CHAPTER 11

Aggregate Demand I: Building the *IS-LM* Model

Presentation Slides

Macroeconomics

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IN THIS CHAPTER, YOU WILL LEARN:

About the *IS* curve and its relationship to:

- the Keynesian cross
- the loanable funds model

About the *LM* curve and its relationship to:

- the theory of liquidity preference

How the *IS*–*LM* model determines income and the interest rate in the short run when ***P*** is fixed

Context, part 1

- Chapter 10 introduced the model of aggregate demand and aggregate supply.
- ***Long run:***
  - prices flexible
  - output determined by factors of production and technology
  - unemployment equals its natural rate
- ***Short run:***
  - prices fixed
  - output determined by aggregate demand
  - unemployment negatively related to output

Context, part 2

- This chapter develops the *IS–LM* model, the basis of the aggregate demand curve.
- We focus on the short run and assume the price level is fixed (so the *SRAS* curve is horizontal).
- Chapters 11 and 12 focus on the closed-economy case.

The Keynesian cross

- A simple closed-economy model in which income is determined by expenditure.
  (due to J. M. Keynes)
- Notation:

  I = planned investment

  PE = ***C*** + ***I*** + ***G*** = planned expenditure

  Y = real GDP = actual expenditure
- Difference between actual and planned expenditure = unplanned inventory investment

Elements of the Keynesian cross

consumption function : $\mathbf{C = C(Y - T)}$

government policyvariables : $\boldsymbol{G = \bar{G}, T = \bar{T}}$

for now, plannedinvestment is exogenous : $\boldsymbol{I = \bar{I}}$

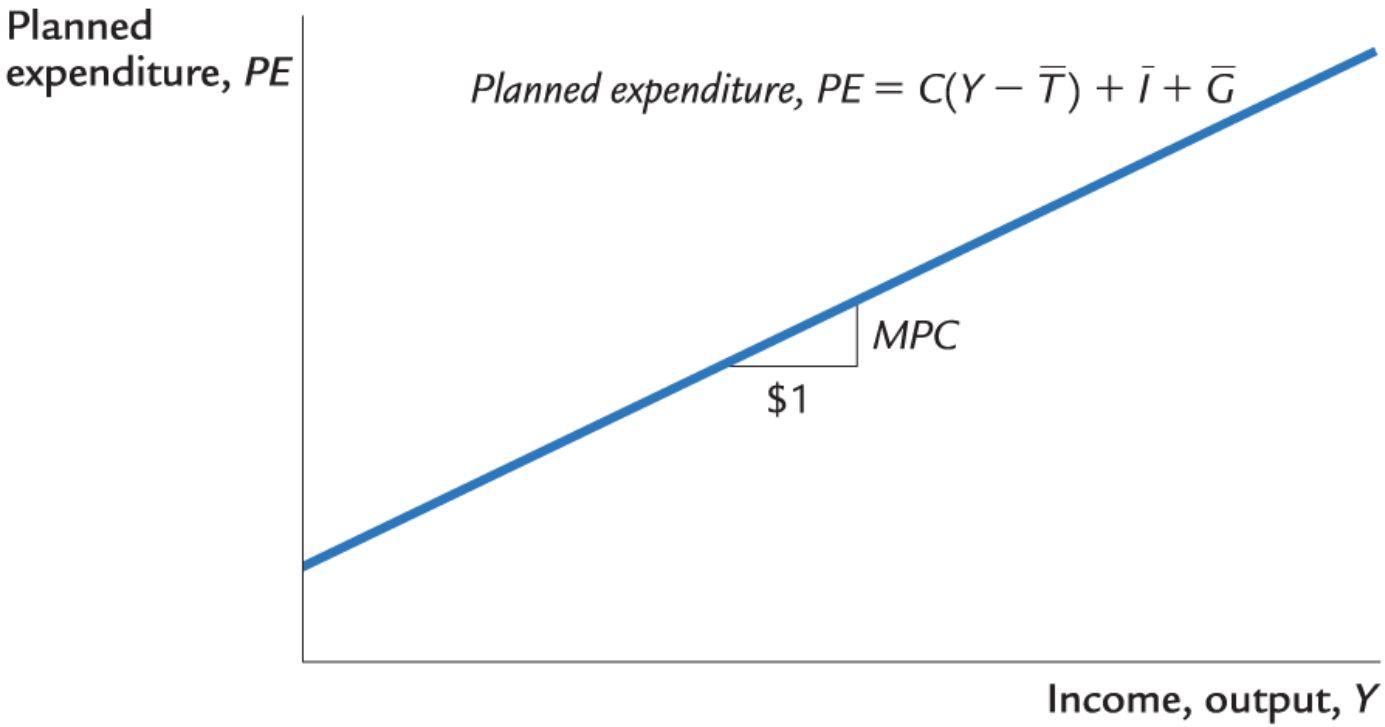
planned expenditure : $\boldsymbol{PE = C(Y - \bar{T}) + \bar{I} + \bar{G}}$

equilibrium condition:

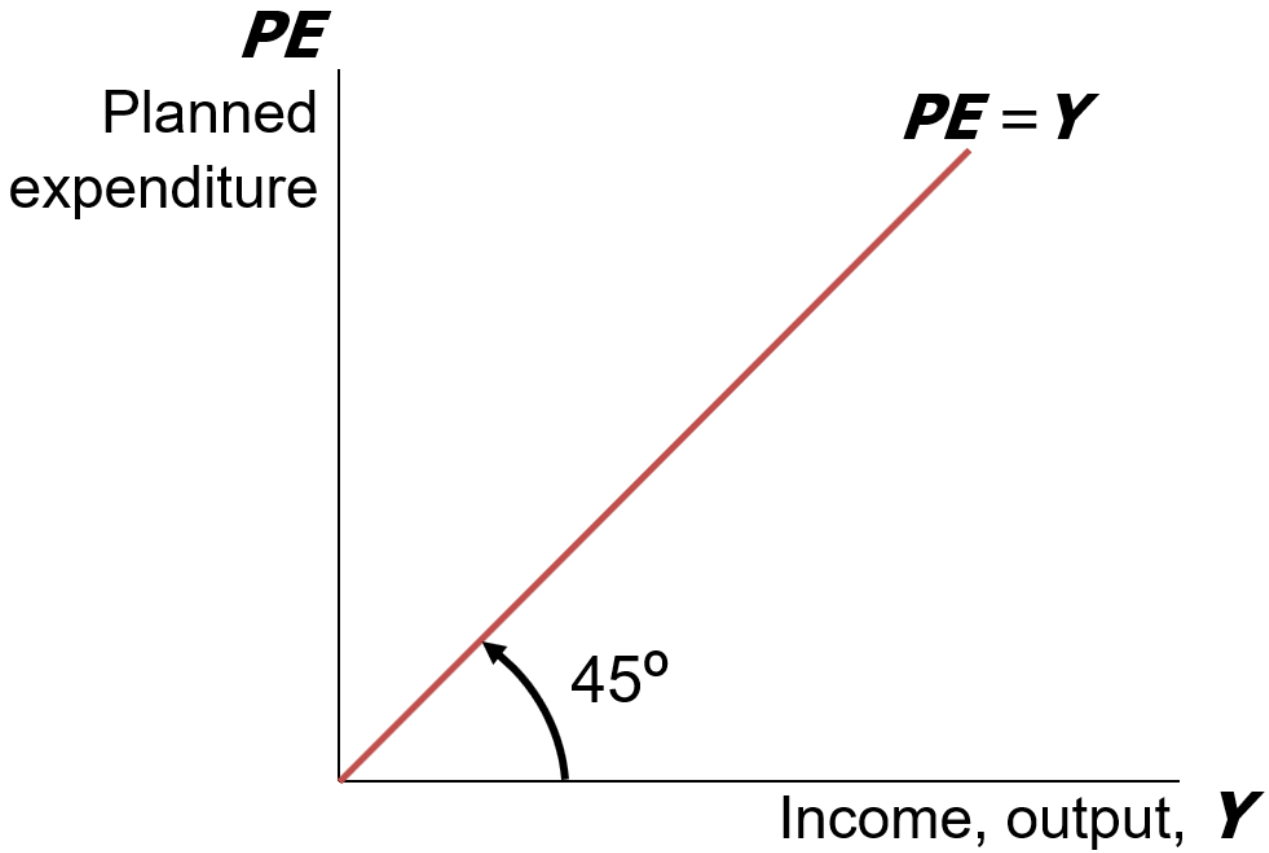
actual expenditure = planned expenditure

$$\boldsymbol{Y = PE}$$

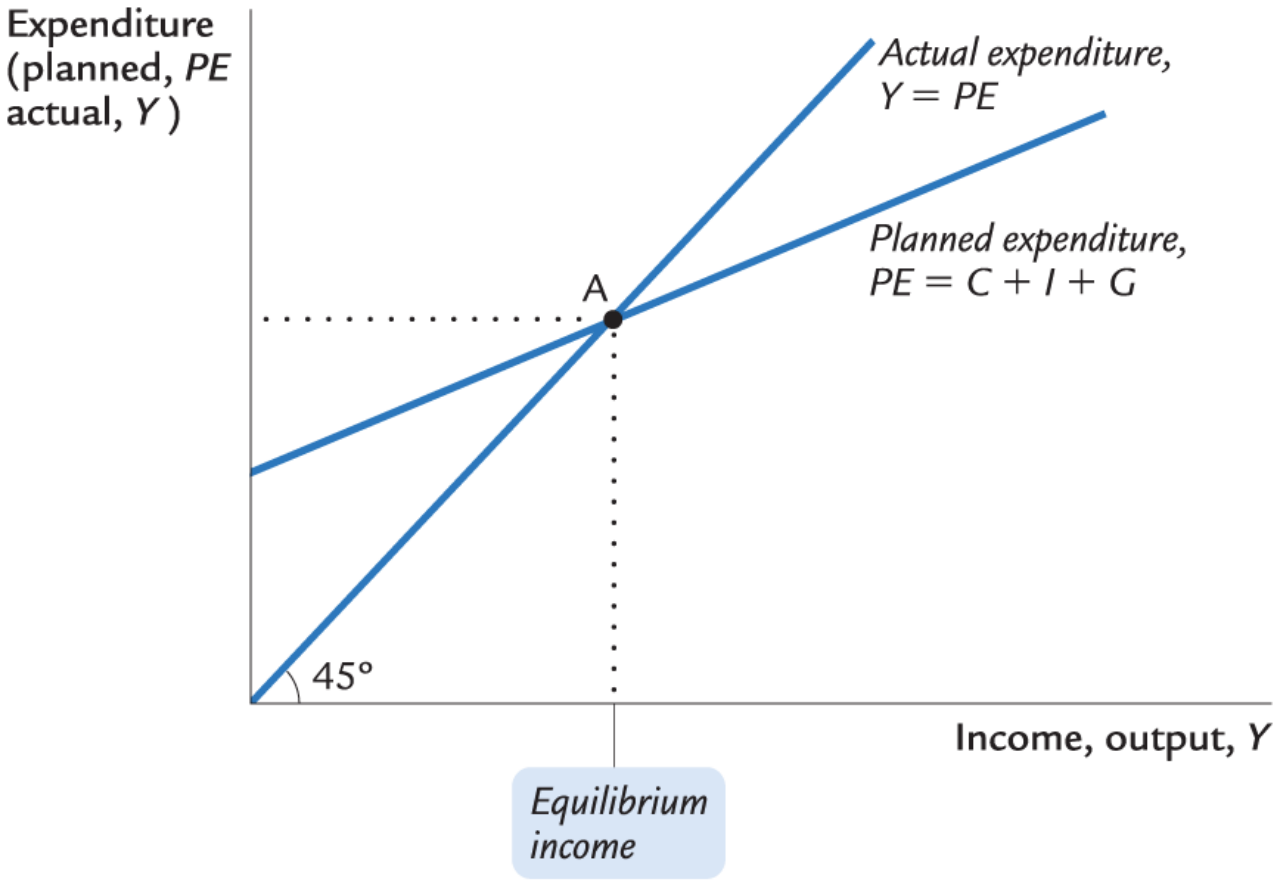
Graphing planned expenditure



Graphing the equilibrium condition



The equilibrium value of income



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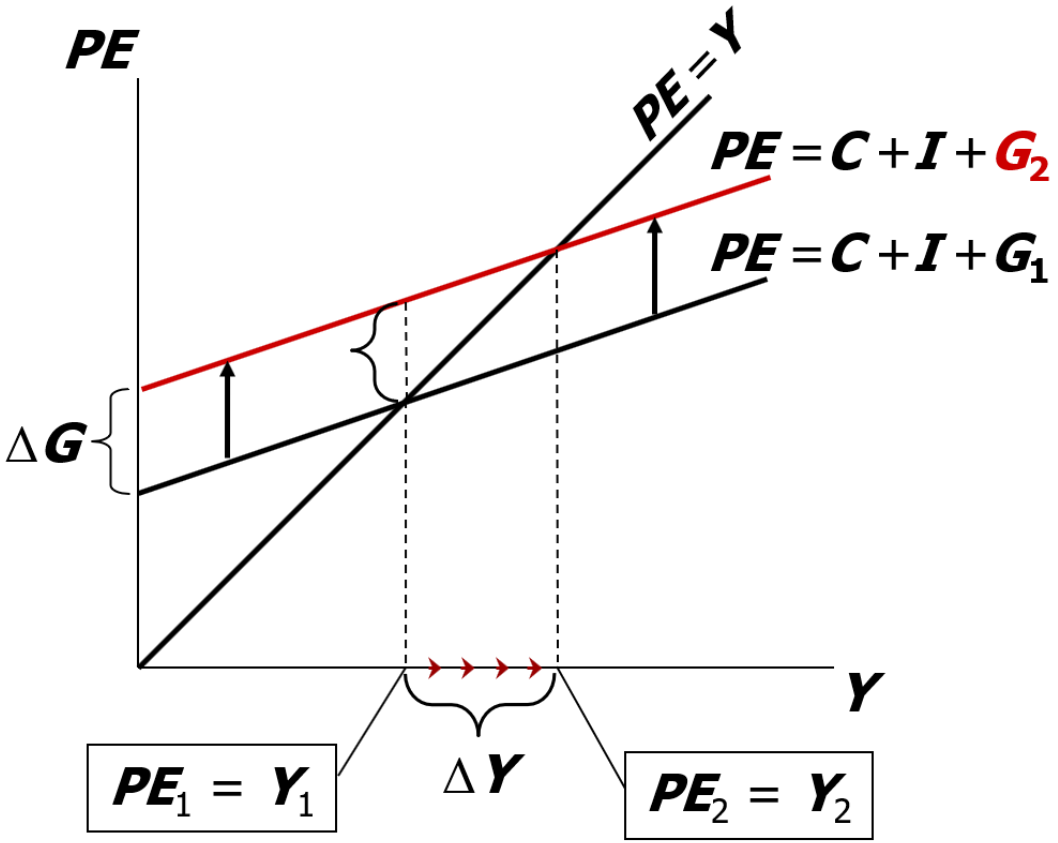
An increase in government purchases

At Y_1, there is now an unplanned drop in inventory . . .

. . . so firms increase output, and income rises toward a new equilibrium.



Solving for ΔY (1 of 2)

$$Y = C + I + G \text{ equilibrium condition}$$

$$\Delta Y = \Delta C + \Delta I + \Delta G \text{ in changes}$$

$$= \Delta C + \Delta G \text{ because } I \text{ exogenous}$$

$$= \text{MPC} \times \Delta Y + \Delta G \text{ because } \Delta C = \text{MPC}\Delta Y$$

Collect terms with ΔY on the left side of the equals sign:

$$(1 - \text{MPC}) \times \Delta Y = \Delta G$$

Solve for ΔY:

$$\Delta Y = \left(\frac{1}{1 - \text{MPC}} \right) \times \Delta G$$

The government purchases multiplier

definition: the increase in income resulting from a $1 increase in ***G***.

In this model, the govt purchases multiplier equals

$$\frac{\Delta Y}{\Delta G} = \frac{1}{1-\text{MPC}}$$

Example: If *MPC* = 0.8, then

$$\frac{\Delta Y}{\Delta G} = \frac{1}{1-0.8} = 5$$

One unit increase in ***G*** causes income to increase 5 times as much!

Why the multiplier is greater than 1

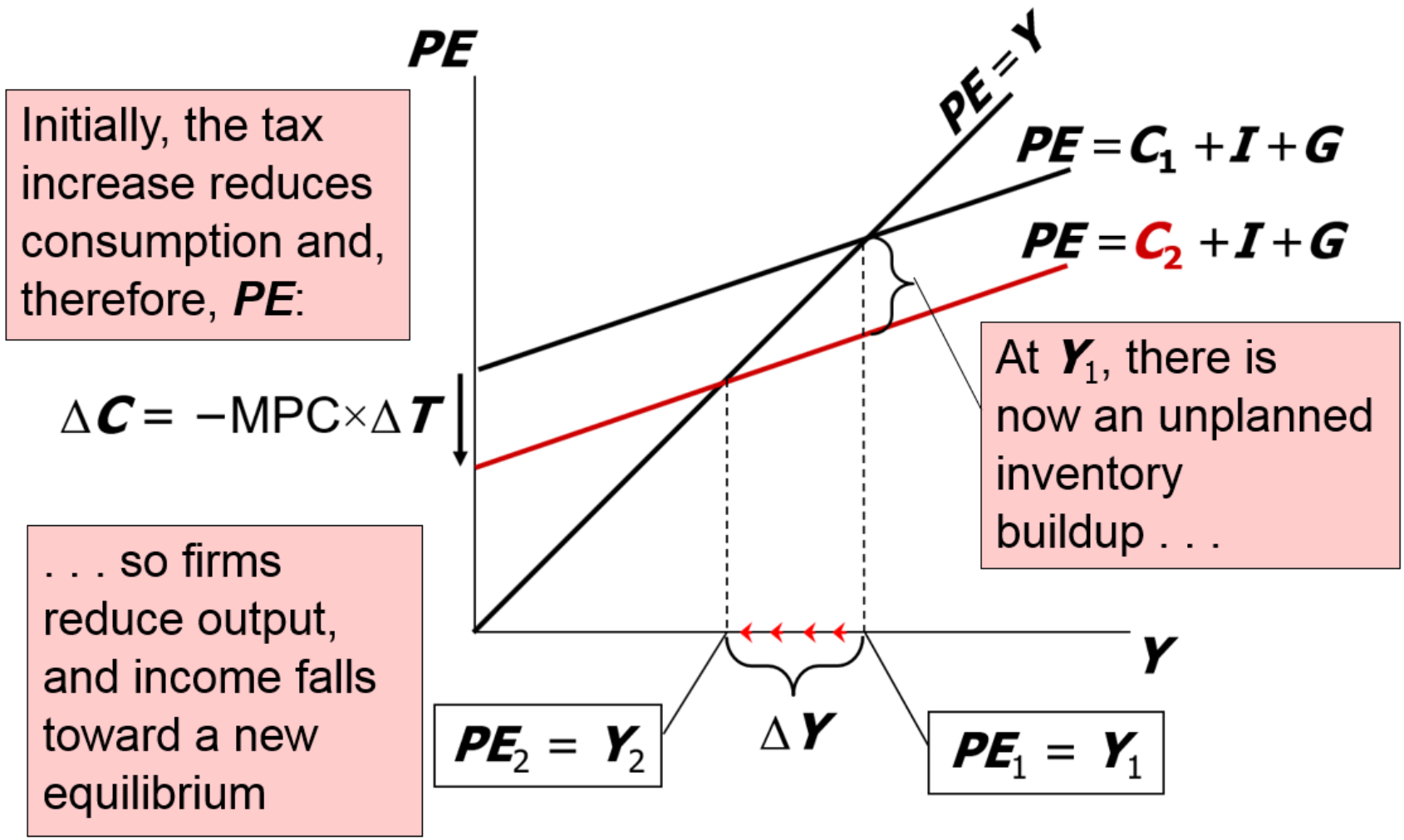
- Initially, the increase in ***G*** causes an equal increase in ***Y:*** $\Delta Y = \Delta G$.
- But $\uparrow Y$ causes $\uparrow C$

  which causes further $\uparrow Y$

  which then causes further $\uparrow C$

  which then causes further $\uparrow Y$
- So the final impact on income is much bigger than the initial ΔG.

An increase in taxes



Solving for ΔY (2 of 2)

$\Delta Y = \Delta C + \Delta I + \Delta G$ eq'm condition in changes

$= \Delta C$ I *and* G *exogenous*

$= \text{MPC} \times (\Delta Y - \Delta T)$

Solving for ΔY : $(1 - \text{MPC}) \times \Delta Y = -\text{MPC} \times \Delta T$

Final result:

$$\Delta Y = \left(\frac{-\text{MPC}}{1 - \text{MPC}} \right) \times \Delta T$$

The tax multiplier, part 1

Definition: the change in income resulting from a \$1 increase in ***T*** :

$$\frac{\Delta Y}{\Delta T} = \frac{-\text{MPC}}{1 - \text{MPC}}$$

If *MPC* = 0.8, then the tax multiplier equals

$$\frac{\Delta Y}{\Delta T} = \frac{-0.8}{1 - 0.8} = \frac{-0.8}{0.2} = -4$$

The tax multiplier, part 2

. . . is *negative:*
A tax increase reduces ***C***, which reduces income.

. . . is *greater than one* (*in absolute value*):
A change in taxes has a multiplier effect on income.

. . . is *smaller than the govt spending multiplier:*
Consumers save the fraction (1 – *MPC*) of a tax cut, so the initial boost in spending from a tax cut is smaller than from an equal increase in ***G***.

NOW YOU TRY

Practice with the Keynesian cross

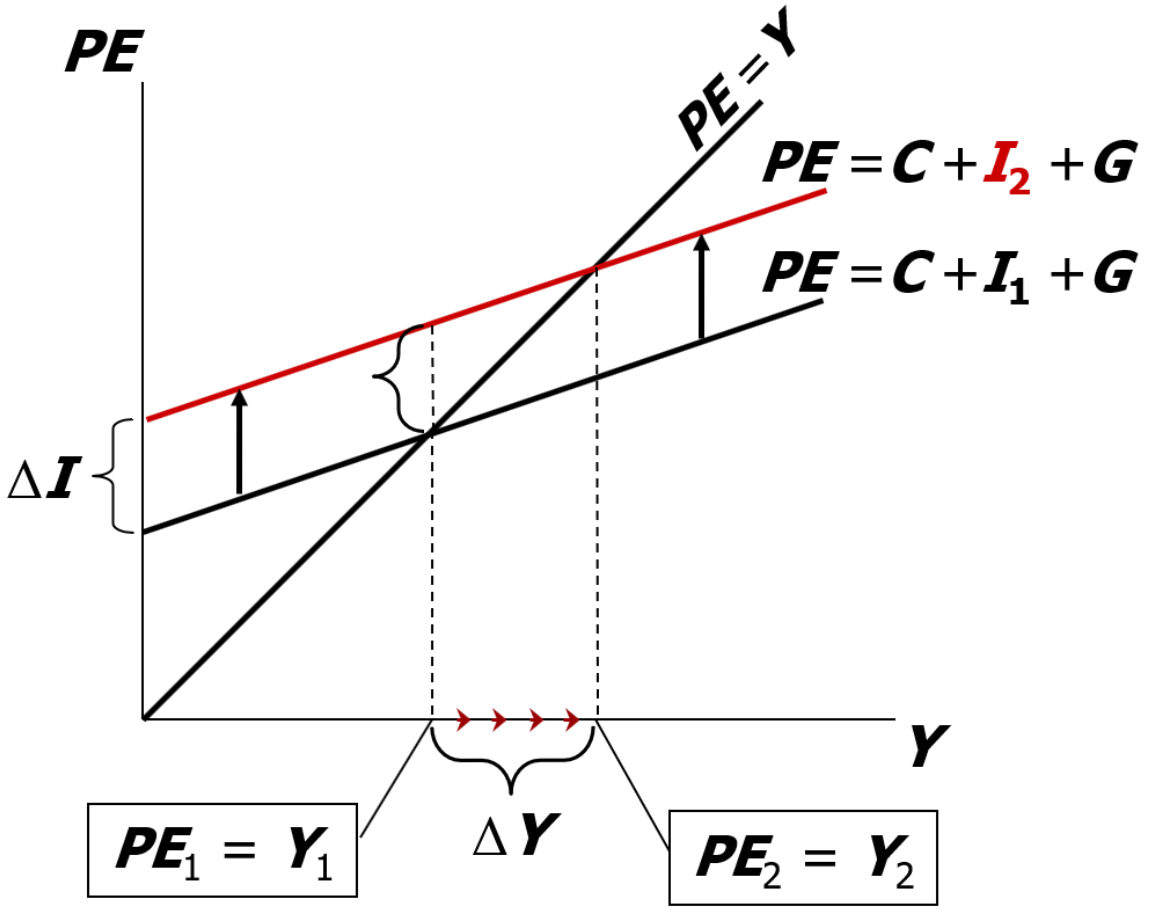
Use a graph of the Keynesian cross to show the effects of an increase in planned investment on the equilibrium level of income/output.

NOW YOU TRY

Practice with the Keynesian cross, answer

At Y_1, there is now an unplanned drop in inventory . . .

. . . so firms increase output, and income rises toward a new equilibrium.



The *IS* curve

definition: a graph of all combinations of ***r*** and ***Y*** that result in goods market equilibrium

example: actual expenditure (output)
= planned expenditure

The equation for the *IS* curve is:

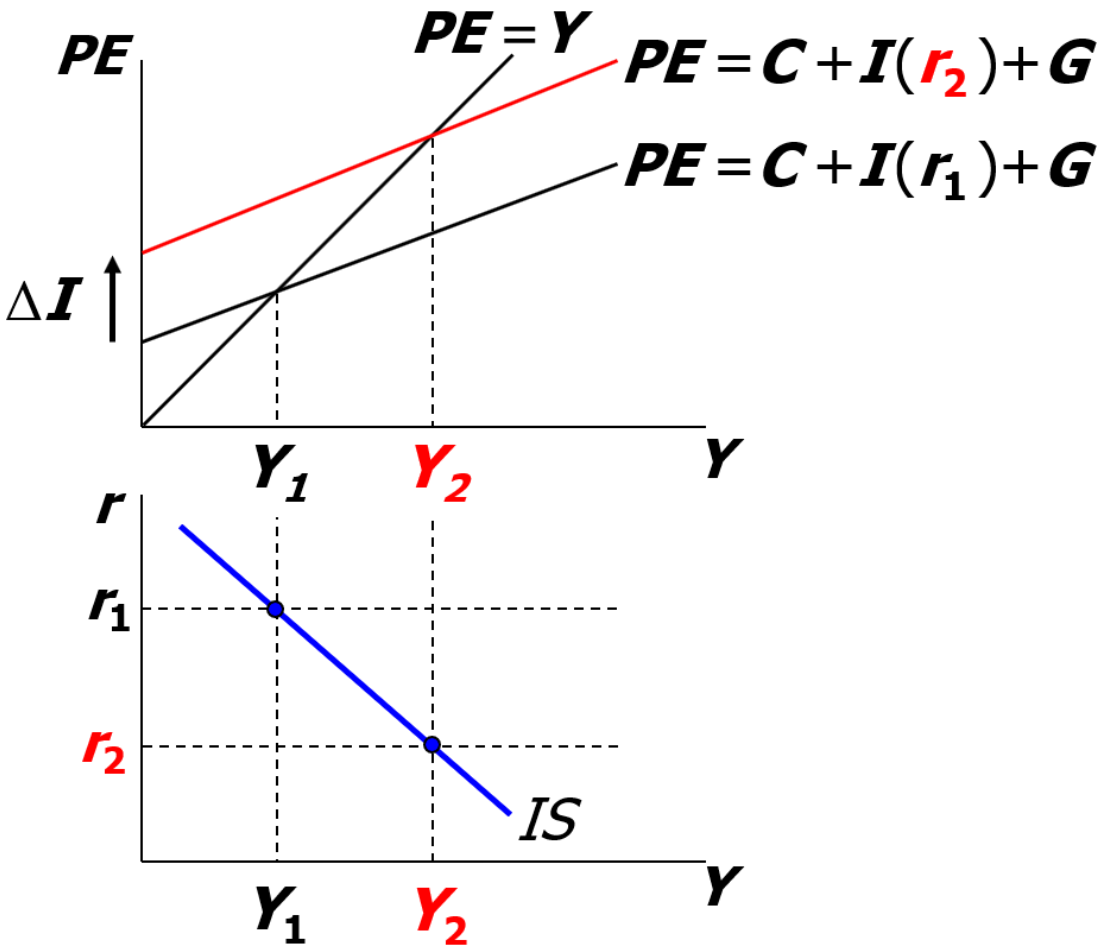
$$Y = C(Y - \bar{T}) + I(r) + \bar{G}$$

Deriving the IS curve

$\downarrow r \rightarrow \uparrow I$

$\rightarrow \uparrow PE$

$\rightarrow \uparrow Y$



When the *IS* curve is negatively sloped

- A fall in the interest rate motivates firms to increase investment spending, which drives up total planned spending (***PE***).
- To restore equilibrium in the goods market, output (a.k.a. actual expenditure, ***Y***) must increase.

Fiscal policy and the *IS* curve

- We can use the *IS–LM* model to see how fiscal policy (***G*** and ***T***) affects aggregate demand and output.
- Let's start by using the Keynesian cross to see how fiscal policy shifts the *IS* curve . . .

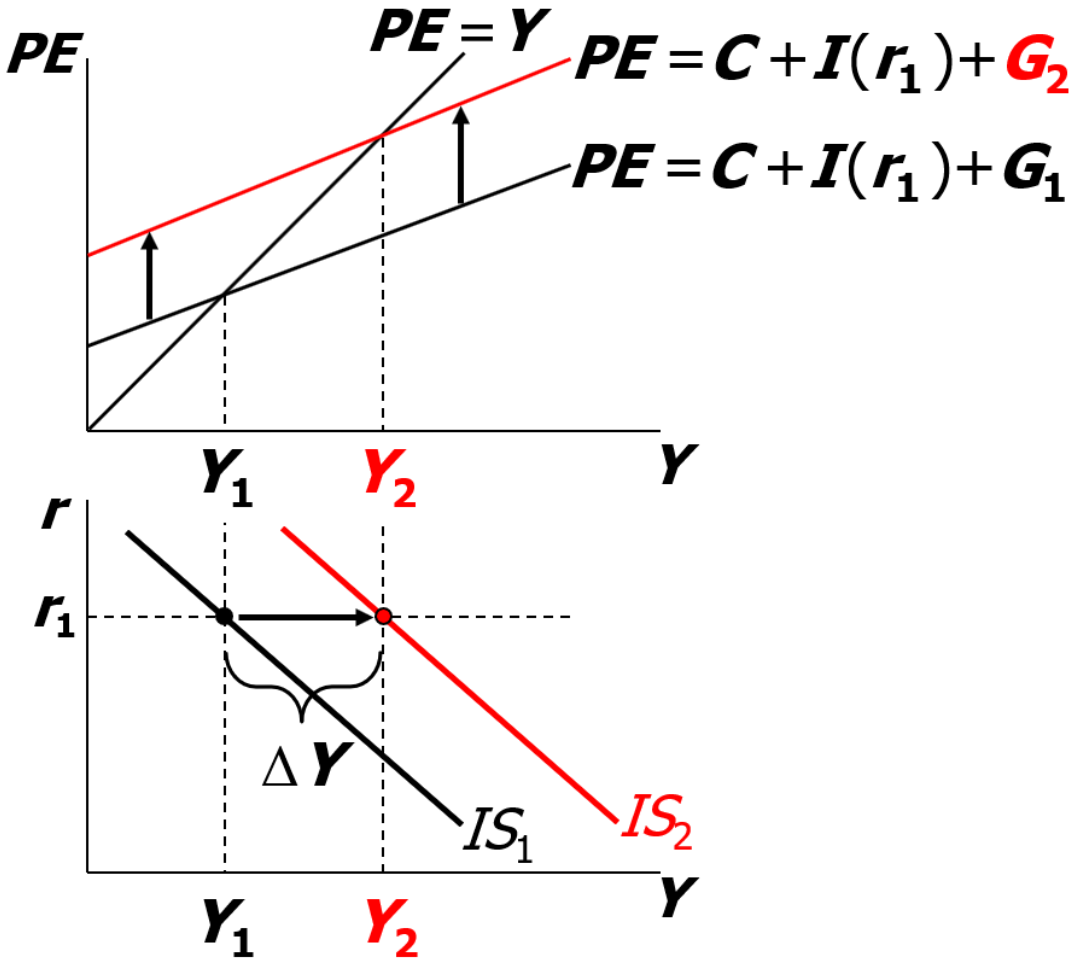
Shifting the *IS* curve: ΔG

At any value of r,
$\uparrow G \rightarrow \uparrow PE \rightarrow \uparrow Y$

. . . so the *IS* curve shifts to the right.

The horizontal distance of the *IS* shift equals

$$\Delta Y = \frac{1}{1-\text{MPC}} \Delta G$$



NOW YOU TRY

Shifting the *IS* curve: ΔT

- Use the diagram of the Keynesian cross or loanable funds model to show how an increase in taxes shifts the IS curve.
- If you can, determine the size of the shift.

NOW YOU TRY

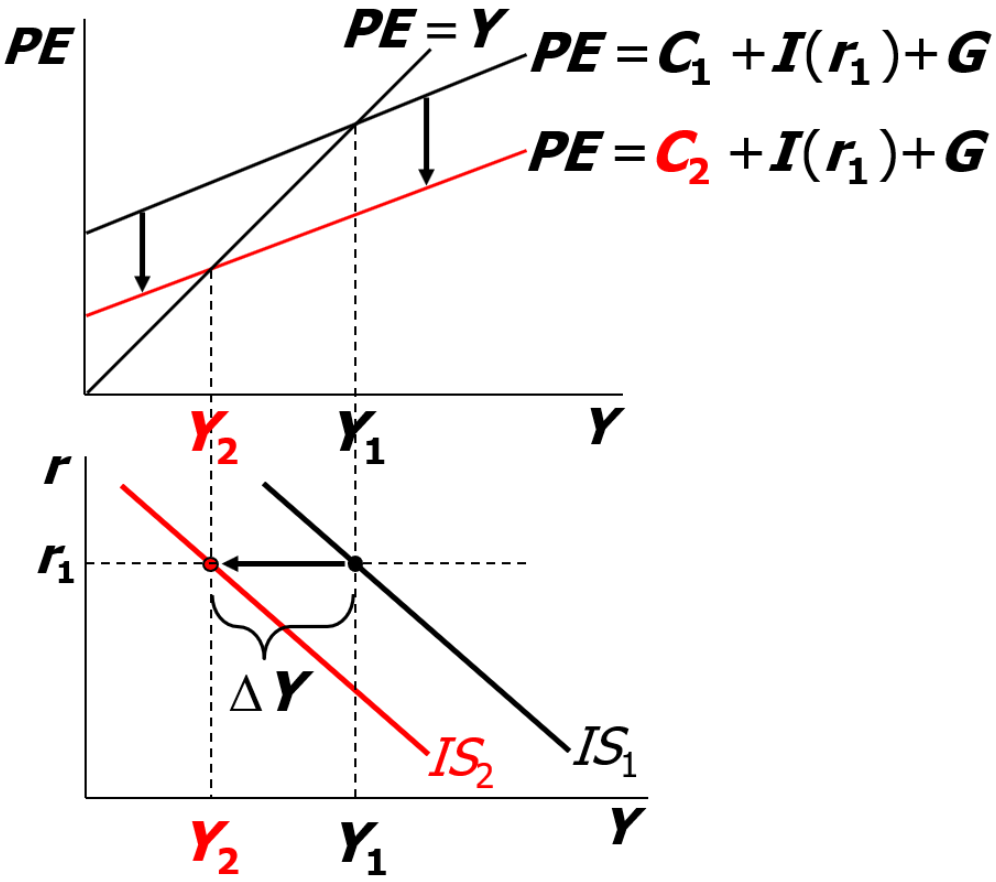
Shifting the *IS* curve: ΔT, answer

At any value of r,
$\uparrow T \rightarrow \downarrow C \rightarrow \downarrow PE$

. . . so the *IS* curve shifts to the left.

The horizontal distance of the *IS* curve shift equals

$$\Delta Y = \frac{-\text{MPC}}{1-\text{MPC}} \Delta T$$



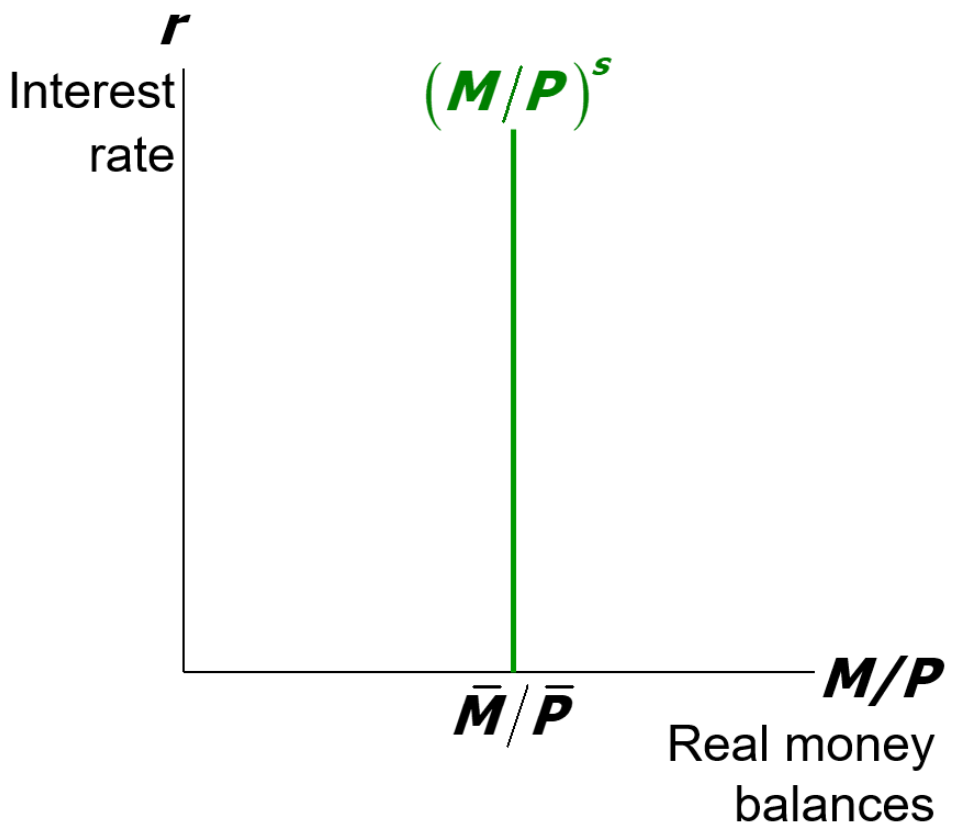
The theory of liquidity preference

- due to John Maynard Keynes
- a simple theory in which the interest rate is determined by money supply and money demand

Money supply

The supply of real money balances is fixed:

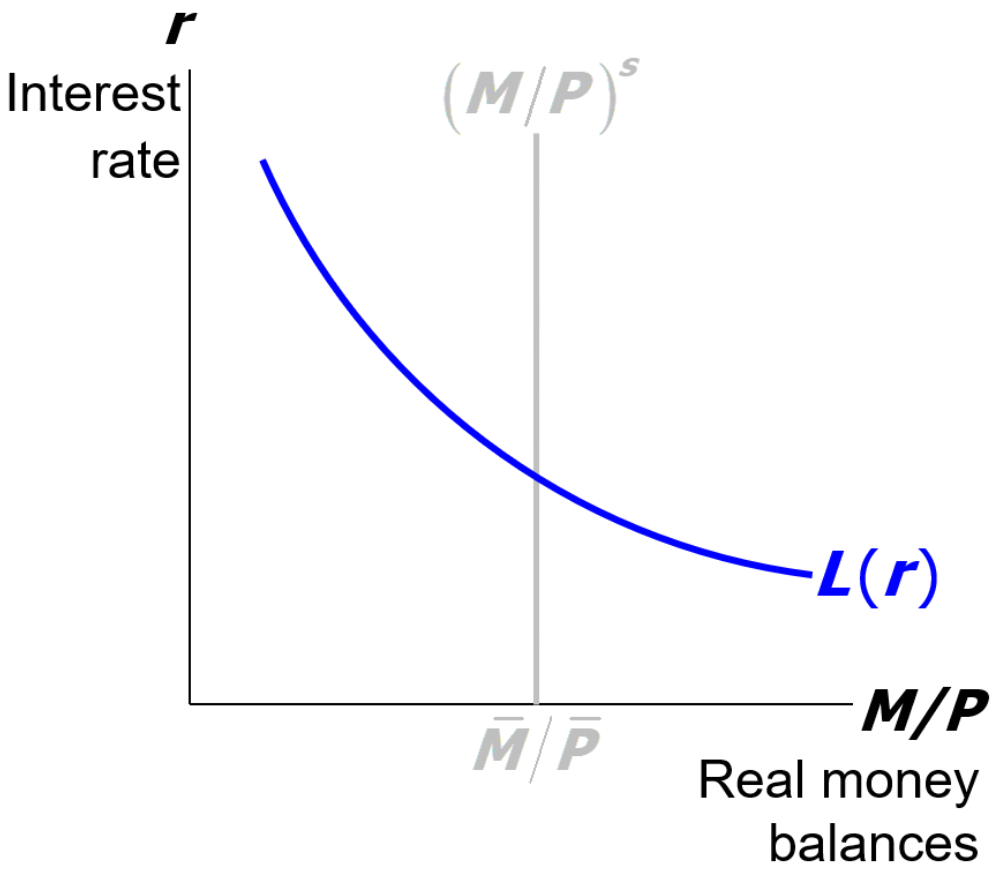
$$\left(M/P\right)^{s} = \bar{M}/\bar{P}$$



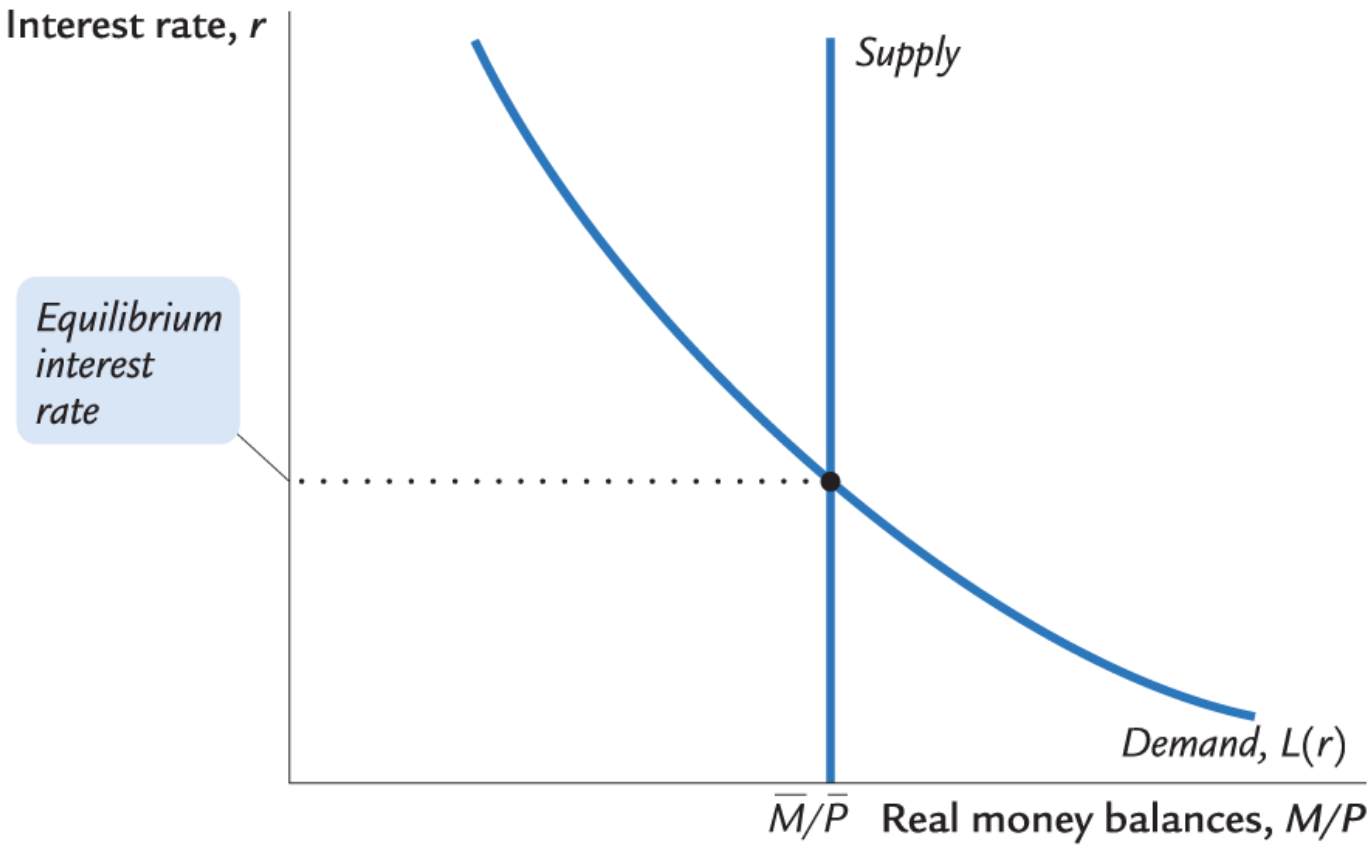
Money demand

Demand for real money balances:

$$\left(M/P\right)^{d} = L(r)$$



Equilibrium



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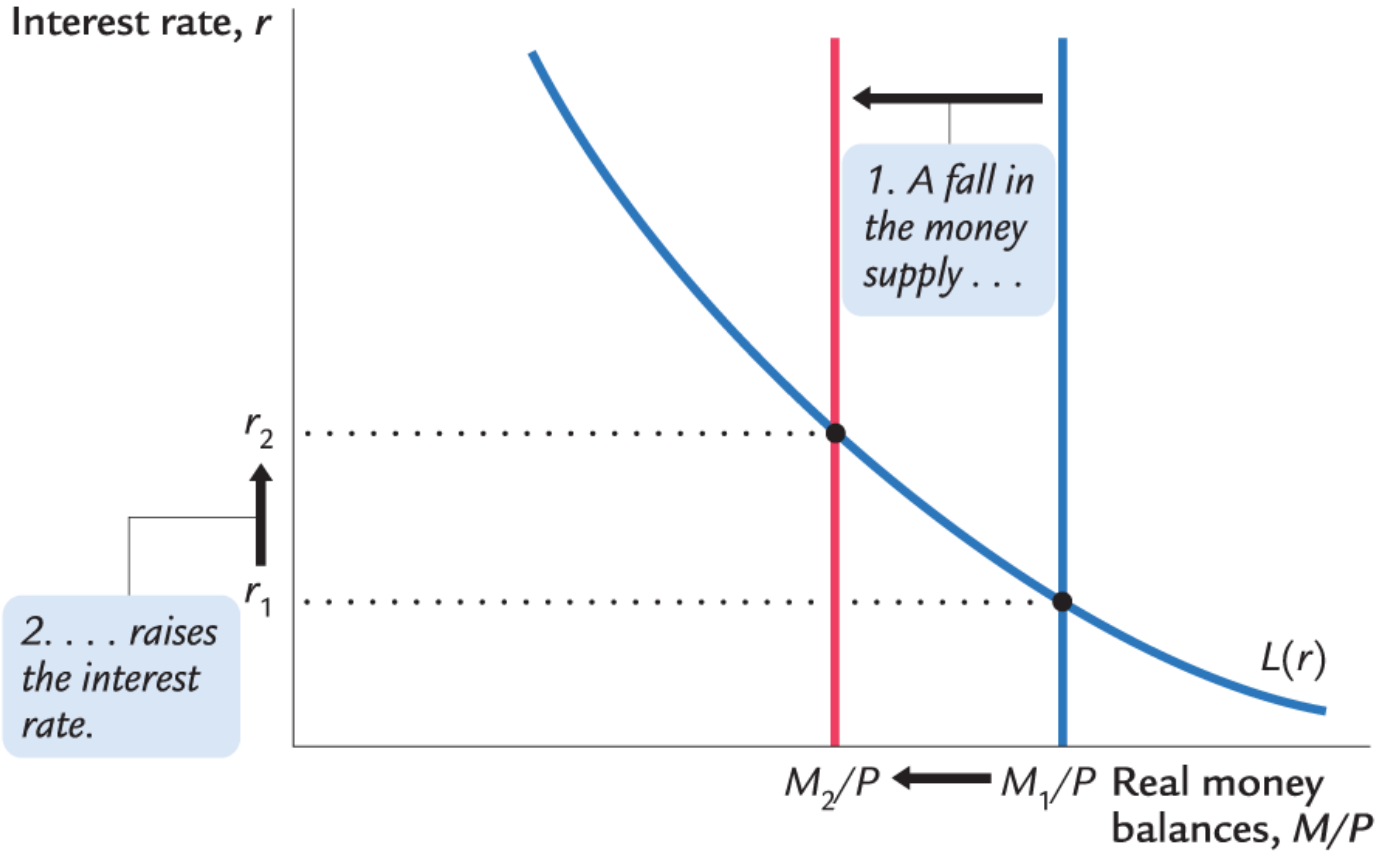
How the Fed raises the interest rate



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The *LM* curve

Now let's put ***Y*** back into the money demand function:

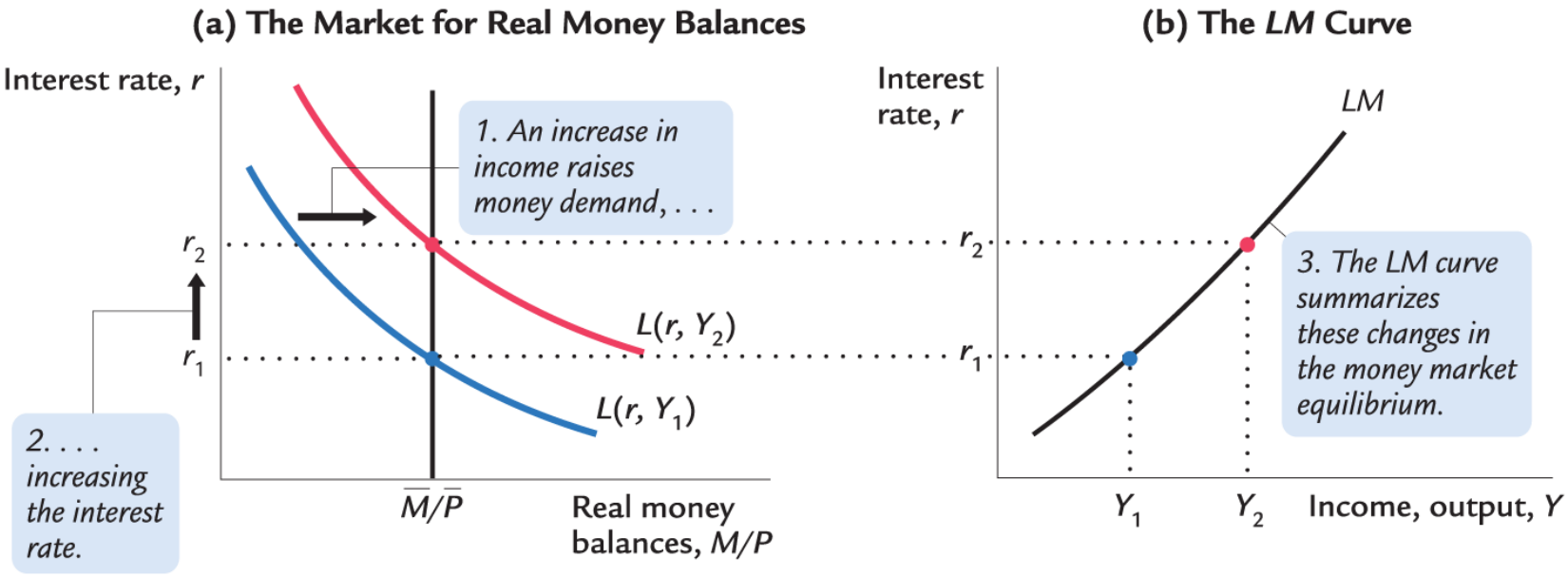
$$\left(M/P\right)^{d} = L(r,Y)$$

The ***LM* curve** is a graph of all combinations of ***r*** and ***Y*** that equate the supply and demand for real money balances.

The equation for the *LM* curve is:

$$\bar{M}/\bar{P} = L(r,Y)$$

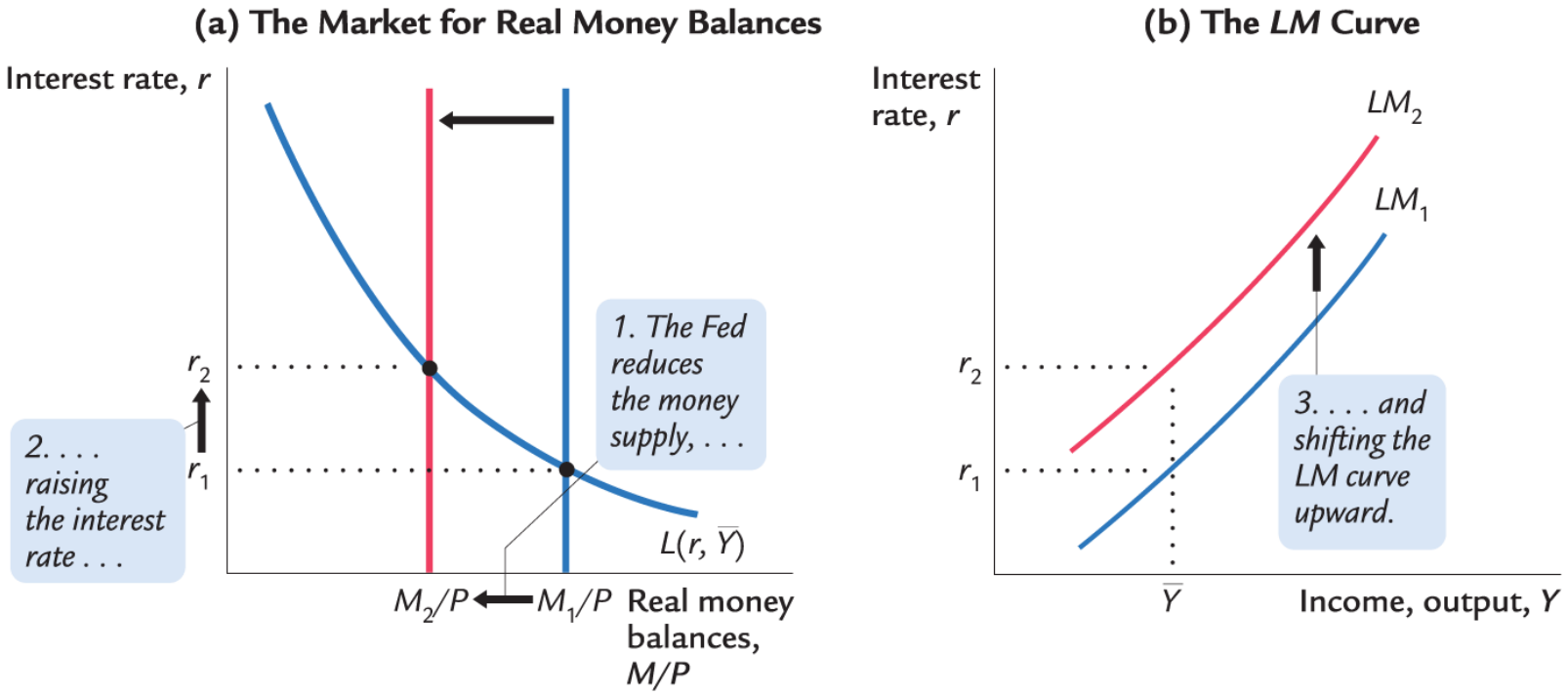
Deriving the *LM* curve



Why the *LM* curve is upward sloping

- An increase in income raises money demand.
- Since the supply of real balances is fixed, there is now excess demand in the money market at the initial interest rate.
- The interest rate must rise to restore equilibrium in the money market.

How Δ*M* shifts the *LM* curve

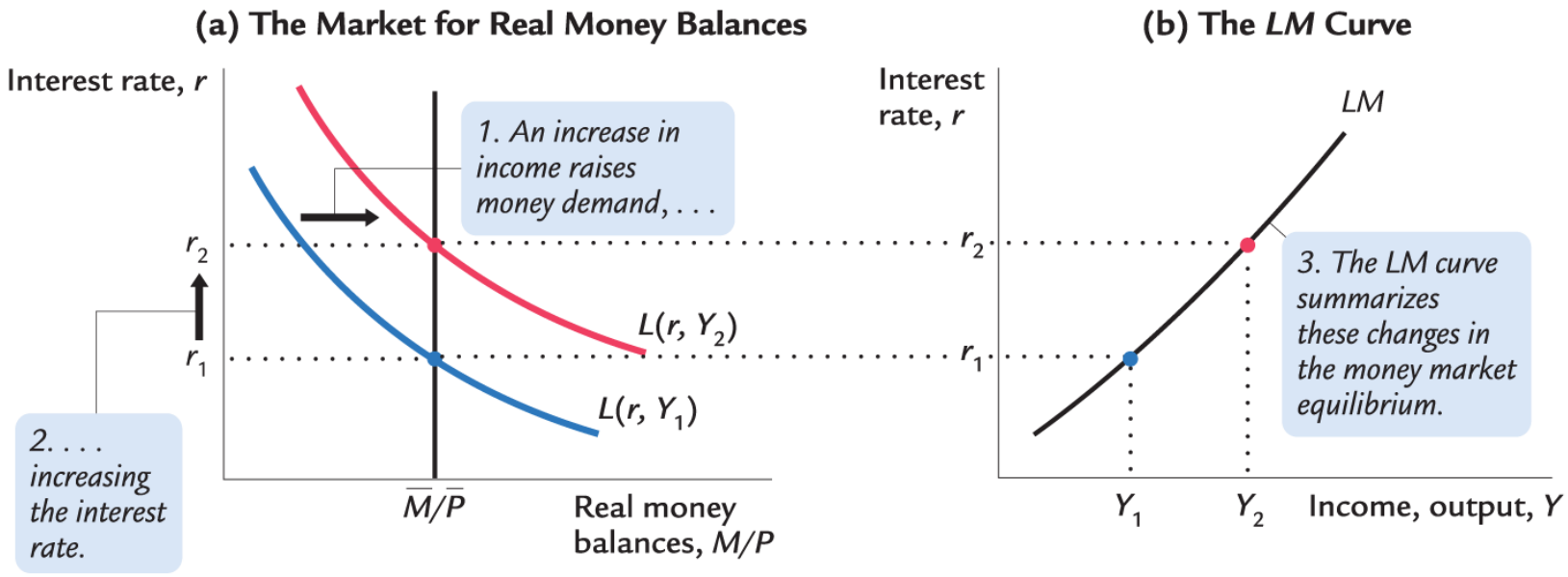


NOW YOU TRY

Shifting the *LM* curve

- Suppose a wave of credit card fraud causes consumers to use cash more frequently in transactions.
- Use the liquidity preference model to show how these events shift the LM curve.

NOW YOU TRY Shifting the *LM* curve, answer



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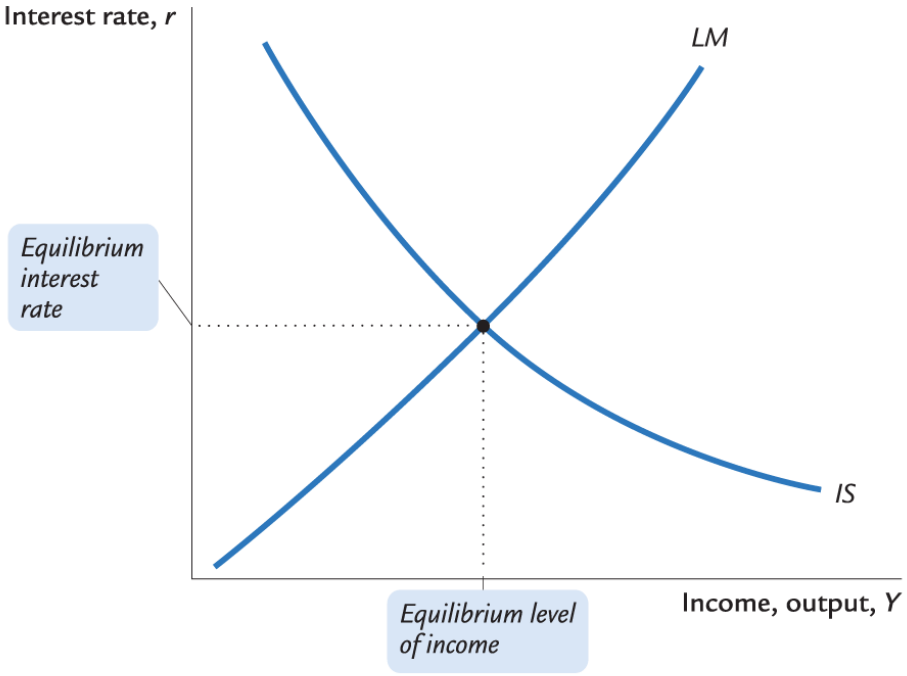
The short-run equilibrium

The short-run equilibrium is the combination of ***r*** and ***Y*** that simultaneously satisfies the equilibrium conditions in the goods and money markets:

$$Y = C(Y - \bar{T}) + I(r) + \bar{G}$$

$$\bar{M}/\bar{P} = L(r, Y)$$



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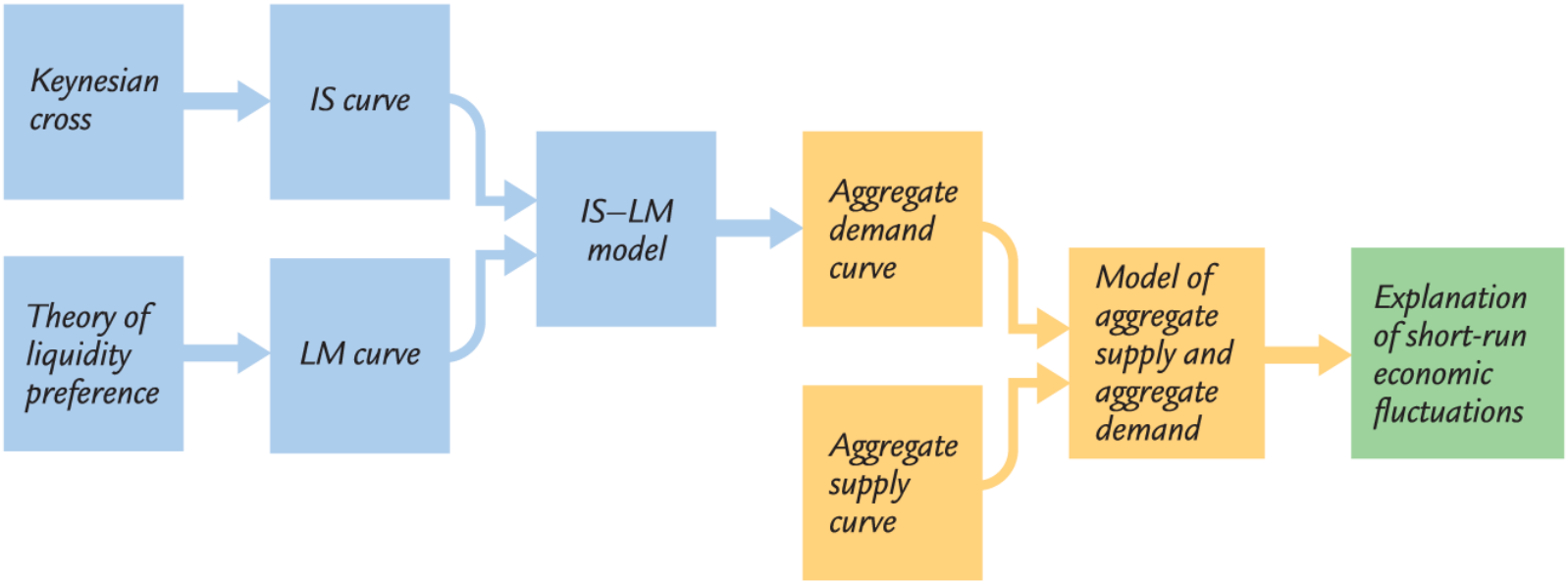
The big picture



Preview of Chapter 12

In Chapter 12, we will

- use the *IS–LM* model to analyze the impact of policies and shocks.
- learn how the aggregate demand curve comes from *IS-LM*.
- use the *IS–LM* and *AD–AS* models together to analyze the short-run and long-run effects of shocks.
- use our models to learn about the Great Depression.

CHAPTER SUMMARY, PART 1

- Keynesian cross
  - basic model of income determination
  - takes fiscal policy and investment as exogenous
  - fiscal policy has a multiplier effect on income
- IS curve
  - comes from Keynesian cross when planned investment depends negatively on interest rate
  - shows all combinations of r and Y that equate planned expenditure with actual expenditure on goods and services

CHAPTER SUMMARY, PART 2

- Theory of liquidity preference
  - basic model of interest rate determination
  - takes money supply and price level as exogenous
  - an increase in the money supply lowers the interest rate
- *LM* curve
  - comes from liquidity preference theory when money demand depends positively on income
  - shows all combinations of ***r*** and ***Y*** that equate demand for real money balances with supply

CHAPTER SUMMARY, PART 3

- *IS–LM* model
  - The intersection of the *IS* and *LM* curves shows the unique point (***Y***, ***r***) that satisfies equilibrium in both the goods and money markets.