

# LECTURE 8

## IS-LM | IS SUBMODEL

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# OVERVIEW

- IS submodel describes how expenditures on goods (Z) relates to income (Y) in the economy
  1. consumers' behavior: expenditure function
  2. accounting identity: income = expenditure
- in equilibrium, both conditions are satisfied

# DEFINING THE EQUILIBRIUM

- first equilibrium condition: expenditure function
  - $Z = [c_0 + I + G - c_1 \times T] + c_1 \times Y$
- second equilibrium condition: expenditure = income
  - $Z = Y$
- 2 equations & 2 variables (Z,Y): equilibrium is well defined

# EQUILIBRIUM INCOME

- to determine the **equilibrium level of income  $Y^*$** , we jointly solve both equilibrium conditions
- $Z = [c_0 + I + G - c_1 \times T] + c_1 \times Y$  and  $Z = Y$
- $Y = [c_0 + I + G - c_1 \times T] + c_1 \times Y$  [substituting  $Z$  out]
- $(1 - c_1) \times Y = c_0 + I + G - c_1 \times T$  [algebra]
- hence:  $Y^* = (c_0 + I + G - c_1 \times T) / (1 - c_1)$
- in equilibrium: income  $Y^* =$  expenditure  $Z^* =$  GDP

# AUTONOMOUS EXPENDITURE

- $Y^* = (c_0 + I + G - c_1 \times T) / (1 - c_1)$
- $(c_0 + I + G - c_1 \times T)$ : autonomous expenditure
  - it measures aggregate demand (AD): the level of demand in the economy, determined by the desire to spend of households ( $c_0$ ), firms (I), and the government (G)
  - shocks to AD are key drivers of business cycles
  - changes in  $c_0$  reflect changes in people's desire to spend: it is an especially important AD shock

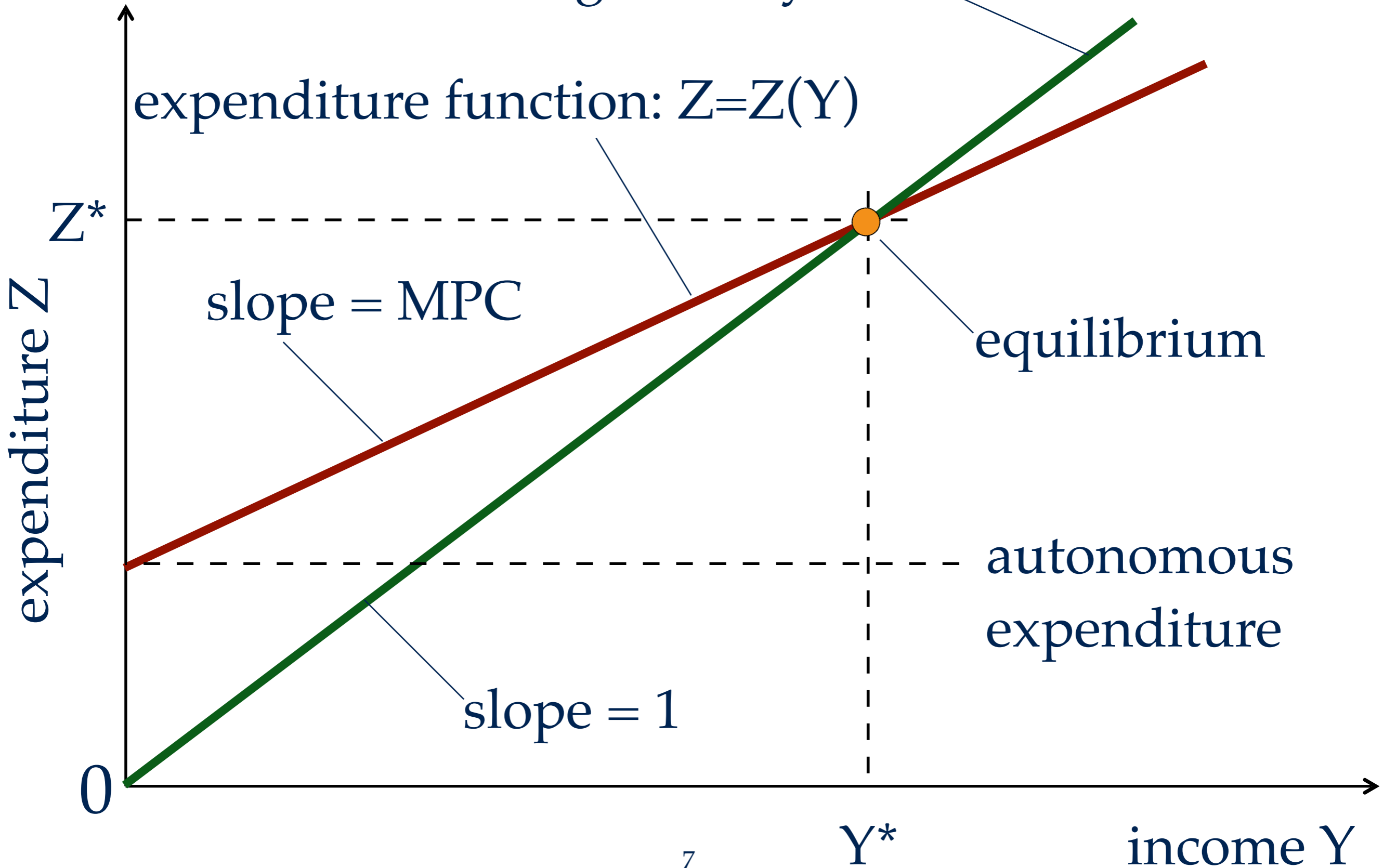
# SPENDING MULTIPLIER

- $Y^* = (c_0 + I + G - c_1 \times T) / (1 - c_1)$
- $1 / (1 - c_1)$ : spending multiplier
  - it “multiplies” autonomous expenditure to get equilibrium expenditure: it how \$1 of autonomous expenditure translates into GDP
  - if  $c_1 = 0.6$ , multiplier is  $1 / (1 - 0.6) = 2.5$ : an increase in autonomous spending by \$1 increases GDP by \$2.5
  - the multiplier is different for different consumption and investment functions

# IS EQUILIBRIUM DIAGRAM

accounting identity:  $Z=Y$

expenditure function:  $Z=Z(Y)$

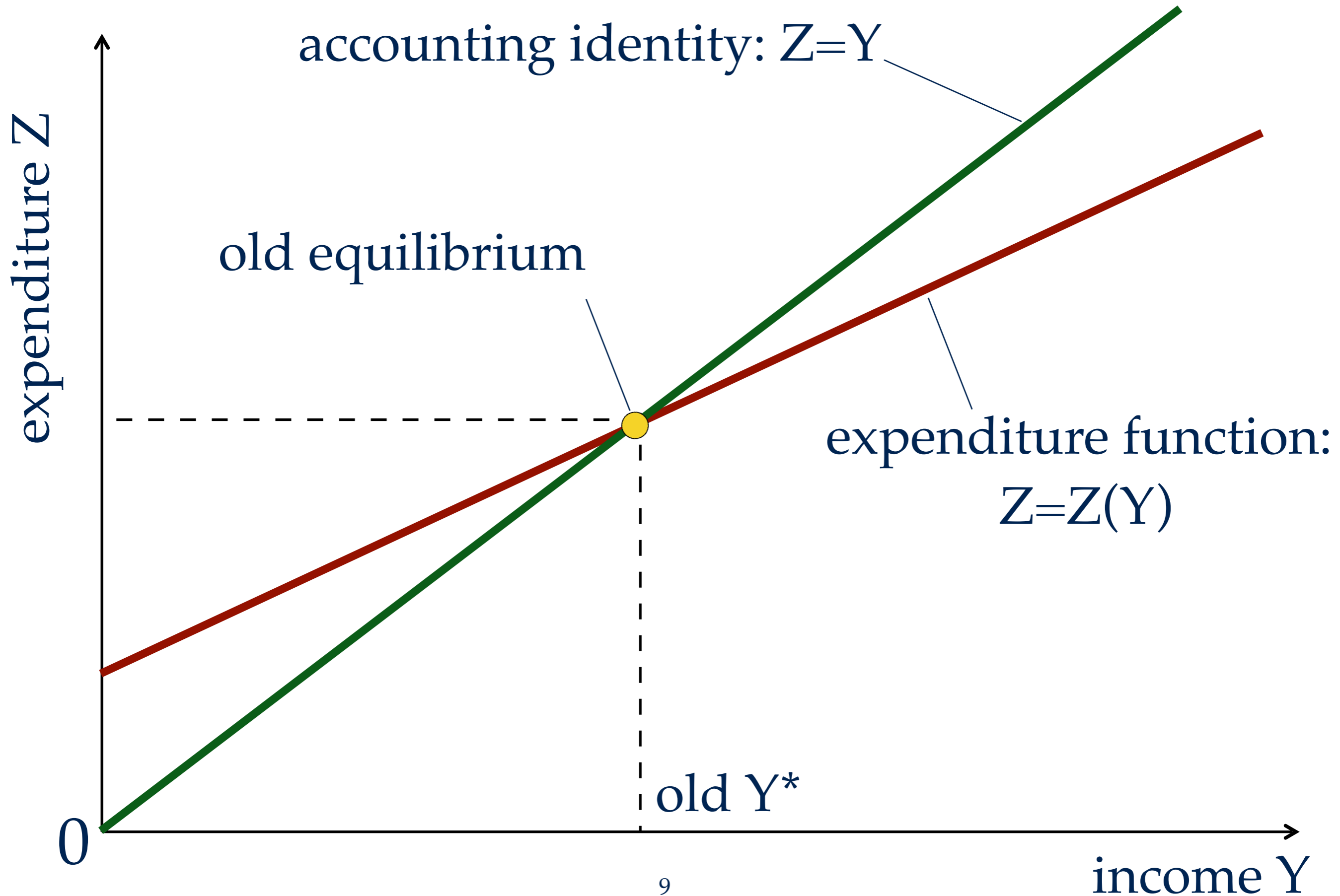


# EFFECT OF AD SHOCKS

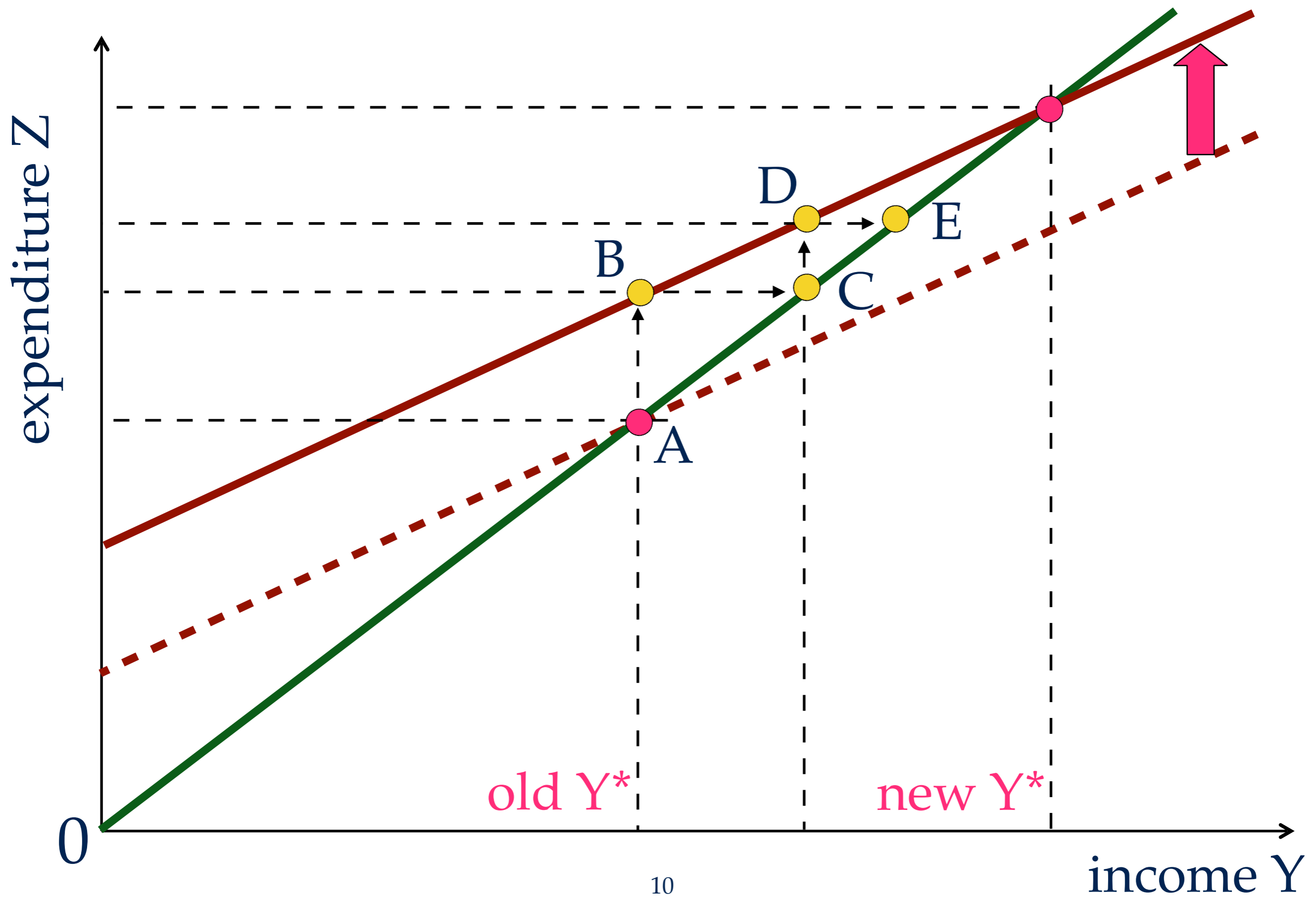
- a positive AD shock is an increase in autonomous expenditure
  - an increase in the level  $c_0$  of the consumption function
  - an increase in government spending  $G$
  - an increase in investment  $I$
  - a reduction in taxes / an increase in transfers (decrease in  $T$ )
- through the multiplier, an increase in autonomous expenditure has a greater than one-for-one effect on equilibrium income  $Y^*$



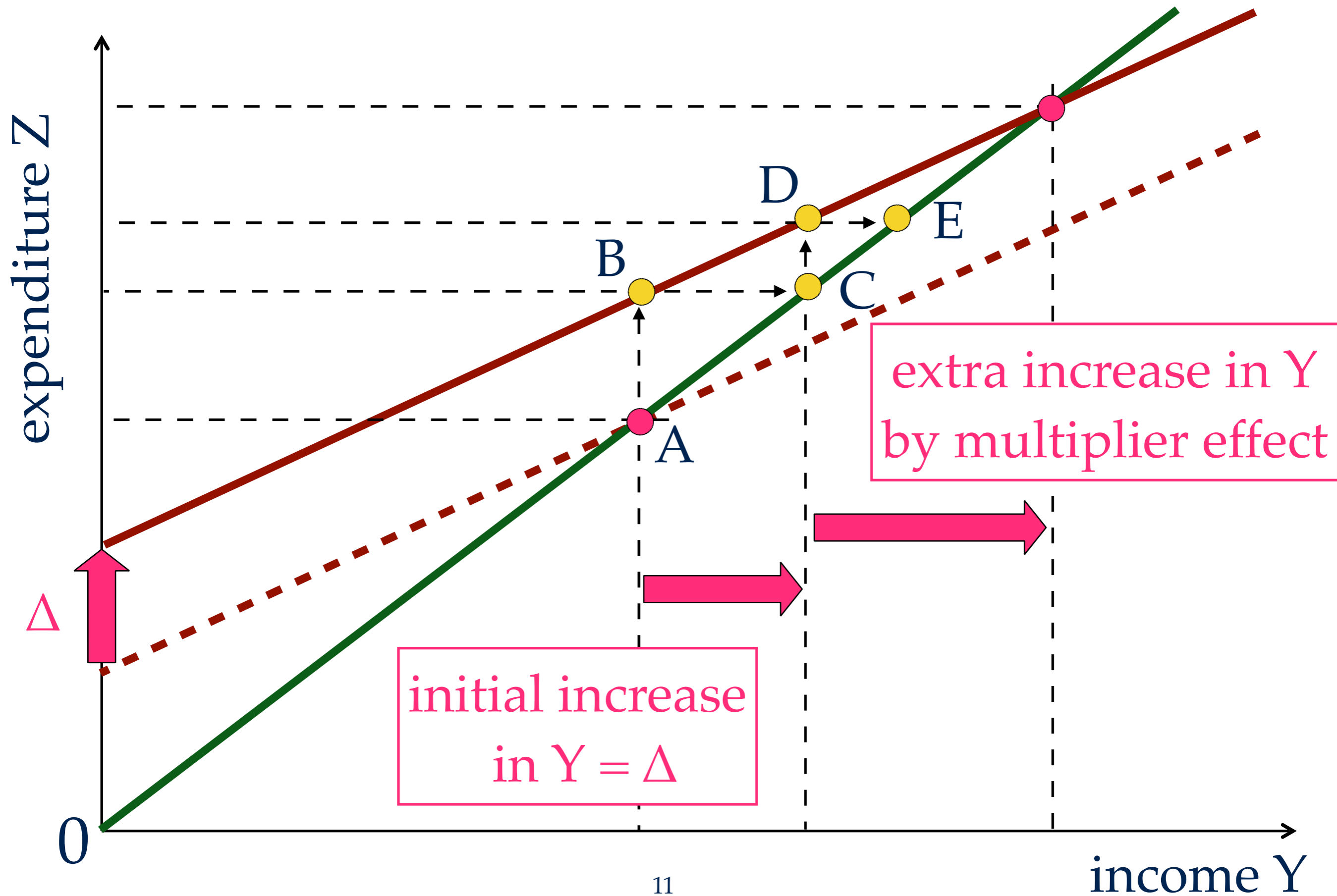
# DIAGRAM FOR POSITIVE AD SHOCK



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# AD SHOCK EXAMPLE: GOVERNMENT SPENDING

- an increase in government spending  $G$  leads to an increase in income, which in turn leads to an increase in expenditure: thus government spending is “multiplied”
- the equilibrium increase in income is larger than the initial increase in spending, by a factor equal to the **spending multiplier:  $1 / (1 - MPC) > 1$**
- the government multiplier depends on the marginal propensity to consume (MPC), which can be estimated using econometric methods

# INVESTMENT = SAVING

- an alternative formulation of the condition expenditure = income ( $Z=Y$ ) is investment = saving
- this is the original formulation proposed by John Maynard Keynes in the “General Theory of Employment, Interest and Money” in 1936
- it explains the name “IS curve”

# PRIVATE AND PUBLIC SAVING

- private saving ( $S$ ) is disposable income less consumption expenditure:  $S = D - C = Y - T - C$
- public saving is revenue from taxes less spending on transfers less spending on goods & services:
  - public saving =  $T - G$
  - public saving  $> 0$ : budget surplus
  - public saving  $< 0$ : budget deficit

# EQUIVALENCE BETWEEN INCOME = EXPENDITURE AND INVESTMENT = SAVING

- income = expenditure:  $Y = C + I + G$
- $Y - T - C = I + (G - T)$  [subtract T]
- $S = I + (G - T)$  [definition of private saving]
- $I = S + (T - G)$
- hence, investment = private saving + public saving
- or, investment = total saving

# MARGINAL PROPENSITY TO SAVE

- private saving is disposable income – consumption
  - $S = D - C$
- consumption function yields  $S = D - c_0 - c_1 \times D$ 
  - $S = -c_0 + (1 - c_1) \times D$
- $-c_0 < 0$ : dis-saving when  $D = 0$
- $1 - c_1 > 0$ : marginal propensity to save (MPS)
  - when  $D$  increases by \$1, saving increases by MPS



# PROPENSITY TO SAVE IN THE US

**TABLE 13.2**

## **Saving Rates by Income Quintile**

<b>Income Quintile</b>	<b>Median Saving Rate</b>
<b>1 (Lowest)</b>	8.6%
<b>2</b>	12.9%
<b>3</b>	16.3%
<b>4</b>	18.0%
<b>5 (Highest)</b>	23.0%

- richer households save a larger share of their income
- poorer households save a smaller share of their income
- for this reason, government transfers are often targeted to poorer households: this will create larger multipliers