Essentials of Economics II
Chapter 5: IS – LM (Olivier Blanchard)

Essentials of Economics II

Ferdowsi University of Mashhad

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Introduction, IS - LM

❖ **The IS-LM model:**

- The **IS-LM** model is named after its two main components: the IS curve and the LM curve. Here's what the names stand for and what they represent:
- IS curve: The "IS" stands for "Investment-Saving" or "Investment-Saving equilibrium". This curve represents the equilibrium in the goods market, where investment (I) equals savings (S). It shows the relationship between interest rates and the level of output (GDP) in the goods market.
- LM curve: The "LM" stands for "Liquidity preference-Money supply" or "Liquidity preference-Money supply equilibrium". This curve represents the equilibrium in the money market, where the demand for money (liquidity preference) equals the supply of money. It shows the relationship between interest rates and the level of output in the money market.

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❖ **The IS-LM model:**

- It is a macroeconomic model that shows how the market for economic **goods** (IS) interacts with the loanable **funds** market (LM).
- It is used to illustrate how changes in interest rates and output levels affect the economy in the short run.
- **The IS curve:** represents the relationship between interest rates and output levels in the goods market.
- **The LM curve:** represents the relationship between interest rates and output levels in the money market.
- **The intersection** of the IS and LM curves represents the **short-run equilibrium** levels of interest rates and output in the economy.
- Changes in **market preferences**, such as changes in investment or consumption, can shift the IS curve and affect equilibrium levels of GDP and interest rates.
- Changes in **monetary policy**, such as changes in the money supply, can shift the LM curve and also affect equilibrium levels of GDP and interest rates.
- The IS-LM model is a useful tool for understanding how different factors affect the economy in the short run, and it can help policymakers make decisions about **appropriate stabilization policies**.

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- **Equilibrium** in the goods market exists when production, Y, is equal to the demand for goods, Z.
- In the simple model developed in chapter 1-4, the interest rate did not affect the demand for goods. The equilibrium condition was given by:

- In this chapter, we capture the effects of two factors affecting investment:
    - The level of sales (+)
    - The interest rate (-)

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- Taking into account the investment relation above, the equilibrium condition in the goods market becomes:

$$Y = C(Y - T) + I(Y, i) + G$$

❖ **The IS-LM model:**

- In order to drive the **IS** mathematically we start with a three sector model:
  - Here we assume that investment be a function of interest rates as bellow:

$$I = I_0 - ar$$

In which "a" is the sensitivity of investor toward interest rates and "r" is the interest rate.

$$y^d = C + I + G$$

$$C = C_0 + c (Y - T_0 - tY) => Y = C_0 + c (Y - T_0 - tY) + I_0 - ar + G => ar = C_0 - c T_0 + I_0 + G - 1 - c(1-t)Y$$

$$=> r = \frac{C_0 + I_0 + - c T_0}{a} - \frac{1 - c(1-t)}{a} Y$$

Slope

$$r = \boxed{\frac{C_0 \ + I_0 +- \ \mathsf{c} \ T_0}{a}} - \boxed{\frac{1-c(1-t)}{a}} \, Y$$

width from origin (constant)

❖ **The IS-LM model:**

➢ **Equilibrium in the Goods Market (IS):**

- The demand for goods is an increasing function of output. Equilibrium requires that the demand for goods be equal to output.

- Note: The ZZ line is flatter than the 45° line only if increases in consumption and investment do not exceed the corresponding increase in output.
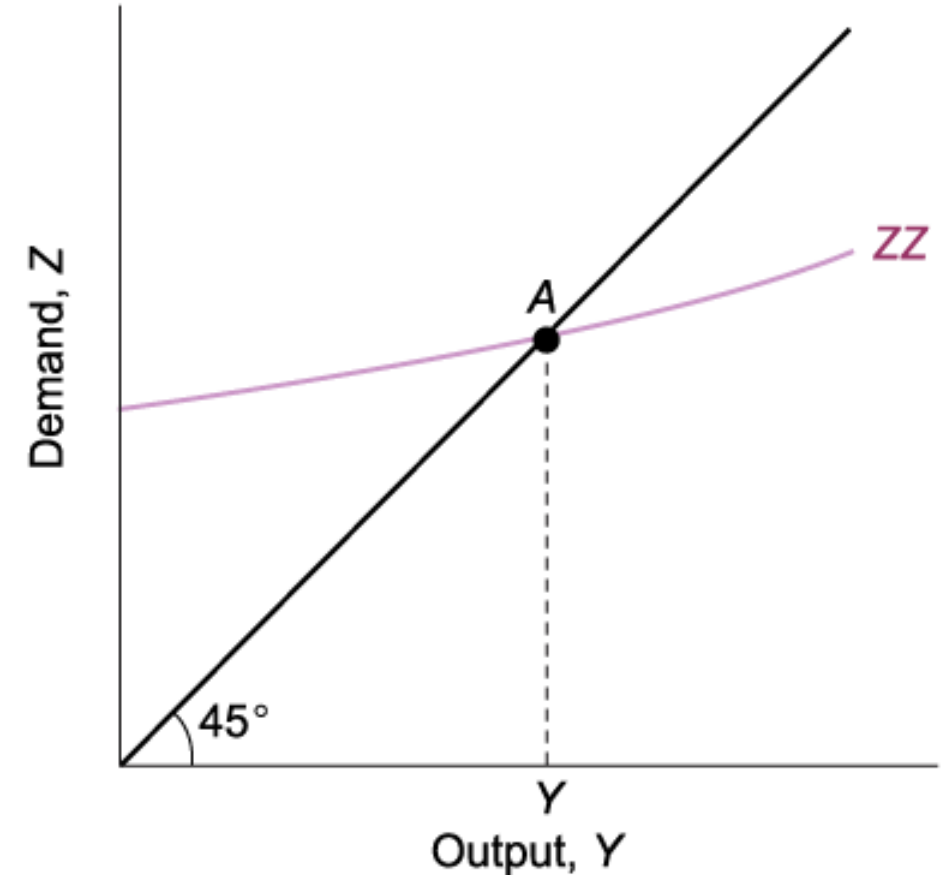
Introduction, IS - LM

❖ **The IS-LM model:**

➢ **Equilibrium in the Goods Market (IS):**

- The Effects of an Increase in the Interest Rate on Output:

• An increase in the interest rate decreases the demand for goods at any level of output.
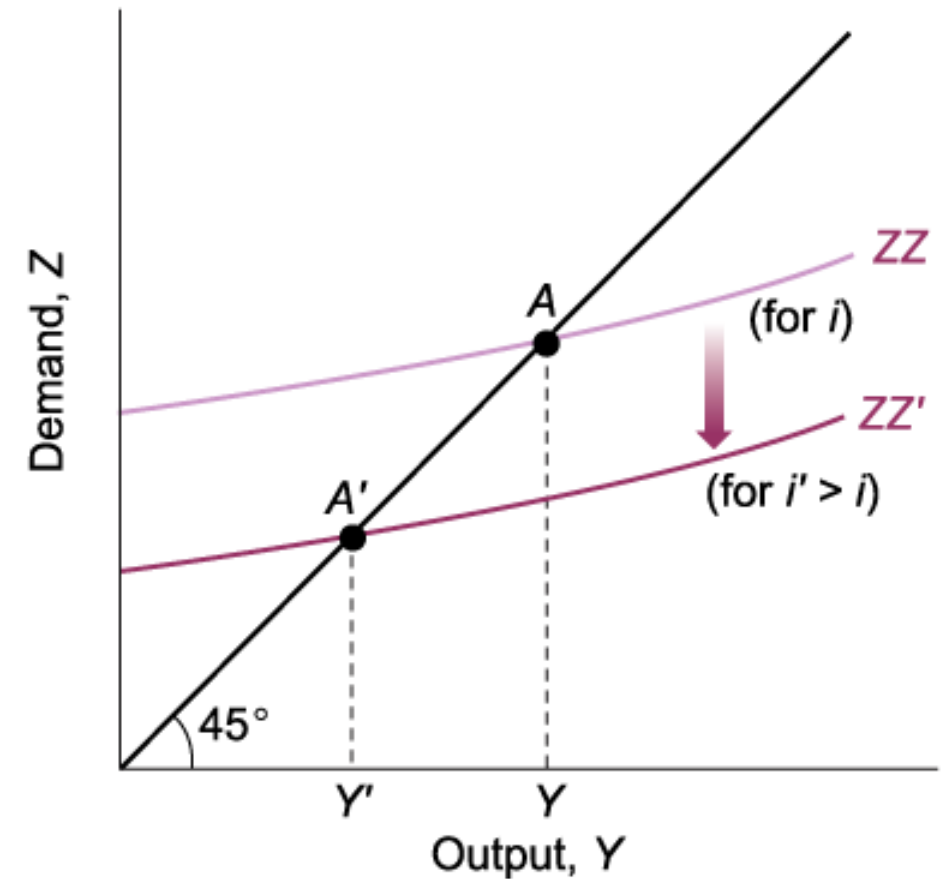
❖ **The IS-LM model:**

➢ **Equilibrium in the Goods Market (IS):**

- The Derivation of the IS Curve :

• Equilibrium in the goods market implies that an increase in the interest rate leads to a decrease in output. The IS curve is downward sloping.
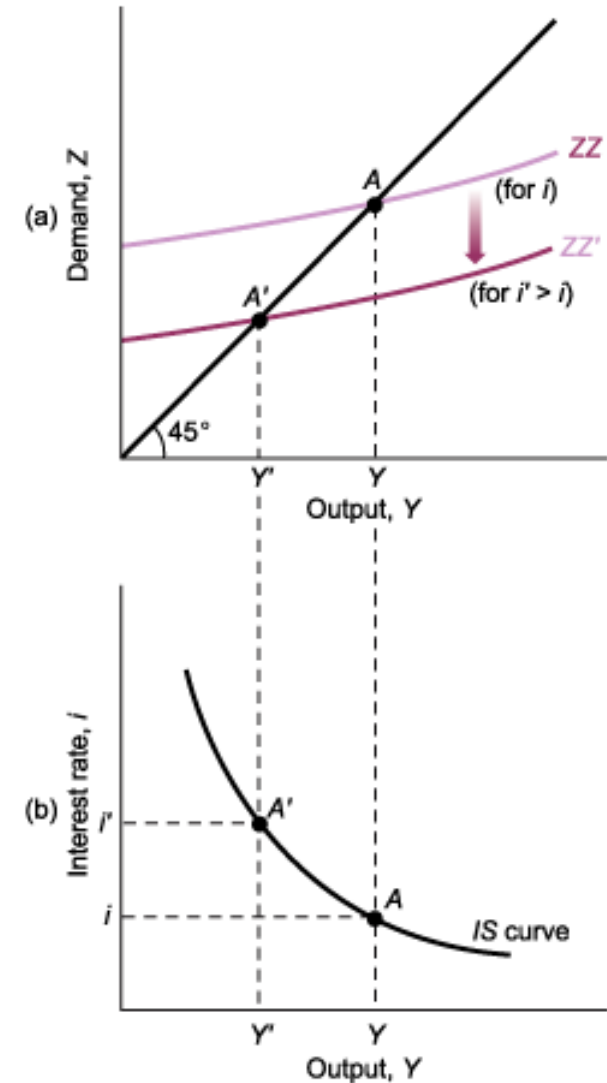
❖ **The IS-LM model:**

➢ **Equilibrium in the Goods Market (IS):**

　- Shifts of the IS Curve :

• An increase in taxes shifts the IS curve to the left.
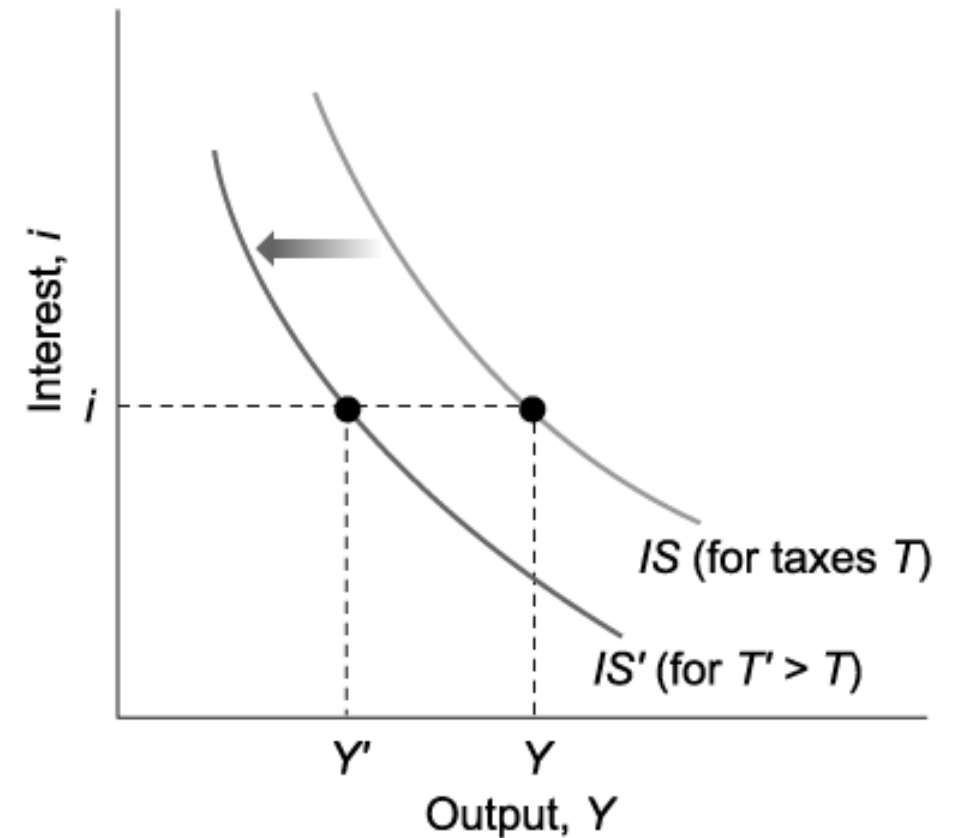
❖ **The IS-LM model:**

➤ **Equilibrium in the Money Market (LM):**

• The interest rate is determined by the equality of the supply of and the demand for money:

$$M = \$YL(i)$$

Such that :

M = nominal money stock
$YL(i) = demand for money
$Y = nominal income
i = nominal interest rate

❖ **The IS-LM model:**

➤ **Equilibrium in the Money Market (LM):**

• The LM relation: In equilibrium, the real money supply is equal to the real money demand, which depends on real income, Y, and the interest rate, i:

$$\frac{M}{P} = YL(i)$$

• Nominal GDP = Real GDP multiplied by the GDP deflator:

$$\$Y = YP$$

• Equivalently:

$$\frac{\$Y}{P} = Y$$

❖ **The IS-LM model:**

➢ **Equilibrium in the Money Market (LM):**

- Deriving the LM Curve:
- The Effects of an Increase in Income on the Interest Rate:

An increase in income leads, at a given interest rate, to an increase in the demand for money. Given the money supply, this leads to an increase in the equilibrium interest rate.
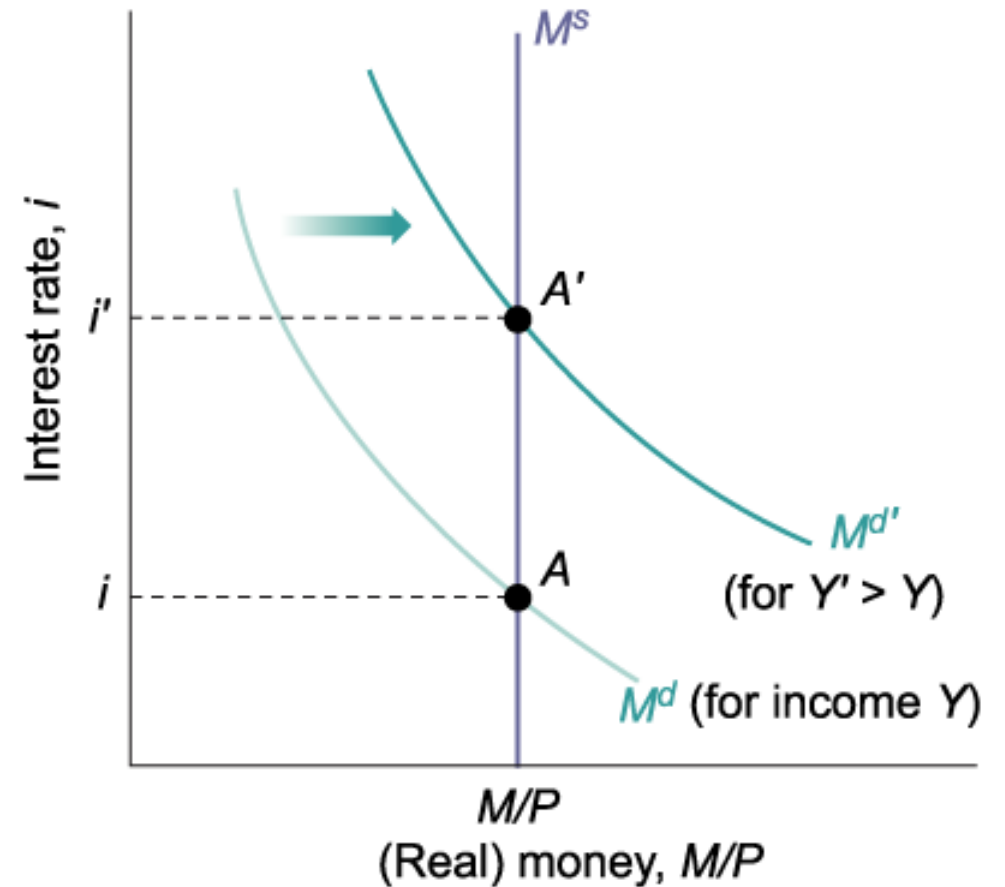
❖ **The IS-LM model:**

➢ **Equilibrium in the Money Market (LM):**

• Deriving the LM Curve:
- The Effects of an Increase in Income on the Interest Rate:

Equilibrium in financial markets implies that an increase in income leads to an increase in the interest rate. The LM curve is upward-sloping.
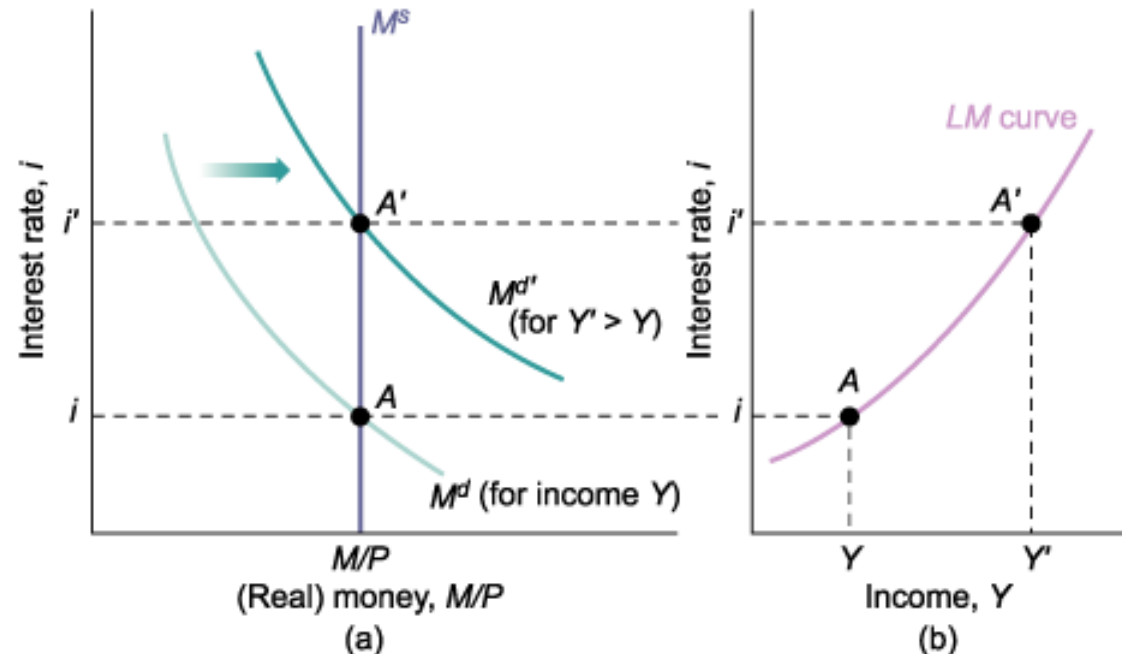
❖ **The IS-LM model:**

➢ **Equilibrium in the Money Market (LM):**

- Shifts of the LM Curve :

  An increase in money leads the LM curve to shift down.
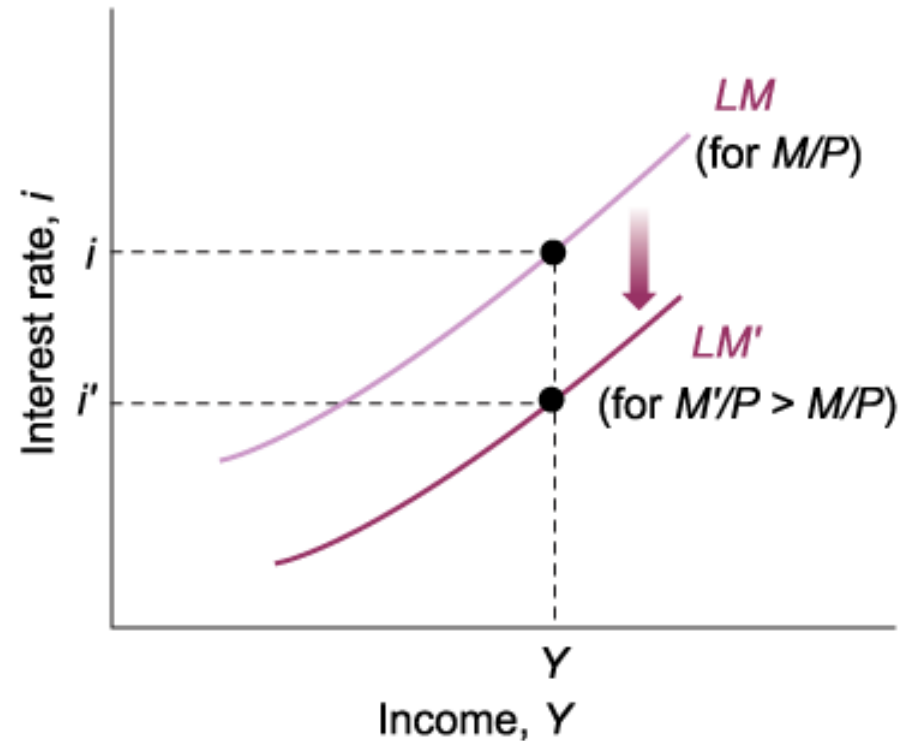
Putting the *IS* and the *LM* Relations Together

❖ **The IS-LM model:**

➢ **Equilibrium in both markets (IS- LM):**

- Equilibrium in the goods market implies that an increase in the interest rate leads to a decrease in output.
- Equilibrium in financial markets implies that an increase in output leads to an increase in the interest rate.
- When the IS curve intersects the LM curve, both goods and financial markets are in equilibrium.

$$IS\ relation:\ Y = C(Y - T) + I(Y,i) + G$$

$$LM\ relation:\ \frac{M}{P} = YL(i)$$

Introduction, IS – LM, Fiscal Policy, Activity, and the Interest Rate
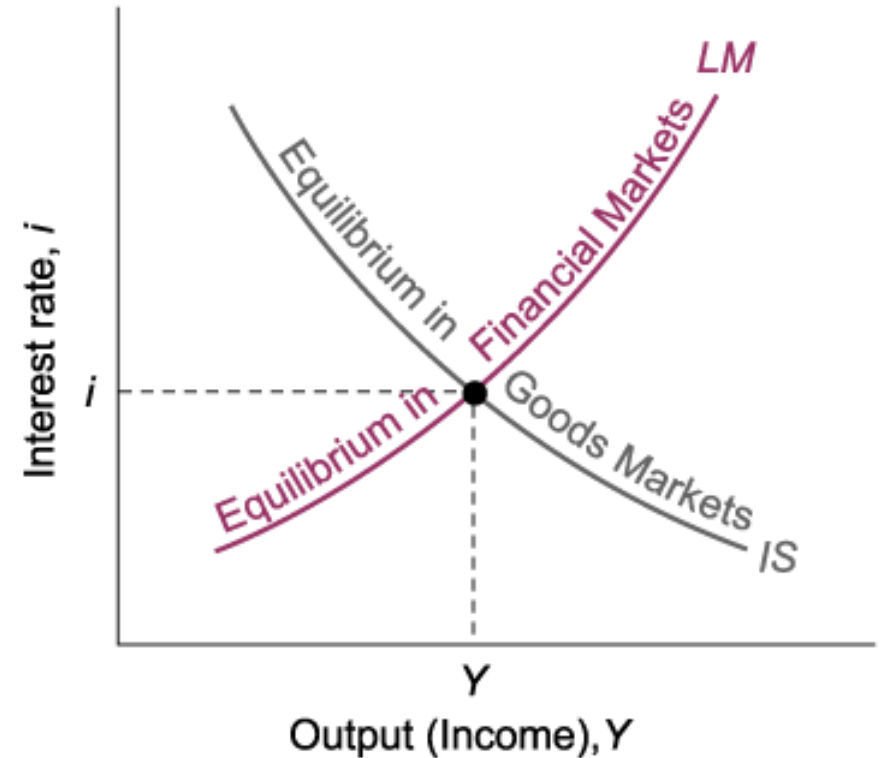
❖ **Fiscal Policy, Activity, and the Interest Rate:**

- **Fiscal contraction**, or fiscal consolidation, refers to fiscal policy that reduces the budget deficit.
- An increase in the deficit is called a **fiscal expansion**.
- **Taxes** affect the **IS** curve, not the LM curve.

Introduction, IS – LM, Fiscal Policy, Activity, and the Interest Rate

❖ **The Effects of an Increase in Taxes :**

- An increase in taxes shifts the IS curve to the left, and leads to a decrease in the equilibrium level of output and the equilibrium interest rate.
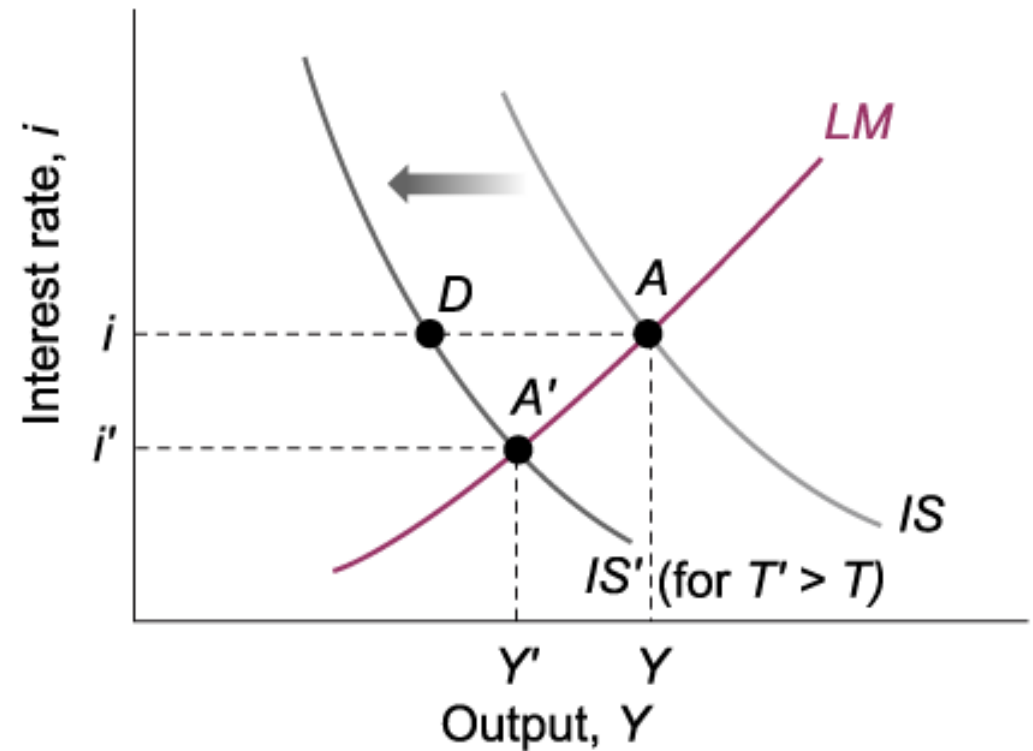
❖ **The Monetary Policy:**

- **Monetary contraction**, or monetary tightening, refers to a decrease in the money supply.
- An increase in the money supply is called **monetary expansion**.
- **Monetary policy** does not affect the IS curve, only the **LM** curve. For example, an increase in the money supply shifts the LM curve down.

❖ **The Effects of a Monetary Expansion:**

• **Monetary expansion** leads to higher output and a lower interest rate.

❖ **Using a Policy Mix:**

The **combination** of monetary and fiscal polices is known as the **monetary-fiscal** policy mix, or simply, the policy mix.

Table 5-1	The Effects of Fiscal and Monetary Policy.			
	Shift of IS	**Shift of LM**	**Movement of Output**	**Movement in Interest Rate**
Increase in taxes	left	none	down	down
Decrease in taxes	right	none	up	up
Increase in spending	right	none	up	up
Decrease in spending	left	none	down	down
Increase in money	none	down	up	down
Decrease in money	none	up	down	up

❖ **Using a Policy Mix:**

The Clinton-Greenspan Policy Mix

Table 5-2	Selected Macro Variables for the United States, 1991-1998							
	1991	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
Budget surplus (% of GDP) (minus sign = deficit)	−3.3	− 4.5	− 3.8	− 2.7	− 2.4	− 1.4	− 0.3	0.8
GDP growth (%)	−0.9	2.7	2.3	3.4	2.0	2.7	3.9	3.7
Interest rate (%)	7.3	5.5	3.7	3.3	5.0	5.6	5.2	4.8

1.**Global economic conditions:** In 1995, the U.S. economy was impacted by a slowdown in global growth, particularly in Japan and Europe. This led to reduced demand for U.S. exports, further affecting GDP growth.

2.**Business cycle:** The U.S. economy experienced a natural slowdown in the mid-1990s after a period of expansion in the early 1990s. This is a typical phenomenon in business cycles, where periods of growth are followed by periods of slower growth or recession.

Introduction, IS – LM, Policy Mix

❖ **Using a Policy Mix:**

The Clinton-Greenspan Policy Mix

• **Deficit Reduction and Monetary Expansion**
- The appropriate combination of deficit reduction and monetary expansion can achieve a reduction in the deficit without adverse effects on output.

❖ **Using a Policy Mix:**

German Unification and the German Monetary-Fiscal Tug of War:

Table 5-2 Selected Macro Variables for West Germany, 1988-1991				
	1991	**1992**	**1993**	**1994**
GDP growth (%)	3.7	3.8	4.5	3.1
Investment growth (%)	5.9	8.5	10.5	6.7
Budget surplus (% of GDP) (minus sign = deficit)	–2.1	0.2	–1.8	–2.9
Interest rate (%)	4.3	7.1	8.5	9.2

❖ **Using a Policy Mix:**

German Unification and the German Monetary-Fiscal Tug of War:
(The Monetary-Fiscal Policy Mix of Post-Unification Germany)
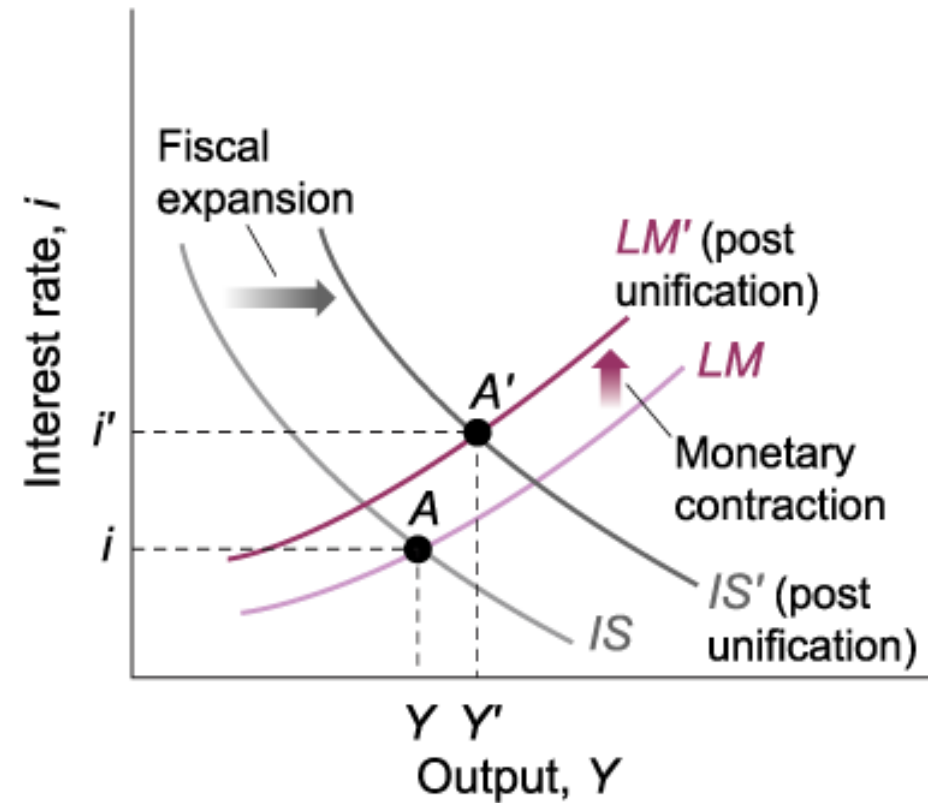
More practice

❖ **The Fed's response to ΔG > 0:**

Suppose Congress increases G.

Possible Fed responses:

1. hold M constant
2. hold r constant
3. hold Y constant

In each case, the effects of the Δ*G* are different:

❖ **The Fed's response to ΔG > 0:**

❖ **Response 1: Hold M constant**

If Congress raises **G**, the *IS* curve shifts right.

If Fed holds M constant, then LM curve doesn't shift.

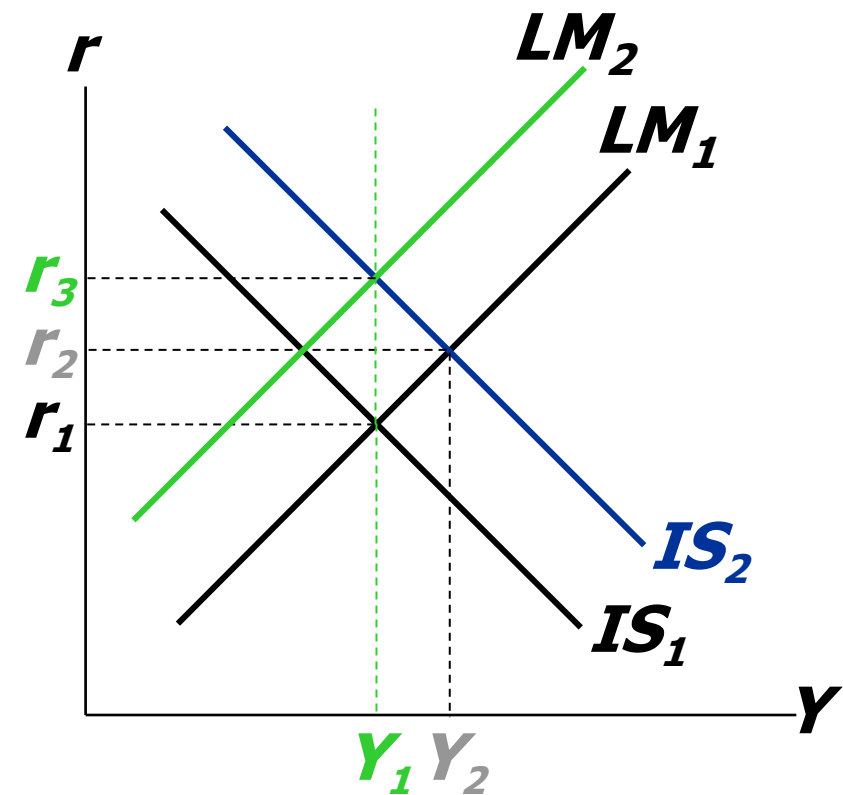Results:

$$\Delta Y = Y_2 - Y_1$$

$$\Delta r = r_2 - r_1$$
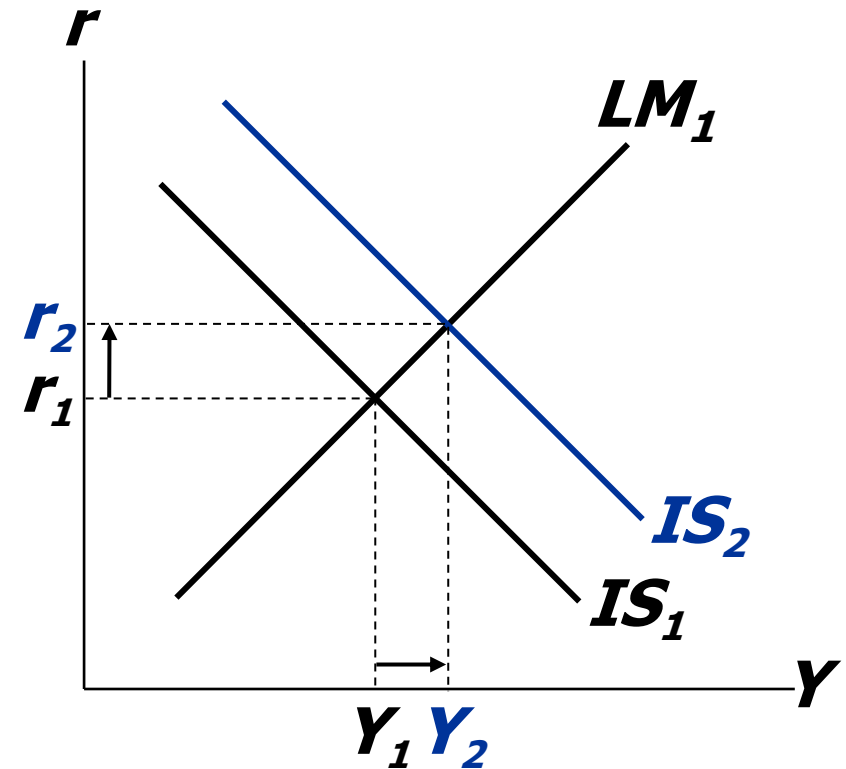
❖ **The Fed's response to ΔG > 0:**

❖ **Response 2: Hold r constant**

If Congress raises *G*, the *IS* curve shifts right.

To keep r constant, Fed increases M to shift LM curve right.

Results:

$$\Delta Y = Y_3 - Y_1$$
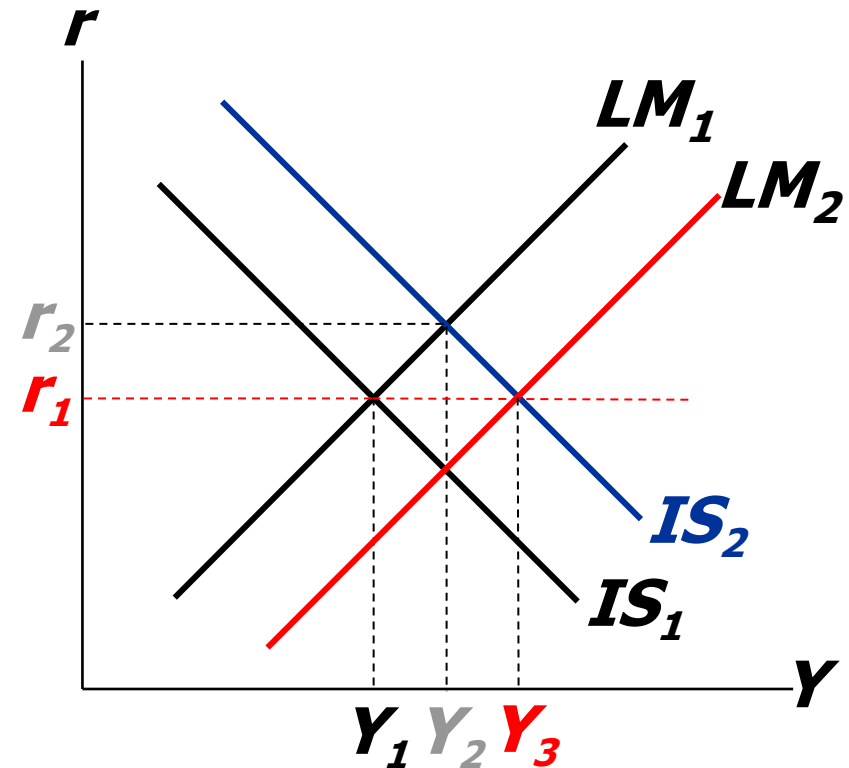
$$\Delta r = 0$$

❖ **The Fed's response to ΔG > 0:**

❖ **Response 3: Hold Y constant**

If Congress raises **G**, the *IS* curve shifts right.

To keep Y constant, Fed reduces M to shift LM curve left.

Results:

$$\Delta Y = 0$$

$$\Delta r = r_3 - r_1$$

Shocks in the IS -LM model

Shocks in the IS -LM model

IS shocks: exogenous changes in the demand for goods & services.

Examples:

stock market boom or crash
$\Rightarrow$ change in households' wealth
$\Rightarrow \Delta C$

change in business or consumer
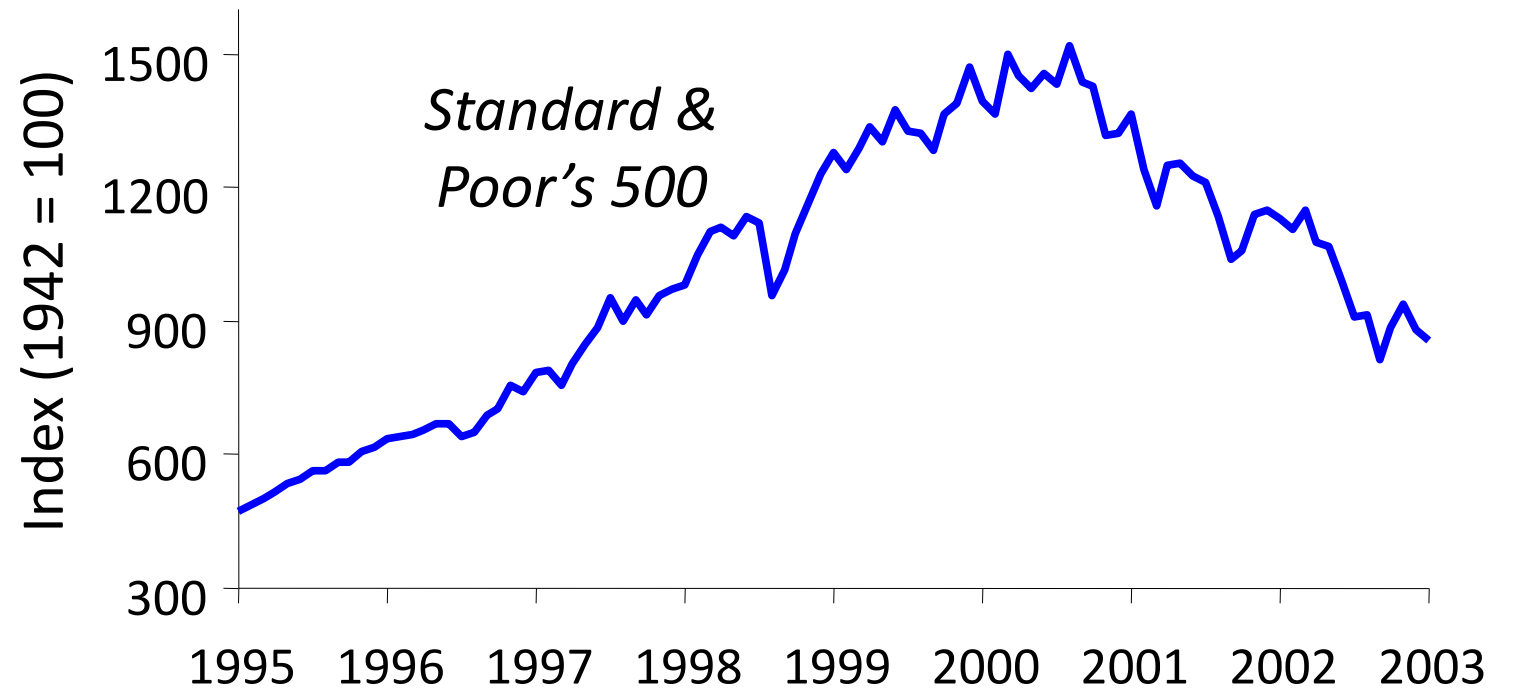confidence or expectations
$\Rightarrow \Delta I$ and/or ΔC

CASE STUDY:

The U.S. recession of 2001

➤ During 2001, 2.1 million people lost their jobs, as unemployment rose from 3.9% to 5.8%. GDP growth slowed to 0.8% (compared to 3.9% average annual growth during 1994-2000).

Causes: 1) Stock market decline $\Rightarrow \downarrow C$

Standard & Poor's 500

Shocks in the IS -LM model

CASE STUDY:
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Causes: 2) 9/11
   increased uncertainty fall in consumer & business confidence result: lower spending, *IS* curve shifted left

Causes: 3) Corporate accounting scandals
   Enron, WorldCom, *etc*. reduced stock prices, discouraged investment

Shocks in the IS -LM model

CASE STUDY:
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Fiscal policy response: shifted *IS* curve right
- tax cuts in 2001 and 2003
- spending increases
    - airline industry bailout (Congress approves $15 billion airline bailout)
    - NYC reconstruction (2003)
    - Afghanistan war

Shocks in the IS -LM model

LM **shocks**: exogenous changes in the demand for money.

Examples:

- A wave of credit card fraud increases demand for money.
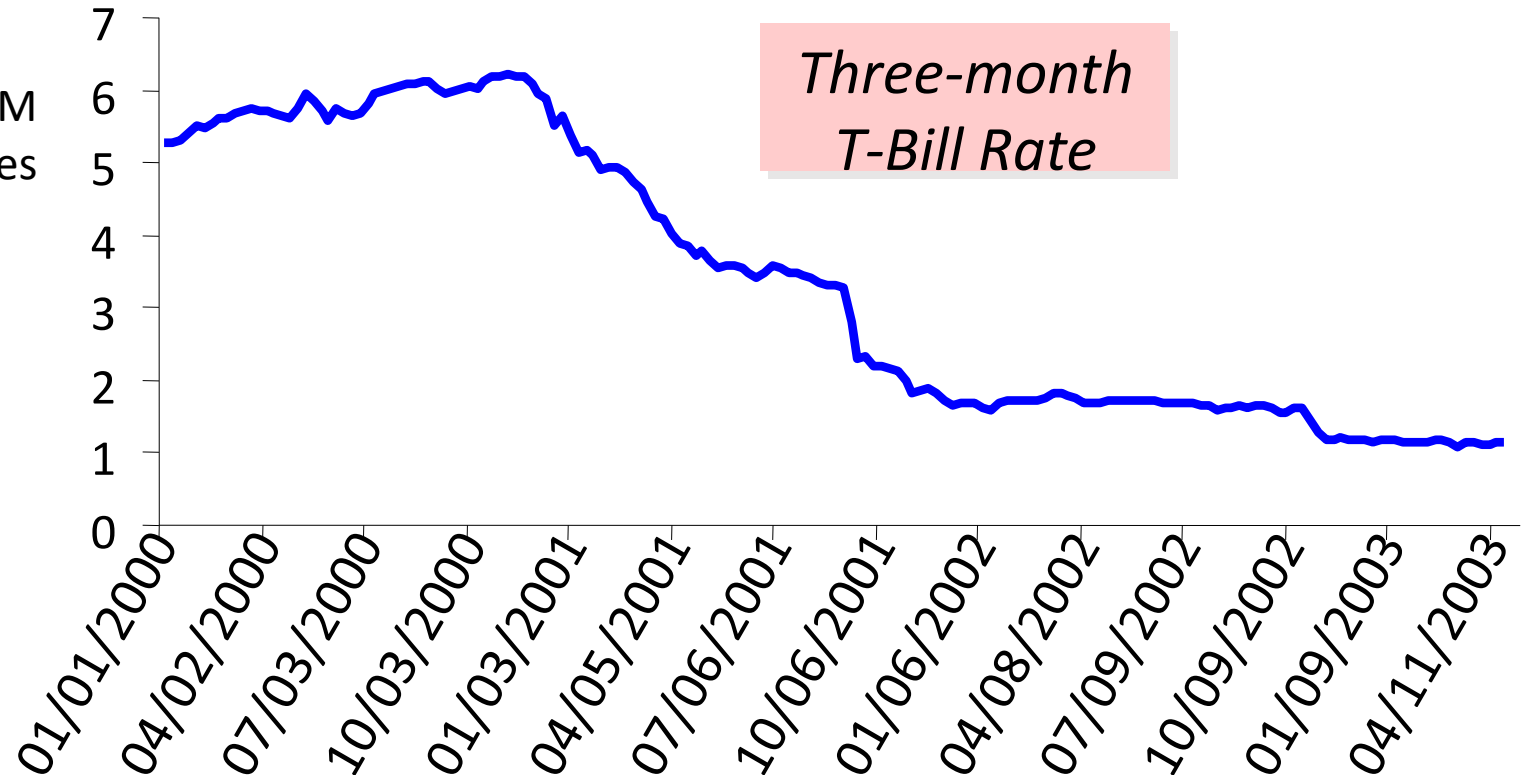- More ATMs or the Internet reduce money demand.

CASE STUDY:
The U.S. recession of 2001

Monetary policy response: shifted LM curve right

Easier monetary policy shifted the LM curve to the right, causing interest rates to fall, as shown in this graph.

Three-month T-Bill Rate

Deriving the AD curve

Deriving the AD curve

❖ The aggregate demand curve (AD) illustrates the relationship between two factors: the **quantity of output** that is demanded and the **aggregate price level**.
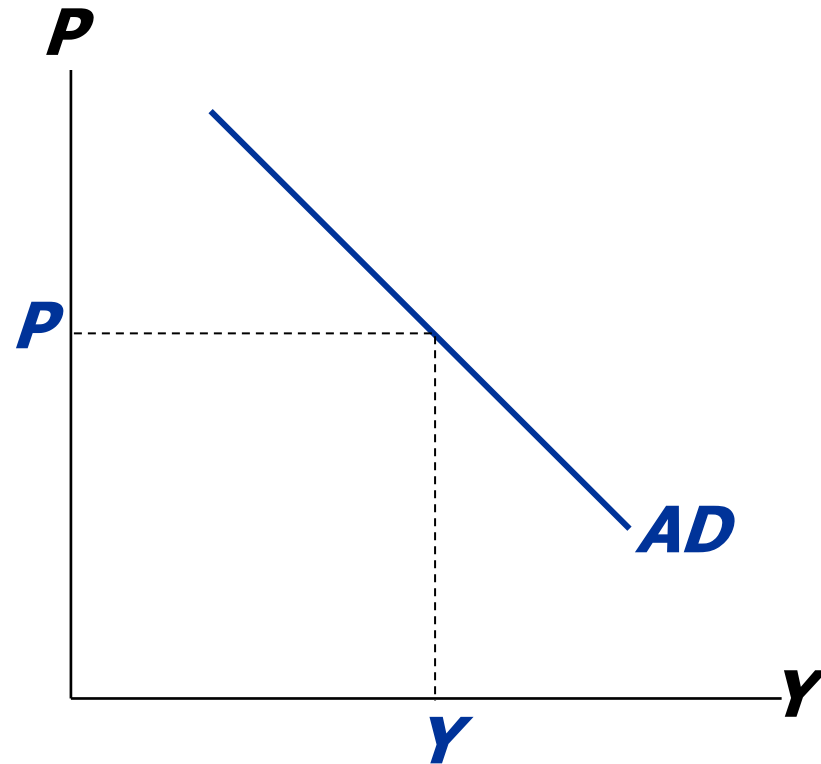
Deriving the AD curve

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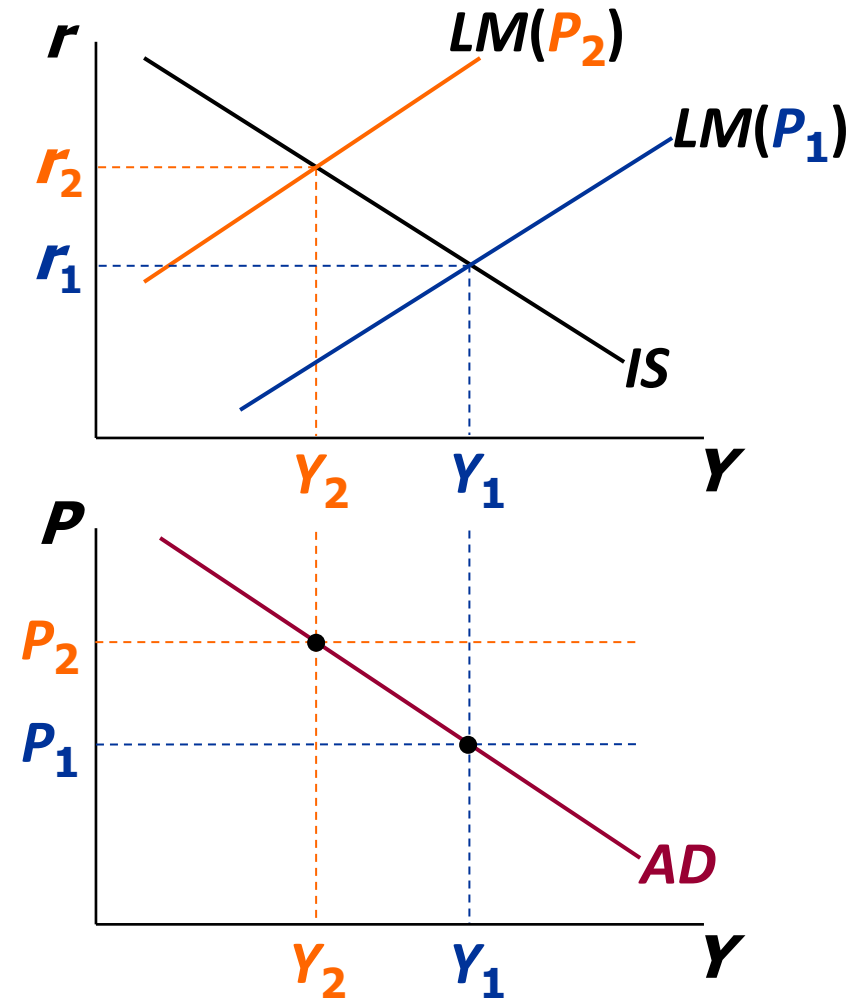Intuition for slope of *AD* curve:

$\uparrow P \Rightarrow \downarrow (M/P)$

$\Rightarrow LM$ shifts left

$\Rightarrow \uparrow r$

$\Rightarrow \downarrow I$

$\Rightarrow \downarrow Y$
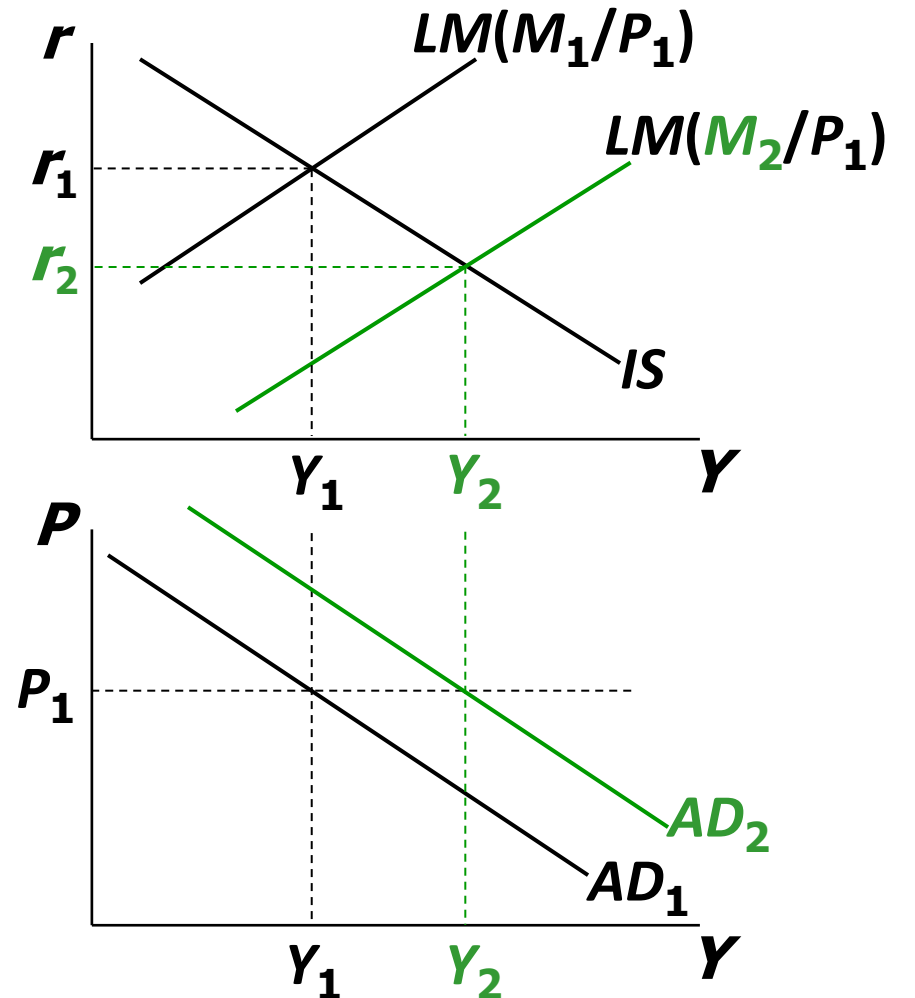
Monetary policy and the AD curve

The Fed can increase aggregate demand:

$\uparrow M \Rightarrow LM$ shifts right

$\qquad \Rightarrow \downarrow r$

$\qquad \Rightarrow \uparrow I$

$\qquad \Rightarrow \uparrow Y$ at each
$\qquad\qquad$ value of P

Fiscal policy and the AD curve

Deriving the AD curve

Expansionary fiscal policy ($\uparrow G$ and/or $\downarrow T$) increases agg. demand:

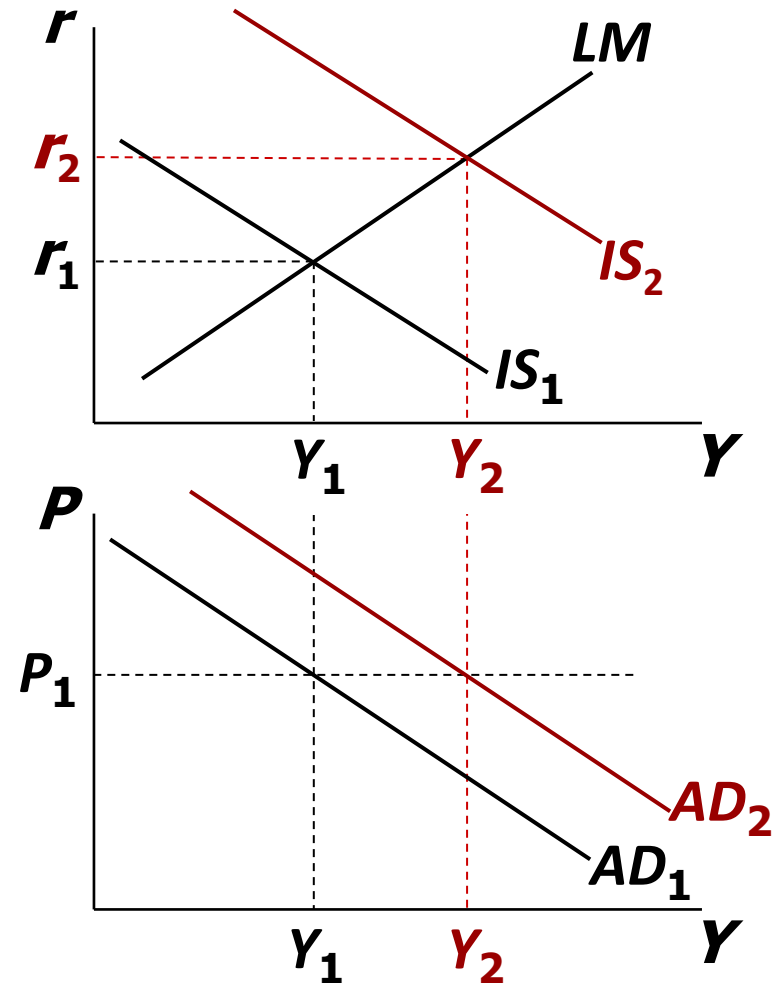$\downarrow T \Rightarrow \uparrow C$

$\Rightarrow$ IS shifts right

$\Rightarrow \uparrow Y$ at each

value

of P

The Great Depression