Expenditure Multipliers

Expenditures have a magnified effect on real GDP through the multiplier.

- Consumption expenditure (C)
- Investment (I)
- Government expenditures on good and services (G)
- Net exports – Exports (X) minus imports (M)

Real GDP $= Y = C + I + G + (X - M)$.

Disposable income

$$YD = Y - NT$$

YD = disposable income

NT = Net taxes — taxes minus transfer payments

Y = Real GDP or aggregate income

$$YD = C + S$$

C → planned consumption expenditure

S → planned saving

	Disposable income	Planned consumption Expenditure	Planned saving
A	0	150	−150
B	200	300	−100
C	400	450	−50
D	600	600	0
E	800	750	50
F	1,000	900	100

consumption expenditures and saving depend on disposable income (real GDP or aggregate income).

Marginal propensity to consume

The fraction of a change in disposable income that is consumed.

$$MPC = \frac{\Delta C}{\Delta (YD)} = \frac{C_1 - C_0}{YD_1 - YD_0}$$

$$= \frac{750 - 600}{800 - 600} = \frac{150}{200}$$

$$= 0.75$$

The change in total consumption divided by the change in total disposable income.

$$\Delta C = MPC(\Delta YD)$$

$$\Delta C = 0.75(\Delta YD)$$

If disposable income increases by #1, consumption will increase by #0.75

Consumption function

The relationship between consumption expenditure and disposable income

The general Form of the consumption function

$$C = C_0 + MPC(YD)$$

Autonomous consumption expenditure

does not depend on income

induced consumption expenditure

caused by an increase in disposable income

Autonomous consumption changes because of changes in interest rates, wealth and expectations of future economic conditions.

construct the consumption function using our numbers

when $YD = 0$, $C = C_0 = 150$.

Hence,

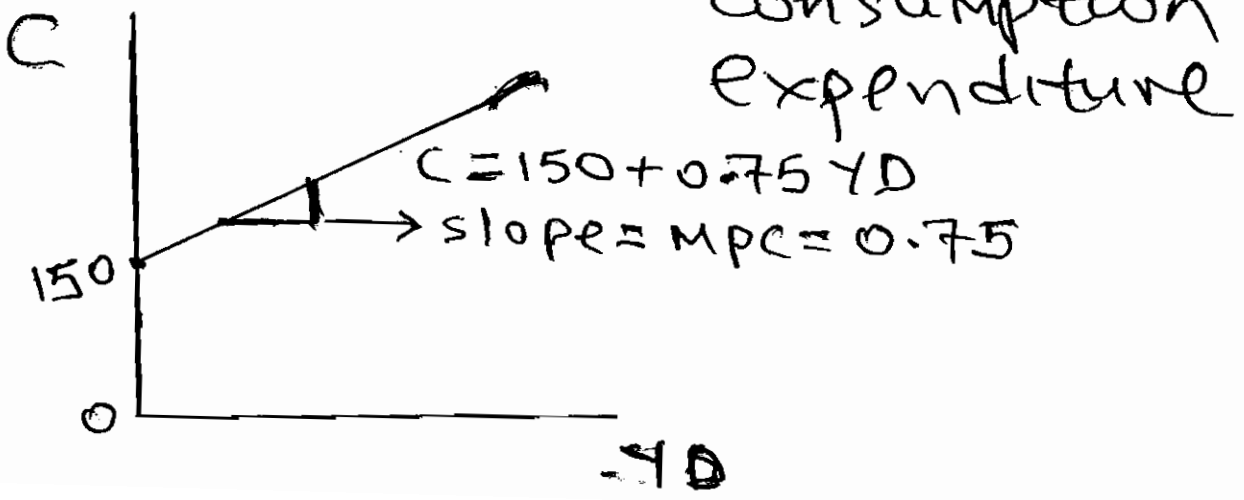
$$\boxed{C = 150 + 0.75\,YD}$$

when $YD = 800$,

$C = 150 + 0.75(800)$

$= 150 + 600$

$= \#750$ planned consumption expenditure



Marginal Propensity to save

The fraction of a change in disposable income that is saved

$$MPS = \frac{\Delta S}{\Delta(YD)} = \frac{S_1 - S_0}{YD_1 - YD_0}$$

$$= \frac{50 - 0}{800 - 600} = \frac{50}{200}$$

$$= 0.25$$

we can write,

$$\Delta S = MPS(\Delta DY)$$

$$\Delta S = 0.25(\Delta DY)$$

If disposable income increases by #1, saving will increase by #0.25.

Note that

$$MPC + MPS = 1$$

$$0.75 + 0.25 = 1$$

10

saving function

The relationship between saving and disposable income

The general form of the saving function

$$S = S_0 + MPS(Y_D)$$

- S_0: Autonomous part
- $MPS(Y_D)$: caused by a change in disposable income

Construct the saving function using our numbers

$$YD = C + S$$

disposable income equals planned consumption expenditure plus planned saving.

Substitute for consumption

$$C = 150 + 0.75\,YD$$

$$YD = (150 + 0.75\,YD) + S$$

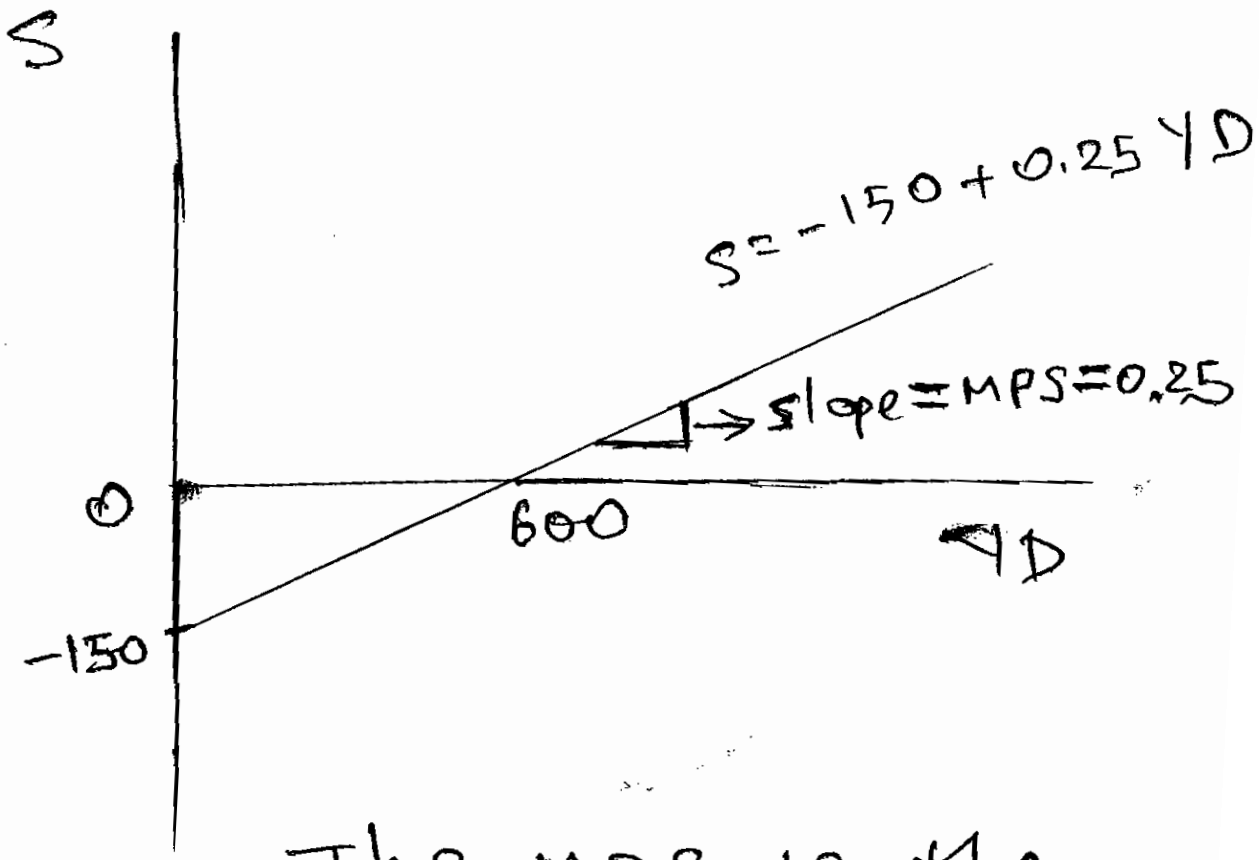
$$S = -150 + YD - 0.75\,YD$$

$$S = -150 + (1 - 0.75)\,YD$$

$$\boxed{S = -150 + 0.25\,YD}$$

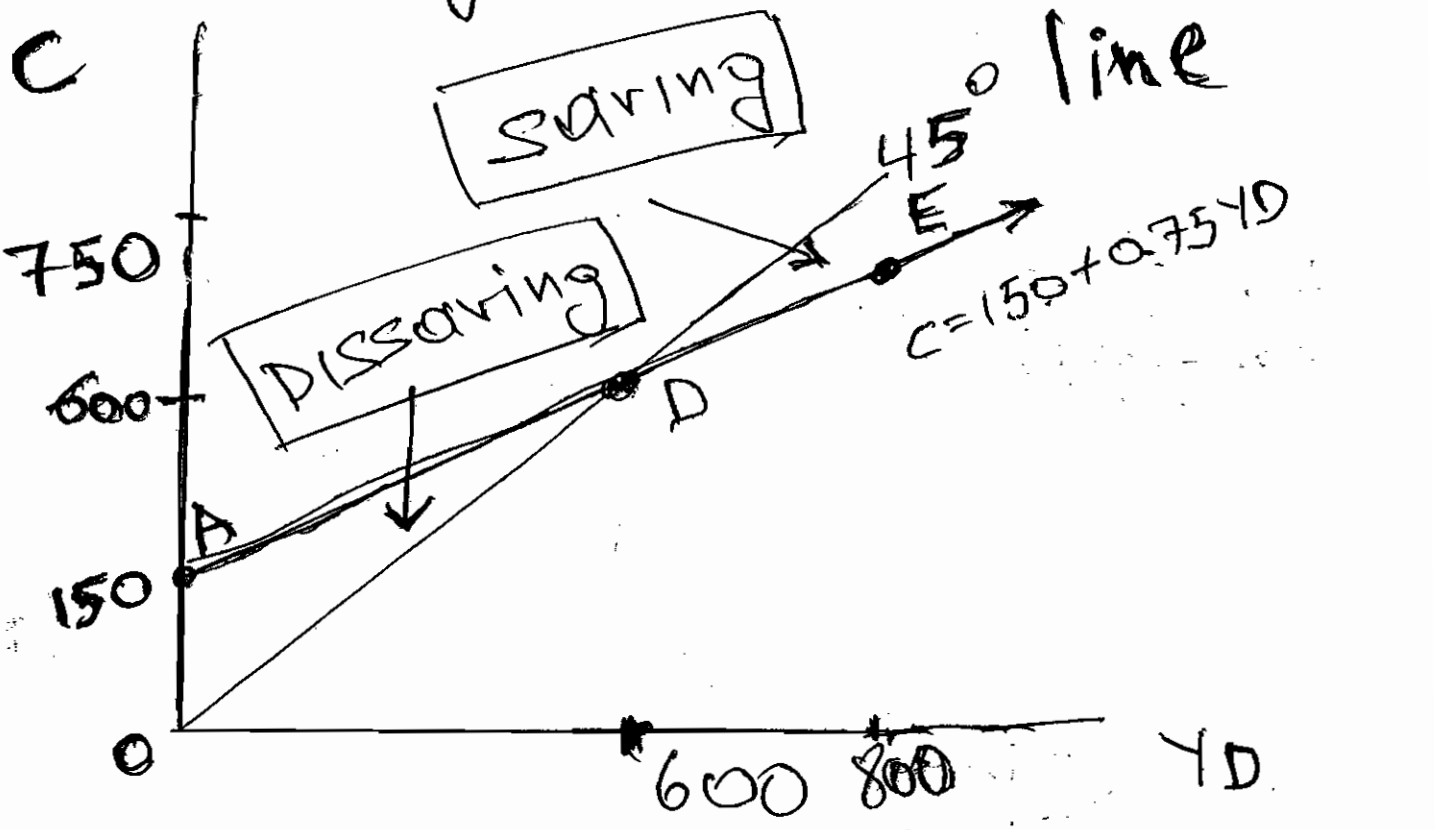
when $YD = 800$

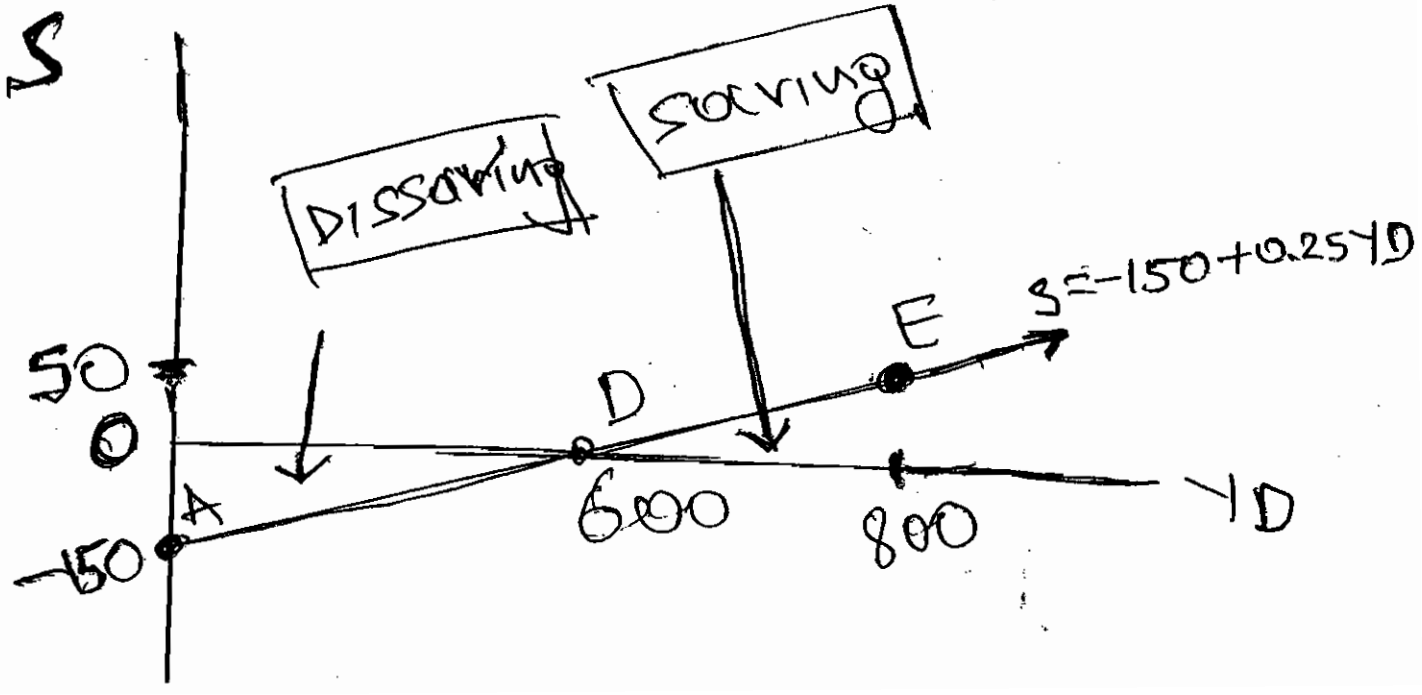
$S = -150 + 0.25(800) = \#50$



The MPS is the slope of the saving function

Consumption and saving function





A change in disposable income brings movements along the consumption and saving functions

where the consumption function crosses the 45° line, consumption is equal to income, and saving is zero.

shifts in the Consumption and saving functions

If there is a change in

1. Expected future disposable income
2. Real interest rates
3. wealth.

A. fall in the real interest rate, an increase in wealth, or an increase in expected future disposable income shifts the consumption function upward and the saving function downward

As the consumption function shifts upward, autonomous consumption expenditure increases

An increase in wealth, other things remaining the same stimulates consumption expenditure and decreases saving

the consumption function shifts downward when ~~there~~ is recession because at such a time expected future disposable income decreases

Import Function

The relationship between imports and real GDP or aggregate income

The general form

$$M = M_0 + mY$$

M_0: Autonomous imports

mY: induced imports

The greater the Canadian real GDP, the larger is the quantity of Canadian imports

Marginal propensity to import

The fraction of an increase in real GDP that is spent on imports.

$$m = MPM = \frac{\Delta M}{\Delta Y} = \frac{M_1 - M_0}{Y_1 - Y_0}$$

$$= \frac{220 - 200}{1{,}100 - 1{,}000}$$

$$= \frac{20}{100} = 0.20$$

If real GDP increases by \$1, imports will rise by \$0.20

Aggregate planned Expenditures

$$AE = C + I + G + (X - M)$$

$$C = a + b(YD)$$

since $YD = Y - NT$,

$$C = a + b(Y - NT)$$

Net taxes equal real GDP (Y) multiplied by the marginal tax rate (t).

$$NT = tY$$

$$C = a + b(Y - tY)$$

and

$$C = a + b(1-t)Y$$

a: Autonomous consumption expenditures

$b(1-t)Y$: induced consumption expenditures

Imports depend on real GDP.

$$M = mY$$

mY → induced imports

The autonomous part equals zero

Assume that investment (I), government expenditure (G), and exports are not influenced by real GDP (Y). I, G and X are autonomous

Rewrite the planned expenditure equation

$$AE = C + I + G + (X - M)$$

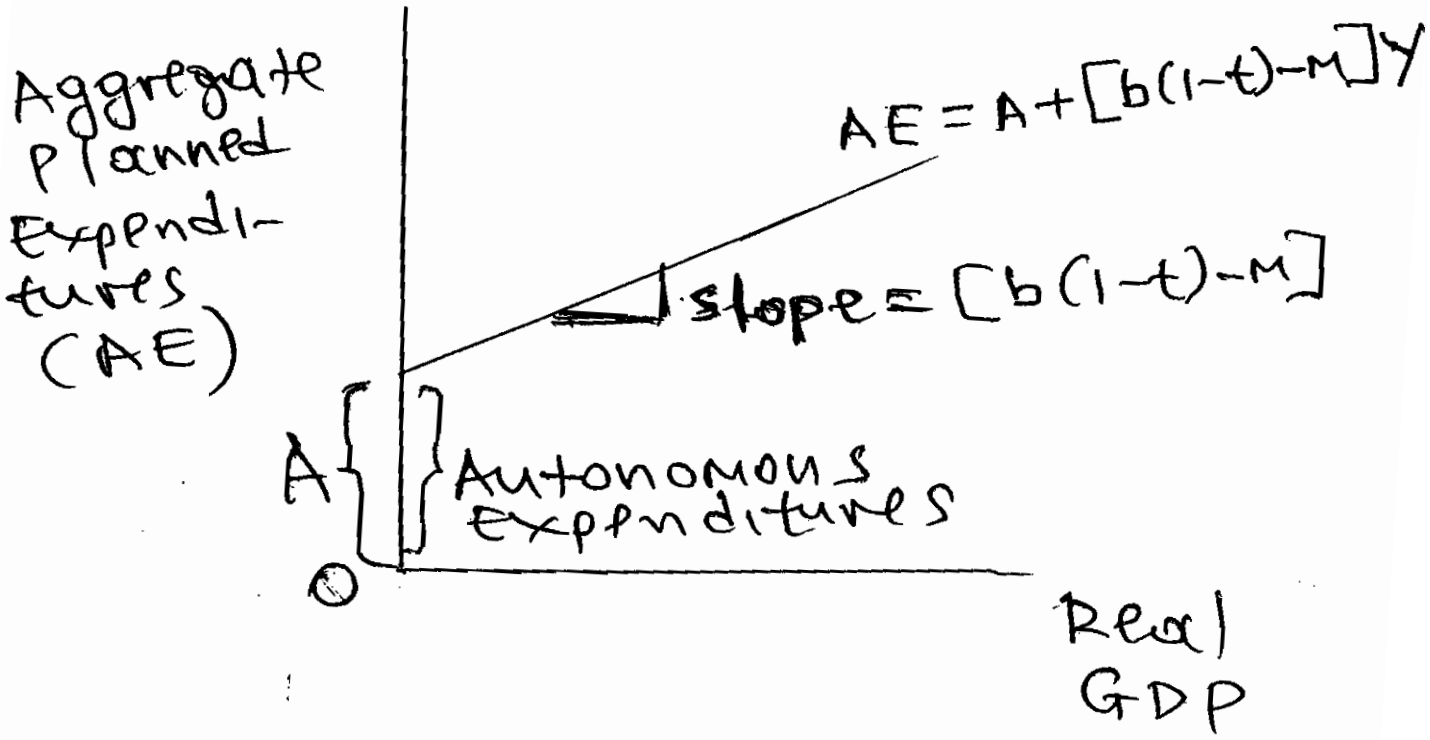
$$AE = \underbrace{a + b(1-t)Y} + I + G + (X - mY)$$

$$AE = a + I + G + X + \underbrace{b(1-t)Y - mY}$$

Combine this term

$$AE = \underbrace{(C + I + G + X)}_{\text{Autonomous Expenditures}} + \underbrace{[b(1-t) - M]}_{\text{induced Expenditures}} Y$$

$$AE = A + [b(1-t) - M]\,Y$$



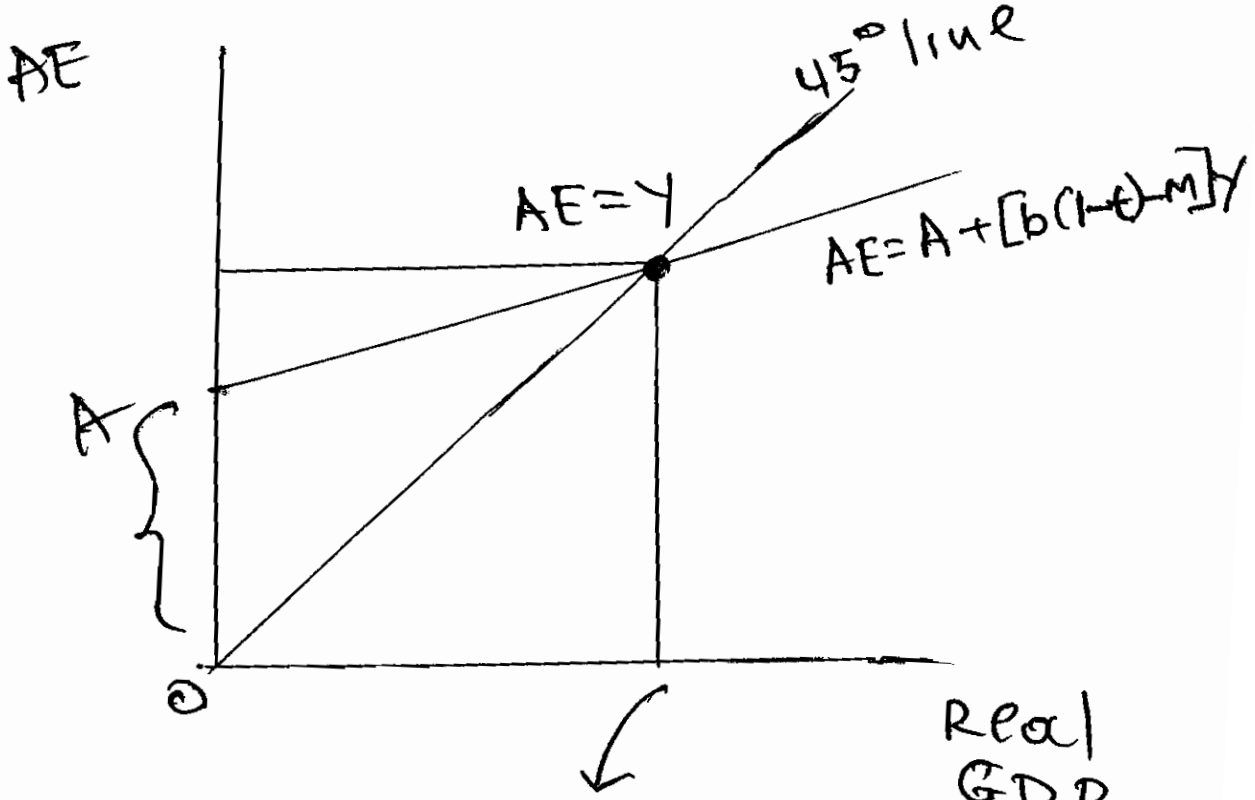
The AE curve captures the relationship between aggregate planned expenditures and real GDP

Equilibrium Expenditure

The level of aggregate expenditure that occurs when aggregate planned expenditure equals real GDP.

- Prices are fixed in the short run
- Aggregate demand is determined by aggregate expenditures.
- At equilibrium, unplanned inventory changes are zero and firms do not change their production.

Equilibrium Expenditure and Real GDP



$$Y = \frac{A}{1-[b(1-t)-m]}$$

To find equilibrium real GDP, we start with

$$Y = AE$$

$$AE = A + [b(1-t) - m]Y$$

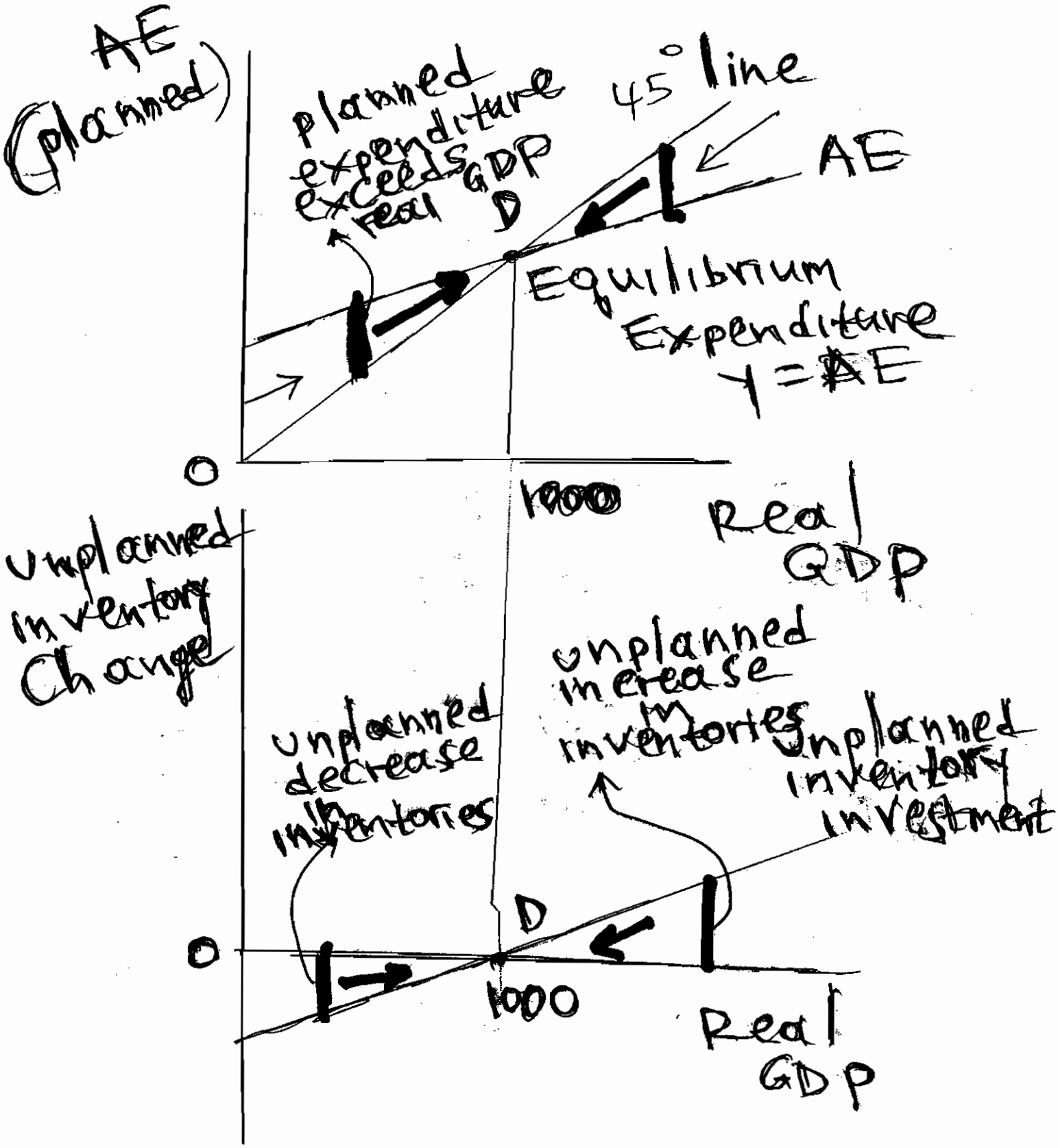
$$Y = A + [b(1-t) - m]Y$$

$$Y - [b(1-t) - m]Y = A$$

$$[1 - [b(1-t) - m]]Y = A$$

$$Y = \frac{A}{1 - [b(1-t) - m]}$$

$A = (\alpha + I + G + X)$ – Autonomous Expenditures


AE
(planned)
planned expenditure exceeds real GDP
45° line
AE
D
Equilibrium Expenditure
Y = AE
0
1000
Real GDP
Unplanned inventory Change
unplanned decrease in inventories
unplanned increase in inventories
Unplanned inventory investment
D
0
1000
Real GDP

The Multiplier

An increase in autonomous consumption or investment expenditure causes an even greater increase in equilibrium expenditure and real GDP.

$$\text{multiplier} = \frac{\text{change in equilibrium expenditure}}{\text{change in autonomous expenditure}}$$

$$= \frac{200 \text{ billion}}{50 \text{ billion}} = 4$$

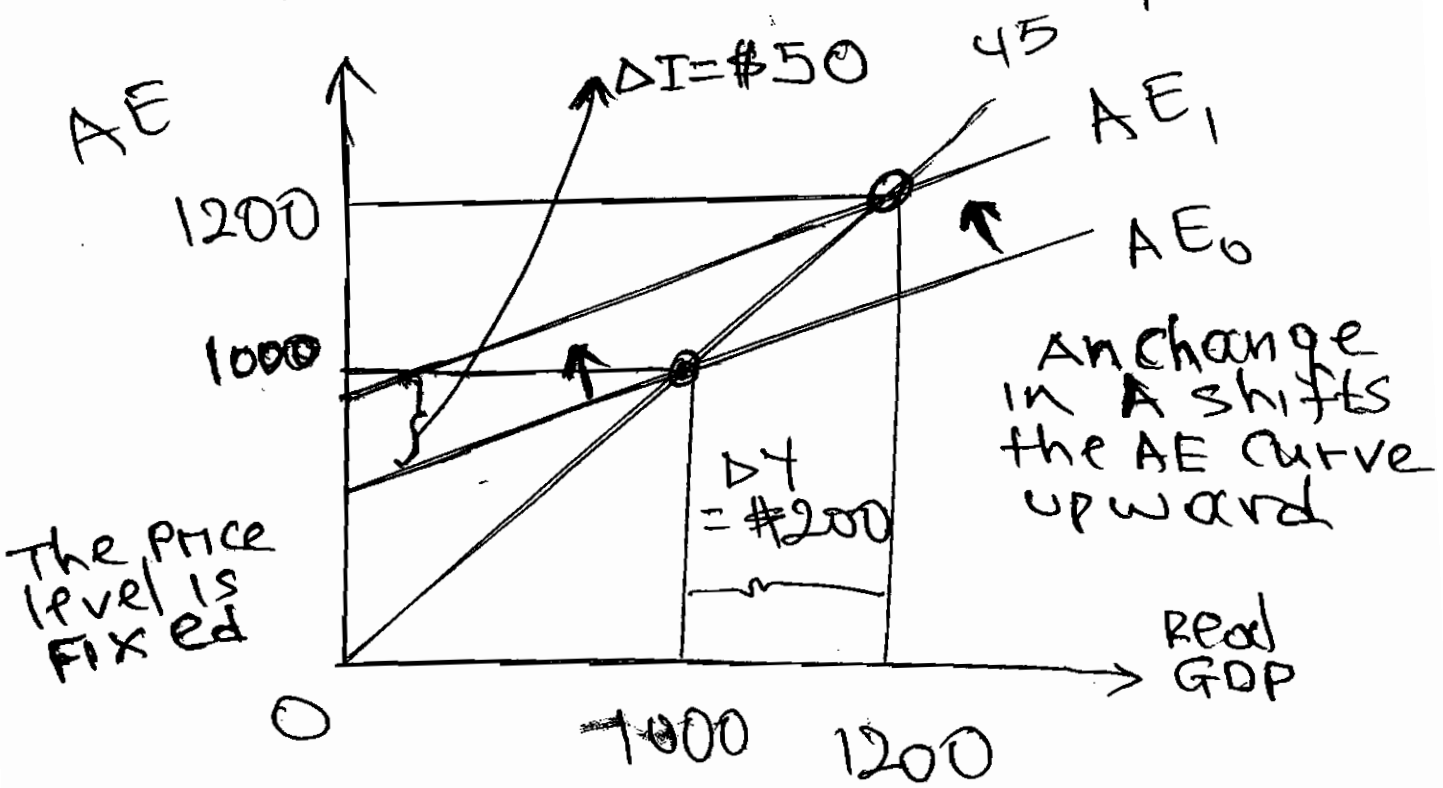
The increase in equilibrium expenditure and real GDP is 4 times the increase in autonomous expenditure.

Hence,

Change in Equilibrium Expenditure or Real GDP = (Multiplier)(Change in Autonomous Expenditure)

Example

Autonomous expenditure increases by #50 billion ($\Delta A = \Delta I = \$50$ billion). Then equilibrium expenditure and real GDP increases by $(4)(50) = \#200$



From our Macroeconomic Model,

$$\Delta Y = \frac{1}{1-[b(1-t)-M]}\Delta A$$

A change in autonomous expenditures (ΔA) changes equilibrium expenditure and real GDP (ΔY)

$$\text{Multiplier} = \frac{\Delta Y}{\Delta A} = \frac{1}{1-[b(1-t)-M]}$$

$$= \frac{1}{1-\text{slope of AE curve}}$$

Multiplier without imports and taxes

If $m = 0$
$t = 0$,

then

$$\text{Multiplier} = \frac{1}{1-b}$$

$$= \frac{1}{1-MPC}$$

$$= \frac{1}{MPS}.$$

$MPC + MPS = 1$

$MPS = 1 - MPC$

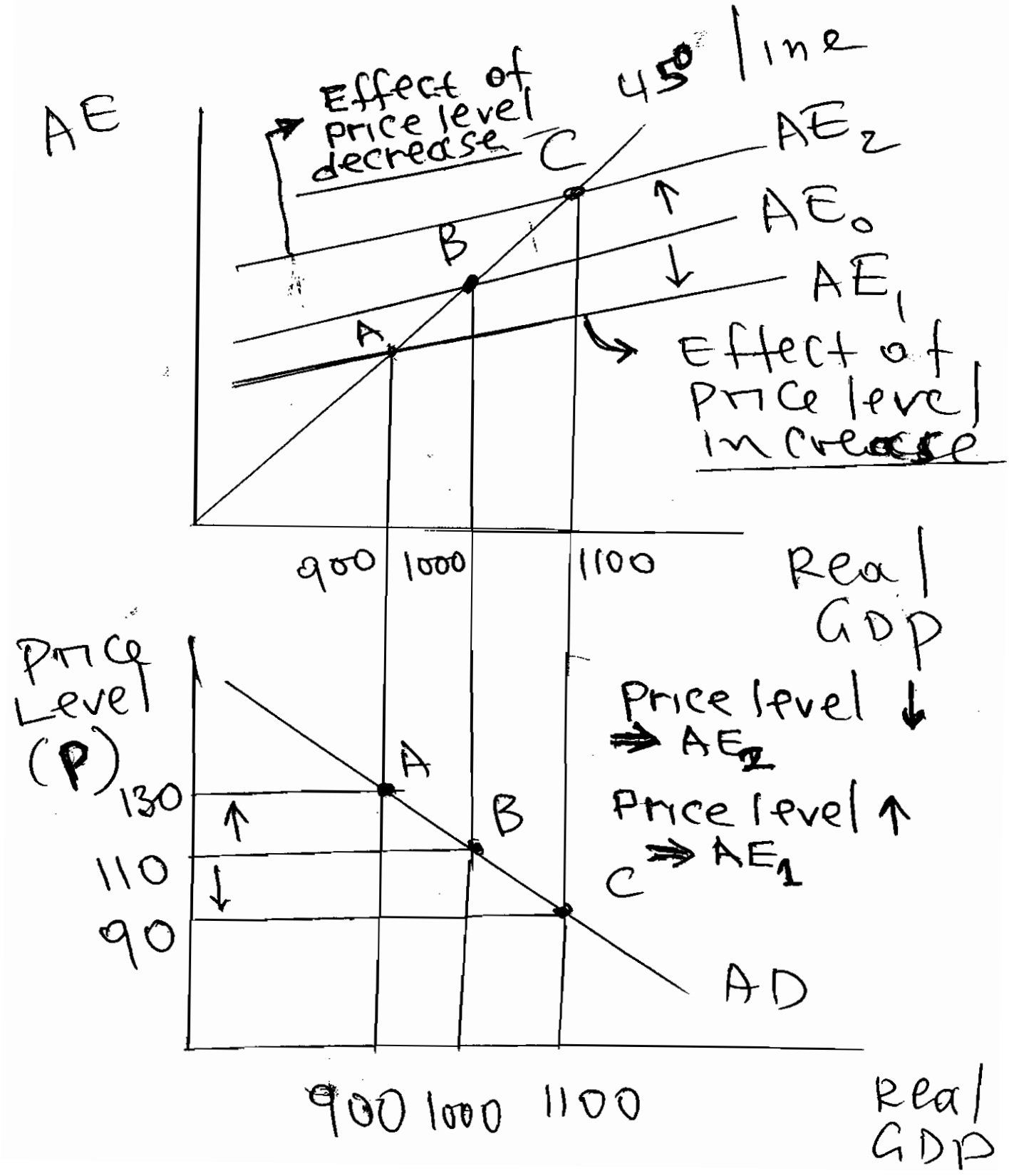
1. Imports decrease the value of the multiplier.

The larger is the marginal propensity to import, the smaller is the change in real GDP

2. Income taxes make the multiplier smaller

Aggregate Expenditure, and Aggregate Demand

A change in the price level shifts the AE curve and results in a movement along the AD curve.


AE
Effect of price level decrease
45° line
C
AE_2
B
AE_0
A
AE_1
Effect of price level increase
900
1000
1100
Real GDP
Price Level (P)
130
110
90
A
B
C
Price level ↓ ⇒ AE_2
Price level ↑ ⇒ AE_1
AD
900
1000
1100
Real GDP

When the price level changes, aggregate planned expenditure changes and the quantity of real GDP demanded changes

The multiplier decreases as the price level increases.

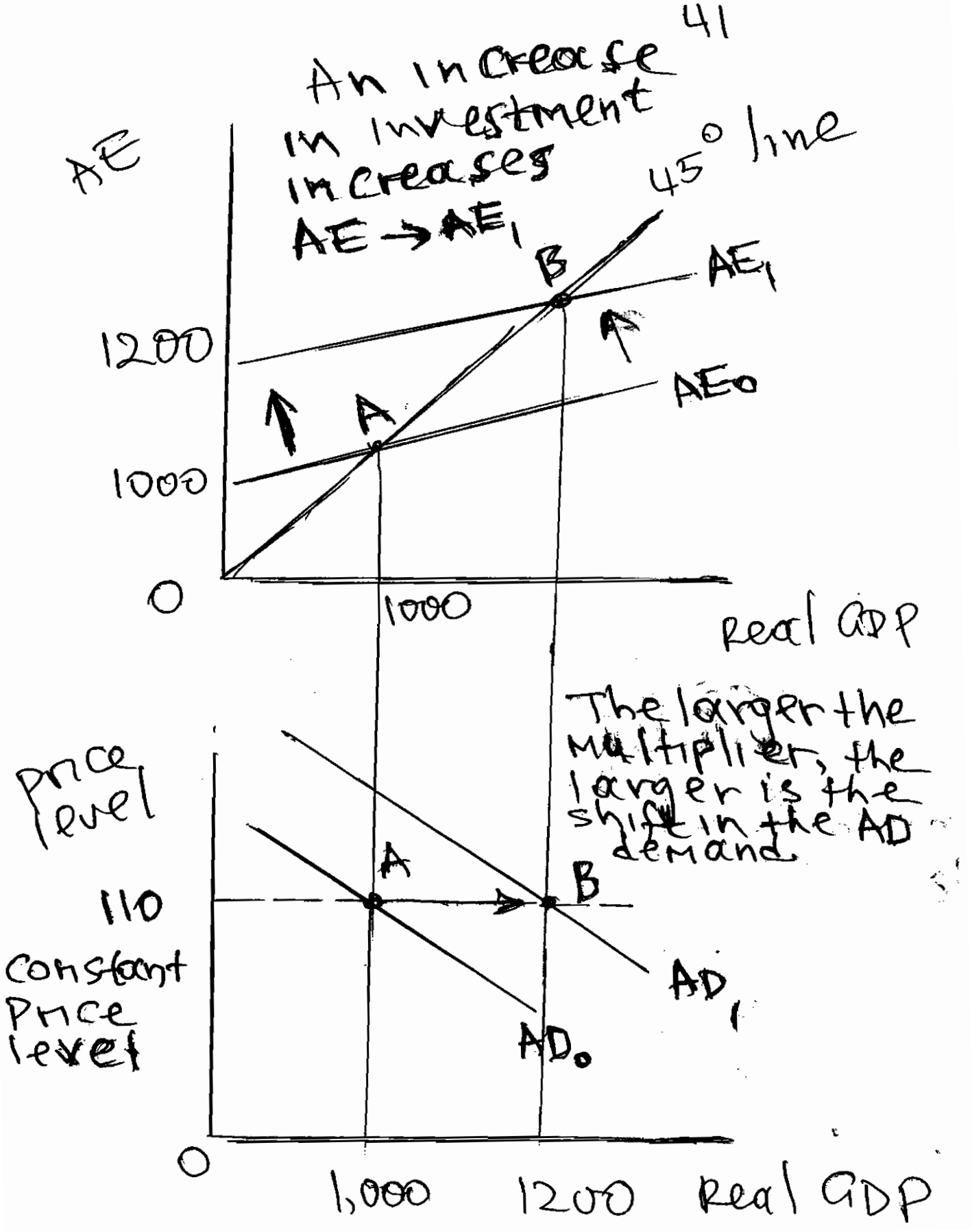
The multiplier in the long run is zero (or very small).

In the long-run real GDP is equal to potential GDP.

Changes in autonomous Expenditures and shifts in aggregate demand

Price level is constant

An increase in autonomous expenditure shifts the AD curve to the right


An increase in investment increases AE → AE1
AE
45° line
B
AE1
1200
A
AE0
1000
0
1000
Real GDP
The larger the multiplier, the larger is the shift in the AD demand.
price level
A
B
110
AD1
AD0
Constant Price level
0
1,000
1200
Real GDP

Questions

Q6. If the saving function is $S = -25 + 0.4\,YD$, then the consumption function is

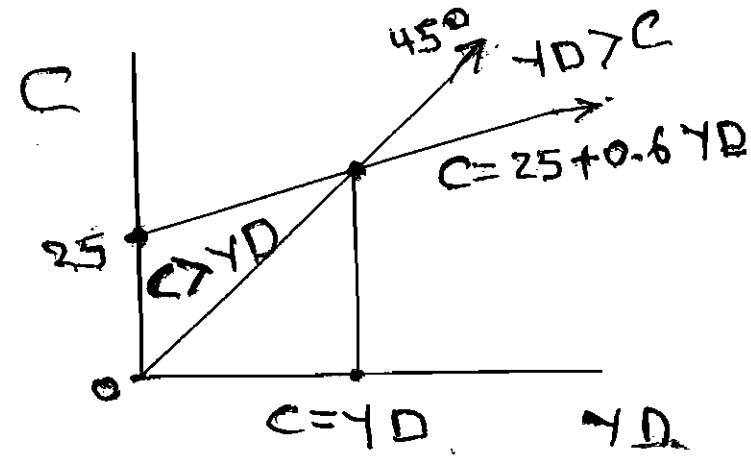
$$YD = C + S$$

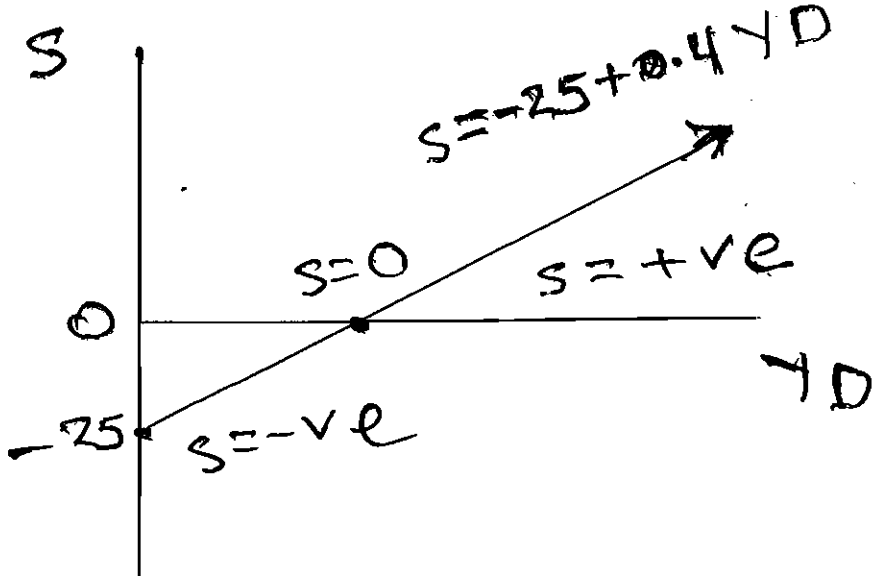
$$YD = C + (-25 + 0.4\,YD)$$

$$= C - 25 + 0.4\,YD$$

$$(1 - 0.4)\,YD + 25 = C$$

$$C = 25 + 0.6\,YD$$


C
45°
YD > C
C = 25 + 0.6 YD
25
C > YD
0
C = YD
YD


S
S = -25 + 0.4 YD
S = 0
S = +ve
0
YD
-25
S = -ve

Q2. Autonomous consumption is 50. With every increase of one dollar in disposable income, consumption goes up 60 cents. The marginal tax rate is 10 cents. In this case, the equation of the consumption function is:

$$C = a + b(1-t)Y$$

$$C = 50 + 0.6(1-0.10)Y$$

$$C = 50 + 0.54Y$$

Q3. If $AE = 100 + 0.7Y$ and $Y = 300$, then unplanned inventories are:

$AE = 100 + 0.7(300)$

$AE = 100 + 210$

$AE = 310$

$AE = 310 > Y = 300$

Inventories decrease by 10

Q4 An economy has

$C = 15 + 0.7Y$

$I = 8$

$G = 12$

$X = 20$

$M = 0.2Y$

(a) Find the aggregate expenditure function.

$AE = C + I + G + (X - M)$

$AE = 15 + 0.7Y + 8 + 12 + (20 - 0.2Y)$

$AE = 55 + 0.7Y - 0.2Y$

$AE = 55 + 0.5Y$

(b) Find Equilibrium real GDP

At Equilibrium,

$Y = AE$

$Y = 55 + 0.5Y$

$Y - 0.5Y = 55$

$Y(1 - 0.5) = 55$

$0.5Y = 55$

$Y = \frac{55}{0.5} = 110$

(c) Find consumption in Equilibrium

$C = 15 + 0.7Y$

$C = 15 + 0.7(110) = 15 + 77 = 92$

(d) Find multiplier

$\frac{1}{1 - (0.7 - 0.2)} = \frac{1}{0.5} = 2$

05 An economy has a consumption function of

$C = 10 + 0.8Y$,

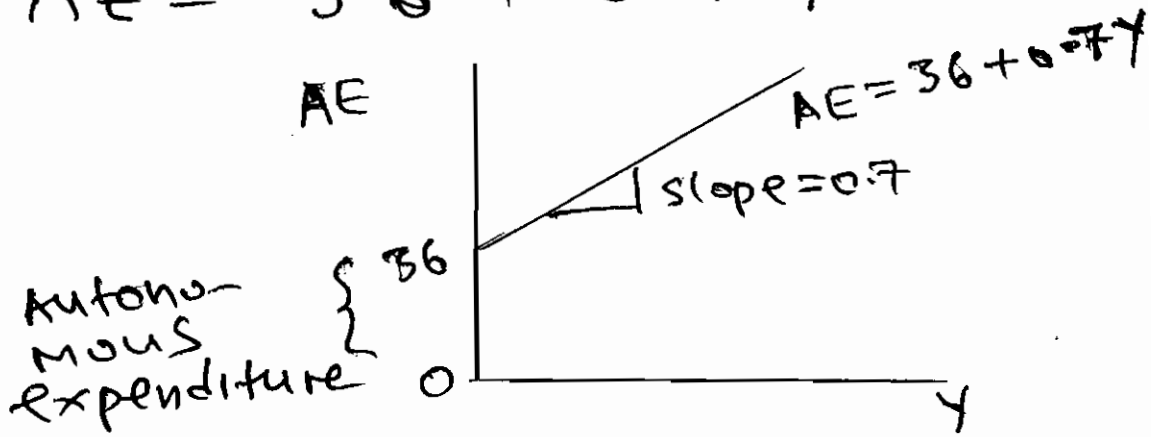
Investment equal to 6, government purchases equal to, exports equal to 10, an import function of $M = 0.1Y$, and no income taxes.

(a) what is the equation for the AE function for this economy?

$$AE = C + I + G + (X - M)$$

$$AE = (10 + 0.8Y) + 6 + 10 + (10 - 0.1Y)$$

$$AE = 36 + 0.7Y$$



(b) what is equilibrium real GDP in this economy?

$$Y = AE$$

$$Y = 36 + 0.7Y$$

$$Y - 0.7Y = 36$$

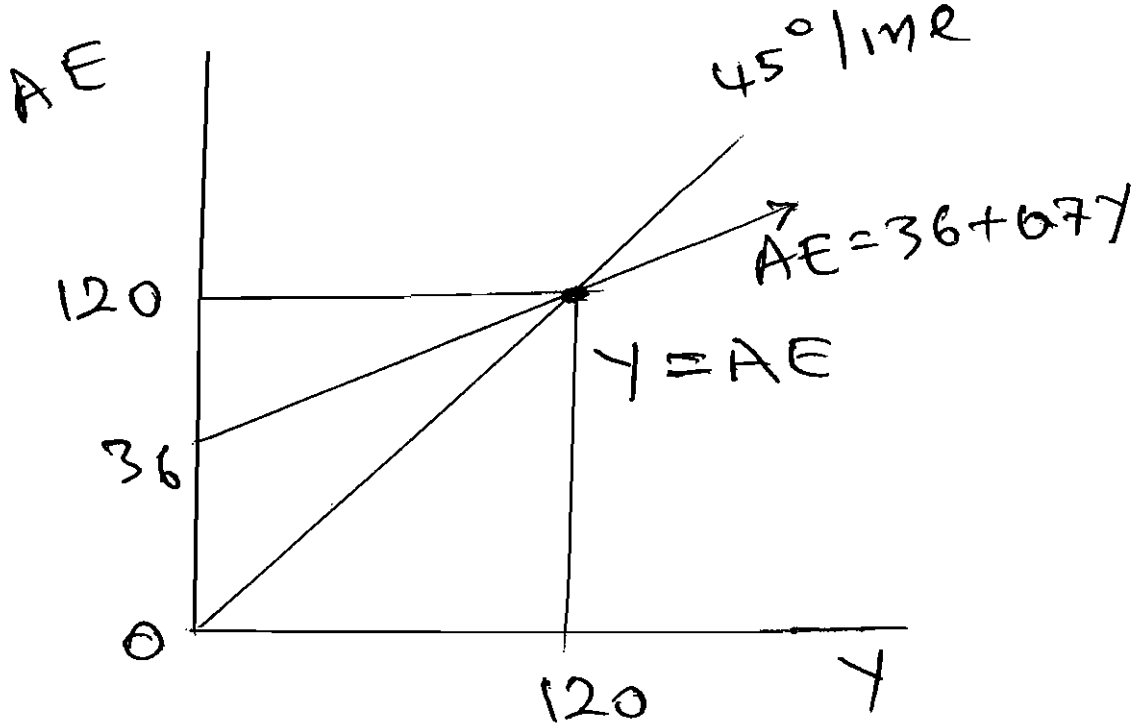
$$(1 - 0.7)Y = 36$$

$$Y = \frac{36}{0.3} = 120$$

equilibrium real GDP

$$AE = 36 + 0.7Y$$
$$= 36 + 0.7(120)$$
$$= 36 + 84$$

$AE = 120$ Equilibrum Expenditure



(c) what is consumption in equilibrium in this economy?

$C = 10 + 0.8Y$

$= 10 + 0.8(120)$

$= 10 + 96$

$C = 106$

(d) what is the multiplier for this economy?

$\frac{1}{0.3} = 3.33$

Q. If Autonomous Consumption rises by 10, what is the new equilibrium real GDP for this economy?

$C = 10 + 10 + 0.8Y$

$C = 20 + 0.8Y$

↓ Autonomous Consumption Expenditure

↘ Induced Consumption Expenditure

$$AE = C + I + G + (X - M)$$

$$AE = (20 + 0.8Y) + 6 + 10 + (10 - 0.1Y)$$

$$AE = 46 + 0.7Y$$

$$Y = AE$$

$$Y = 46 + 0.7Y$$

$$Y - 0.7Y = 46$$

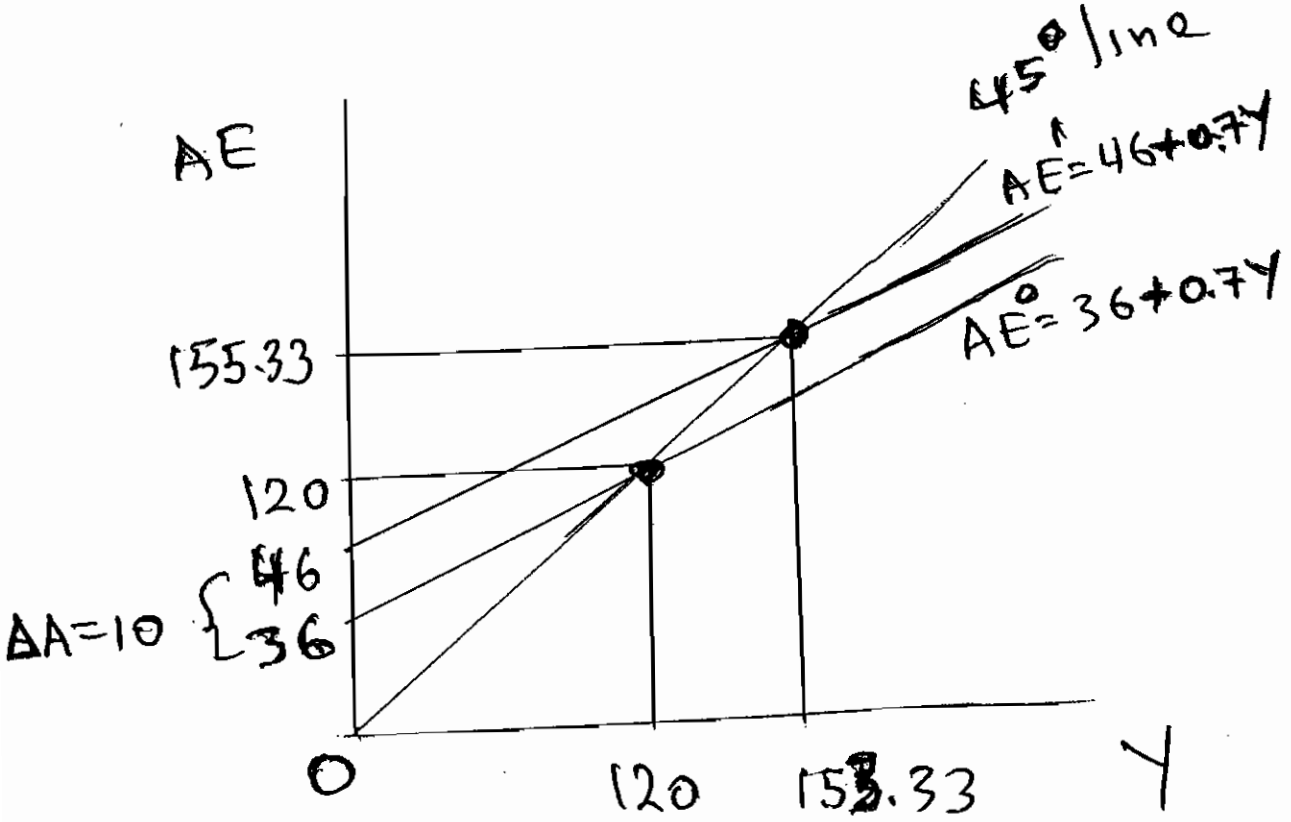
$$Y(1 - 0.7) = 46$$

$$Y = \frac{46}{0.3} = 153.33$$

Equilibrium real GDP

$$AE = 46 + 0.7Y$$
$$= 46 + 0.7(155.33)$$
$$= 153.33$$

Equilibrium Aggregate expenditure



$$\Delta Y = (\text{multiplier})(\Delta A)$$
$$= 3.33(10) = 33.33$$