# ECO 209Y
MACROECONOMIC
THEORY AND POLICY

LECTURE 3:
AGGREGATE EXPENDITURE AND
EQUILIBRIUM INCOME

ASSUMPTIONS

- We will assume that:

    - There is no *depreciation*

    - There are no *indirect taxes*

    - Net payment to foreign factors of production is nil

- Therefore, *GDP*, *Net Domestic Income*, and *Gross National Product* are all equal

- In other words, the values of *output* and *income* are assumed to be equal and we will use the notation **Y** to refer to both

GRAPHICAL REPRESENTATION OF GDP = NATIONAL INCOME (Y)

GDP

GDP = Y

Slope = 1

45°

Y
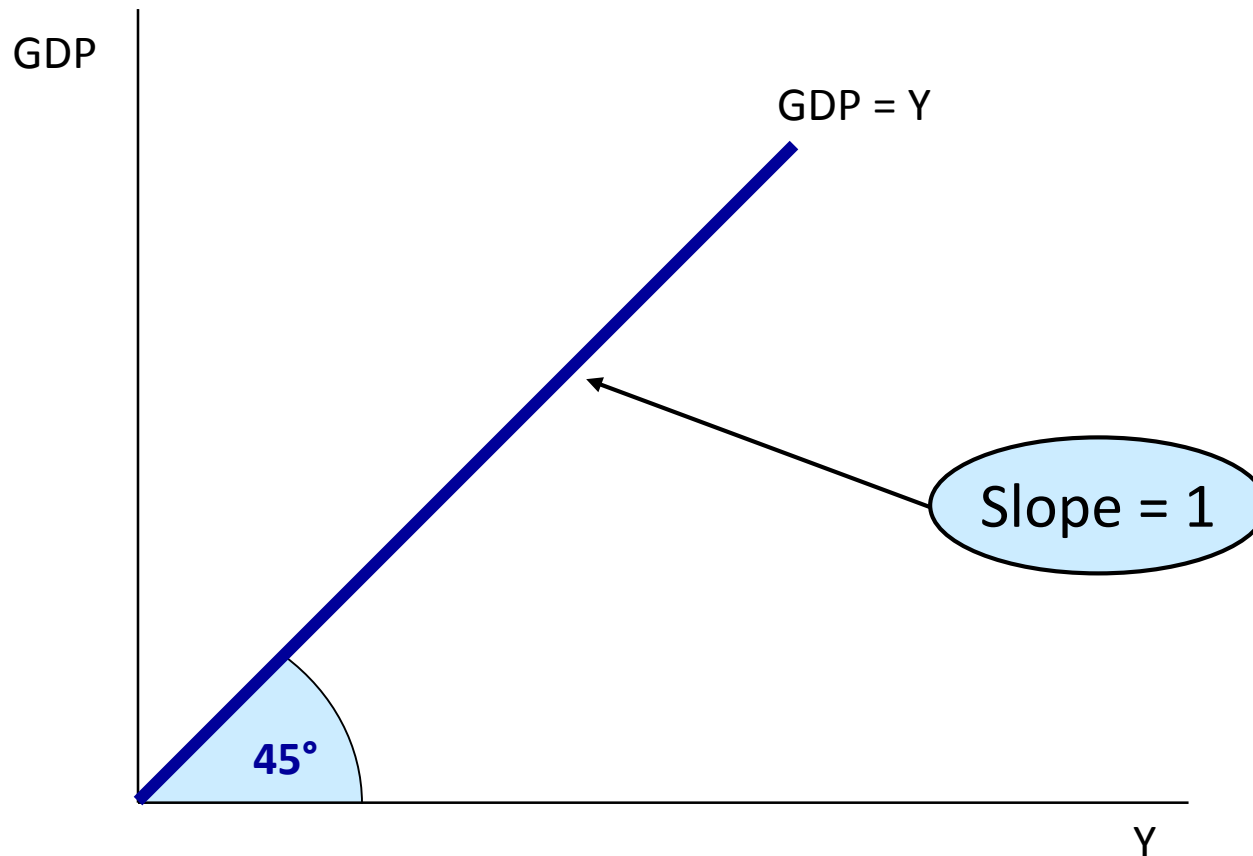
ASSUMPTIONS (CONT'D)

We will also assume that the *price level* (**P**) is fixed

➢ Therefore, this model applies to a situation where the economy is in a *deep recession* characterized by *excess capacity* and *high unemployment*

➢ That is, we will consider the so-called short-run *Keynesian model*

AGGREGATE EXPENDITURE

- *Aggregate Expenditure* (**AE**) is the total *desired* or *planned* expenditure on goods and services in the economy, that is:

$$AE = C + I + G + NX$$

- Using the expenditure approach, we have seen that **GDP** was equal to:

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

- **GDP** is equal to the *actual* expenditure on domestically produced goods and services
  - Therefore, *actual expenditure* on domestically produced goods and services is equal to *income* (**Y**) since **GDP** is equal to *income* by assumption

AGGREGATE EXPENDITURE (CONT'D)

- The ***Aggregate Expenditure*** function indicates the desired level of expenditure at each level of income (**Y**)

  - ➤ The ***Aggregate Expenditure*** function is an ***increasing function*** of **Y**

- Therefore, there must be a level of income at which ***desired*** aggregate expenditure (**AE**) is equal to ***actual*** aggregate expenditure (**GDP** = **Y**)

- This level of income at which **Y = AE** is the ***equilibrium*** level of output or income (**Y***)

  - ➤ At **Y*** the ***goods market*** is in ***equilibrium***

  - ➤ Economic agents are purchasing (**Y**) exactly what they had planned to purchase (**AE**)

AGGREGATE EXPENDITURE (CONT'D)

- If **Y ≠ AE**, then the economy is not in equilibrium
  - If **Y > AE** → excess supply in the goods market
  - If **Y < AE** → excess demand in the goods market

- Since **P** is assumed fixed, then the implicit assumption is that **aggregate expenditure** determines the amount of goods produced in the economy

- That is, **Y** must change in order to match **AE** and restore equilibrium in the economy
  - **Y** must increase to eliminate an excess demand
  - **Y** must decrease to eliminate an excess supply

A SIMPLE MODEL

■ Consider a simple model of an economy without government sector ($G = 0$) and without external sector ($X = Q = 0$)

■ Therefore, $AE = C + I$

■ How is equilibrium income (Y^*) determined in this economy?

THE PLANNED (OR DESIRED) CONSUMPTION FUNCTION

■ The ***planned consumption function*** is a description of the total planned personal consumption expenditure by all households in the economy

■ Planned consumption expenditure depends on variables such as:

  ➤ Disposable income

  ➤ Wealth

  ➤ Interest rates

  ➤ Expectations about the future

THE PLANNED CONSUMPTION FUNCTION

- *Assumption:* With the exception of *disposable income*, all the variables that determine *planned consumption* will be assumed *constant*

- *Assumption:* Therefore, *planned consumption* will be assumed to be a function of *disposable income* (**YD**):

$$C = \overline{C} + c\,YD$$

- This equation indicates that *planned consumption* is equal to some constant ($\overline{C}$) plus another constant (**c**) times disposable income (**YD**)

THE CONSUMPTION FUNCTION (CONT'D)

- The constant $\overline{C}$ describes the elements of consumption which are *independent* of disposable income

  - The constant $\overline{C}$ is called *autonomous consumption* and captures the impact on **C** of all the constant variables

- The constant **c** describes the *rate of change* of consumption as disposable income changes, that is, it indicates the increase in consumption per unit increase in disposable income:

$$c = \frac{\Delta C}{\Delta YD}$$

  - The constant **c** is called the *marginal propensity to consume* out of disposable income (**MPC**$_{YD}$)
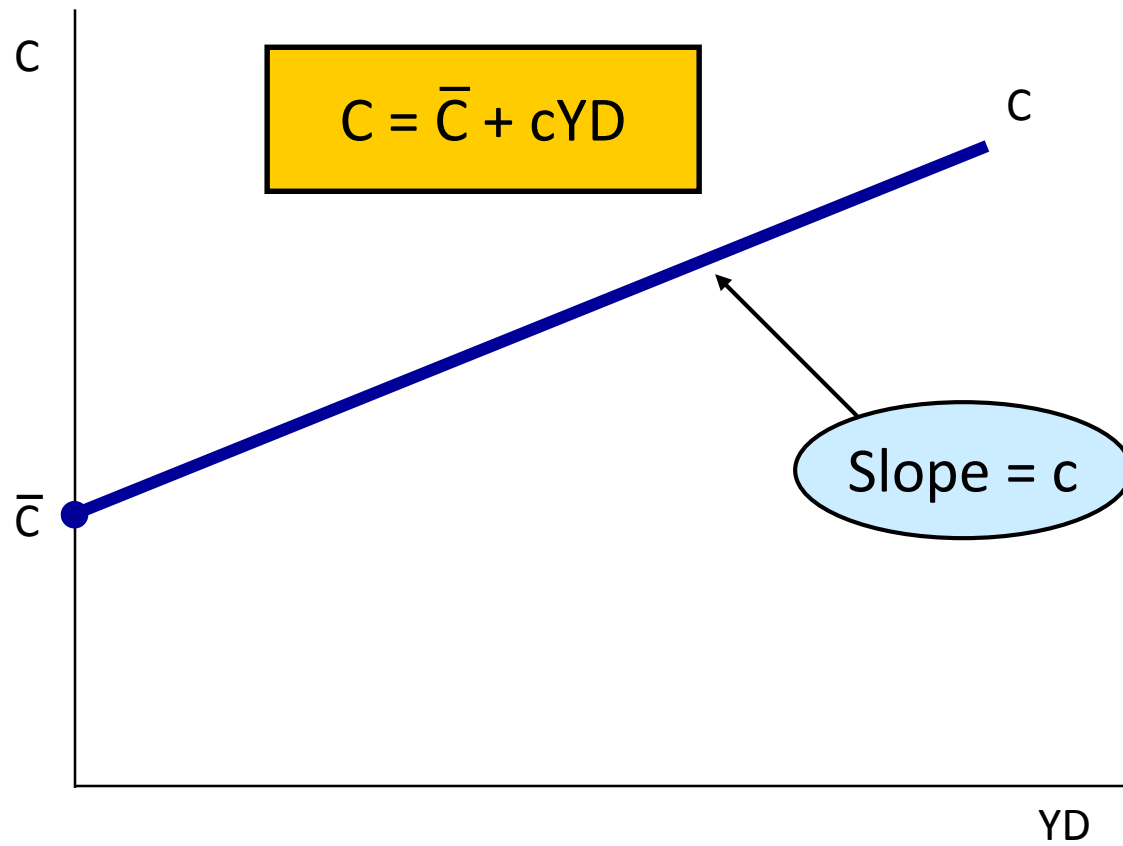
MARGINAL PROPENSITY TO CONSUME

- Since we are assuming that there is no government sector, taxes (**TA**) and transfer payments (**TR**) are nil

  ➢ Therefore, **YD = Y**

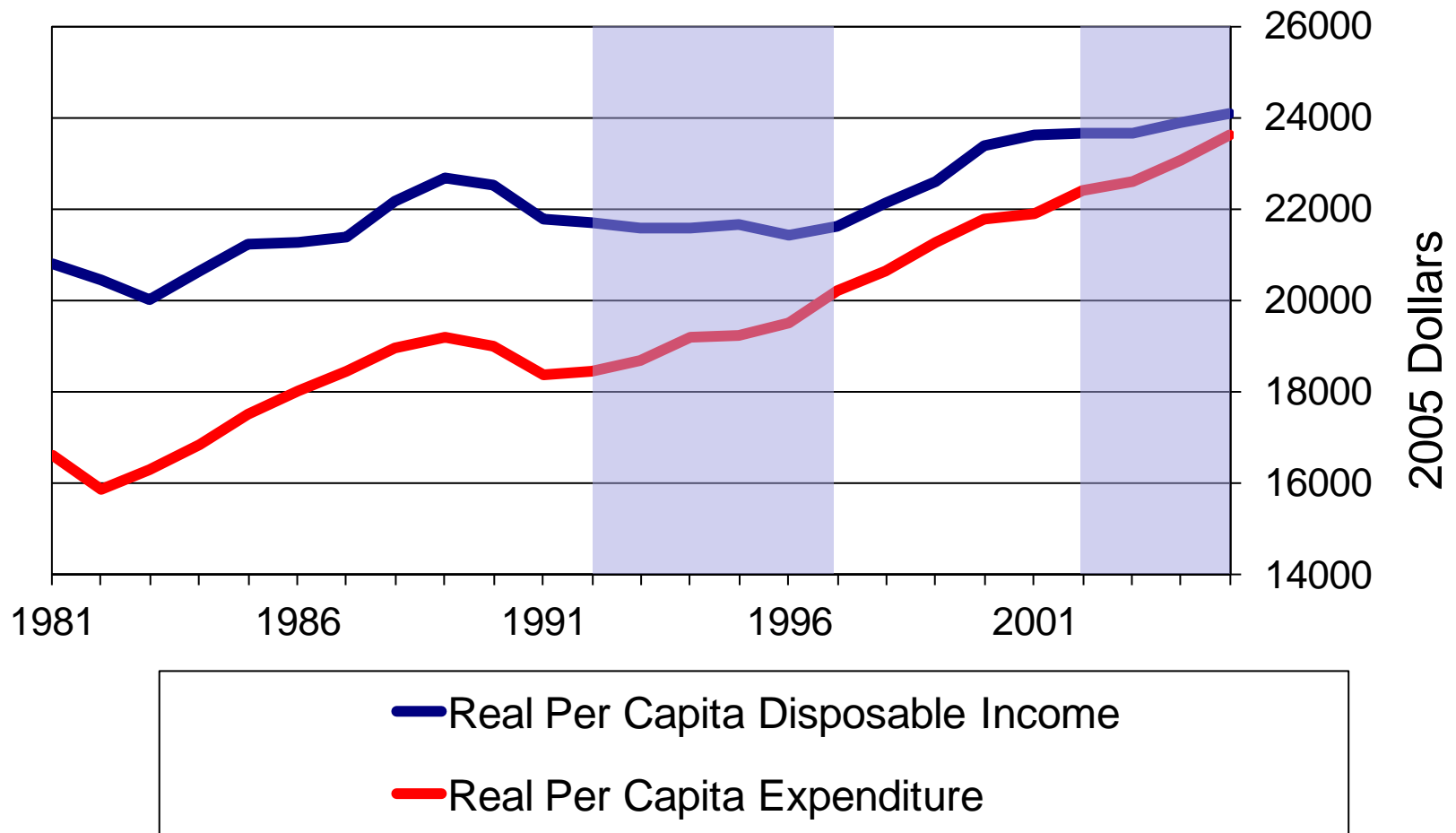 ➢ This means that consumption is assumed to depend on *income* (**Y**) alone:

  $$C = \bar{C} + cY$$

- Note that since **Y = YD**, then $MPC_Y = MPC_{YD}$

- However, as we will soon see, when **YD** differs from **Y**, MPC_Y also differs from MPC_{YD}

THE CONSUMPTION CURVE

$$C = \overline{C} + cYD$$

C

Slope = c

$\overline{C}$

YD

CANADA: PER CAPITA CONSUMPTION AND DISPOSABLE INCOME (1981-2005)

Legend:
— Real Per Capita Disposable Income
— Real Per Capita Expenditure

MARGINAL PROPENSITY TO SAVE

- The **MPC$_{YD}$** is positive but less than 1, thus implying that a $1 increase in *disposable income* does *not* increase *consumption* by $1

- A fraction **c** is spent on consumption and the rest is saved (i.e., a fraction **s = 1 − c** is saved)

- The constant **s** is the *marginal propensity to save* out of disposable income (**MPS$_{YD}$**)

- Therefore, **c + s = 1**
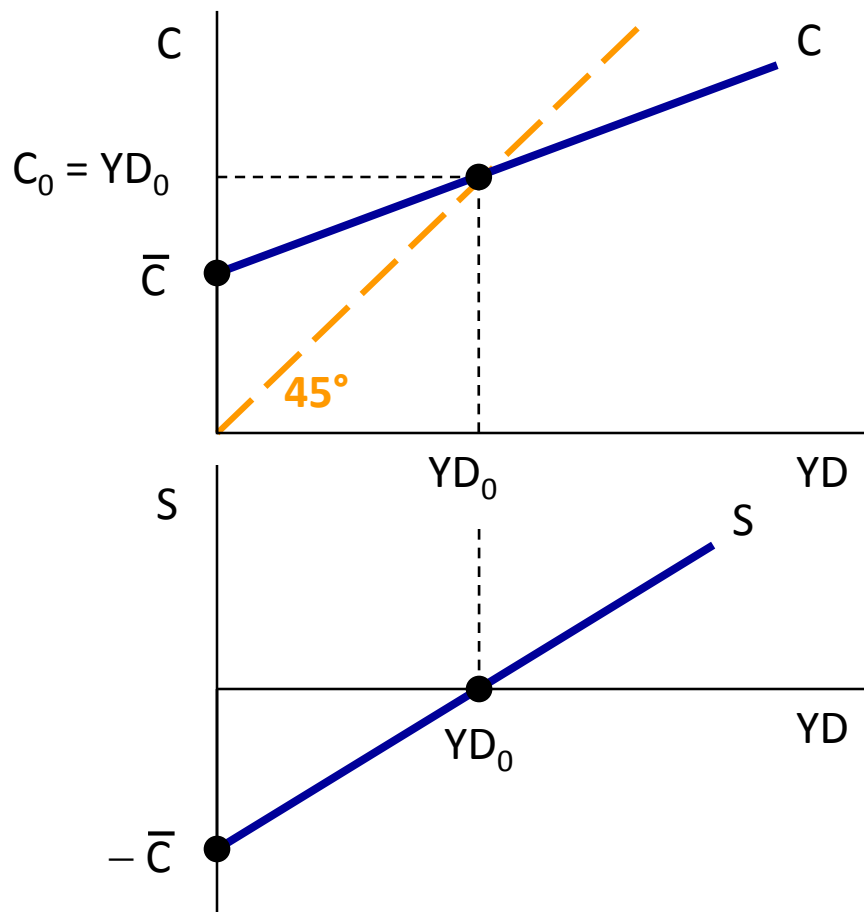
THE PLANNED SAVINGS FUNCTION

- Since **YD = C + S**, the *savings function* is given by:

$$S = YD - C$$
$$= YD - (\overline{C} + cYD)$$
$$= -\overline{C} + (1 - c)YD$$
$$= -\overline{C} + sYD$$

- Note that the **MPS$_{YD}$** is also positive and less than 1 since **s = 1 − c**

- The *savings function* is sort of the mirror image of the consumption function

CONSUMPTION AND SAVINGS FUNCTIONS

$$C = \overline{C} + c\,YD$$
$$S = -\overline{C} + (1 - c)\,YD$$

When YD = 0, then $C = \overline{C}$ and $S = -\overline{C}$

At the level of YD at which the C curve intersects the 45° line, C = YD and thus S = 0.

For $YD < YD_0$, C > YD and thus S < 0.
For $YD > YD_0$, C < YD and thus S > 0.

THE PLANNED INVESTMENT FUNCTION

- The *investment function* is a description of the total (desired or planned) investment expenditure by all private economic agents in the economy

- In general, planned investment expenditure depends on:
  - The *real* rate of interest
  - The level of economic activity (**Y**)
  - Businesses' *expectations* about the behaviour of these variables during the lifetime of the investment

- I would argue that *expectation* about **Y** (and therefore about *future demand*) is the most relevant variable determining investment

THE PLANNED INVESTMENT FUNCTION

- *Assumption:* For simplicity, we will *assume* that the rate of interest and expectations about the future are constant

- *Assumption:* For simplicity, we will further *assume* that planned investment is independent of the level of income (**Y**)

- *Assumption:* Therefore, *planned investment* will not change as the level of income (**Y**) changes

  - ➤ **I** is equal to autonomous investment: $I = \bar{I}$

THE INVESTMENT CURVE

$I = \bar{I}$
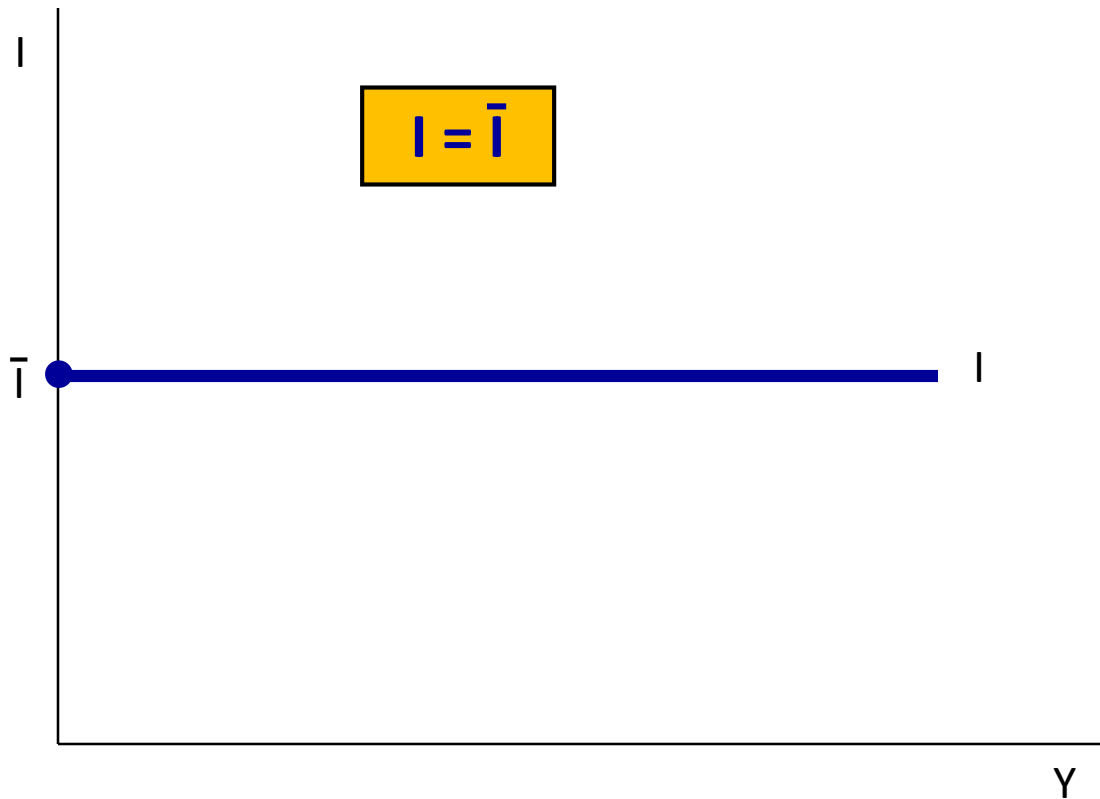
THE AGGREGATE EXPENDITURE FUNCTION

■ In this very simple model, the *aggregate expenditure* function is:

$$AE = C + I$$
$$= (\overline{C} + cY) + \overline{I}$$
$$= (\overline{C} + \overline{I}) + cY$$
$$= \overline{AE} + cY$$

where $\overline{AE} = \overline{C} + \overline{I}$ is *autonomous* aggregate expenditure and **cY** is *induced* aggregate expenditure

■ $\overline{AE}$ is the vertical intercept of the **AE** function, and **c** is the slope of the **AE** function (or the *marginal propensity to spend*)

Aggregate Expenditure Function

$$C = \overline{C} + cY$$
$$I = \overline{I}$$
$$AE = \overline{AE} + cY$$

Slope = c

AE

C

I

$$\overline{AE} = \overline{C} + \overline{I}$$

$$\overline{I}$$

$$\overline{C}$$

$$\overline{I}$$

AE
C
I

Y
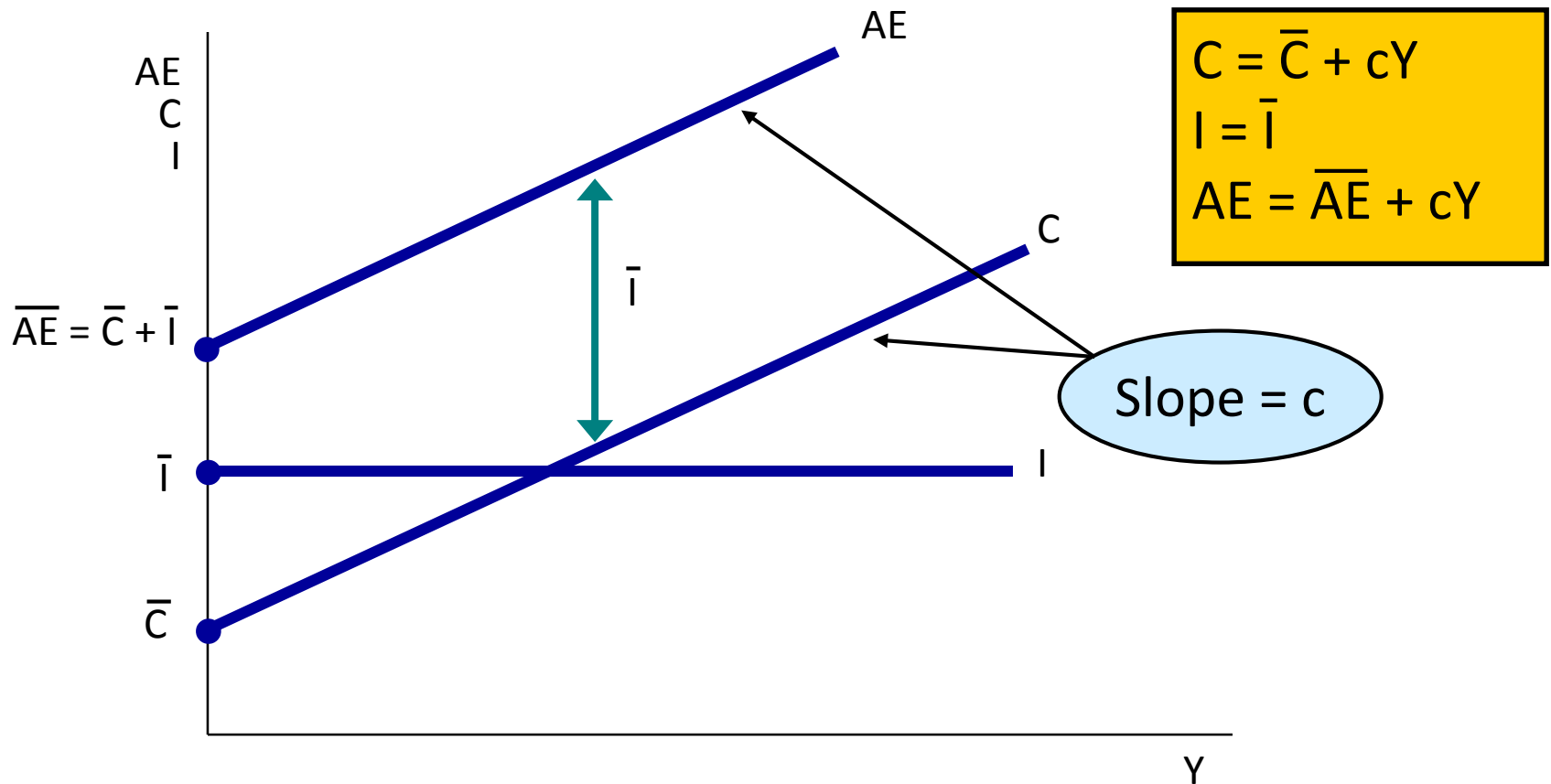
EQUILIBRIUM INCOME AND OUTPUT

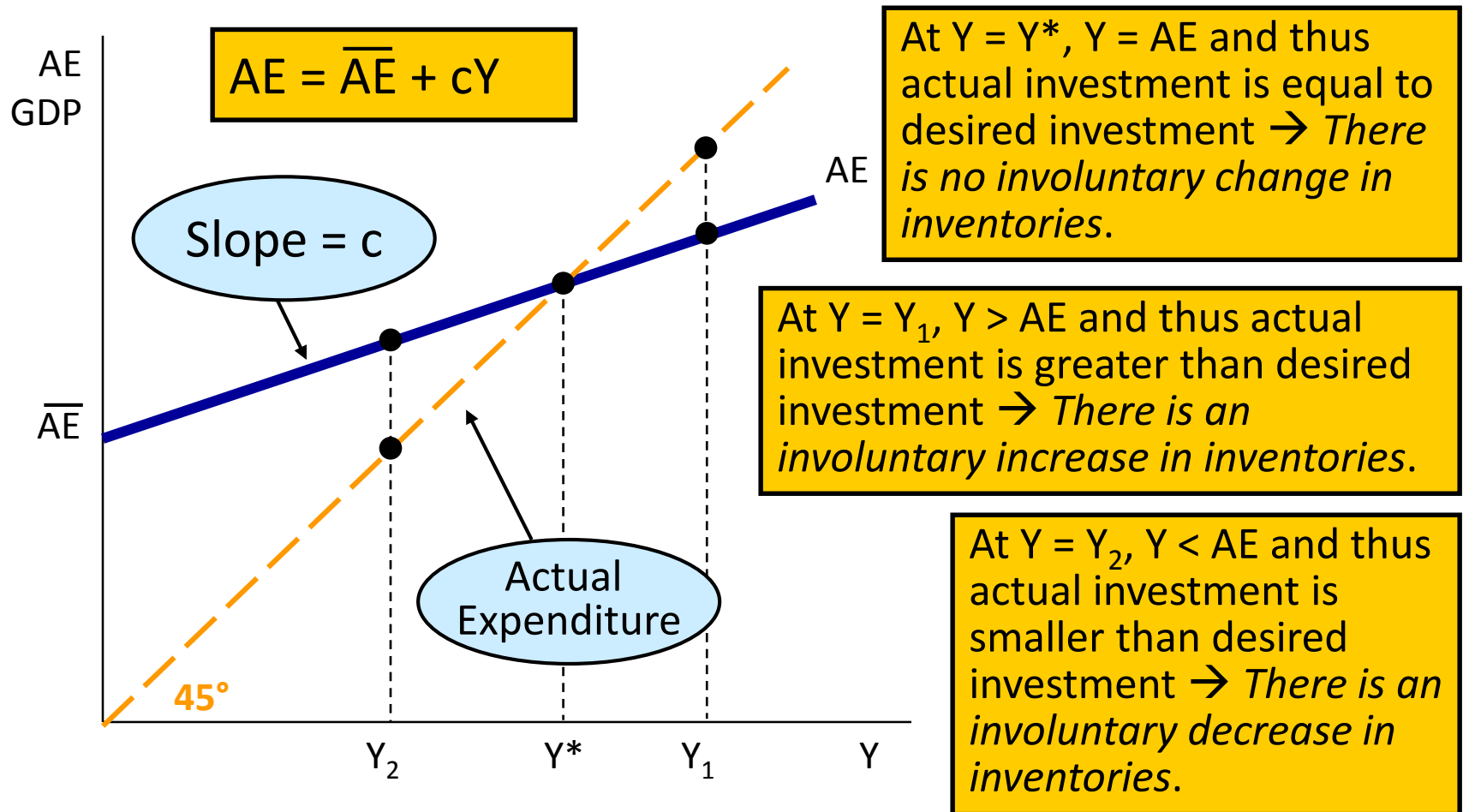- We have seen that in *equilibrium*, *output* (**GDP**) or *income* (**Y**) is equal to *aggregate expenditure* (**AE**):

$$Y = AE$$
$$= \overline{AE} + cY$$

- Therefore, $Y - cY = \overline{AE}$

$$(1 - c)Y = \overline{AE}$$

and *equilibrium income* is:

$$Y^* = \frac{1}{1 - c} \, \overline{AE}$$

AGGREGATE EXPENDITURE FUNCTION

$$AE = \overline{AE} + cY$$

Slope = c

Actual Expenditure

AE

GDP

$\overline{AE}$

45°

Y_2 Y^* Y_1 Y

At Y = Y*, Y = AE and thus actual investment is equal to desired investment → *There is no involuntary change in inventories*.

At Y = Y_1, Y > AE and thus actual investment is greater than desired investment → *There is an involuntary increase in inventories*.

At Y = Y_2, Y < AE and thus actual investment is smaller than desired investment → *There is an involuntary decrease in inventories*.

CONSUMPTION AND SAVING

■ The implicit *assumption* is that *actual* consumption is always equal to *desired* consumption as a result of *involuntary* changes in inventory

➢ If **AE > Y**, there is an *involuntary* decrease in inventory to satisfy the level of desired consumption

➢ If **AE < Y**, there is an *involuntary* increase in inventory because desired consumption is not enough (i.e., saving is too large)

■ Therefore, since *actual* consumption and *desired* consumption are always equal, then *actual* saving and *desired* saving are always equal as well

SAVINGS AND INVESTMENT

- By definition, *savings* is equal to *actual investment*
  - ➢ Output (**GDP**) is equal to income (**Y**) by assumption
  - ➢ Income not spend on consumption is saved
  - ➢ Output not used for consumption is used for investment

- **Y = C + S** and **Y = C +** *actual* **I → S =** *actual* **I**

- In equilibrium, when **Y = AE**, there is no *involuntary* change in inventory
  - ➢ Therefore, *desired* and *actual* investment are equal

- Therefore, in a closed economy with no government sector,
  - ➢ If **Y = AE**, then **S = desired I**
  - ➢ If **Y < AE**, then **S < desired I**
  - ➢ If **Y > AE**, then **S > desired I**

TWO WAS OF EXPRESSING EQUILIBRIUM INCOME IN THE ECONOMY
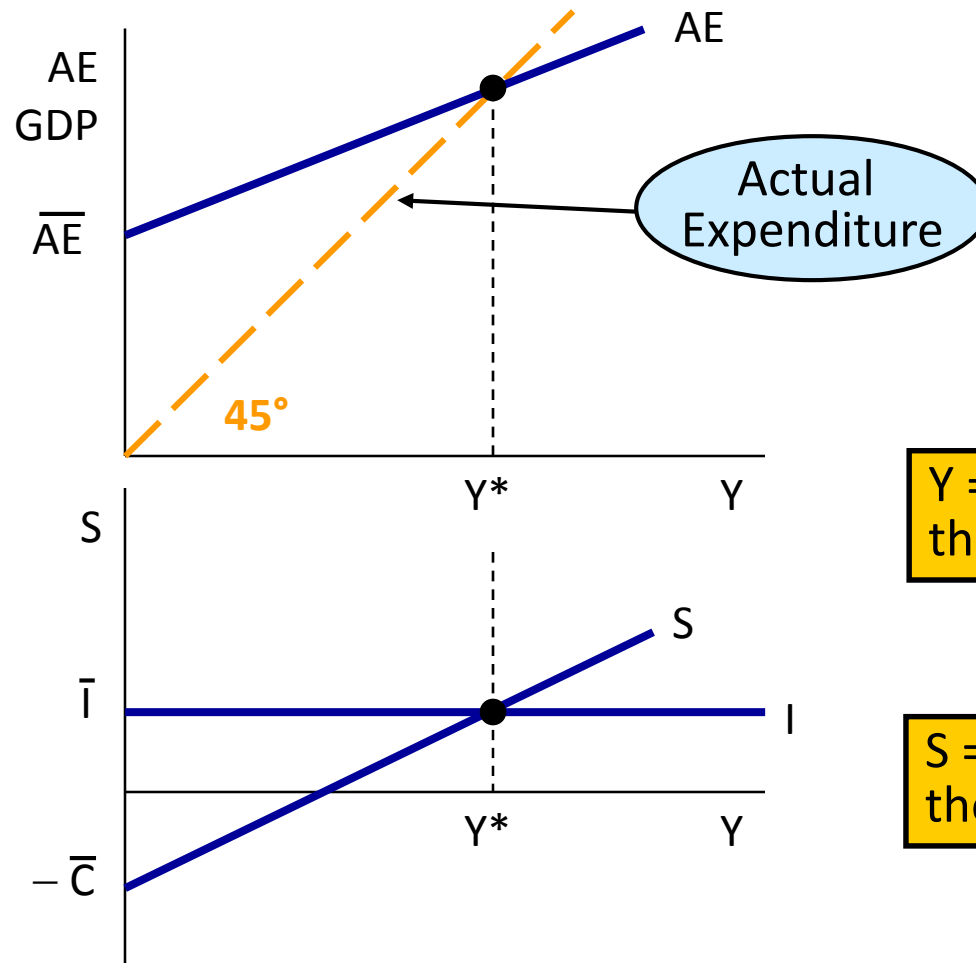
$$S = -\overline{C} + (1-c)Y$$
$$I = \overline{I}$$
$$\overline{AE} = AE + cY$$

Y = AE at Y = Y*, and thus Y* is the equilibrium level of income.

S = I at Y = Y*, and thus Y* is the equilibrium level of income.

SAVINGS AND INVESTMENT

■ By definition, *savings* is always equal to *actual investment*

■ **Question:** If high rates of *investment* are desirable, are high rates of *savings* also desirable?

➢ If savings determine *productive* investment, then high rates of savings might be desirable

■ But *high desired savings* is the result of *low desired consumption expenditure*

➢ Therefore, *actual investment* is large because firms are experiencing *involuntary* increases in inventory

■ Therefore, *higher desired savings* does not translate into *higher productive capacity* of the economy

➢ But *higher desired investment* does translate into *higher Y* and thus into *higher desired savings*

SAVINGS AND INVESTMENT (CONT'D)
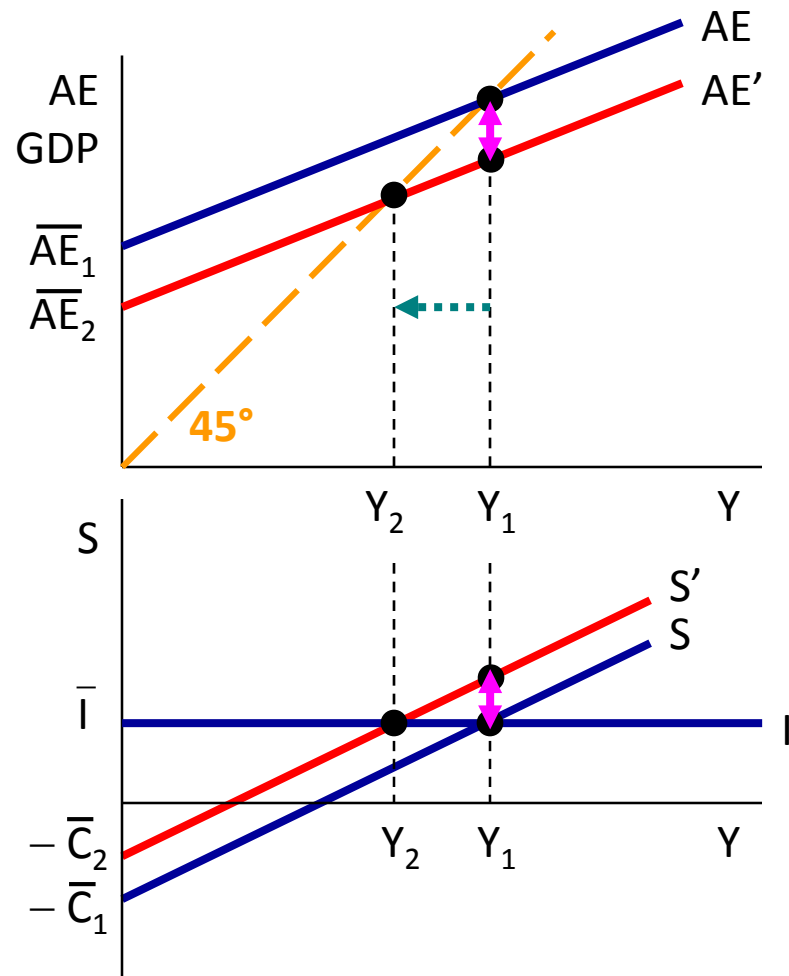
$$S = -\overline{C} + (1-c)Y$$
$$I = \overline{I}$$
$$AE = \overline{AE} + cY$$

Initially the economy is in equilibrium at Y_1.

As desired savings increases to S' and aggregate expenditure decreases to AE', Y > AE and Y falls.

THE MULTIPLIER

$$Y^* = \frac{1}{1-c}\ \overline{AE}$$

- How does a change in *autonomous expenditure* ($\overline{AE}$) affect *equilibrium income* (**Y***)?

- The equation for equilibrium income shows that a **$\Delta\overline{AE}$** will affect **Y*** in the following way:

$$\Delta Y^* = \frac{1}{1-c}\ \Delta\overline{AE}$$

- The expression

$$\alpha_{AE} = \frac{\Delta Y^*}{\Delta\overline{AE}} = \frac{1}{1-c} = \frac{1}{1-\text{slope of AE curve}}$$

  is called the *autonomous expenditure multiplier* or just the *multiplier*

THE MULTIPLIER (CONT'D)

- A change in autonomous expenditure ($\Delta\overline{\text{AE}}$) causes equilibrium income (**Y***) to change by the initial change in $\overline{\text{AE}}$ times the multiplier (α_{AE})

- This change in **Y***, $\alpha_{AE}\,\Delta\overline{\text{AE}}$, is the *final result* and does not show the *process* leading to it

- Let's have a look at the process leading to this final outcome

- Suppose that autonomous expenditure increases by $\Delta\overline{\text{AE}}$

PROCESS OF ADJUSTMENT

Round	ΔAE this round	ΔY this round	Accumulated ΔY
1	$\Delta\overline{AE}$	$\Delta\overline{AE}$	$\Delta\overline{AE}$
2	$c\,\Delta\overline{AE}$	$c\,\Delta\overline{AE}$	$(1+c)\,\Delta\overline{AE}$
3	$c^2\,\Delta\overline{AE}$	$c^2\,\Delta\overline{AE}$	$(1+c+c^2)\,\Delta\overline{AE}$
4	$c^3\,\Delta\overline{AE}$	$c^3\,\Delta\overline{AE}$	$(1+c+c^2+c^3)\,\Delta\overline{AE}$
…	…	…	…
n	$c^{n-1}\,\Delta\overline{AE}$	$c^{n-1}\,\Delta\overline{AE}$	$[1/(1-c)]\,\Delta\overline{AE}$

PROCESS OF ADJUSTMENT (CONT'D)

- After **n** rounds, the series $1 + c + c^2 + c^3 + ...$ converges to $\alpha_{AE} = 1/(1 - c)$

- Let's call $a = 1 + c + c^2 + c^3 + ...$

- Multiply **a** by **c** $\rightarrow$ $ca = c + c^2 + c^3 + ...$

- Now subtract **ca** from **a**:
  $$a - ca = (1 + c + c^2 + c^3 + ...) - (c + c^2 + c^3 + ...) = 1$$

- Therefore, $a(1 - c) = 1$ $\rightarrow$ $\boxed{a = 1/(1 - c)}$

INTRODUCTION OF THE GOVERNMENT SECTOR

- Disposable income (**YD**) changes:
  - ➢ Households pay **taxes**
  - ➢ Households receive **transfer payments**

- Equation for **AE** changes:
  - ➢ **AE = C + I + G**

- We will assume that **government expenditure** on goods and services is **independent** of the level of income, that is, **G** is **fixed** → $G = \overline{G}$

DISPOSABLE INCOME AND THE CONSUMPTION FUNCTION

- We have seen that consumption is a function of **disposable income** (**YD**):

$$C = \overline{C} + cYD$$

where $\overline{C}$ is autonomous consumption and **c** is the *marginal propensity to consume* out of *disposable income* (MPC_{YD})

- Disposable income (**YD**) is equal to:

$$YD = Y + TR - TA$$

where **TR** are *government transfer payments* and **TA** are *direct taxes*

DISPOSABLE INCOME AND THE CONSUMPTION FUNCTION (CONT'D)

- Let's assume that taxes are a function of income and that transfer payments are independent of income:

  - $TA = \overline{T} + tY$

  - $TR = \overline{TR}$

- Therefore, disposable income is equal to:

$$YD = Y + \overline{TR} - (\overline{T} + tY)$$
$$= \overline{TR} - \overline{T} + (1 - t)Y$$

THE CONSUMPTION FUNCTION AS A FUNCTION OF INCOME

- As a function of *income*, the consumption function is:

$$C = \overline{C} + cYD \qquad \boxed{YD = \overline{\overline{TR}} - \overline{T} + (1 - t)Y}$$

$$= \overline{C} + c\,[\,\overline{\overline{TR}} - \overline{T} + (1 - t)Y\,]$$

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

- That is, **$(\overline{C} + c\overline{\overline{TR}} - c\overline{T})$** is the vertical intercept and **$c(1 - t)$** is the slope

- Note that **$c(1 - t)$** is the *marginal propensity to consume* out of *income* (**MPC_Y**)

- Also note that **$MPC_Y < MPC_{YD}$** if **$t > 0$**

THE AGGREGATE EXPENDITURE FUNCTION

- The *aggregate expenditure* function is:

  $$AE = C + I + G$$
  $$= [\ \overline{C} + c\overline{TR} - c\overline{T} + c(1 - t)Y\ ] + \overline{I} + \overline{G}$$
  $$= \overline{AE} + c(1 - t)Y$$

  where $\overline{AE} = \overline{C} + c\overline{TR} - c\overline{T} + \overline{I} + \overline{G}$

- The vertical intercept is $\overline{AE}$ and the slope is $c(1 - t)$

- Recall that the slope of the **AE** curve is the *marginal propensity to spend*

EQUILIBRIUM OUTPUT AND INCOME

- Equilibrium income is determined where **Y = AE**:

$$Y = \overline{AE} + c\,(1 - t)Y$$

$$[\,1 - c\,(1 - t)\,]\,Y = \overline{AE}$$

- Therefore,

$$Y^* = \frac{1}{1 - c\,(1 - t)}\,\overline{AE}$$

THE MULTIPLIER

- The *autonomous expenditure multiplier* becomes:

$$\alpha_{AE} = \frac{1}{1 - c(1 - t)}$$

- Note that as before, the multiplier is equal to 1 over 1 minus the slope of the **AE** curve

- Also note that, as **t** increases, α_{AE} becomes smaller (the **AE** curve becomes flatter)

THE INTRODUCTION OF THE FOREIGN SECTOR

- We will assume that the equations for *exports* (**X**) and *imports* (**Q**) are as follows:

$$X = \bar{X}$$

$$Q = \bar{Q} + mY$$

where **m** is the *marginal propensity to import*

- Therefore, the equation for *net exports* (**NX**) is:

$$NX = X - Q$$

$$= \bar{X} - \bar{Q} - mY$$

THE EQUATION FOR THE AE CURVE

$$NX = \overline{X} - \overline{Q} - mY$$

■ In a closed economy, the equation for AE was:

$$AE = C + I + G$$
$$= \overline{AE} + c(1 - t)Y$$

where $\overline{AE} = \overline{C} - c\overline{T} + c\overline{TR} + \overline{I} + \overline{G}$

■ In an open economy, the equation for **AE** is:

$$AE = C + I + G + NX$$
$$= \overline{AE} + [c(1 - t) - m]Y$$

where $\overline{AE} = \overline{C} - c\overline{T} + c\overline{TR} + \overline{I} + \overline{G} + \overline{X} - \overline{Q}$

EQUILIBRIUM INCOME

- In equilibrium, **Y = AE**, that is,

$$Y = \overline{AE} + [c(1 - t) - m]Y$$

$$\{1 - [c(1 - t) - m]\}Y = \overline{AE}$$

- Therefore, equilibrium income is:

$$Y^* = \frac{1}{1 - c(1 - t) + m}\ \overline{AE}$$

where $\overline{AE} = \overline{C} - c\overline{T} + c\overline{TR} + \overline{I} + \overline{G} + \overline{X} - \overline{Q}$

THE MULTIPLIER

- The multiplier is:

$$\alpha_{AE} = \frac{1}{1 - c(1 - t) + m}$$

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

- Where the *slope* of the **AE** curve (i.e., the *marginal propensity to spend*) is the fraction of each additional dollar of income which is spent on *domestically produced goods*