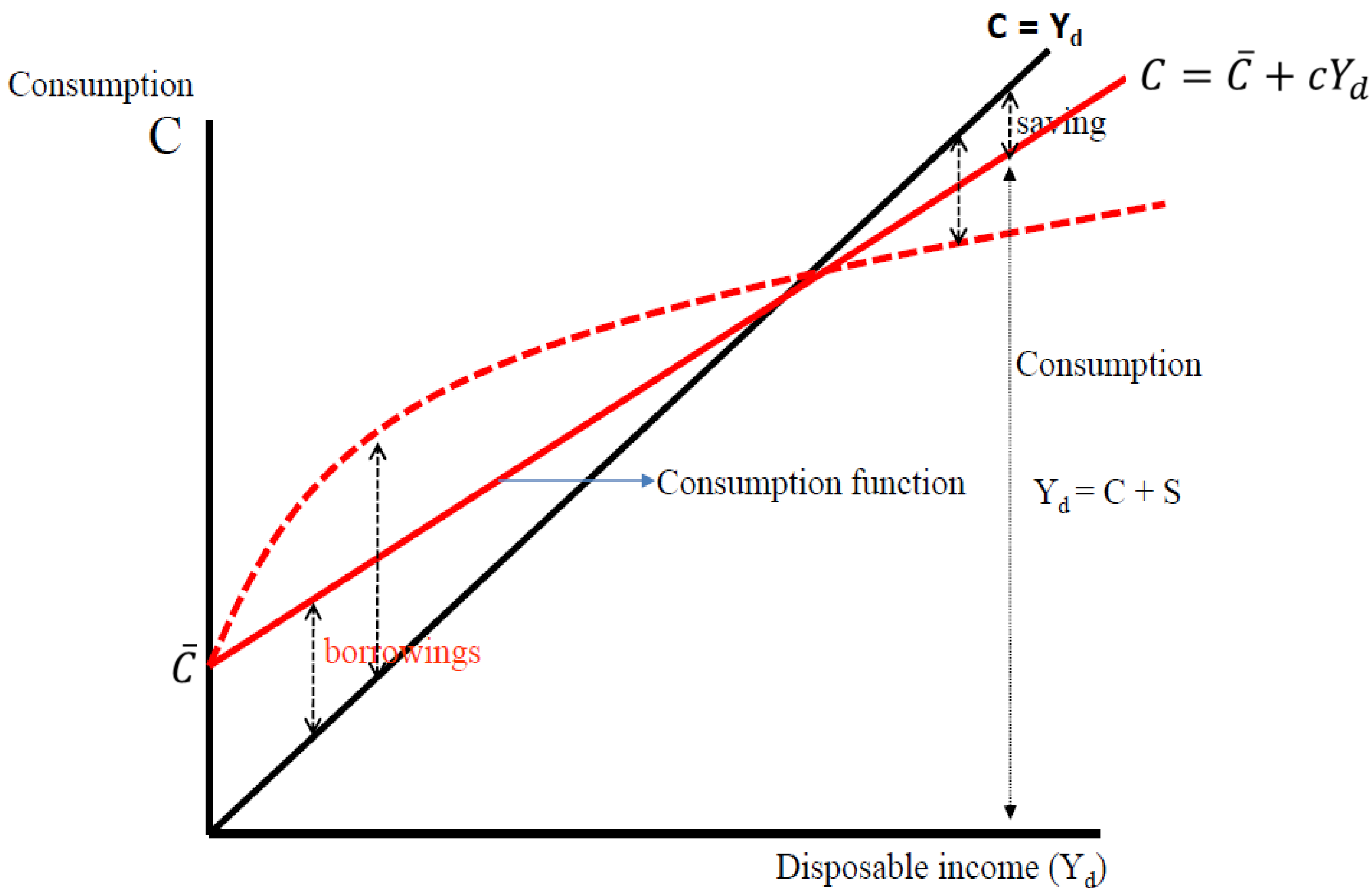
- The relationship between consumption and income is described by the **consumption function**

- If C is consumption and Y_d is income, the consumption function is:

$$C = \bar{C} + c(Y_d) \qquad \text{where } \bar{C} > 0 \text{ and } 0 < c < 1$$

The Consumption Function

- The intercept of equation is the level of consumption when income is zero $\rightarrow$ this is greater than zero since there is a **subsistence** level of consumption
- The slope *c* is known as the marginal propensity to consume (MPC) i.e. the increase in consumption per unit increase in income
- If MPC is 0.9 i.e. for every 1 dollar increase in income, consumption increase by $0.90



$\bar{C}$ is the autonomous consumption

Estimating the MPC

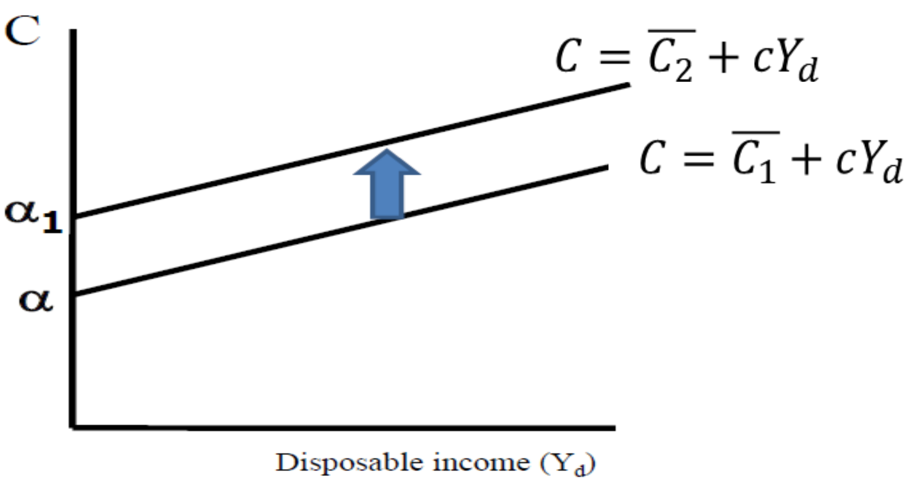
We can estimate the MPC by estimating the slope of the consumption function:

$$MPC = \frac{\text{Change in consumption}}{\text{Change in disposable income}} = \frac{\Delta C}{\Delta YD}$$

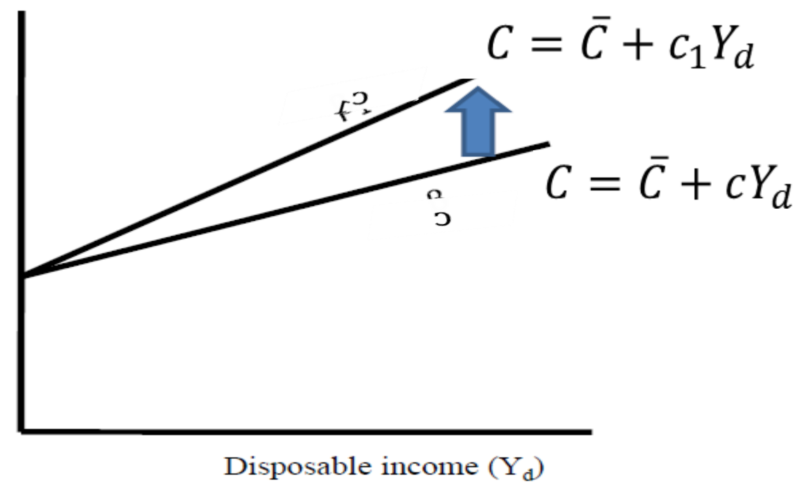
From 2015 to 2016, consumption increased by $308 billion, while disposable income increased by $324 billion:

$$\frac{\Delta C}{\Delta YD} = \frac{\$308 \text{ billion}}{\$324 \text{ billion}} = 0.95$$

Position and Shape of Consumption Function



An increase in autonomous C from $\overline{C_1}$ to $\overline{C_2}$ shifts up the entire C function



An increase in the MPC from c to c_1 increases the slope of the C function

Y_d	C	ΔY_d	ΔC	MPC	APC
0	100				-
100	175	100	75	0.75	1.75
200	250	100	75	0.75	1.25
300	325	100	75	0.75	1.08
400	400	100	75	0.75	1.00
500	475	100	75	0.75	0.95
600	550	100	75	0.75	0.91
700	625	100	75	0.75	0.89
800	700	100	75	0.75	0.88
900	775	100	75	0.75	0.86
1000	850	100	75	0.75	0.85
1100	925	100	75	0.75	0.84
1200	1000	100	75	0.75	0.83

Saving Function

$$S = Y_d - C$$

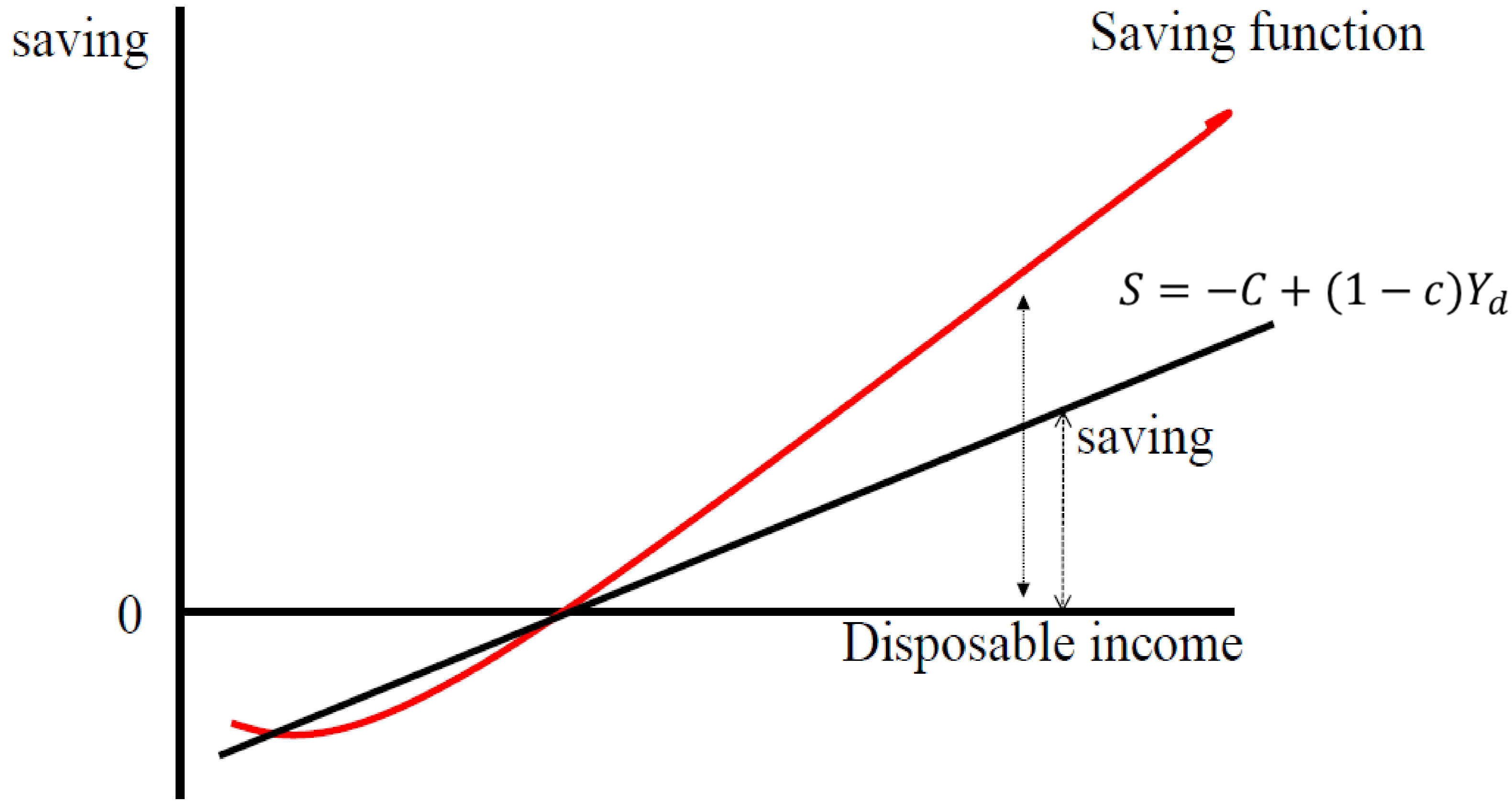
Saving Function: The relationship between the level of saving and personal disposable income.

$$S = f(Y_d)$$

$$S = -C + (1 - c)Y_d$$

- Average propensity to save (APS)
- Marginal propensity to save (MPS)

- Saving function is the mirror image of the consumption function



Saving function is obtained by subtracting vertically the consumption function from the 45^0 line.

Marginal Propensity to Save

- Income is either spent or saved

$$S \equiv Y - C$$ (this is called the **budget constraint**)

$$S \equiv Y - C = Y - \overline{C} - cY = -\overline{C} + (1 - c)Y$$

- Saving is an increasing function of the level of income

- Thus, marginal propensity to save (MPS) is always positive
  MPS = 1-c

- If MPS is 0.1 i.e. for every 1 dollar increase in income, savings increase by $0.10

Marginal Propensity to Save

- Disposable income not spent is saved:

$$Y = C + S$$

$$\Delta Y = \Delta C + \Delta S$$

- Dividing through by ΔY gives:

$$\frac{\Delta Y}{\Delta Y} = \frac{\Delta C}{\Delta Y} + \frac{\Delta S}{\Delta Y}$$

$$1 = MPC + MPS$$

- Marginal propensity to consume plus the marginal propensity to save is equal to 1

Equilibrium Output in an Open Economy

- We know that *AD* = *C* + *I* + *G* + *NX*
  - Consumption now depends on disposable income

$$C = \overline{C} + cYD = \overline{C} + c(Y + TR - TA)$$

  - Disposable income is the income left after paying taxes

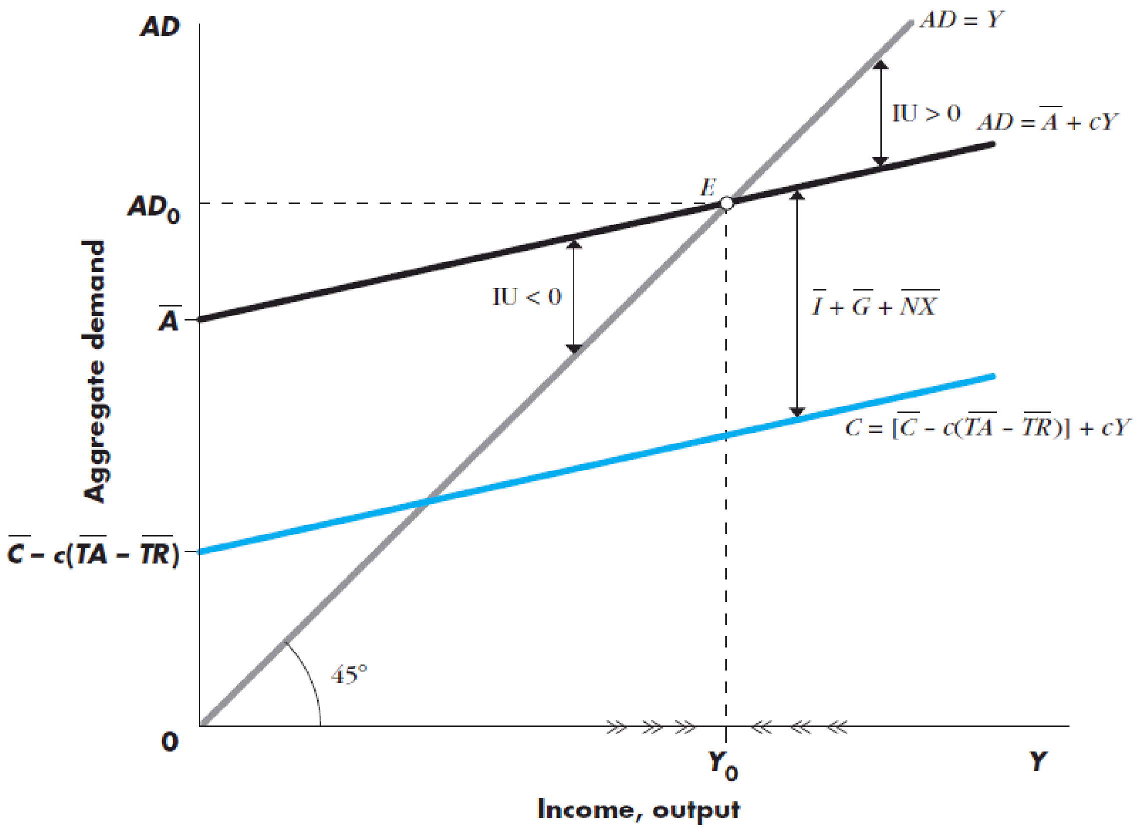
$$YD = Y - TA + TR$$

- AD then becomes

$$AD = C + I + G + NX$$
$$= \overline{C} + c(Y - TA + TR) + I + G + NX$$
$$= \left[\overline{C} - c(TA - TR) + I + G + NX\right] + cY$$
$$= \overline{A} + cY$$

where *A* is independent of the level of income i.e. A is the **autonomous spending**

Equilibrium Output



- If **AD > Y0**, inventories ↓ firms ↑ production until eq. is restored
- If **AD < Y0**, inventories ↑ firms cut back production until eq. is restored
- Thus, a macroeconomic eq. i.e. UI = 0 can lie only on the 45° line
- This model is also known as the **Keynesian cross**

The Multiplier Model

The multiplier model explains how shocks to investment, foreign trade, and government tax and spending policies can affect output and employment in an economy

Assumptions

- Wages and prices are fixed
- There are unemployed resources (AS is flat)
- No role of monetary policy and no financial market reactions to changes in the economy

Multiplier in Action

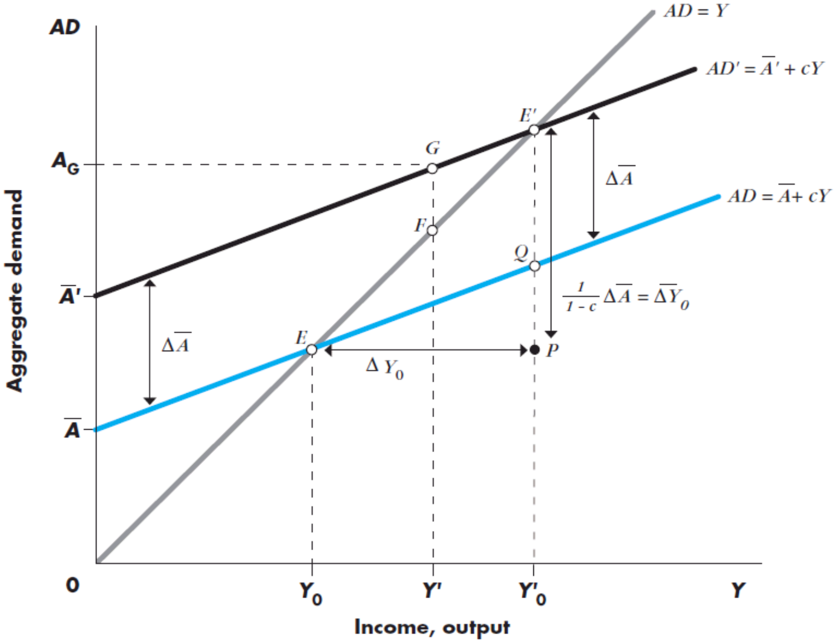
	Increase in demand in this round	Increase in production	Total increase in income (all rounds)
Round 1	$\Delta\bar{A}$	$\Delta\bar{A}$	$\Delta\bar{A}$
Round 2	$c\Delta\bar{A}$	$c\Delta\bar{A}$	$(1+c)\Delta\bar{A}$
Round 3	$c^2\Delta\bar{A}$	$c^2\Delta\bar{A}$	$(1+c+c^2)\Delta\bar{A}$
Round 4	$c^3\Delta\bar{A}$	$c^3\Delta\bar{A}$	$(1+c+c^2+c^3)\Delta\bar{A}$
"	"	"	"
"	"	"	"
"	"	"	"
"	"	"	$\frac{1}{1-c}\Delta\bar{A}$

Multiplier in Action

Assumptions: MPC=0.75 (in ₹ crore)

	Additional Autonomous I	Additional induced C	Total add. expenditure = Total add. GDP
Round 1	₹1000	₹0	₹1000
Round 2	0	₹750	₹1750
Round 3	0	₹562.5	₹2312.5
Round 4	0	₹422	₹2734
Round 5	0	₹316.5	₹3050.5
Round 6	0	₹237	₹3288
"	"	"	"
"	"	"	"
n	0	0	₹4000

The multiplier effect



An increase in an autonomous expenditure shifts the aggregate expenditure line upward

When this happens, output increases by *more* than the change in autonomous expenditures; this is the **multiplier effect**

The change in equilibrium output divided by the change in autonomous expenditures is the **multiplier**

Contd…

$$\Delta Y = \frac{1}{1 - MPC} \Delta A$$

- The increase (decrease) in the output is a multiple of the increase (decrease) in autonomous spending

- Given MPC, an increase in autonomous spending raises the equilibrium level of output

- The larger the MPC (steeper the AD function), the larger the multiplier from the relation between consumption and income and higher the level of output, and vice versa

How does fiscal policy affect output?

Fiscal Policy Multiplier

- Govt. expenditure multiplier is the increase in output or GDP resulting from an increase in govt. purchases of goods and services
- Taxes lower Yd. Since C = MPC*(Yd), C falls and through multiplier, Y comes down
- Higher taxes without increase in G will tend to reduce real GDP

How does fiscal policy affect output?

Taxes reduce consumption

- Let’s assume that there are no transfer payments by the government

Yd = Y - Taxes

Taxes = t.Y t is tax rate

Yd = Y – t.Y

Yd = Y(1-t)

C = MPC(Yd)

If MPC is 0.7 and t = .20, MPC out of national income

= MPC(1-t)Y

= 0.7(.80) = 0.56

If national income increases by Rs. 1 crore, C rises by only Rs. 0.56 crore

How does fiscal policy affect output?

$$C = \overline{C} + c(Y + TR - tY)$$
$$= \overline{C} + cTR + c(1-t)Y$$

$$AD = C + I + G + NX$$
$$= \left[\overline{C} + cTR + c(1-t)Y\right] + I + G + NX$$
$$= A + c(1-t)Y$$

$$Y = \overline{A} + c(1-t)Y$$
$$Y - c(1-t)Y = \overline{A}$$
$$Y\left[1 - c(1-t)\right] = \overline{A}$$
$$Y_0 = \frac{\overline{A}}{1 - c(1-t)}$$

The presence of the government sector flattens the AD curve and reduces the multiplier to: $\frac{1}{1-c(1-t)}$

Automatic Stabilisers

- Higher the tax rate, the lower would be the MPC (and therefore, multiplier) out of national income
- An automatic stabilizer is any mechanism in the economy that automatically reduces the amount by which output changes in response to a change in autonomous demand
- Automatic stabilizers act as a drag on expansion/ contraction
- They reduce both upward and downward movements of national income. Business cycles should be dampened by them
- Examples of automatic stabilizers include – unemployment benefits, proportional income taxes etc.

Effects of a Change in Fiscal Policy

- Suppose government increases TR instead
  - Autonomous spending would increase by only $c\Delta TR$, so output would increase by $\alpha_G c.\Delta TR$
  - The multiplier for transfer payments is smaller than that for G by a factor of c
- If the government increases marginal tax rates, two things happen:
  - The direct effect is that AD is reduced since disposable income decreases and thus consumption falls
  - The multiplier is smaller and the shock will have a smaller effect on AD

Summarizing the Multiplier Effect

- The presence of the income tax lowers the multiplier
- Govt. transfers TR leads to induced spending c.TR
- Multiplier analysis holds when there are unemployed resources
- It leaves many macroeconomic factors out of the picture
- It neglects the influence of **monetary factors** on interest rate and its impact on I and Y
- It omits the **supply side** of the economy
- It assumes prices to be **fixed**

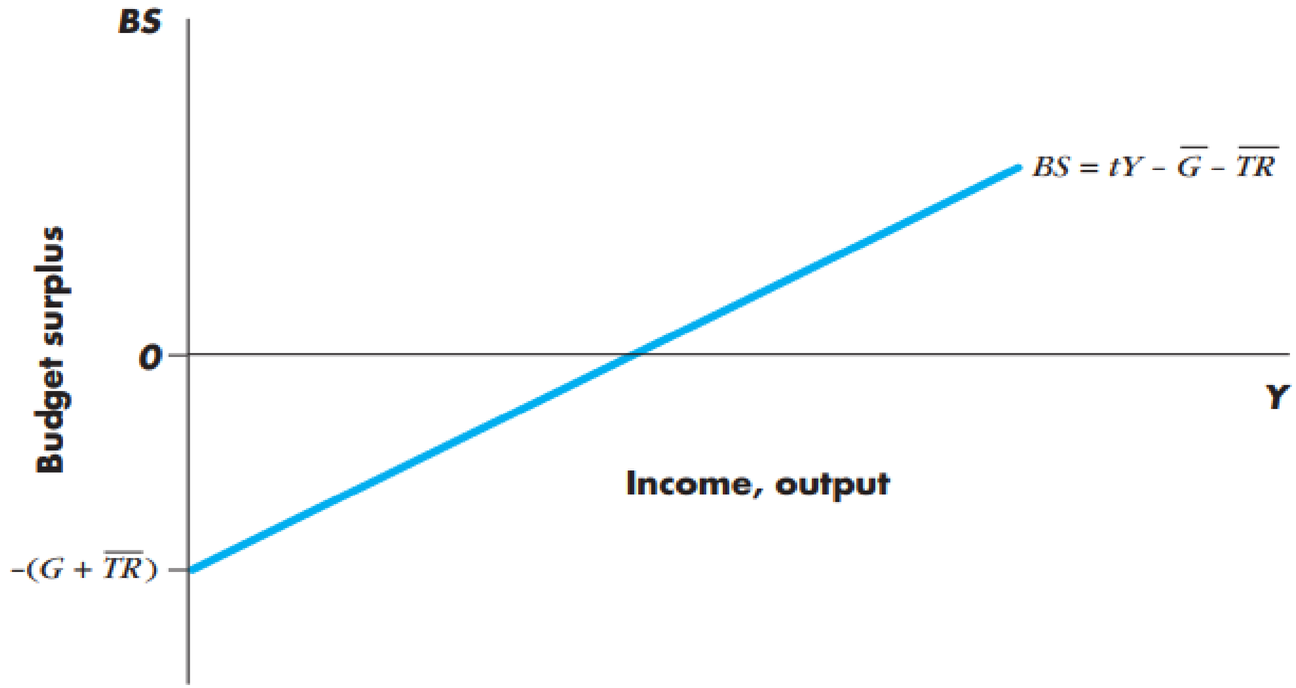
The Budget

- If TA = ***t***Y, the budget surplus is defined as:

$$BS = tY - G - TR$$

- The figure on the next slide shows that
  - At low levels of income, the budget is in deficit since the government spends more than it receives in income
  - At high levels of income, the budget is in surplus since the government receives more in income than it spends

The Budget Surplus



Effects of Government Purchases and Tax Changes on the BS

- How do changes in fiscal policy affect the budget? OR, must an increase in G reduce the BS?
- An increase in G reduces the surplus, but also increases income, and thus tax revenues
- Possibility that increased tax collections > increase in G
- The change in income due to increased G is equal to $\Delta Y = \alpha_G \Delta G$, a fraction of which is collected in taxes
  - Tax revenues increase by $t\alpha_G \Delta G$
  - The change in BS is: $\Delta BS = \Delta TA - \Delta G$

$$= t\alpha_G \Delta G - \Delta G$$

$$= -\frac{(1-c)(1-t)}{1-c(1-t)} \Delta G$$

Numerical Question

Suppose we have an economy, described by the following functions:

$$C = 50 + .8Y_D$$

$$\bar{I} = 70$$

$$\bar{G} = 200$$

$$\overline{TR} = 100 \qquad t = 0.2$$

a. Calculate the equilibrium level of income and the multiplier in this model
b. Calculate also the budget surplus, BS
c. Suppose that t increases to .25. What is the new equilibrium income? The new multiplier?
d. Calculate the change in the budget surplus. Would you expect the change in the surplus to be more or less if c .9 rather than .8?
e. Can you explain why the multiplier is 1 when t =1?