AGGREGATE EXPENDITURE AND EQUILIBRIUM INCOME 2

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EE212

Introductory to macroeconomics

UP TO THIS POINT

- We discussed about the behavior of **components of total spending**.
  - Theory of desired expenditure: C , I , G, X , M (NX)
- Various theories explain the behavior of components of total spending.
  - A common factor driving each type of spending is "**aggregate income**".
- Given the total spending, this lecture focuses on the **aggregate income determination – i.e. equilibrium income determination!**

AGENDA

- **Aggregate expenditure function**
- Equilibrium income determination model
- Change in the equilibrium income and Multiplier
- Policy applications

AGGREGATE EXPENDITURE FUNCTION

- **Aggregate expenditure function:** behavioral equation that relates the aggregate expenditure to aggregate income.
- **Aggregate expenditure function =** Keynesian spending function combined

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

$$C = \bar{C} - c_1(\bar{T} - \bar{R}) + c_1 Y$$

$$I = \bar{I} + I_1 Y$$

$$G = \bar{G}$$

$$X = \bar{X}$$

$$M = \bar{M} + m_1 Y$$

AGGREGATE EXPENDITURE FUNCTION

$$AE = C + I + G + X - M = \overline{\boldsymbol{AE}} + c_1 Y + I_1 Y - m_1 Y$$

- $\overline{AE}$: (Net) autonomous aggregate expenditure
  - = Autonomous C, I, G – mpc*(Autonomous tax – Autonomous transfer) – Autonomous imports
  - Determined by non-income factors (given!)

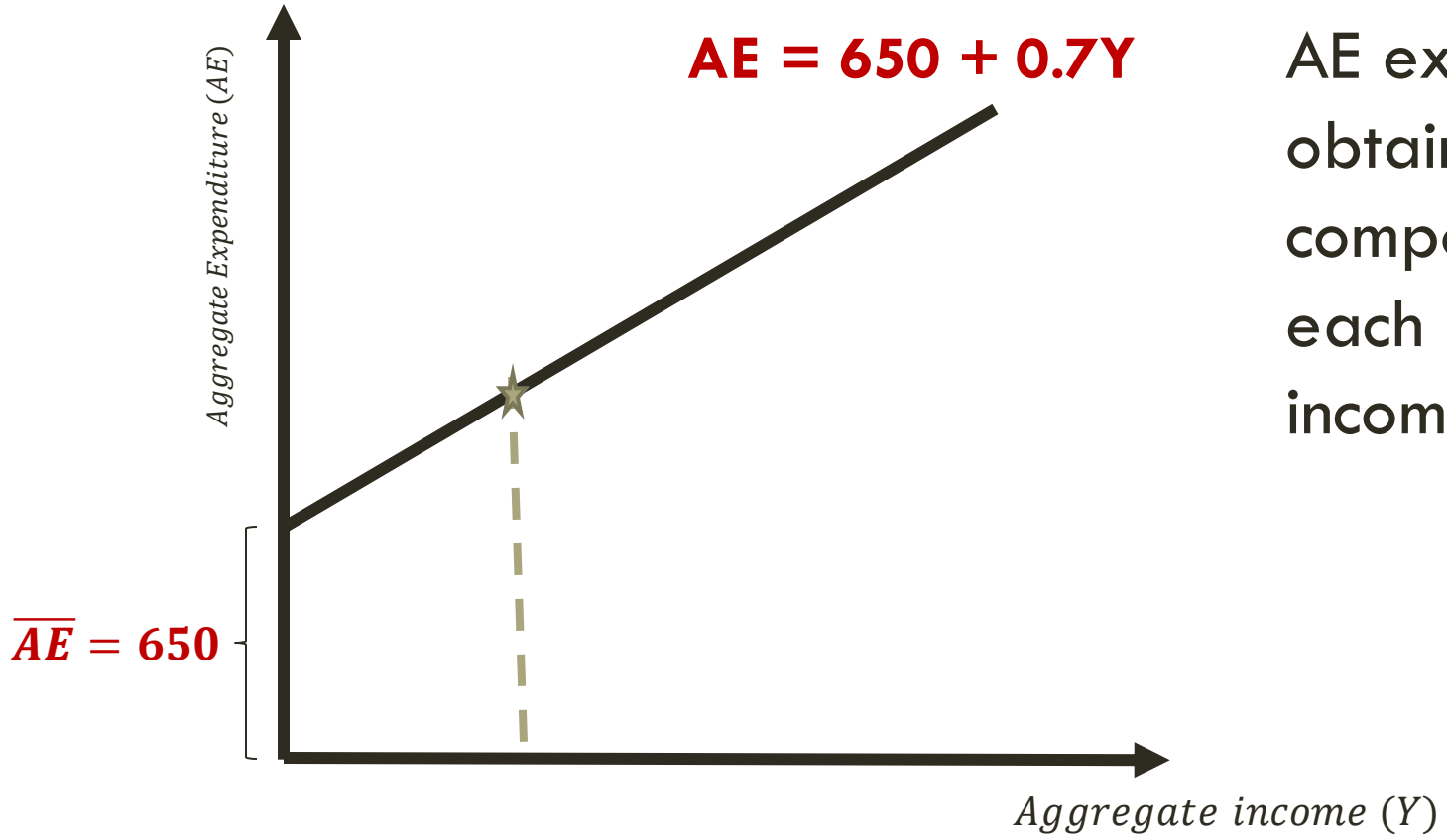
- $c_1 Y + I_1 Y - m_1 Y$: Income-induced desired aggregate expenditure

AGGREGATE EXPENDITURE FUNCTION: NUMERICAL EXAMPLE

- Suppose:
  - C = **175** + 0.75(Y-T+R) ; T = 150, R = 50 → T – R = 100
  - I = **200** + 0.15Y
  - G = **200**
  - X = **300**
  - M = **150** + 0.2Y

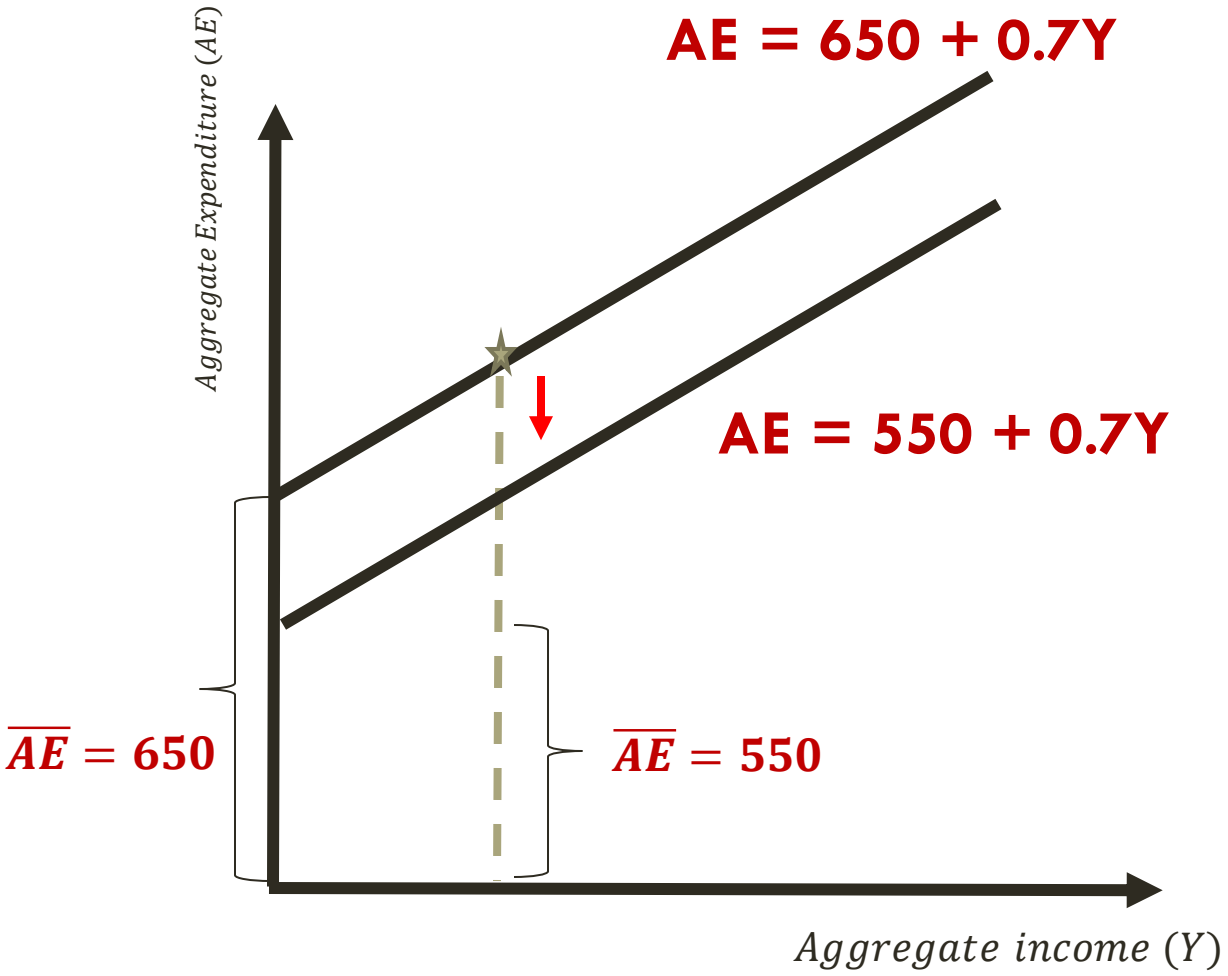
$$\begin{aligned} \mathbf{AE} &= C + I + G + X - M \\ &= 175 + 0.75(Y-100) + 200 + 0.15Y + 200 + 300 - (150 - 0.2Y) \\ &= \mathbf{(175 + 200 + 200 + 300 - 150 - 0.75*100) + 0.7Y} \\ &= \mathbf{650 + 0.7Y} \end{aligned}$$

AGGREGATE EXPENDITURE FUNCTION: AGGREGATE EXPENDITURE LINE



AE expenditure line can be obtained by **vertically summing up** components of total spending at each level of given aggregate income.

AGGREGATE EXPENDITURE FUNCTION: AGGREGATE EXPENDITURE LINE



C = 175 + 0.75(Y-100)
I = 200 + 0.15Y
G = 200
X = 300
M = 150 + 0.2Y

AE expenditure line can be changed if the (net) autonomous aggregate expenditure change or marginal propensity to spending (MPC, MPI, MPM)

Figure: A drop in autonomous consumption by 100 THB.

AGGREGATE EXPENDITURE FUNCTION: CHANGE IN THE AUTONOMOUS EXPENDITURE

- (Net) autonomous expenditure

  = Autonomous consumption + Autonomous investment + Autonomous government spending + Autonomous exports – Autonomous imports – MPC*(Autonomous tax – Autonomous transfer).

- Notice the direction and size of change.

ACTIVE LEARNING: EXPLAINING THE IMPACT OF FOLLOWING SITUATIONS / WHY?

- Tax cut by government
- Business sentiments improve
- Expectation of economic downturn in Thailand
- World GDP income decrease
- Thai baht appreciate
- Government lowers tax collection.
- Central bank increases the interest rate.

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- **Equilibrium income determination model**
- Change in the equilibrium income and Multiplier
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EQUILIBRIUM INCOME DETERMINATION

- Income is components of total expenditure combined.
- But, aggregate expenditure depends on income!

- **Simultaneity problem:** Income and aggregate expenditure (as well as components of spending) *simultaneously* determine each other!
  - Technical jargon: *Endogenously determined*

EQUILIBRIUM INCOME DETERMINATION

- **Equilibrium income:** The level of income that makes *aggregate expenditure function equal to the income*

$$Y^* = AE(Y^*)$$

- **Idea:** Business units choose the level of output (income) that make sure all the output get exactly purchased – i.e. no left-over output / no shortage of output.

EQUILIBRIUM INCOME

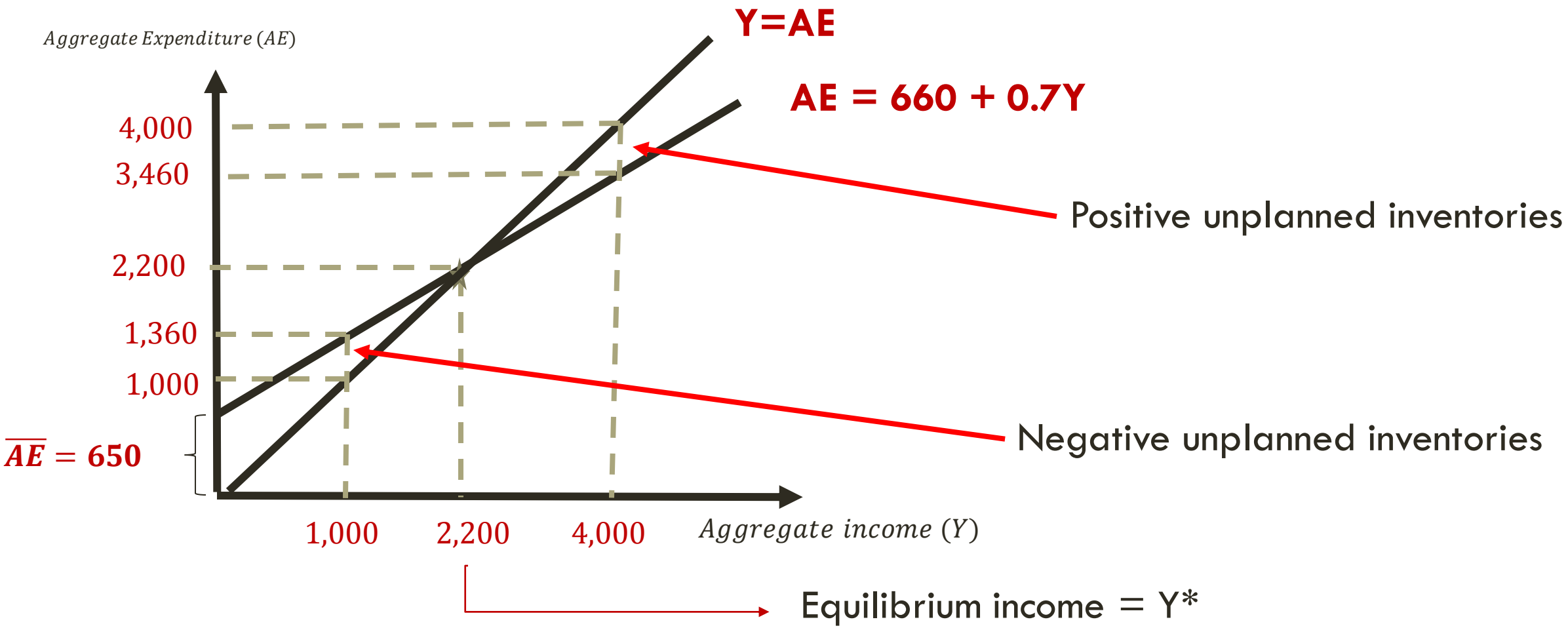
- What do we mean by "all the output get exactly purchased?"
  - Having goods sold out does not mean that no output remains on the shelves.
- **Inventories:** product on the shelves or in the warehouse
  - Planned inventories: most firm plans the optimal inventory holdings.
  - Unplanned inventories: Unexpected drop in sale / Unexpected huge demand causes the amount of inventories higher / lower than planning

EQUILIBRIUM INCOME

- Firm will adjust the level of production (=Income) so as to make sure that unplanned inventories do not exist!
  - No pressure for adding or cutting the production

- Graphically illustrated, equilibrium income occurs where 45-degree line crosses with the (desired) aggregate expenditure line.
  - This is commonly known the Keynesian cross diagram

AGGREGATE EXPENDITURE FUNCTION: EQUILIBRIUM INCOME



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CHANGE IN EQUILIBRIUM INCOME

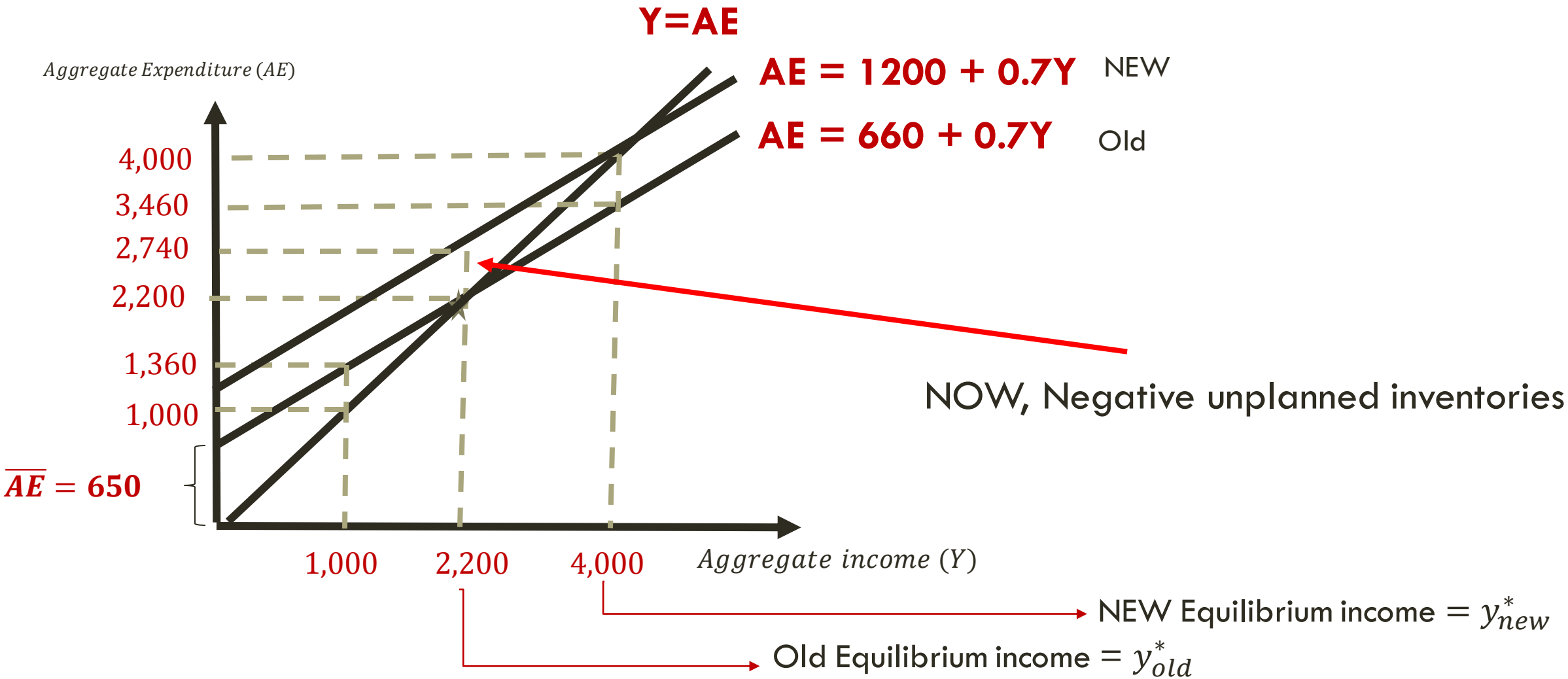
- Equilibrium income is determined by **NET autonomous expenditure**, which is ultimately determined by components of autonomous expenditure
  - Net autonomous aggregate expenditure

= Autonomous consumption + Autonomous investment + Autonomous government spending + Autonomous exports – Autonomous imports – **MPC*(Autonomous tax – Autonomous Transfer).**

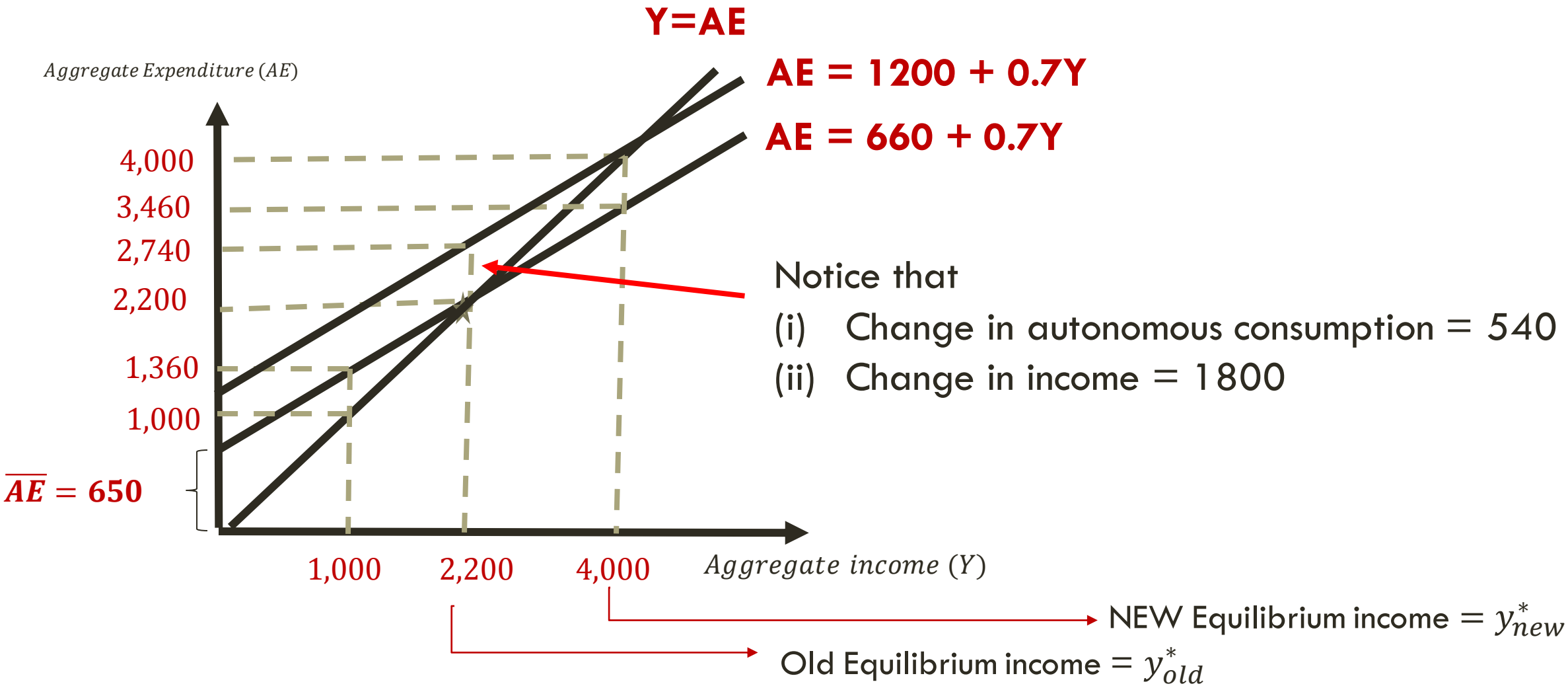
CHANGE IN EQUILIBRIUM INCOME

- If each of the autonomous expenditure changes, the level of equilibrium income will be changed as well
  - **Example:** Private sector may "*exogenously*" increase the autonomous consumption to 715 THB – i.e. an increase by 540 THB.
  - **Exogenous**: Having an external cause or origin.

CHANGE IN EQUILIBRIUM INCOME



CHANGE IN EQUILIBRIUM INCOME: MULTIPLIER



CHANGE IN EQUILIBRIUM INCOME: MULTIPLIER

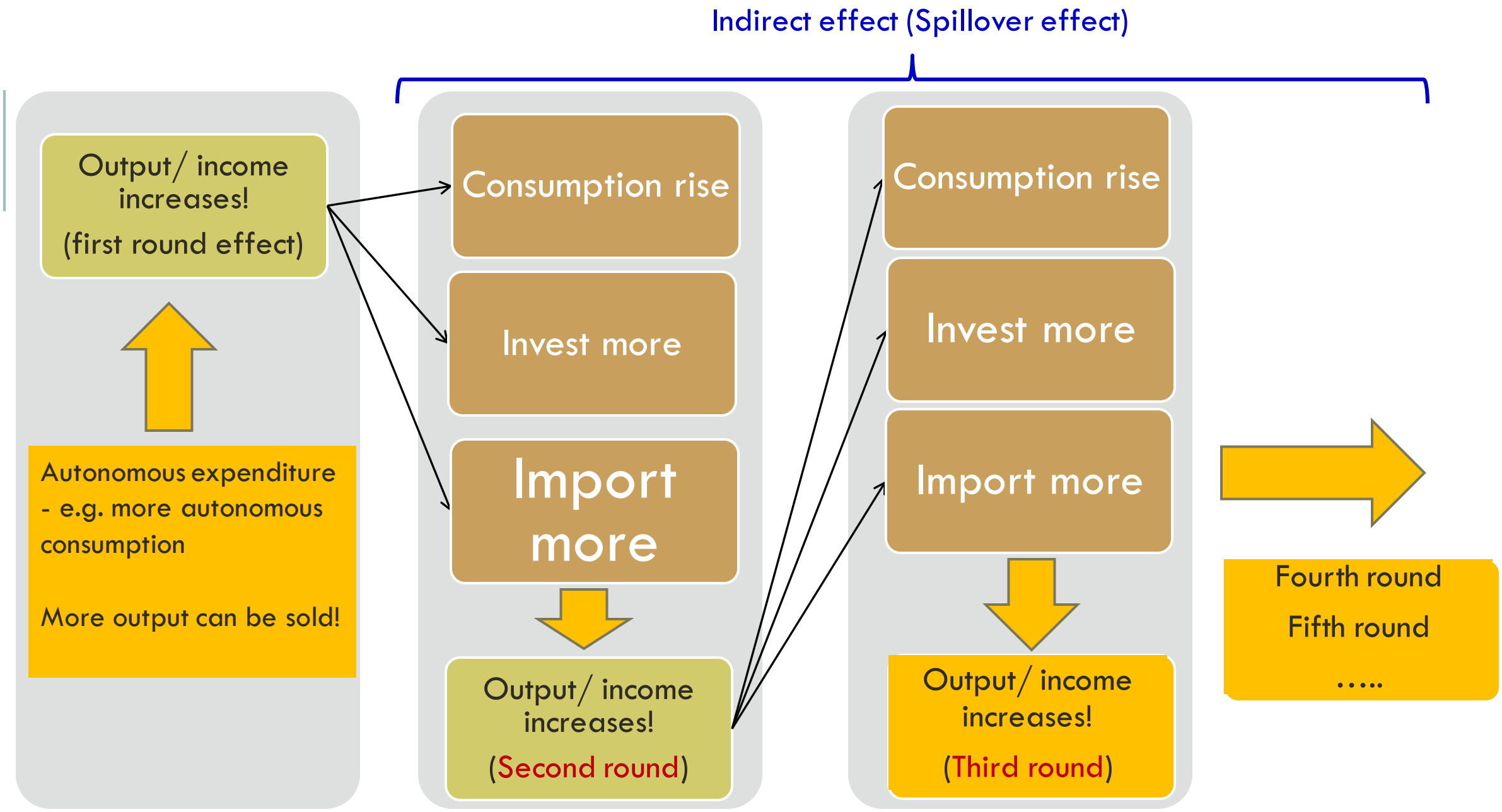
- First, a change in autonomous expenditure can create a change in national income.
- Second, the change in national income is ***bigger*** than the original change in autonomous consumption.

CHANGE IN EQUILIBRIUM INCOME: MULTIPLIER

- This is called the **multiplier effect – i.e.** the ***amplified*** change in equilibrium income due to the change in autonomous expenditure.
  - Multiplier: measuring the change in equilibrium income to the change in autonomous expenditure.
  - Multiplier $= \frac{\Delta y^*}{\Delta \bar{C}} = \frac{1800}{540} = 3.33$

CHANGE IN EQUILIBRIUM INCOME: MULTIPLIER

- Rounds of interaction and impact!
  - **First-round effect:** The initial increase in autonomous consumption increases the aggregate output, and hence income by an equal amount.
  - **Indirect effects:** As income increases, private sector will be spending more, causing feedback effects to the production. This reinforces the effect of the first round impact.


Indirect effect (Spillover effect)
Output/ income increases!
(first round effect)
Autonomous expenditure - e.g. more autonomous consumption
More output can be sold!
Consumption rise
Invest more
Import more
Output/ income increases!
(Second round)
Consumption rise
Invest more
Import more
Output/ income increases!
(Third round)
Fourth round
Fifth round
…..

CHANGE IN EQUILIBRIUM INCOME: MULTIPLIER

- What is the multiplier effect?

Rounds of effect	C	I	G	X	M	Y
First-round	**+540**					**+540**
Second-round	+ 0.75(540)	+ (0.15) (540)			-0.2(540)	+ (0.7)(540)
Third-round	+ 0.75 ((0.7)(540))	+ (0.15) ((0.7)(540))			- 0.75 ((0.7)(540))	+ (0.7)(0.7)(540)
N-round effect						$+ (0.7)^{N-1}(540)$

CHANGE IN EQUILIBRIUM INCOME: MULTIPLIER

- Total effect = First-round effect + **Second-round effect + ….**

$$= 540 + \mathbf{0.7\,(\,540)} + \mathbf{(0.7)^2(540)} + \cdots$$

$$= \{1 + 0.7 + (0.7)^2 + \cdots\}(540)$$

$$= \frac{1}{1-\mathbf{0.7}}(540)$$

$$= \left(\frac{10}{3}\right)(540)$$

CHANGE IN EQUILIBRIUM INCOME: MULTIPLIER

- What is the multiplier effect?

Rounds of effect	C	I	G	X	M	Y (Income)
First round effect	+540					+540
Second round effect	+ MPC(540)	+ (MPI) (540)			-MPM(540)	+ **(MPC+MPI-MPM)**(540)
Third round effect	+ MPC ((0.7)(540))	+ (MPI) ((0.7)(540))			- 0.75 ((0.7)(540))	+ (0.7)(0.7)(540)
N-round effect						+ (0.7)

Total effect $= 540 + 0.7\,(540) + (0.7)^2(540) + \cdots = \{1 + 0.7 + (0.7)^2 + \cdots\}(540) = \frac{1}{1-0.7}(540) = \left(\frac{10}{3}\right)(540)$

CHANGE IN EQUILIBRIUM INCOME: MULTIPLIER

- Total effect = First-round effect + Second-round effect + ….

$$= 540 + (\boldsymbol{mpc + mpi - mpm})\,(\boldsymbol{540}) + (\boldsymbol{mpc + mpi - mpm})^{\boldsymbol{2}}(\boldsymbol{540}) + \cdots$$

$$= \{1 + (mpc + mpi - mpm) + (mpc + mpi - mpm)^2 + \cdots\}(540)$$

$$= \frac{\boldsymbol{1}}{\boldsymbol{1-(mpc+mpi-mpm)}}(540)$$

- Multiplier $= \dfrac{\boldsymbol{1}}{\boldsymbol{1-(mpc+mpi-mpm)}}$

MULTIPLIER OF AUTONOMOUS CONSUMPTION

- Multiplier of autonomous consumption is equal to $\frac{\mathbf{1}}{\mathbf{1-(mpc+mpi-mpm)}}$
  - Positive value (meaning?)
  - Greater than 1 if $mpc + mpi - mpm < 1$
  - For every 1THB increase, equilibrium income will change by the size of multiplier.

MULTIPLIER OF OTHER AUTONOMOUS EXPENDITURES

- How about others?
  - All, except the autonomous tax and autonomous transfer, create a one-to-one change on net autonomous expenditure – i.e. equal shift of AE curve.
  - They all have the same multiplier!

MULTIPLIER OF OTHER AUTONOMOUS EXPENDITURES

Autonomous expenditure	Multiplier
$\bar{C}$	$\frac{1}{1-(mpc+mpi-mpm)}$
$\bar{I}$	
$\bar{G}$	
$\bar{X}$	
$\bar{M}$	$-\frac{1}{1-(mpc+mpi-mpm)}$

MULTIPLIER OF OTHER AUTONOMOUS EXPENDITURES

- What about autonomous tax and autonomous transfer?
- The first-round effect is smaller by a fraction of "MPC"
  - Transfer and tax does not create a direct exchange of goods & services.
  - Induced higher consumption, by a fraction of MPC.
  - Income changes by (MPC x autonomous change in tax-or-transfer)

MULTIPLIER OF OTHER AUTONOMOUS EXPENDITURES

Autonomous expenditure	Multiplier
$\bar{T}$	$\dfrac{mpc}{1-(mpc+mpi-mpm)}$
$\bar{M}$	$-\dfrac{mpc}{1-(mpc+mpi-mpm)}$

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ECONOMIC PROBLEMS

- One of the government objectives is to ensure high-level of output (GDP).
- Ideally, government wish to keep the GDP at the full-employment level.
- In the reality, actual output can be higher or lower than the full-employment level.
- This leads to economic GAP problem.

ECONOMIC PROBLEMS: GAP PROBLEM

- Define GAP = y^* - y^f
  - y^f = full-employment output
  - y^* = actual equilibrium output

- The economy is experiencing a **deflation GAP problem** if **GAP < 0.**
- The economy is experiencing an **inflation GAP problem** if **GAP > 0.**

ECONOMIC PROBLEMS: FIXING THE GAP PROBLEM

- Boom / Recession are both costly.
  - Recession (GAP < 0): Unemployment is high.
  - Boom (GAP > 0): Inflation is high; hurting people
- The GAP problem can be fixed if government assigns the right type of policy.
  - GAP < 0 → Expansionary policy: increase G, decrease T, increase R
  - GAP > 0 → Contractionay policy: lower G, increase T, lower R

ECONOMIC PROBLEMS: SIZE OF POLICY ACTION

- **Applications:** Multiplier effect
- Given we know the size of GAP, one can apply the multiplier concept to back out the required change of government spending, tax, and transfers.

$$\Delta y = multiplier_G * \Delta G \rightarrow \frac{GAP}{multiplier_G} = \Delta G$$

$$\Delta y = multiplier_T * \Delta T \rightarrow \frac{GAP}{multiplier_T} = \Delta T$$

$$\Delta y = multiplier_R * \Delta R \rightarrow \frac{GAP}{multiplier_R} = \Delta R$$