

MACROECONOMICS

N. Gregory Mankiw

PowerPoint® Slides by Ron Cronovich

SEVENTH EDITION

CHAPTER 10

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

In this chapter, you will learn:

- the IS curve, and its relation to:
 - the Keynesian cross
 - the loanable funds model
- the LM curve, and its relation 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

- Chapter 9 introduced the model of aggregate demand and aggregate supply.
- Long run
 - prices flexible
 - output determined by factors of production & technology
 - unemployment equals its natural rate
- Short run
 - prices fixed
 - output determined by aggregate demand
 - unemployment negatively related to output

Context

- 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, *SRAS* curve is horizontal).
- This chapter (and chapter 11) focus on the closed-economy case.
Chapter 12 presents the open-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 & planned expenditure
= unplanned inventory investment

Elements of the Keynesian Cross

consumption function: $C = C(Y - T)$

govt policy variables: $G = \bar{G}, \quad T = \bar{T}$

for now, planned
investment is exogenous:

$$I = \bar{I}$$

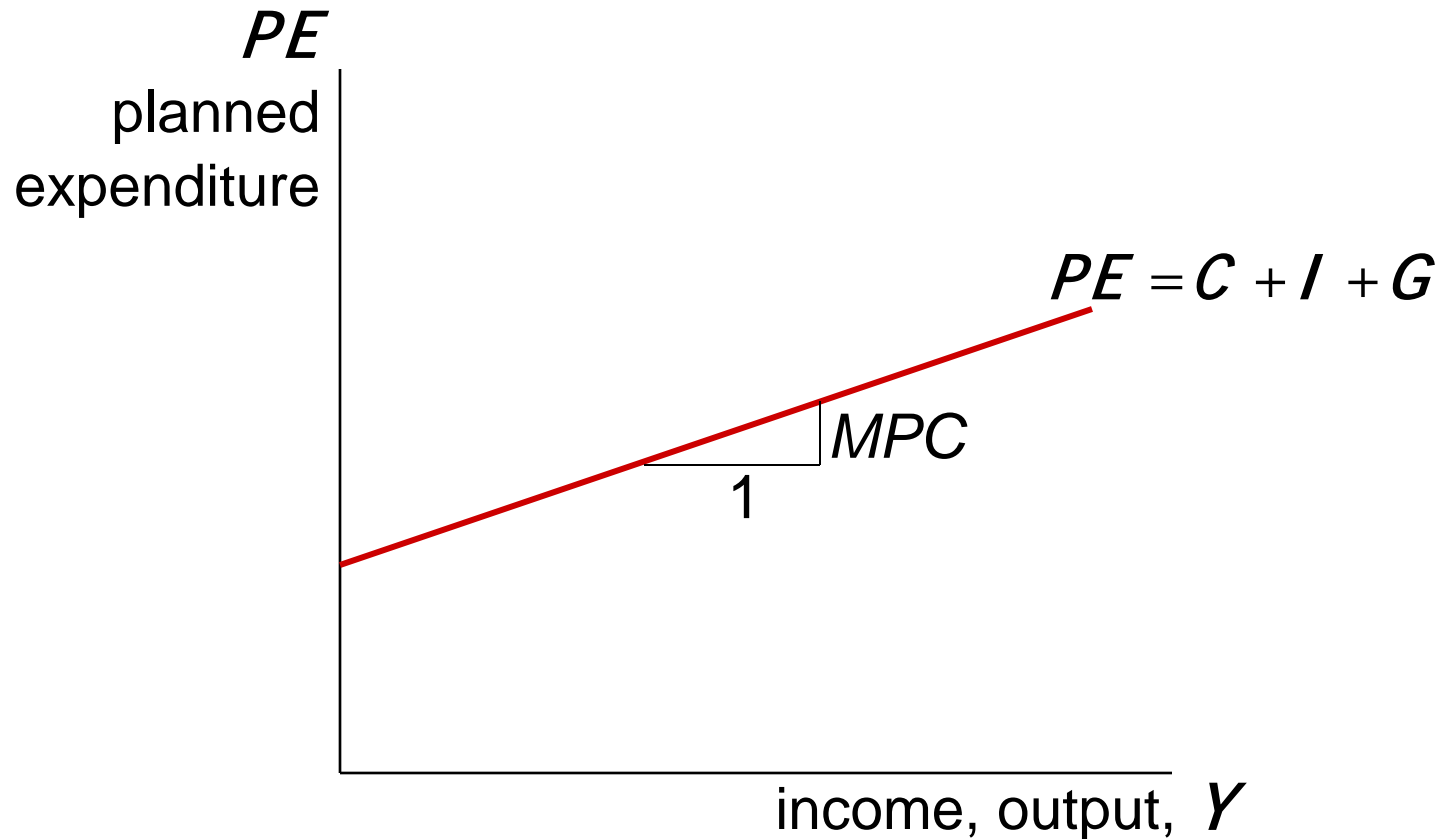
planned expenditure: $PE = C(Y - \bar{T}) + \bar{I} + \bar{G}$

equilibrium condition:

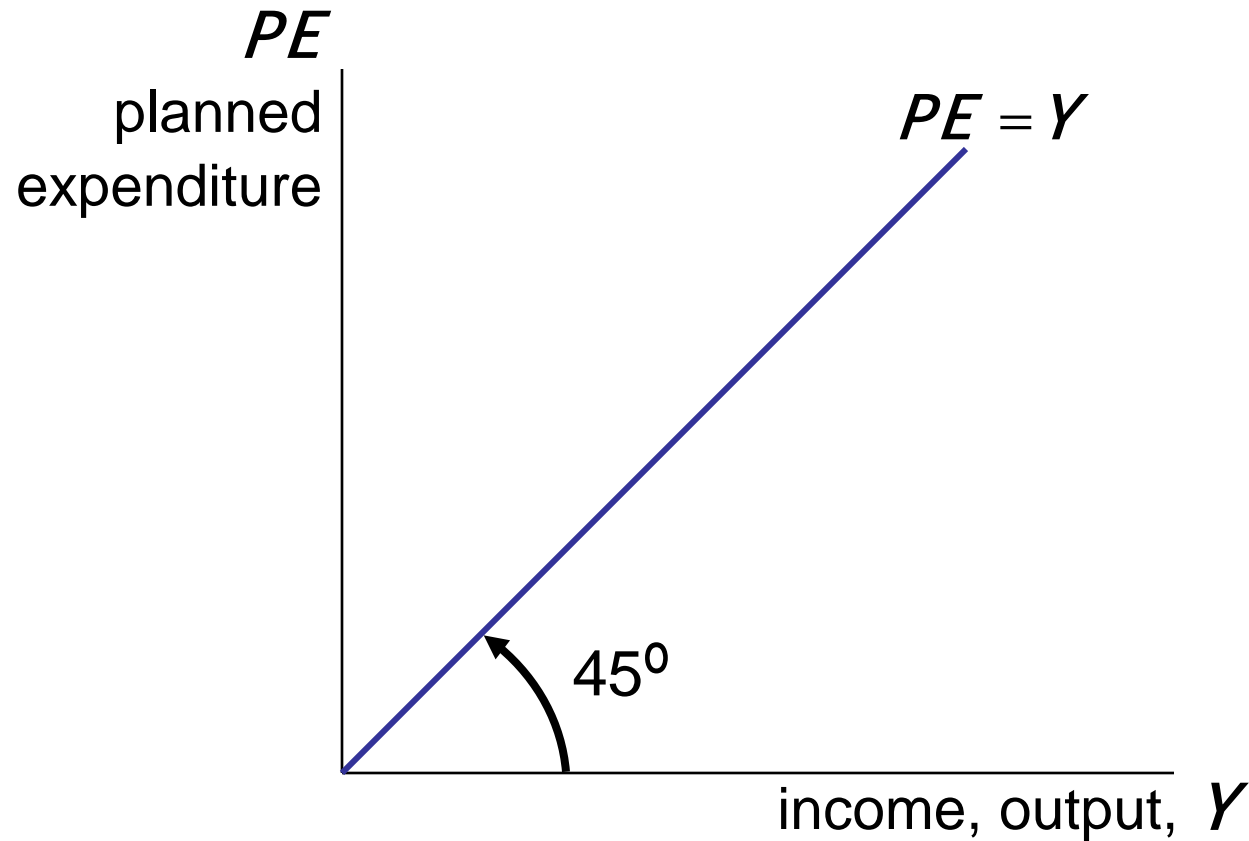
actual expenditure = planned expenditure

$$Y = PE$$

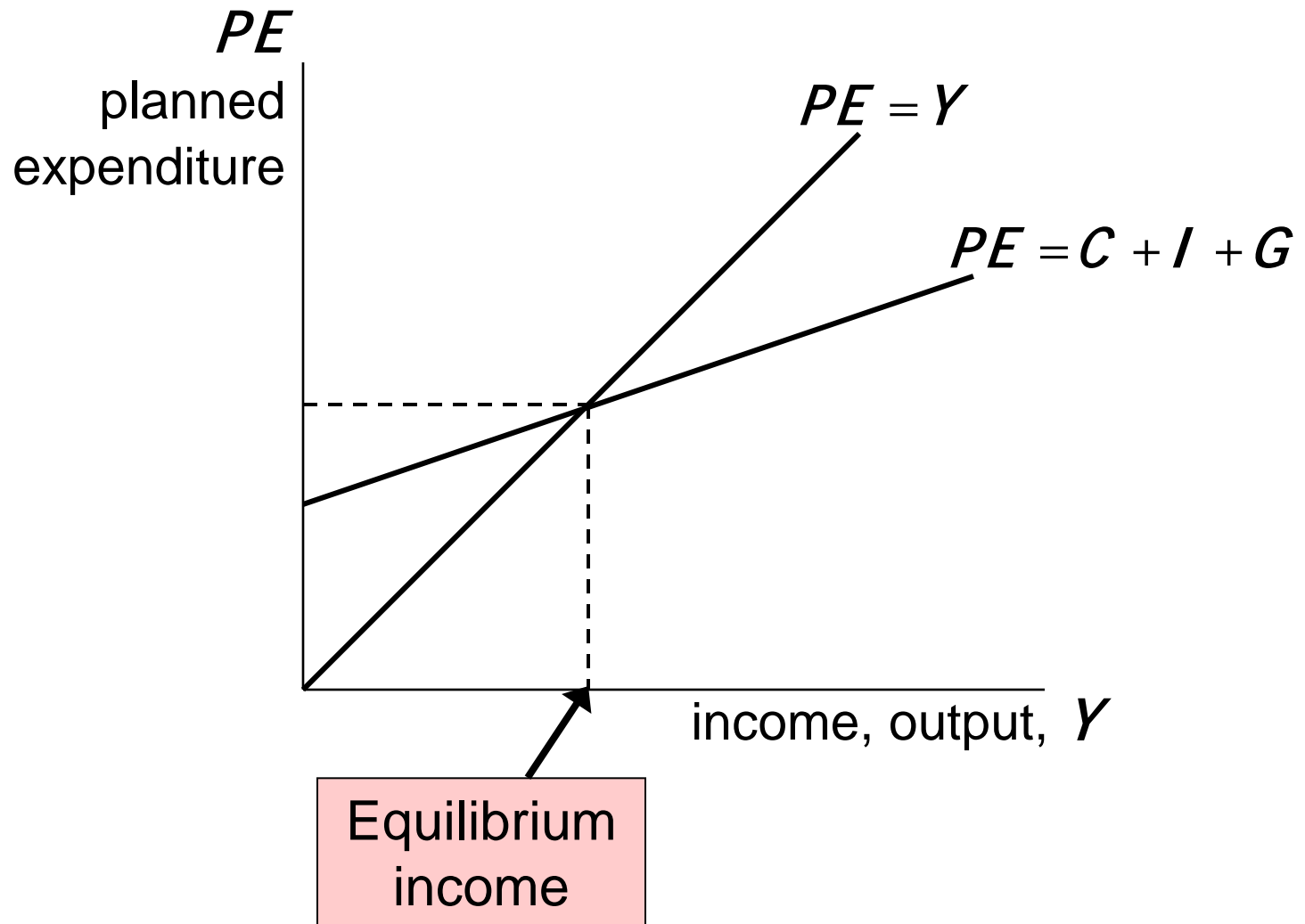
Graphing planned expenditure



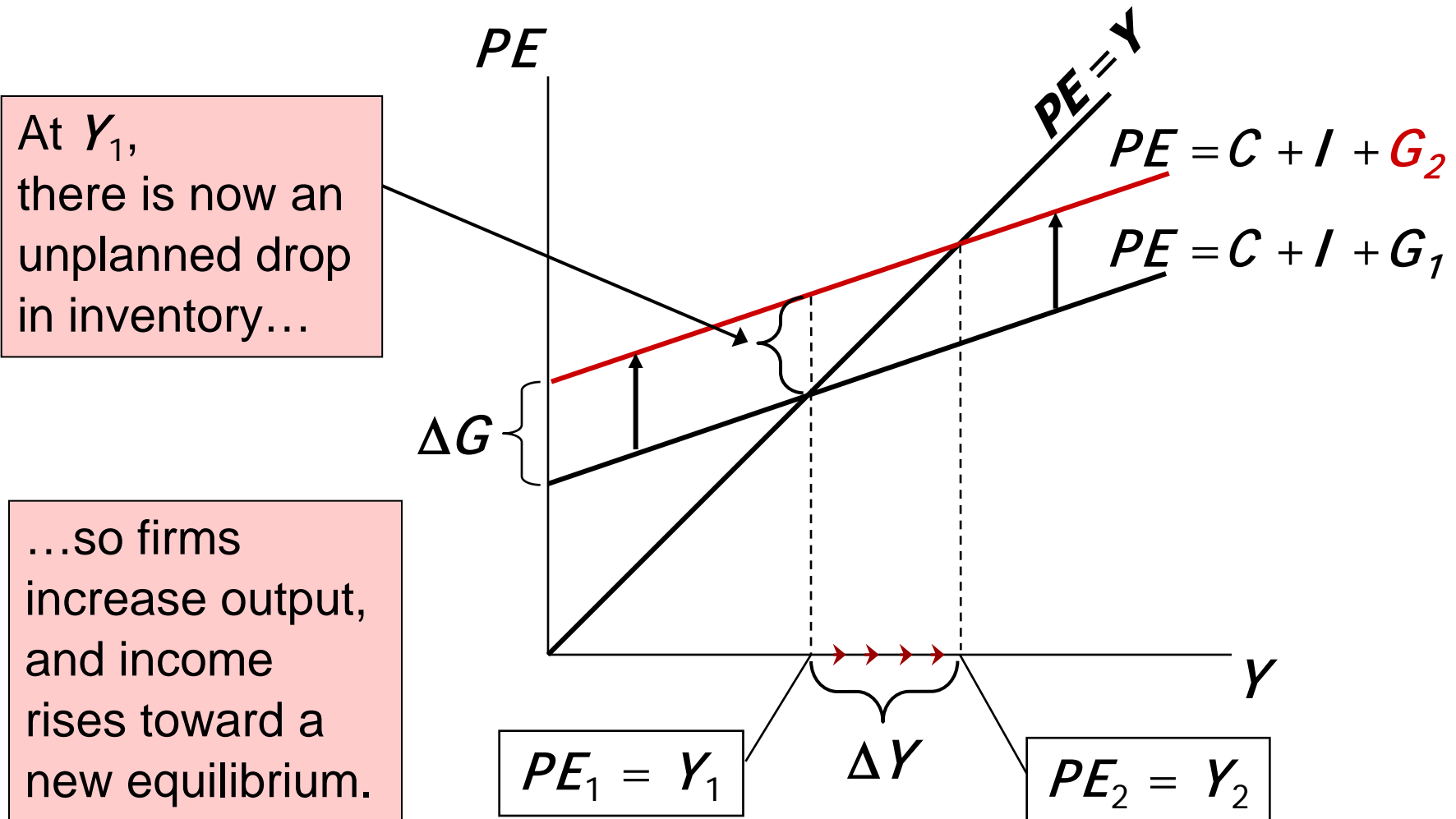
Graphing the equilibrium condition



The equilibrium value of income



An increase in government purchases



Solving for ΔY

$$Y = C + I + G$$

equilibrium condition

$$\Delta Y = \Delta C + \Delta I + \Delta G$$

in changes

$$= \Delta C + \Delta G$$

because I exogenous

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

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

Example: If $MPC = 0.8$, then

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

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

Why the multiplier is greater than 1

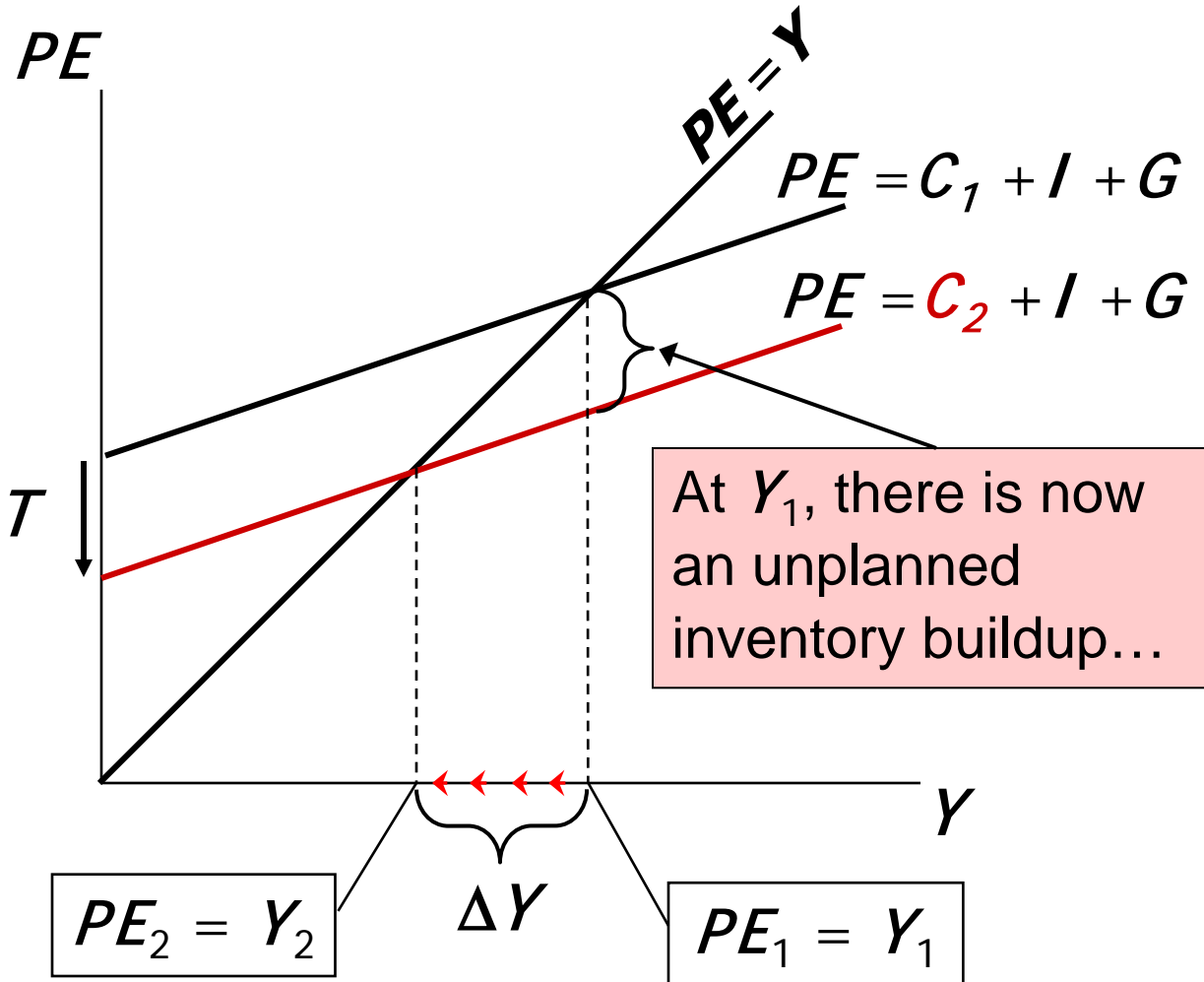
- Initially, the increase in **G** causes an equal increase in **Y**: $\Delta Y = \Delta G$.
- But $\uparrow Y \Rightarrow \uparrow C$
 - \Rightarrow further $\uparrow Y$
 - \Rightarrow further $\uparrow C$
 - \Rightarrow further $\uparrow Y$
- So the final impact on income is much bigger than the initial ΔG .

An increase in taxes

Initially, the tax increase reduces consumption, and therefore **PE**:

$$\Delta C = -\text{MPC } \Delta T$$

...so firms reduce output, and income falls toward a new equilibrium



Solving for ΔY

$$\begin{aligned}\Delta Y &= \Delta C + \Delta I + \Delta G && \text{eq'm condition in changes} \\ &= \Delta C && I \text{ and } G \text{ exogenous} \\ &= \text{MPC} \times (\Delta Y - \Delta T)\end{aligned}$$

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

Final result:

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

The tax multiplier

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

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

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

...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**.



The I/S curve

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

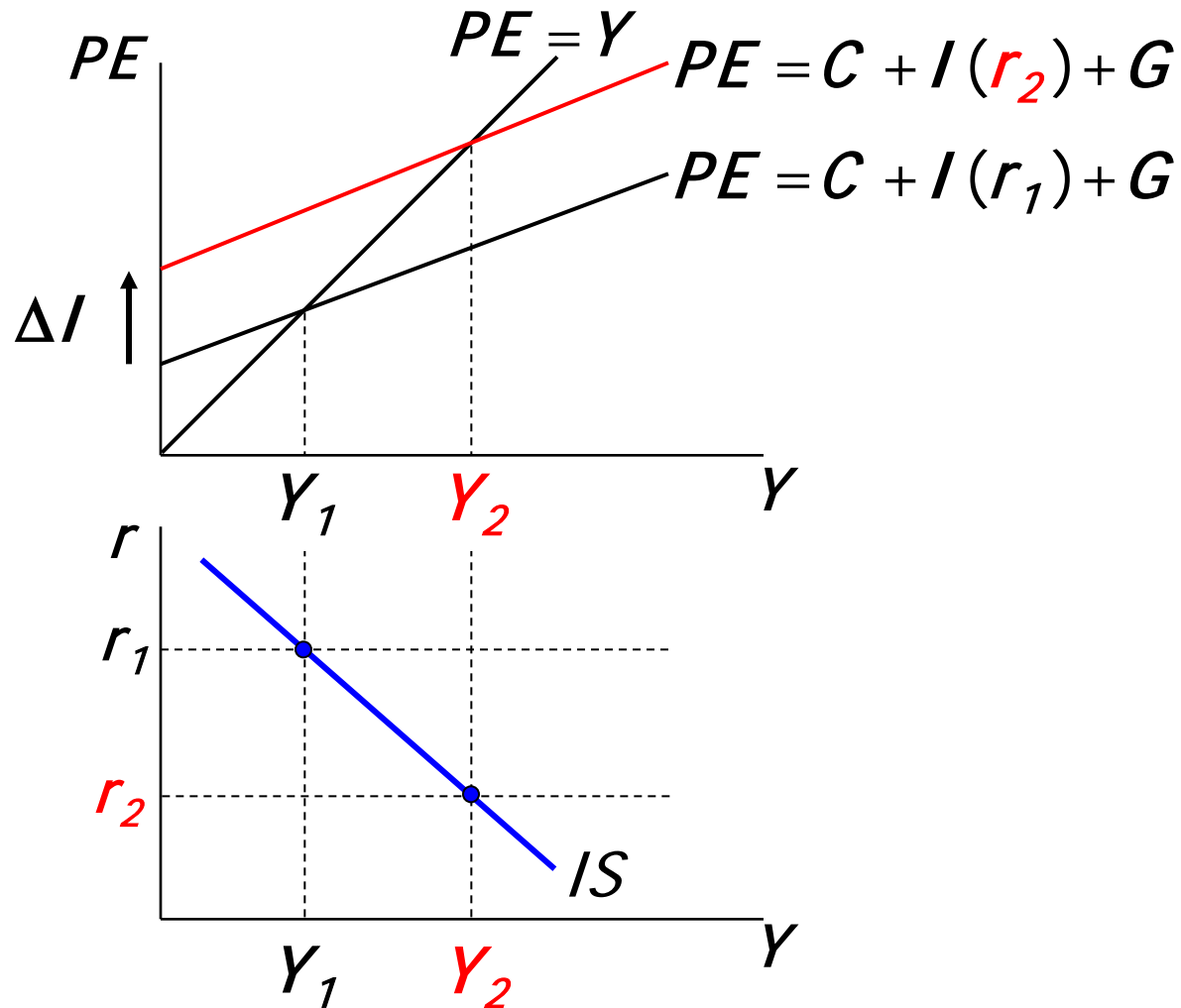
i.e. actual expenditure (output)
= planned expenditure

The equation for the I/S curve is:

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

Deriving the IS curve

$\downarrow r \Rightarrow \uparrow I$
 $\Rightarrow \uparrow PE$
 $\Rightarrow \uparrow Y$



Why the $/S$ 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...

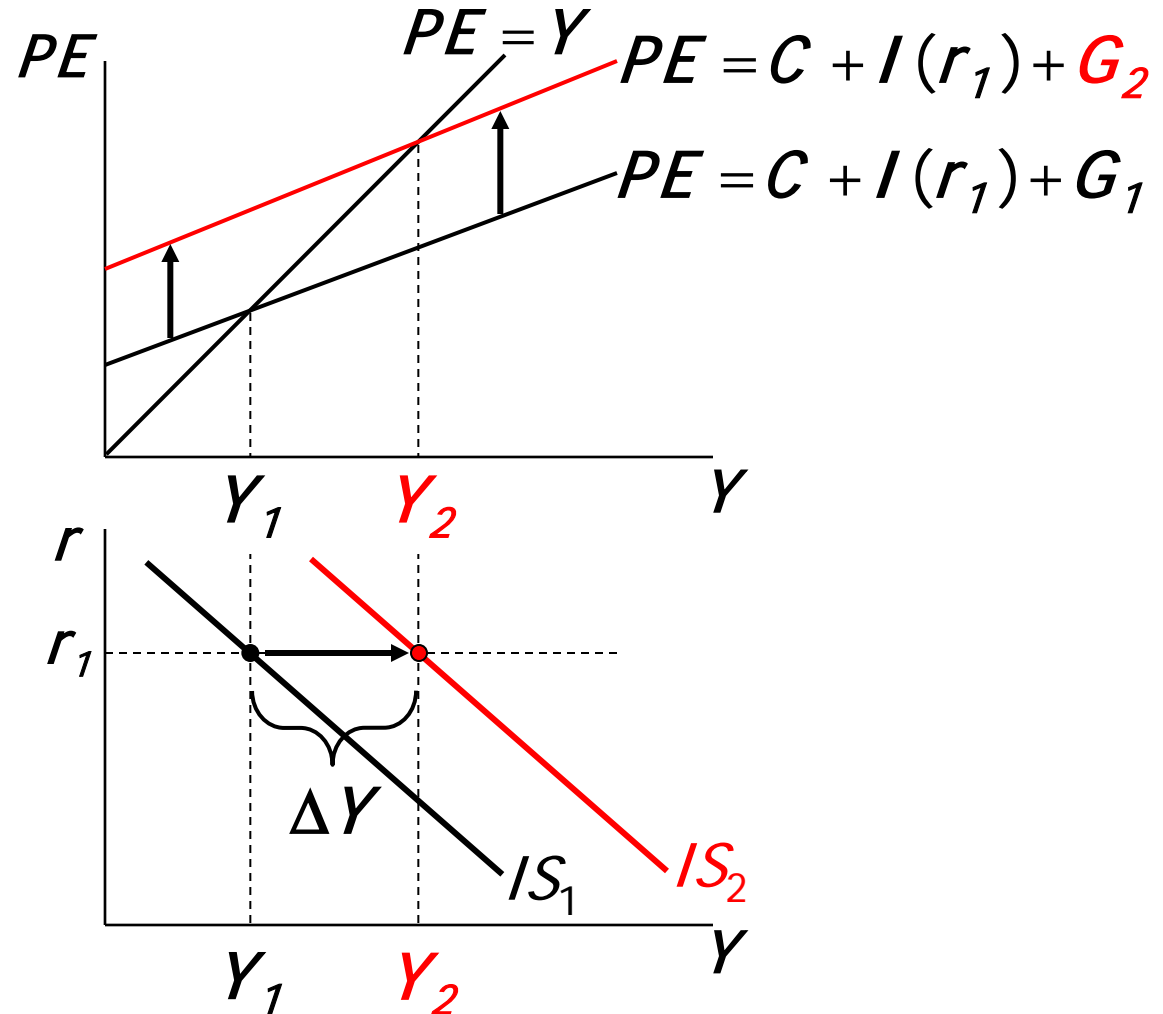
Shifting the IS curve: ΔG

At any value of r ,
 $\uparrow \mathbf{G} \Rightarrow \uparrow \mathbf{PE} \Rightarrow \uparrow \mathbf{Y}$

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

The horizontal distance of the IS shift equals

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



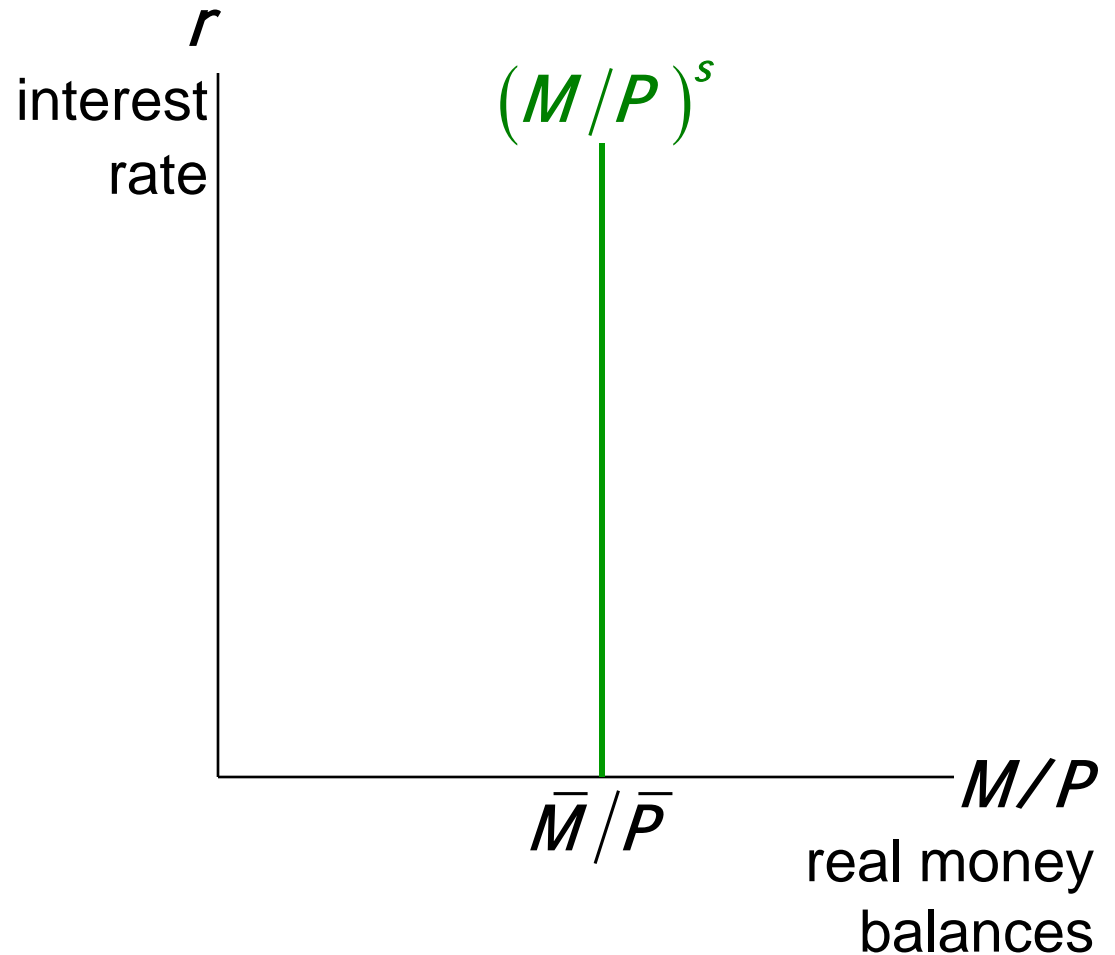
The Theory of Liquidity Preference

- 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:

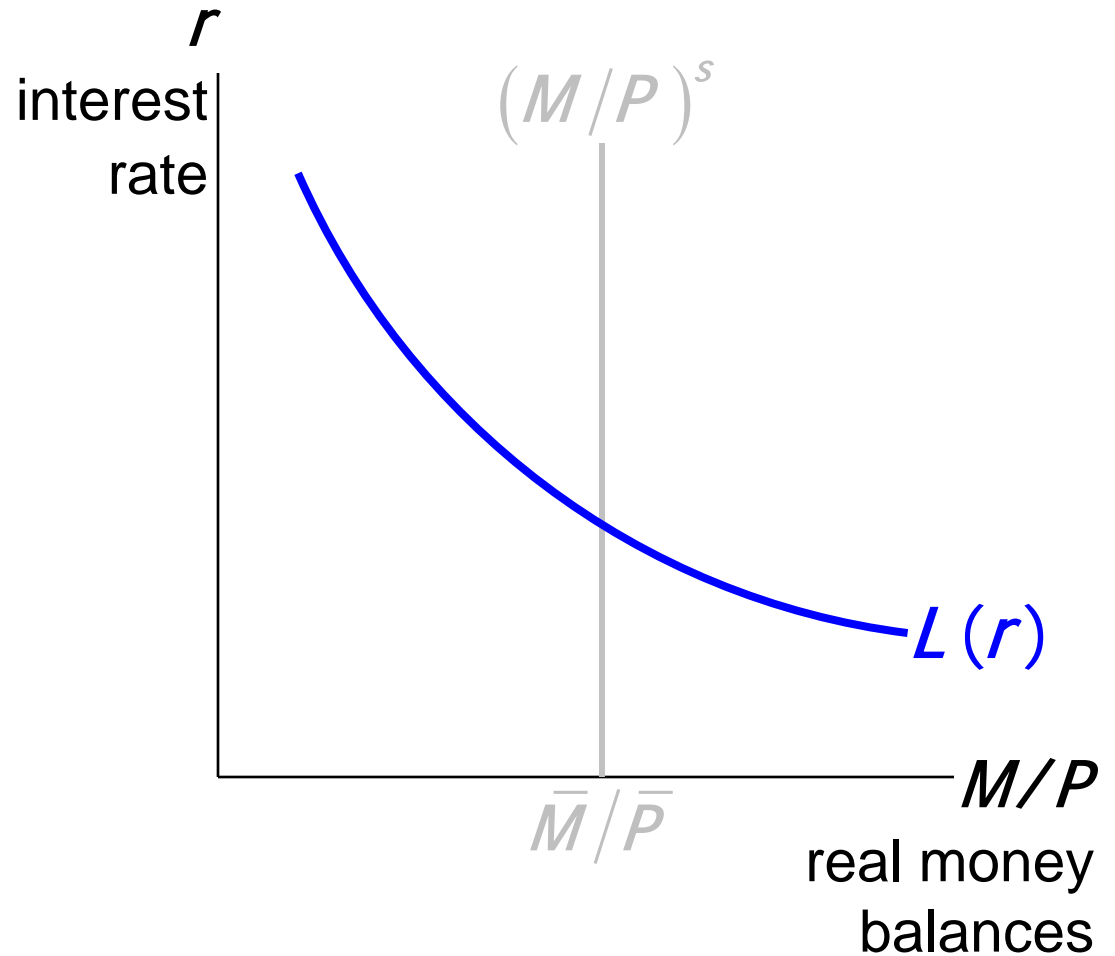
$$(M/P)^s = \bar{M}/\bar{P}$$



Money demand

Demand for
real money
balances:

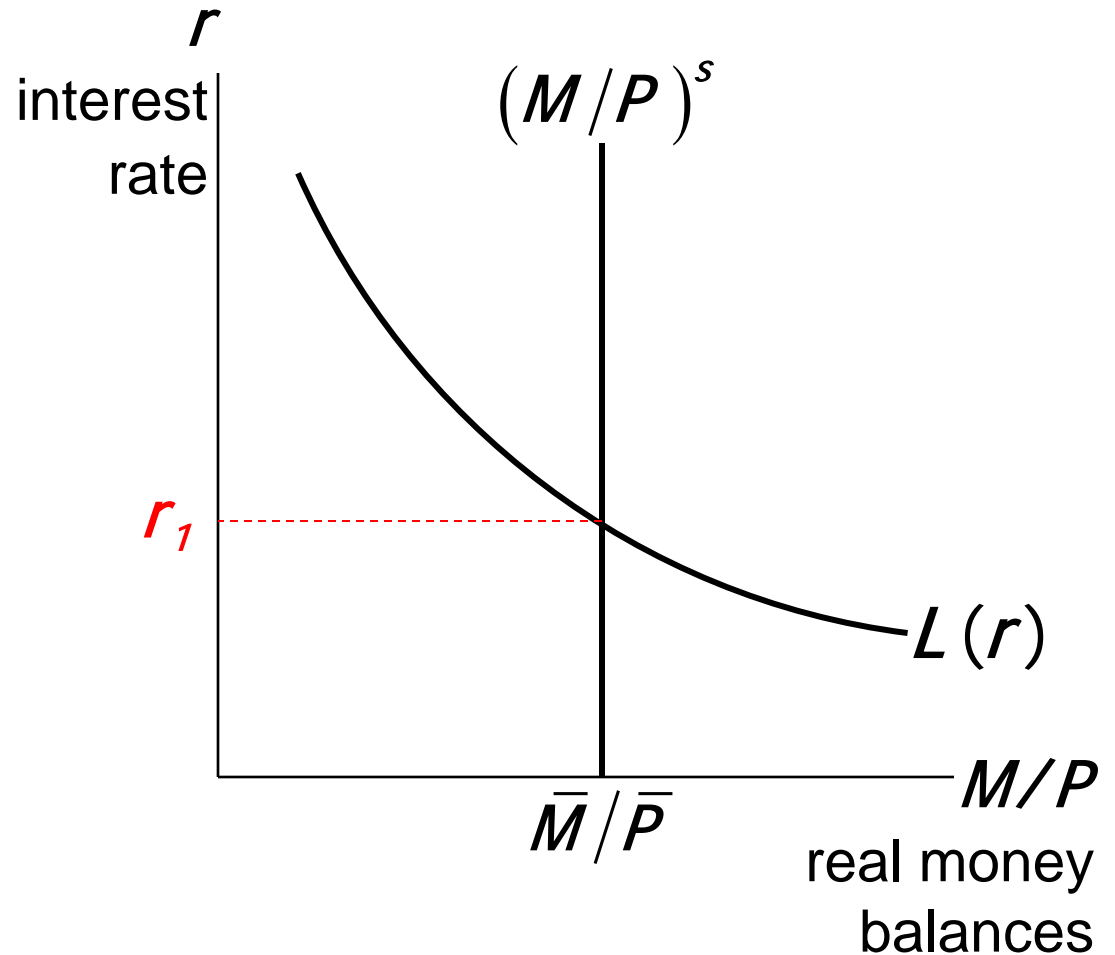
$$(M/P)^d = L(r)$$



Equilibrium

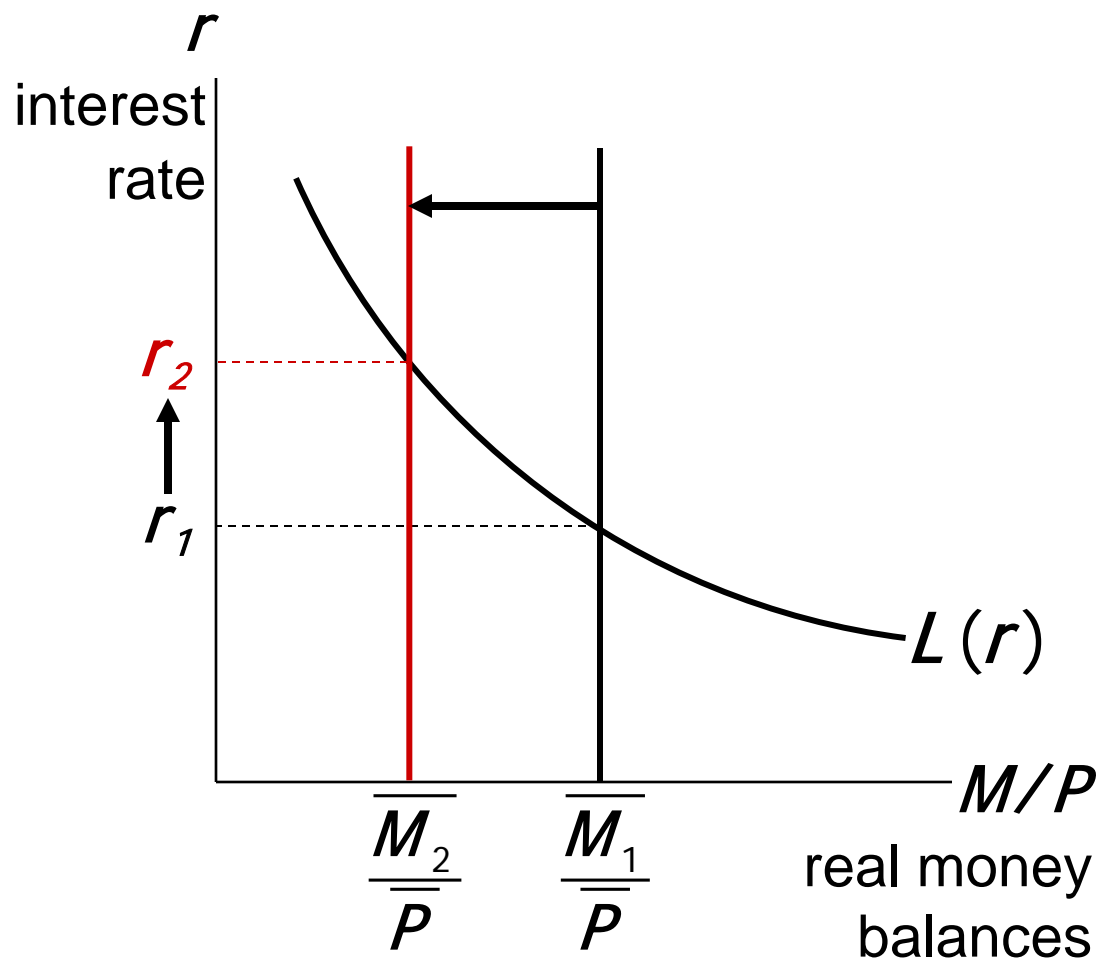
The interest rate adjusts to equate the supply and demand for money:

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



How the Fed raises the interest rate

To increase r ,
Fed reduces M



CASE STUDY:

Monetary Tightening & Interest Rates

- Late 1970s: $\pi > 10\%$
- Oct 1979: Fed Chairman Paul Volcker announces that monetary policy would aim to reduce inflation
- Aug 1979-April 1980: Fed reduces ***M/P*** 8.0%
- Jan 1983: $\pi = 3.7\%$

How do you think this policy change would affect nominal interest rates?

Monetary Tightening & Interest Rates, *cont.*

The effects of a monetary tightening on nominal interest rates

	<i>short run</i>	<i>long run</i>
model	Liquidity preference (<i>Keynesian</i>)	Quantity theory, Fisher effect (<i>Classical</i>)
prices	sticky	flexible
prediction	$\Delta i > 0$	$\Delta i < 0$
actual outcome	8/1979: $i = 10.4\%$ 4/1980: $i = 15.8\%$	8/1979: $i = 10.4\%$ 1/1983: $i = 8.2\%$

The LM curve

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

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

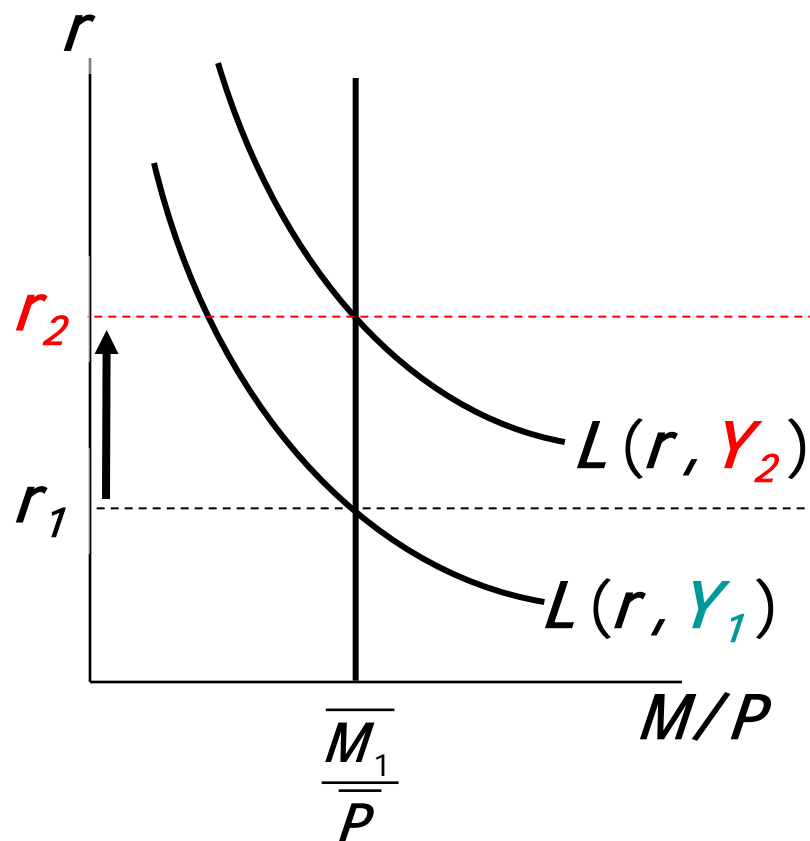
The **LM curve** is a graph of all combinations of r and Y that equate the supply and demand for real money balances.

The equation for the LM curve is:

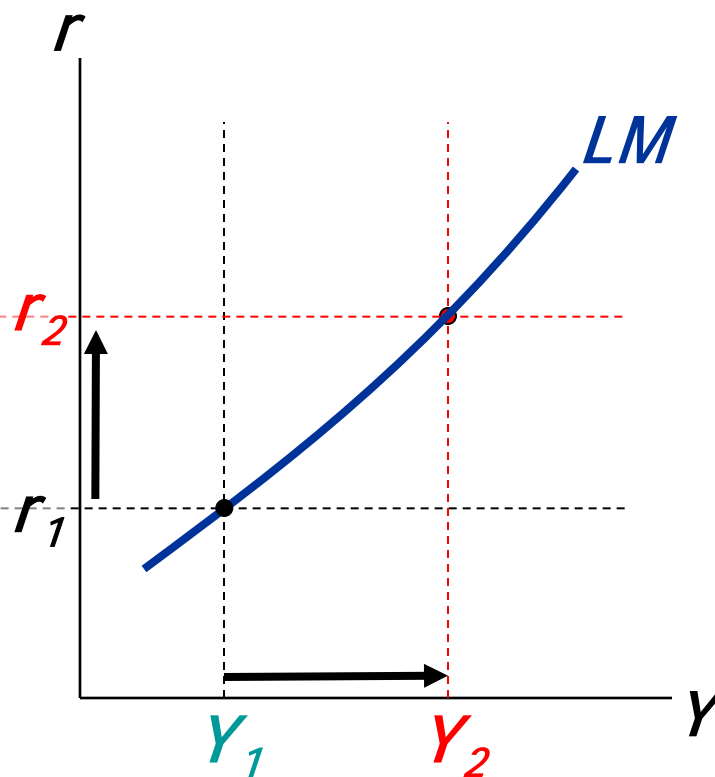
$$\bar{M}/\bar{P} = L(r, Y)$$

Deriving the LM curve

(a) The market for real money balances



(b) The LM curve

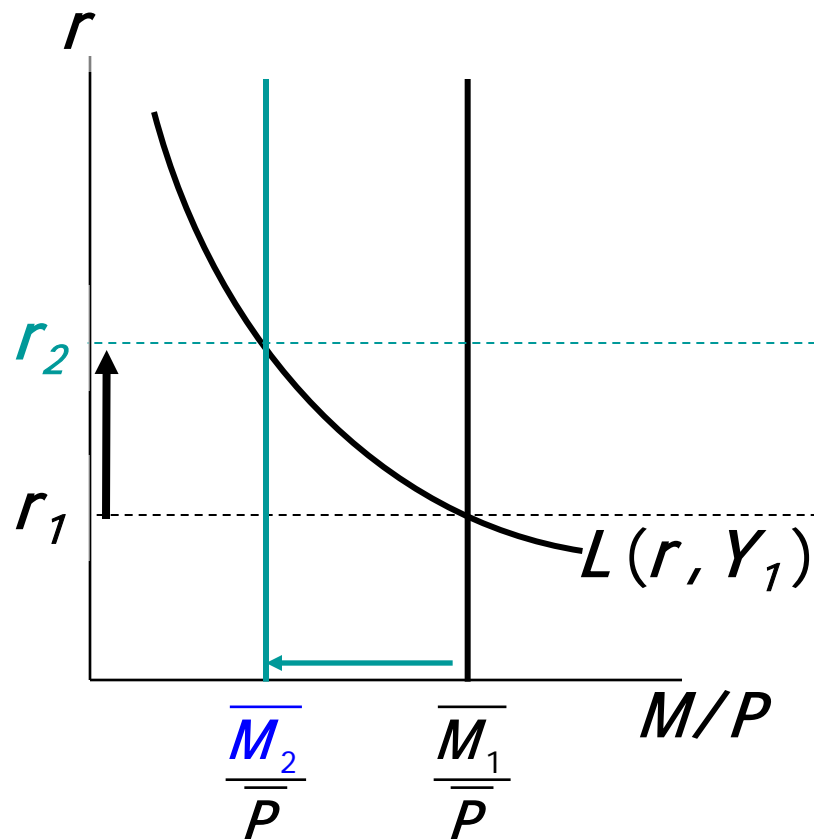


Why the LM curve is upward sloping

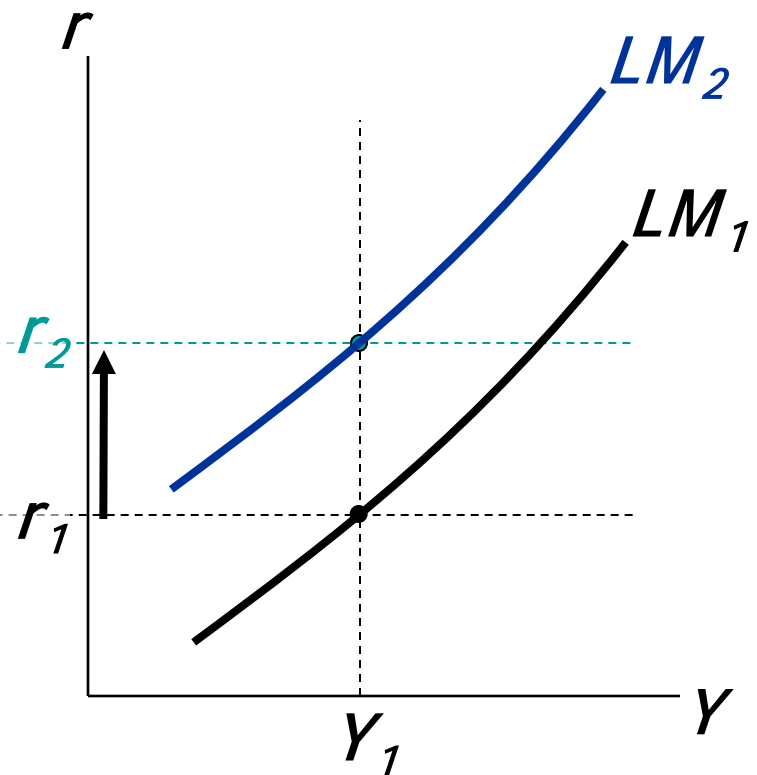
- An increase in income raises money demand.
- Since the supply of real balances is fixed, there is now excess demand in the money market at the initial interest rate.
- The interest rate must rise to restore equilibrium in the money market.

How ΔM shifts the LM curve

(a) The market for real money balances



(b) The LM curve



The short-run equilibrium

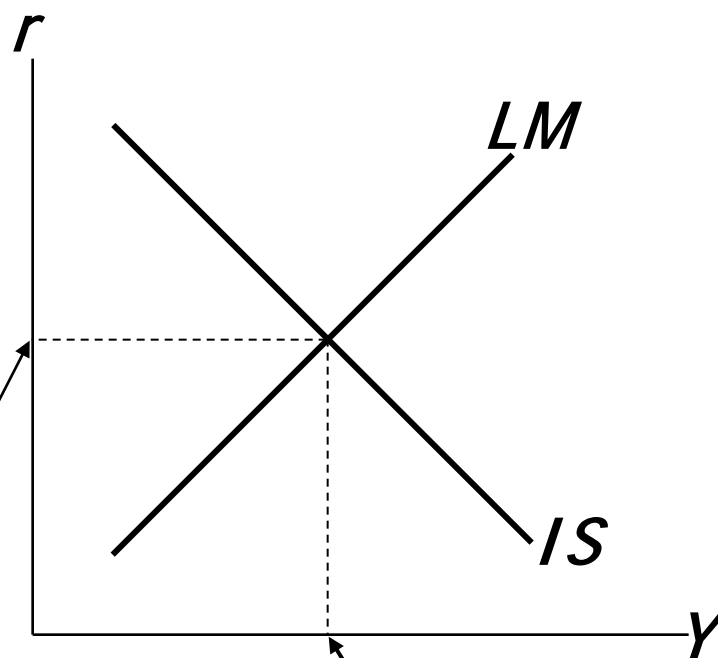
The short-run equilibrium is the combination of r and Y that simultaneously satisfies the equilibrium conditions in the goods & money markets:

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

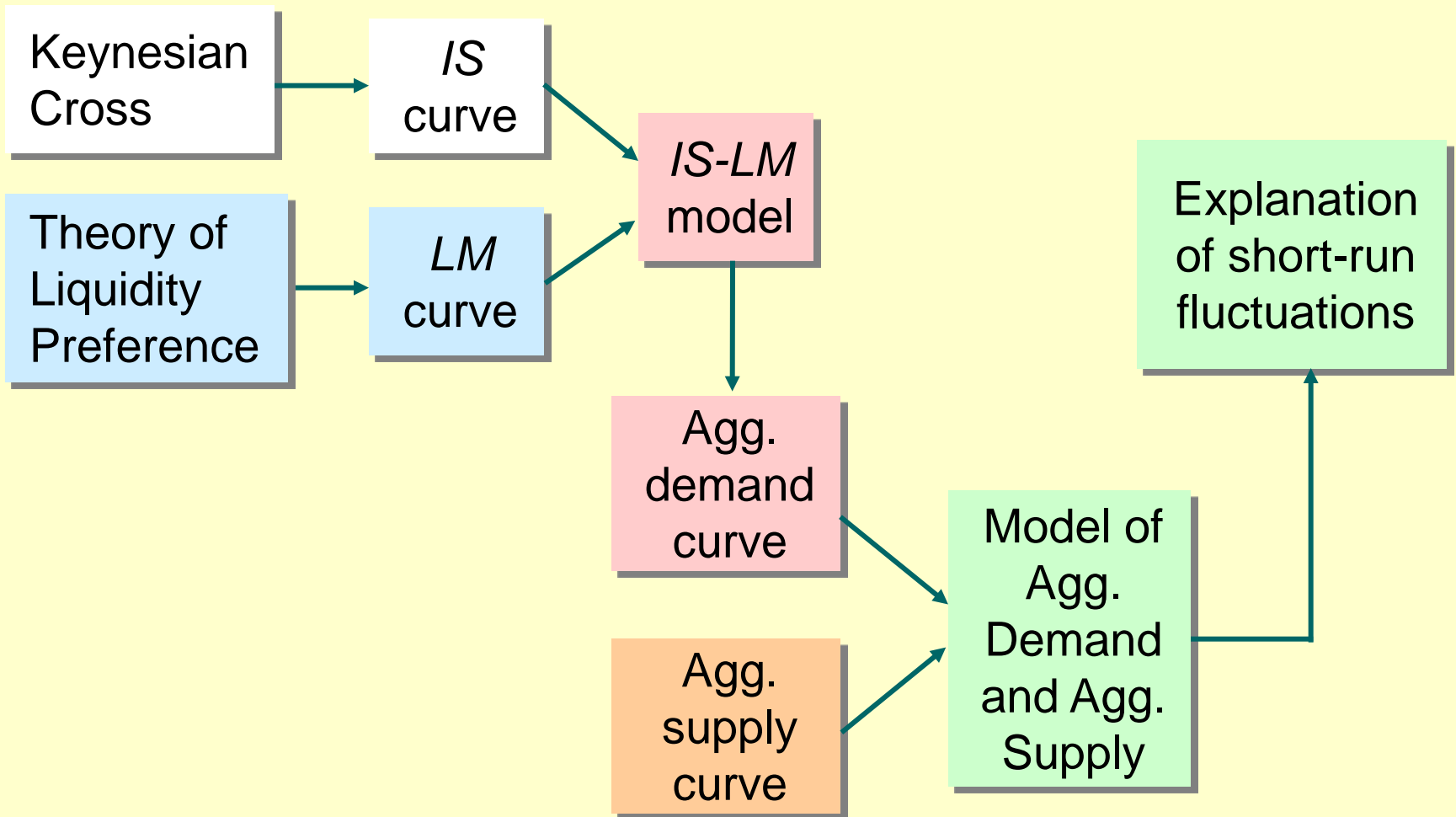
$$\bar{M}/\bar{P} = L(r, Y)$$

Equilibrium
interest
rate

Equilibrium
level of
income



The Big Picture



Preview of Chapter 11

In Chapter 11, 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

1. Keynesian cross

- basic model of income determination
- takes fiscal policy & investment as exogenous
- fiscal policy has a multiplier effect on income

2. 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 & services

Chapter Summary

3. Theory of Liquidity Preference

- basic model of interest rate determination
- takes money supply & price level as exogenous
- an increase in the money supply lowers the interest rate

4. *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

5. *IS-LM* model

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