

# ■ Macroeconomics

■ *N. Gregory Mankiw*

## CHAPTER 12

### **Aggregate Demand II: Applying the *IS- LM* Model**

Presentation Slides



# Context

- Chapter 10 introduced the model of aggregate demand and supply.
- Chapter 11 developed the *IS-LM* model, the basis of the aggregate demand curve.

## IN THIS CHAPTER, YOU WILL LEARN:

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- how to use the *IS-LM* model to analyze the effects of shocks, fiscal policy, and monetary policy
- how to derive the aggregate demand curve from the *IS-LM* model
- several theories about what caused the Great Depression

# **12.1 Explaining Fluctuations with the IS–LM Model**

# Equilibrium in the *IS-LM* model

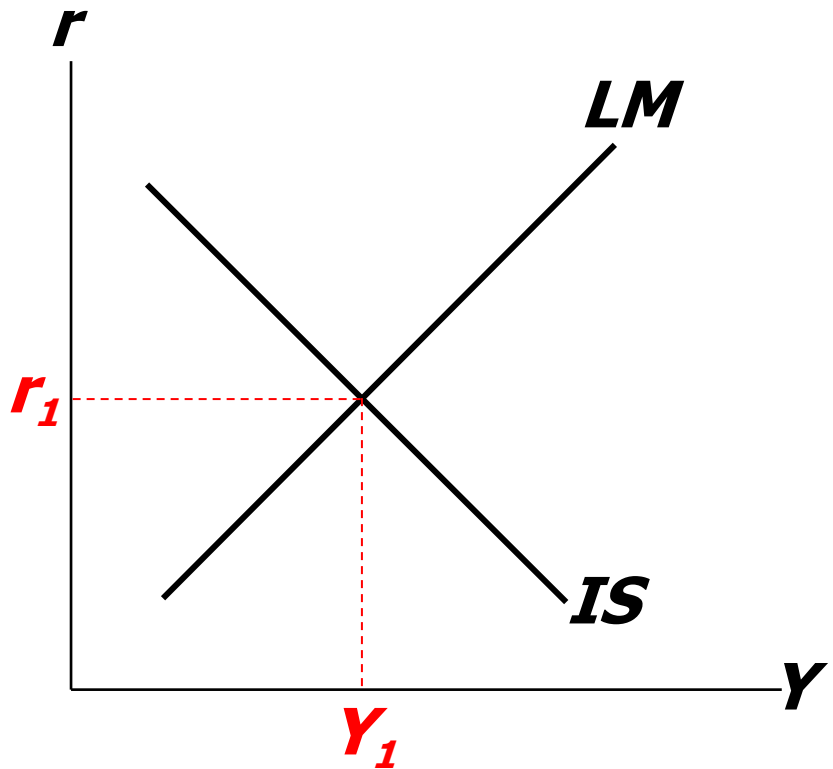
The *IS* curve represents equilibrium in the goods market.

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

The *LM* curve represents money market equilibrium.

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

The intersection determines the unique combination of  $Y$  and  $r$  that satisfies equilibrium in both markets.



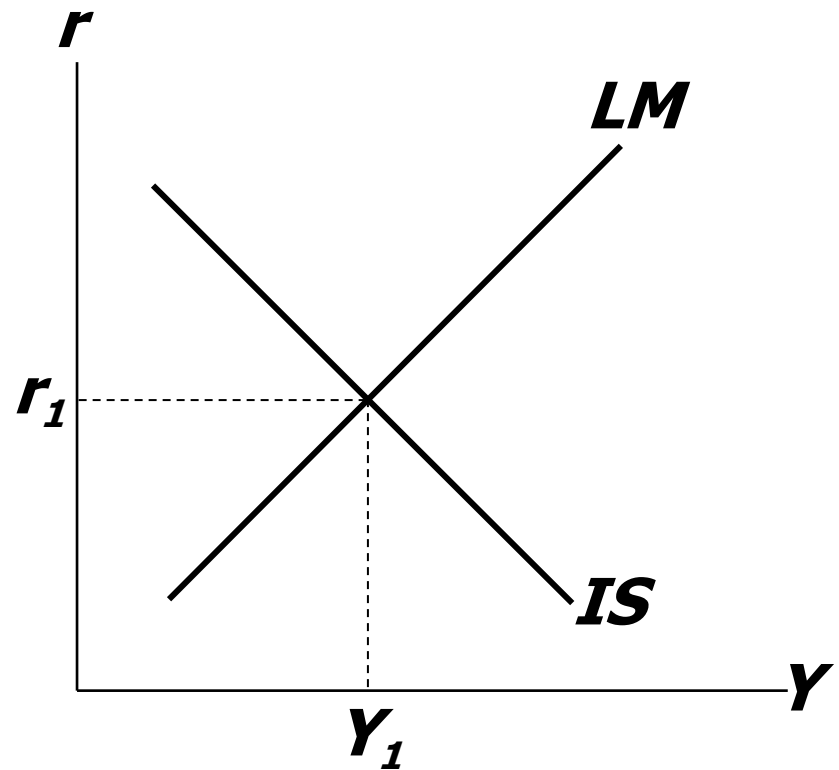
# Policy analysis with the *IS-LM* model

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

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

We can use the *IS-LM* model to analyze the effects of

- fiscal policy:  $\bar{G}$  and/or  $\bar{T}$
- monetary policy:  $\bar{M}$



# An increase in government purchases

1.  $IS$  curve shifts right

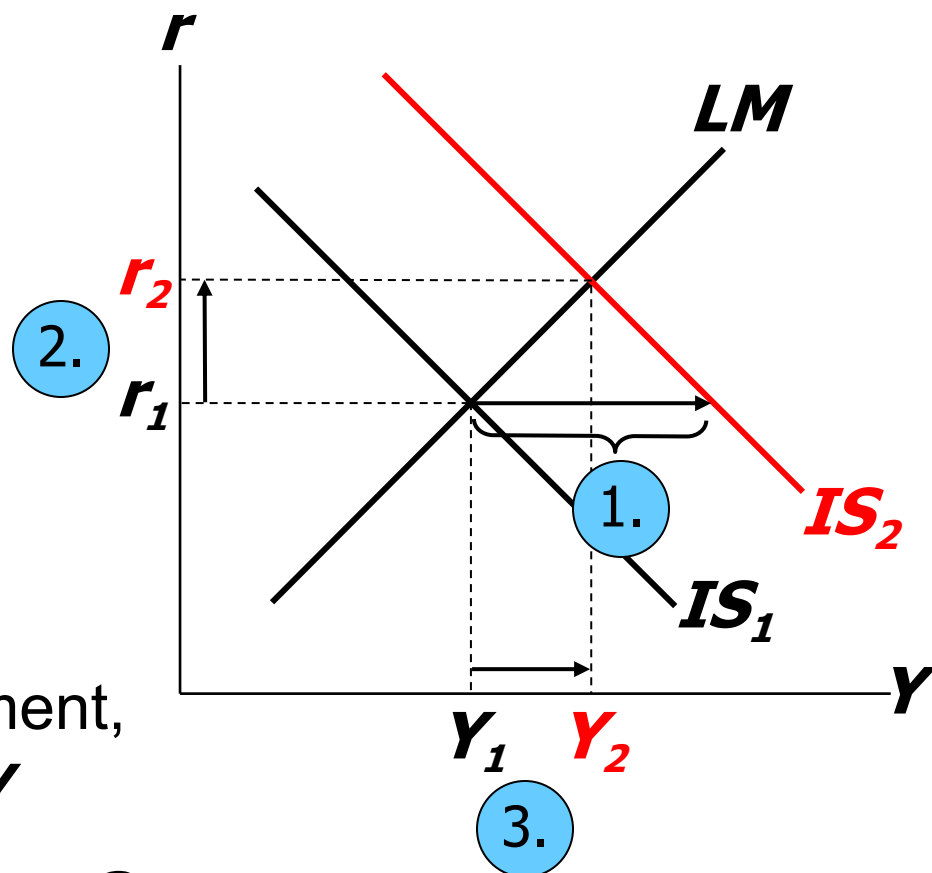
by  $\frac{1}{1 - MPC} \Delta G$

causing output & income to rise.

2. This raises money demand, causing the interest rate to rise...

3. ...which reduces investment, so the final increase in  $Y$

is smaller than  $\frac{1}{1 - MPC} \Delta G$

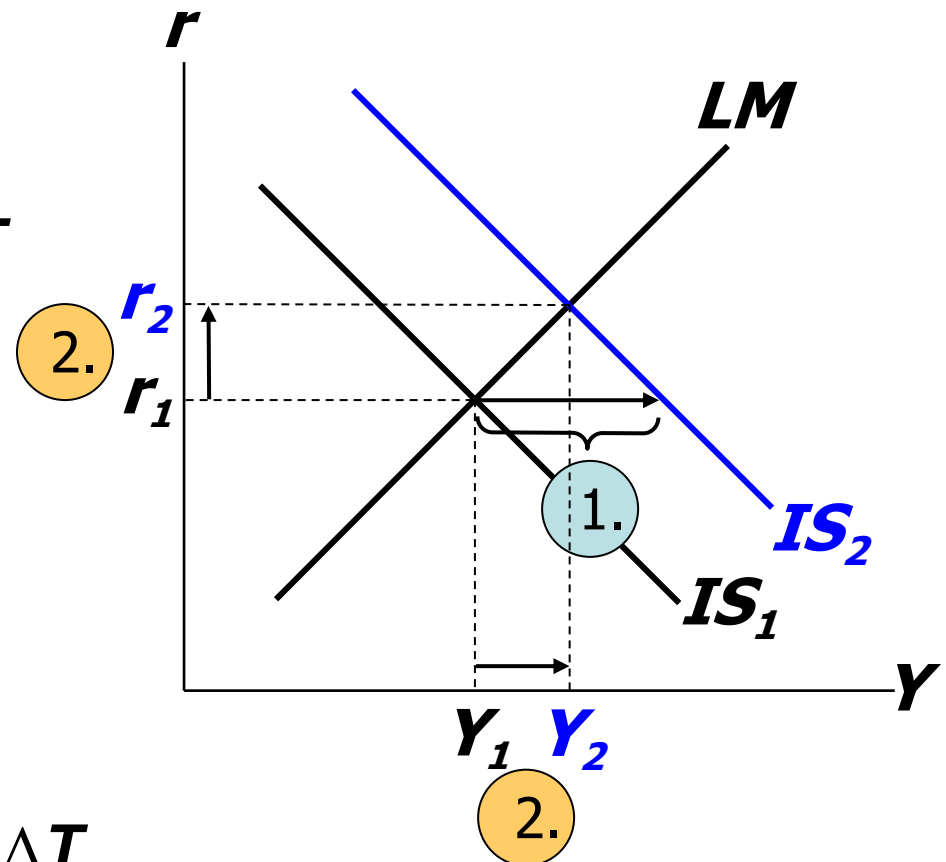


# A tax cut

Consumers save  $(1-MPC)$  of the tax cut, so the initial boost in spending is smaller for  $\Delta T$  than for an equal  $\Delta G$ ... and the  $IS$  curve shifts by

1. 
$$\frac{-MPC}{1-MPC} \Delta T$$

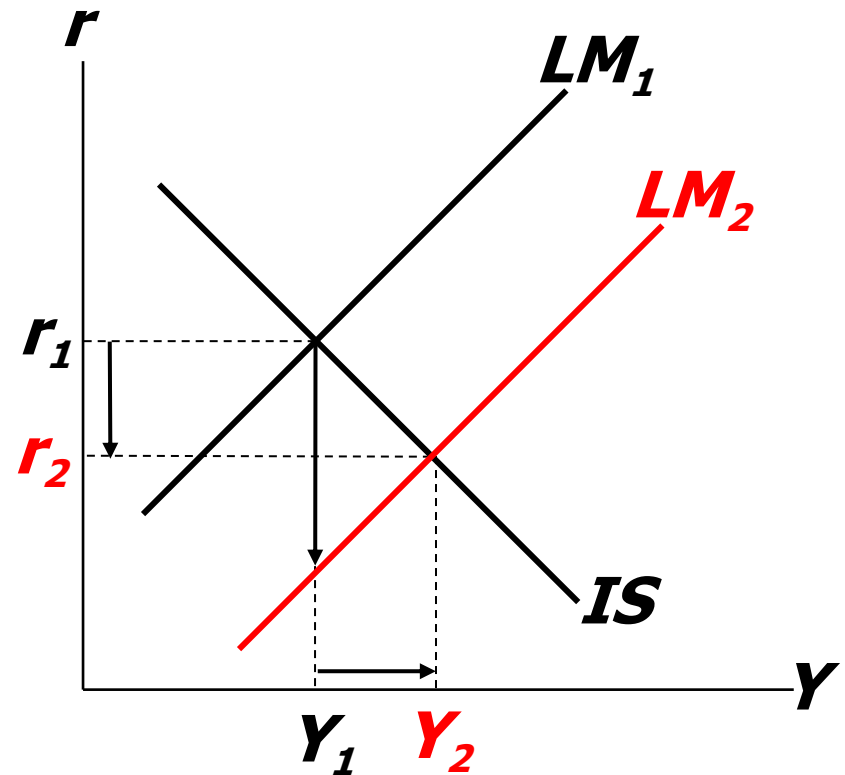
2. ...so the effects on  $r$  and  $Y$  are smaller for  $\Delta T$  than for an equal  $\Delta G$ .





# Monetary policy: An increase in $M$

1.  $\Delta M > 0$  shifts the  $LM$  curve down (or to the right)
2. ...causing the interest rate to fall
3. ...which increases investment, causing output & income to rise.



**Monetary transmission mechanism:**  
**effect of increased  $M$  on  $Y$**

# Interaction between monetary & fiscal policy

$$\begin{aligned} \text{IS: } Y &= C(Y - \bar{T}) + I(r) + \bar{G} \\ \text{LM: } \frac{\bar{M}}{P} &= L(r, Y) \end{aligned}$$

- Model:
  - Monetary & fiscal policy variables ( $M$ ,  $G$ , and  $T$ ) are exogenous.
- Real world:
  - Monetary policymakers may adjust  $M$  in response to changes in fiscal policy, or vice versa.
  - Such interactions may alter the impact of the original policy change.

# The Fed's response to $\Delta G > 0$

- 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  $\Delta G$  are different...

## Response 1: Hold $M$ constant

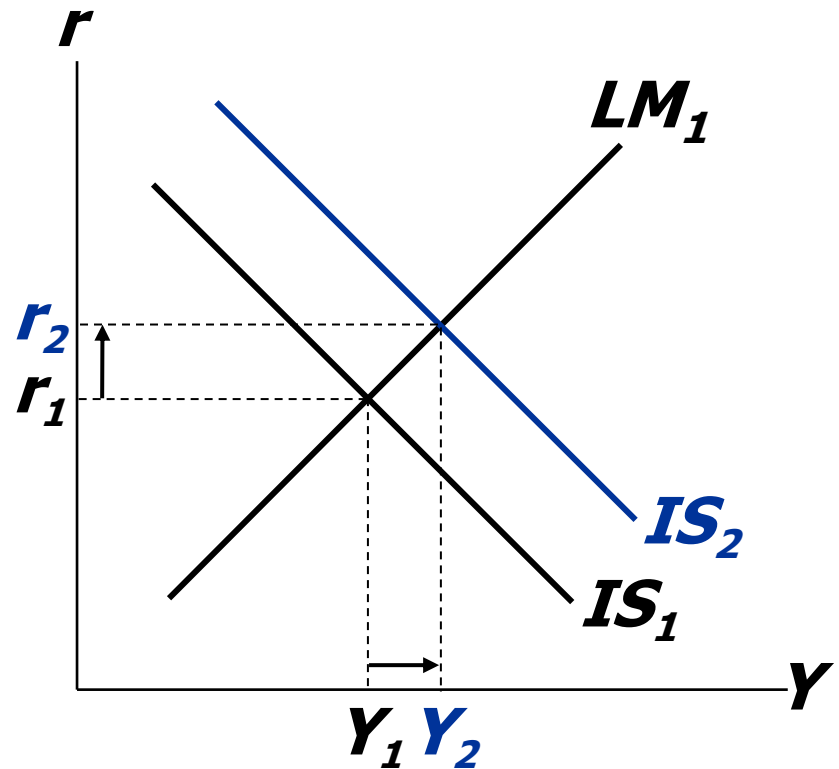
If Congress raises  $G$ ,  
the  $IS$  curve shifts right.

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

Results:

$$\Delta Y = Y_2 - Y_1$$

$$\Delta r = r_2 - r_1$$



## Response 2: Hold $r$ constant

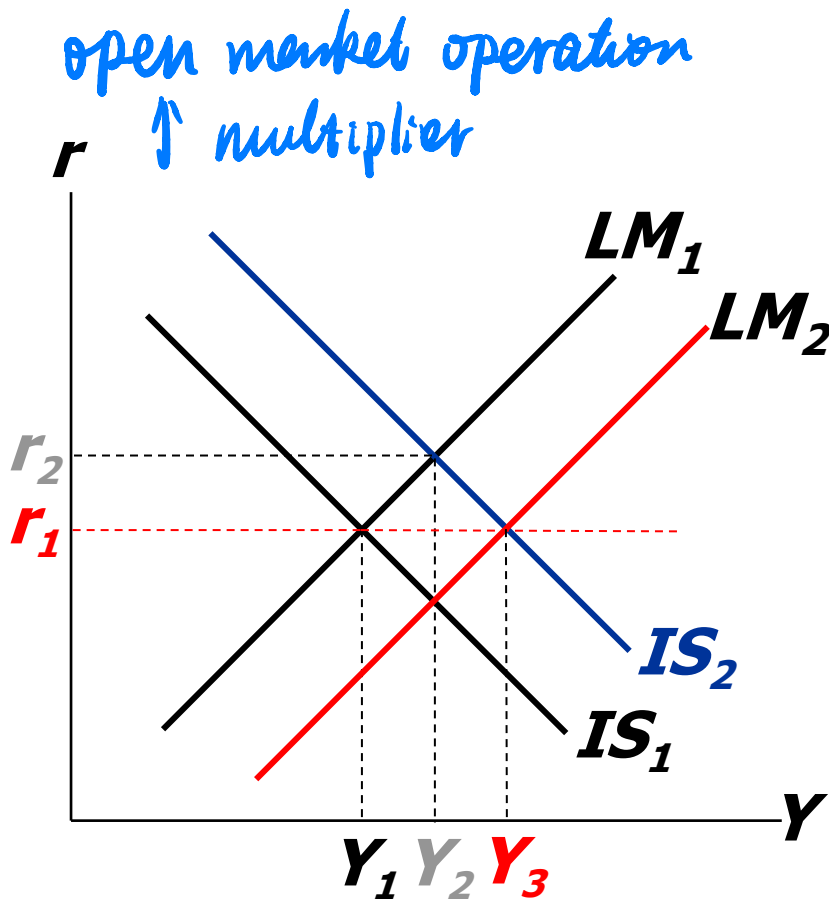
If Congress raises  $G$ ,  
the  $IS$  curve shifts right.

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

Results:

$$\Delta Y = Y_3 - Y_1$$

$$\Delta r = 0$$



## Response 3: Hold $Y$ constant

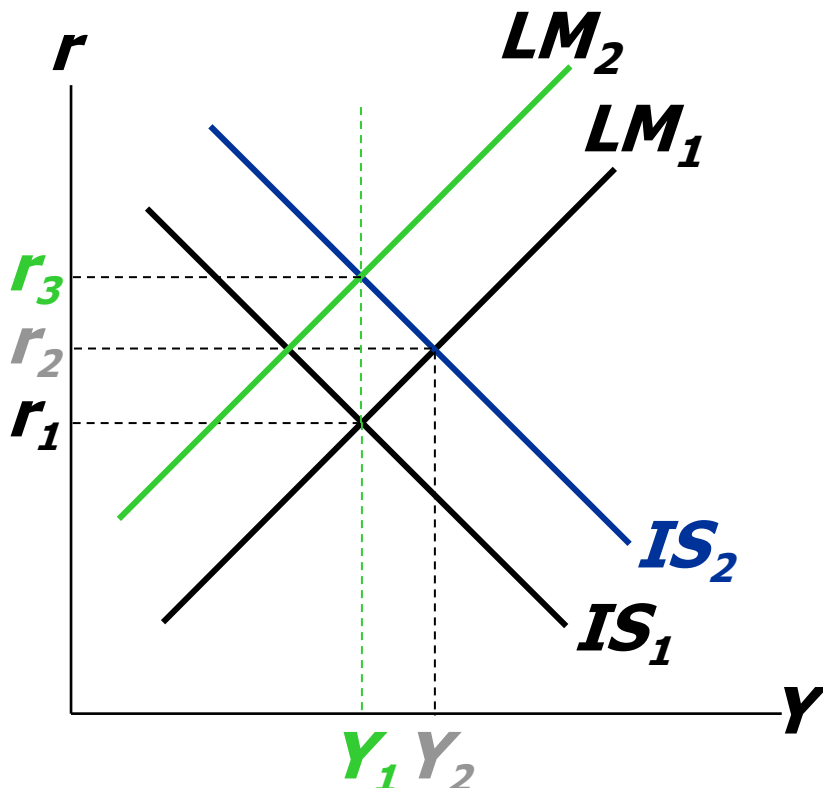
If Congress raises  $G$ ,  
the  $IS$  curve shifts right.

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

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

Examples:

- stock market boom or crash
  - change in households' wealth
  - $\Delta \mathbf{C}$
- change in business or consumer confidence or expectations
  - $\Delta \mathbf{I}$  and/or  $\Delta \mathbf{C}$

# 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.



## NOW YOU TRY

# Analyze shocks with the *IS-LM* model

Use the *IS-LM* model to analyze the effects of

1. a housing market crash that reduces consumers' wealth
2. consumers using cash in transactions more frequently in response to an increase in identity theft

For each shock,

- a. use the *IS-LM* diagram to determine the effects on  $Y$  and  $r$ .
- b. figure out what happens to  $C$ ,  $I$ , and the unemployment rate.

## ANSWERS, PART 1

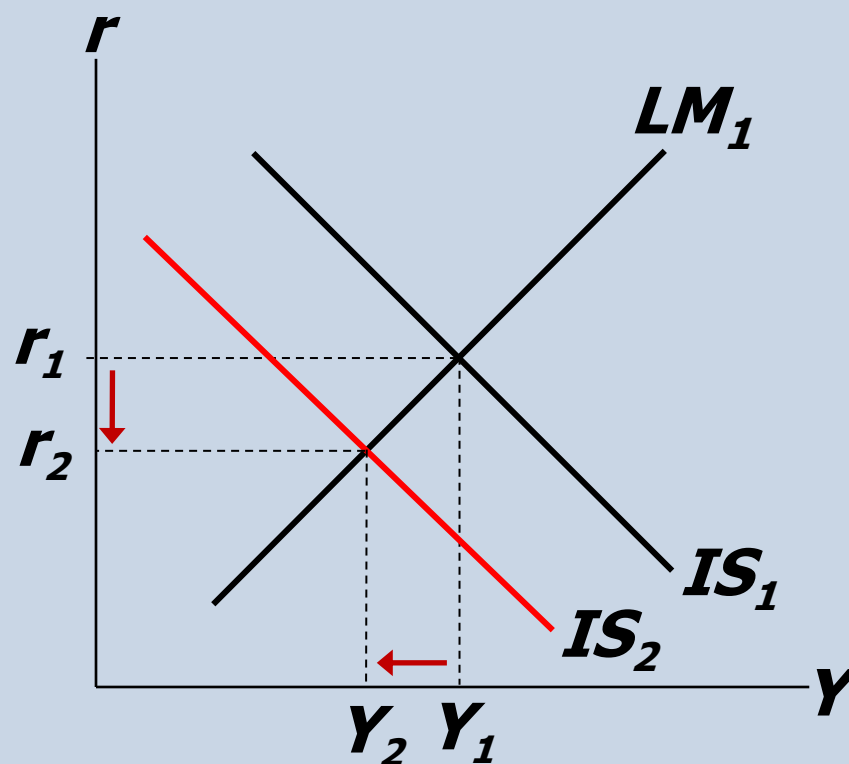
# Housing market crash

$IS$  shifts left, causing  
 $r$  and  $Y$  to fall.

$C$  falls due to lower  
wealth and lower  
income,

$I$  rises because  
 $r$  is lower

$u$  rises because  
 $Y$  is lower  
(Okun's law)



## ANSWERS, PART 2

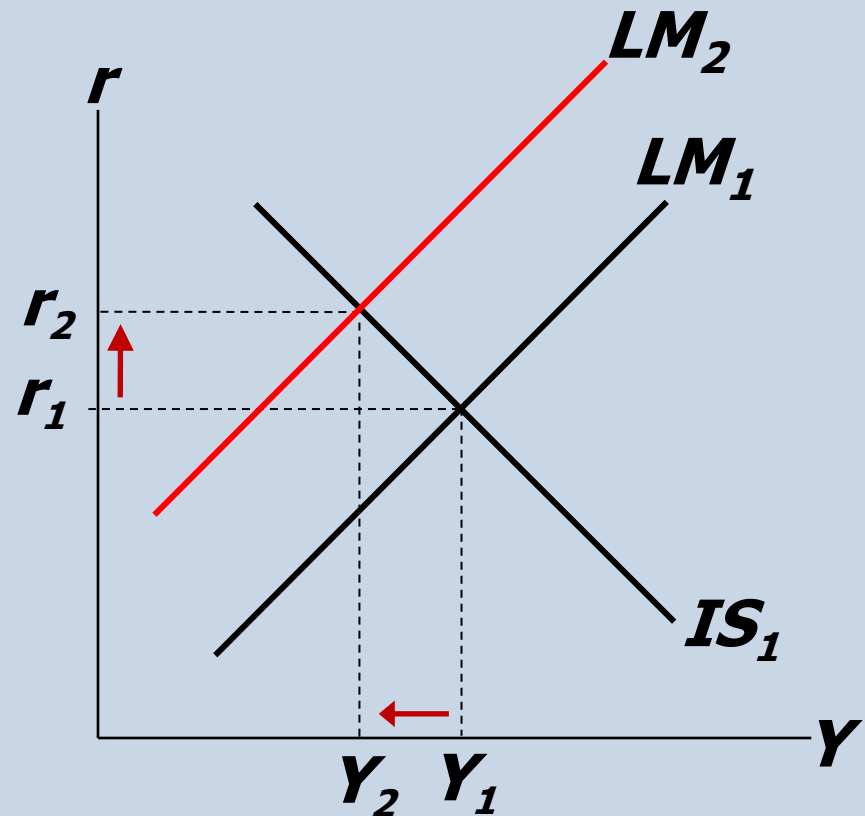
# Increase in money demand

$LM$  shifts left, causing  
 $r$  to rise and  $Y$  to fall.

$C$  falls due to lower  
income,

$I$  falls because  
 $r$  is higher

$u$  rises because  
 $Y$  is lower  
(Okun's law)



## **CASE STUDY:**

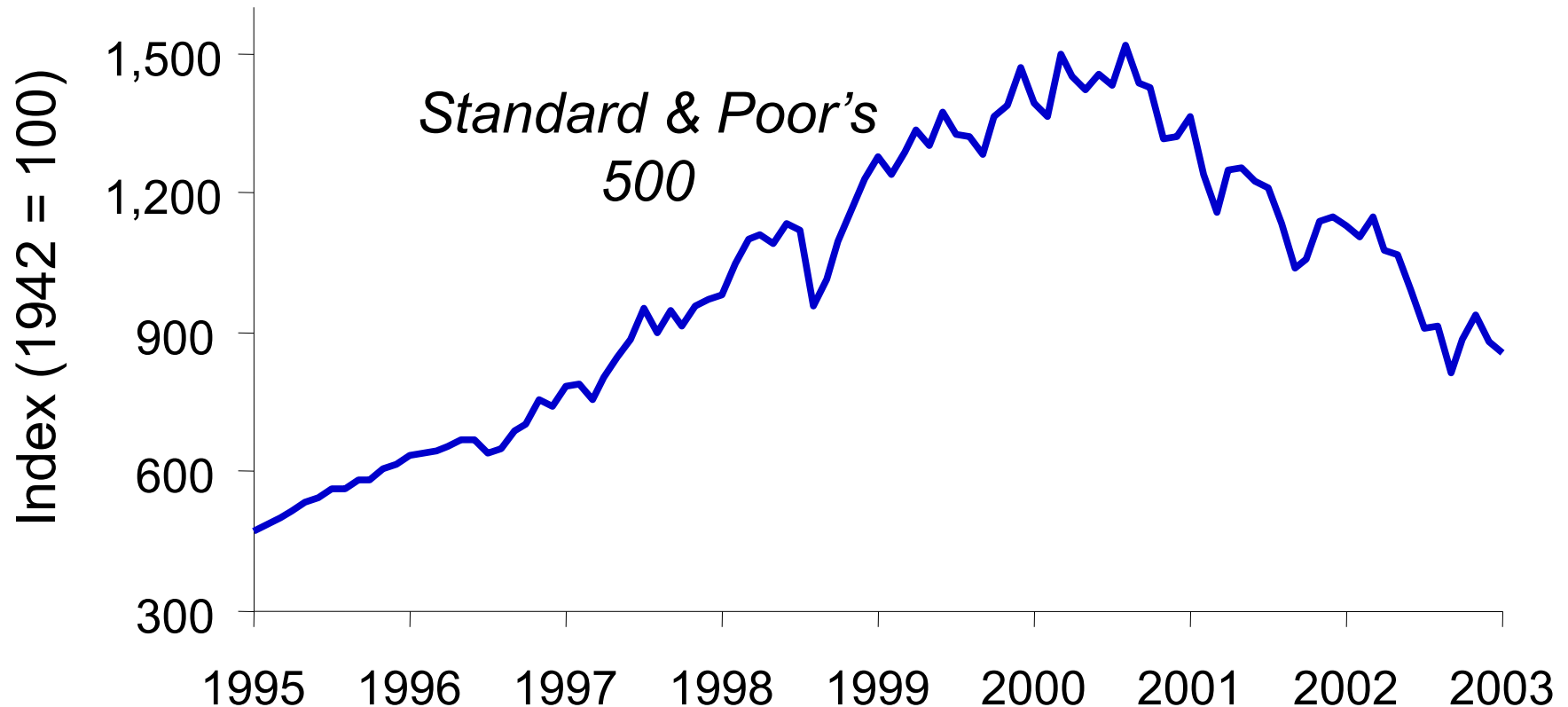
# **The U.S. recession of 2001**

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

# CASE STUDY:

## The U.S. recession of 2001

Causes: 1) Stock market decline → ↓C



## **CASE STUDY:**

# **The U.S. recession of 2001**

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

## CASE STUDY:

# The U.S. recession of 2001

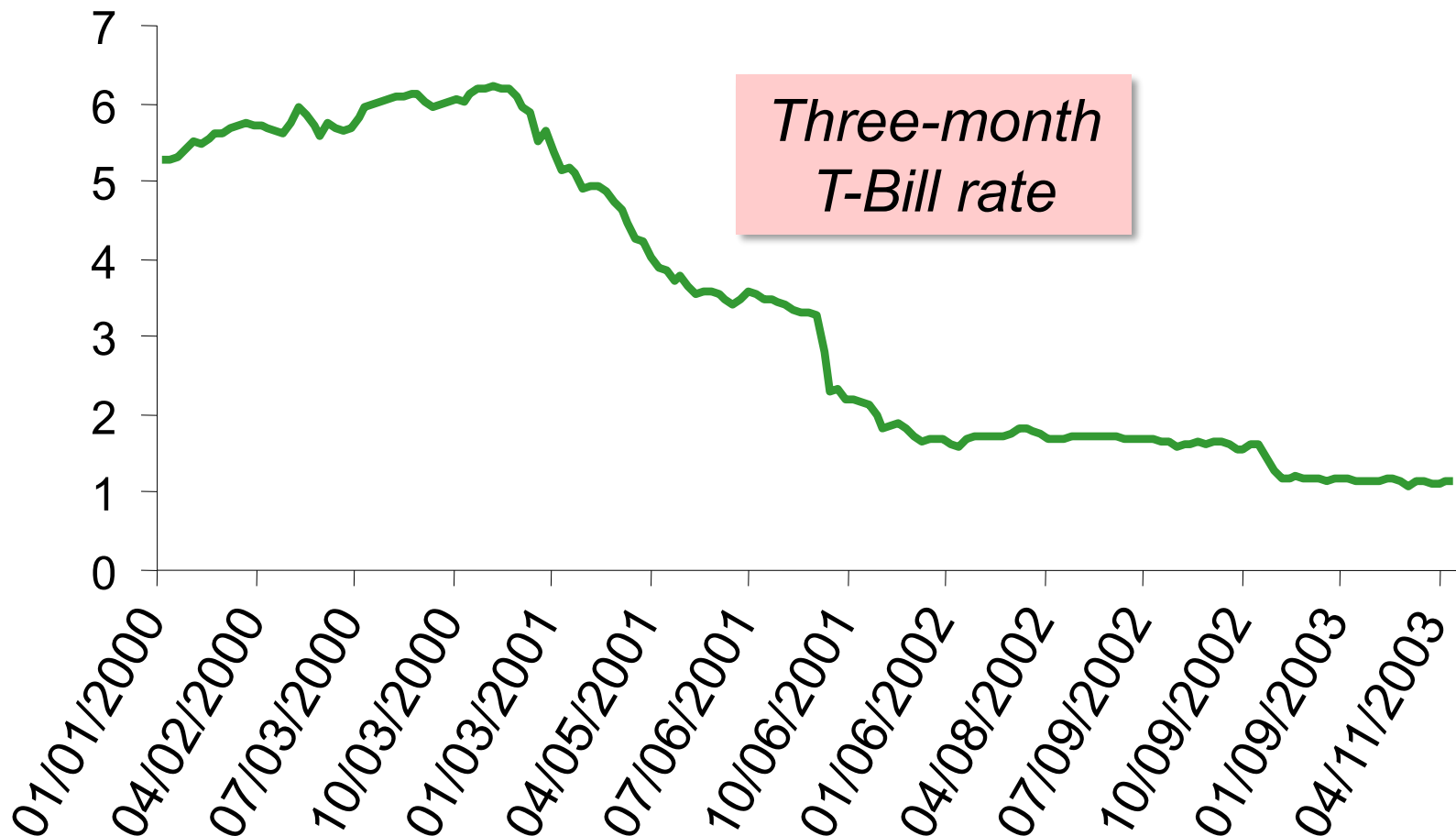
Fiscal policy response: shifted  $IS$  curve right

- tax cuts in 2001 and 2003
- spending increases
  - airline industry bailout
  - NYC reconstruction
  - Afghanistan war

# CASE STUDY:

## The U.S. recession of 2001

Monetary policy response: shifted  $LM$  curve right





# What is the Fed's policy instrument?

- The news media commonly report the Fed's policy changes as interest rate changes, as if the Fed has direct control over market interest rates.
- In fact, the Fed **targets** the federal funds rate—the interest rate banks charge one another on overnight loans.
- The Fed ~~changes the money supply and shifts the LM curve to achieve its target.~~
- Other short-term rates typically move with the federal funds rate.

# What is the Fed's policy instrument?

Why does the Fed target interest rates instead of the money supply?

- 1) They are easier to measure than the money supply.
- 2) The Fed might believe that LM shocks are more prevalent than IS shocks. If so, then targeting the interest rate stabilizes income better than targeting the money supply.  
(See problem 8 of this chapter)

- **8.** The Fed is considering two alternative monetary policies:

**A.** holding the money supply constant and letting the interest rate adjust, or

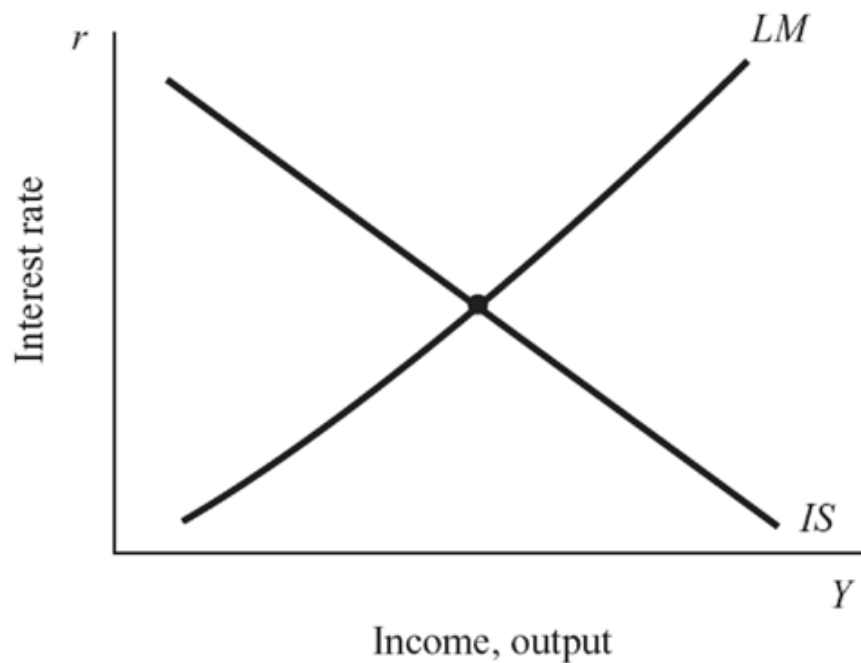
**B.** adjusting the money supply to hold the interest rate constant.

In the *IS–LM* model, which policy will better stabilize output under the following conditions?

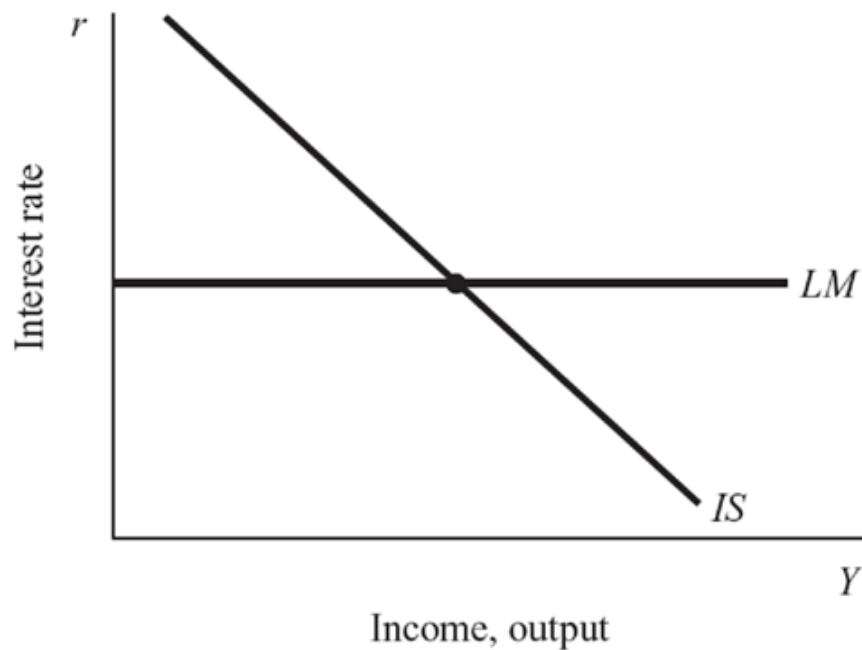
**(1).** All shocks to the economy arise from exogenous changes in the demand for goods and services.

**(2).** All shocks to the economy arise from exogenous changes in the demand for money.

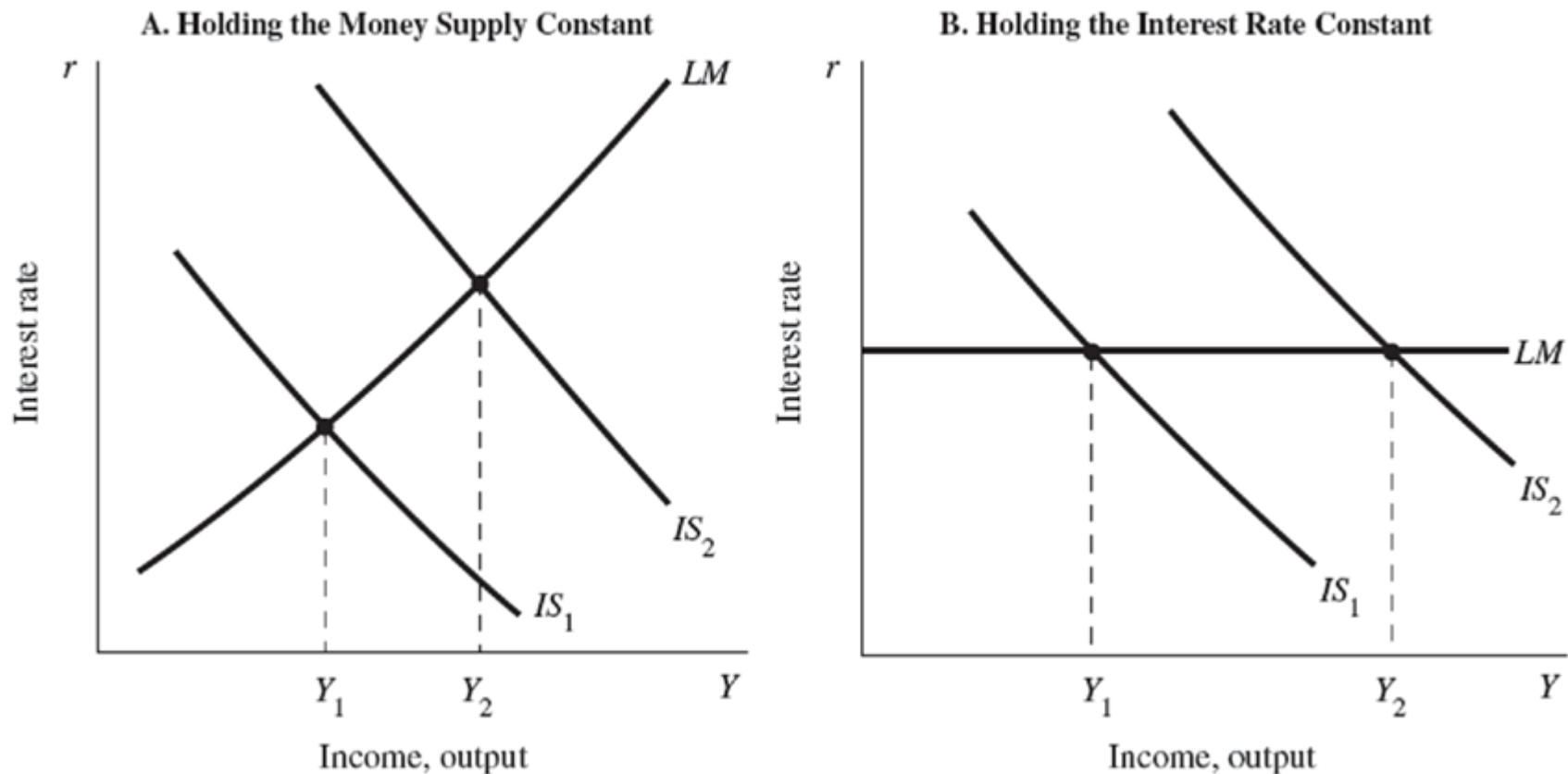
**A. Holding the Money Supply Constant**



**B. Holding the Interest Rate Constant**

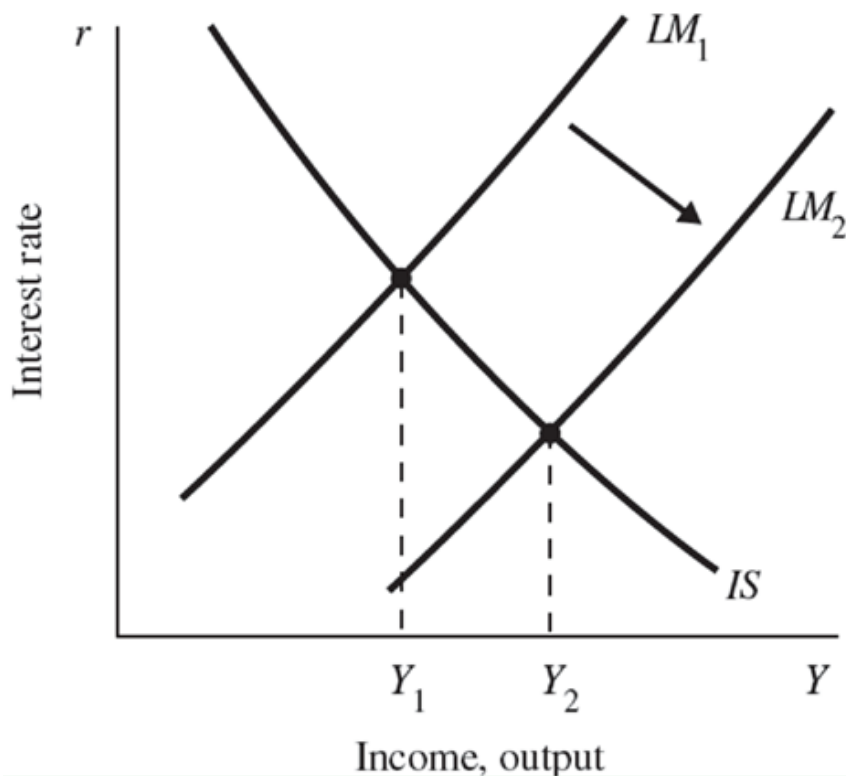


(1). All shocks to the economy arise from exogenous changes in the demand for goods and services.

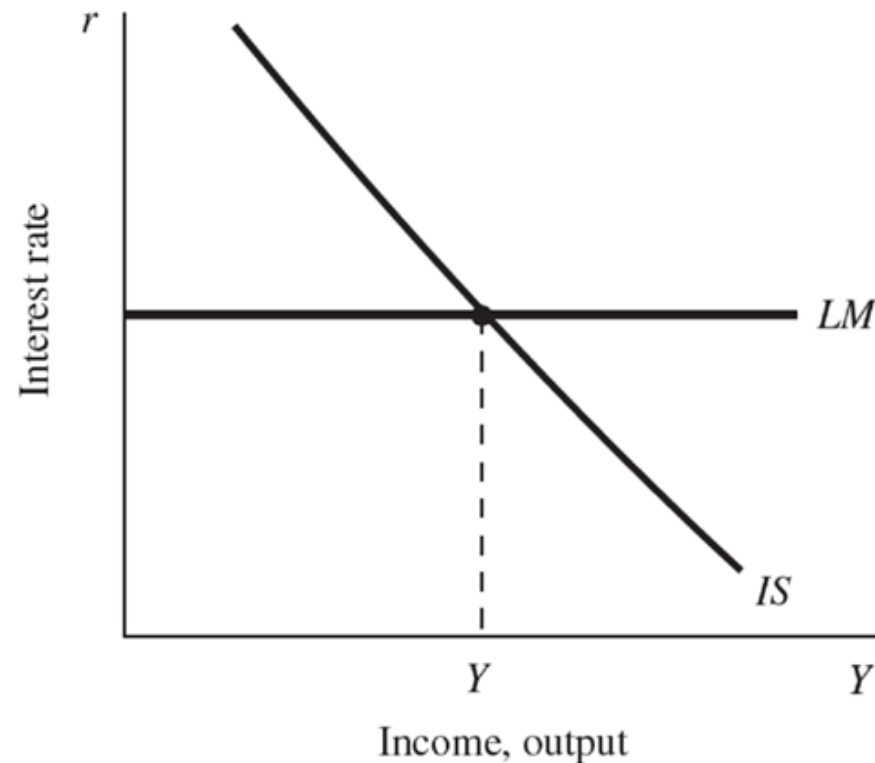


**(2).** All shocks to the economy arise from exogenous changes in the demand for money.

A. Holding the Money Supply Constant



B. Holding the Interest Rate Constant



## 12.2 IS–LM as a Theory of Aggregate Demand

# ***IS-LM* and aggregate demand**

- So far, we've been using the *IS-LM* model to analyze the short run, when the price level is assumed fixed.
- However, a change in  $P$  would shift *LM* and therefore affect  $Y$ .
- The **aggregate demand curve** (*introduced in Chap. 10*) captures this relationship between  $P$  and  $Y$ .



# Deriving the *AD* curve

Intuition for slope  
of *AD* curve:

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

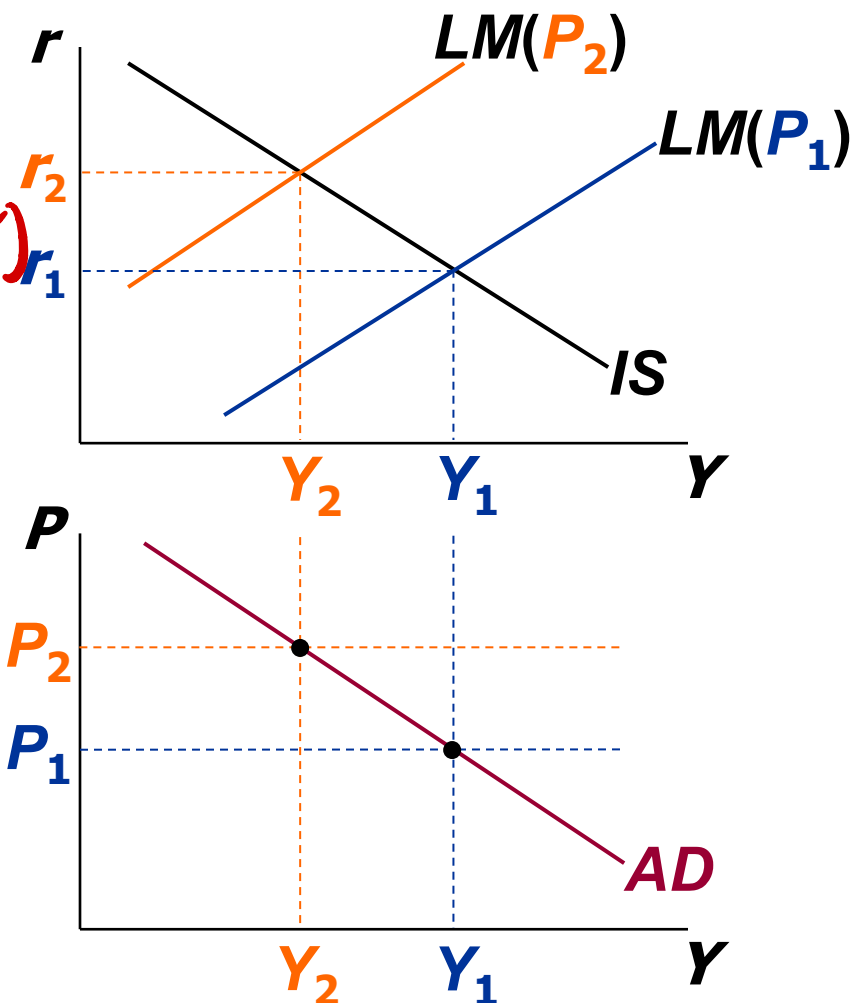
$\rightarrow LM$  shifts left

$\rightarrow \uparrow r$

$\rightarrow \downarrow I$

$\rightarrow \downarrow Y$

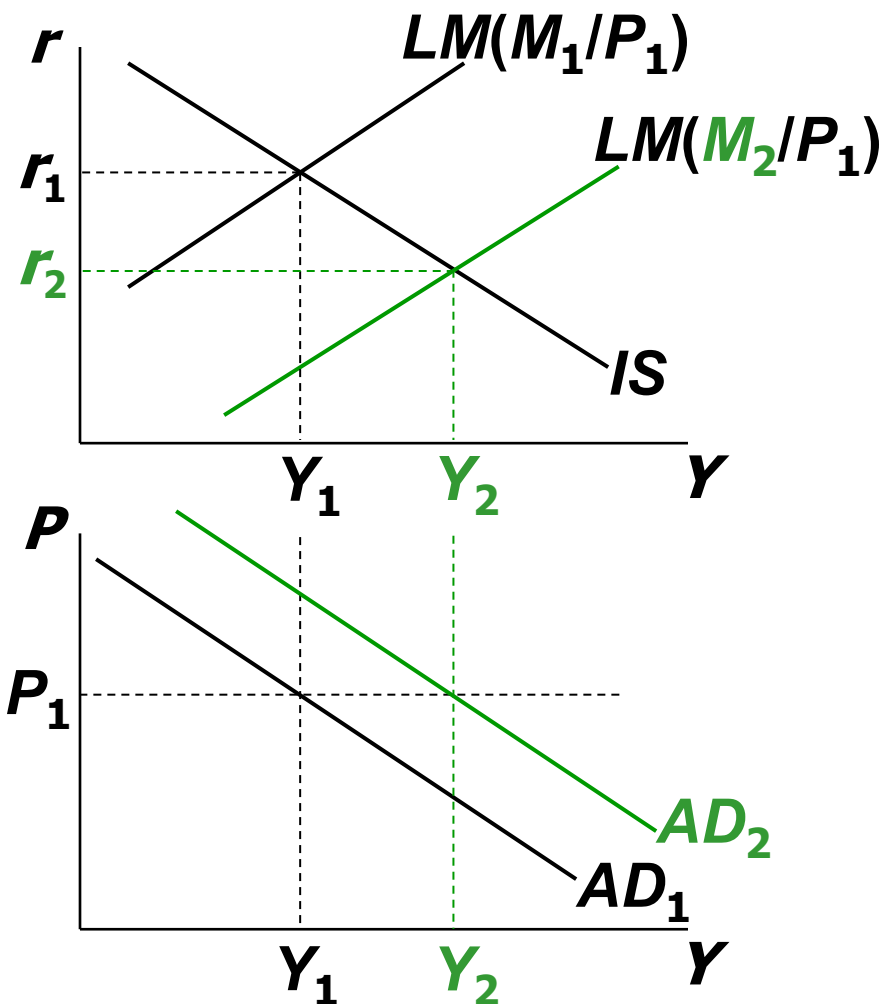
$$\frac{\bar{M}}{P} = L(r, Y)$$



# Monetary policy and the *AD* curve

The Fed can increase aggregate demand:

$\uparrow M \rightarrow LM$  shifts right  
 $\rightarrow \downarrow r$   
 $\rightarrow \uparrow I$   
 $\rightarrow \uparrow Y$  at each  
value of  $P$



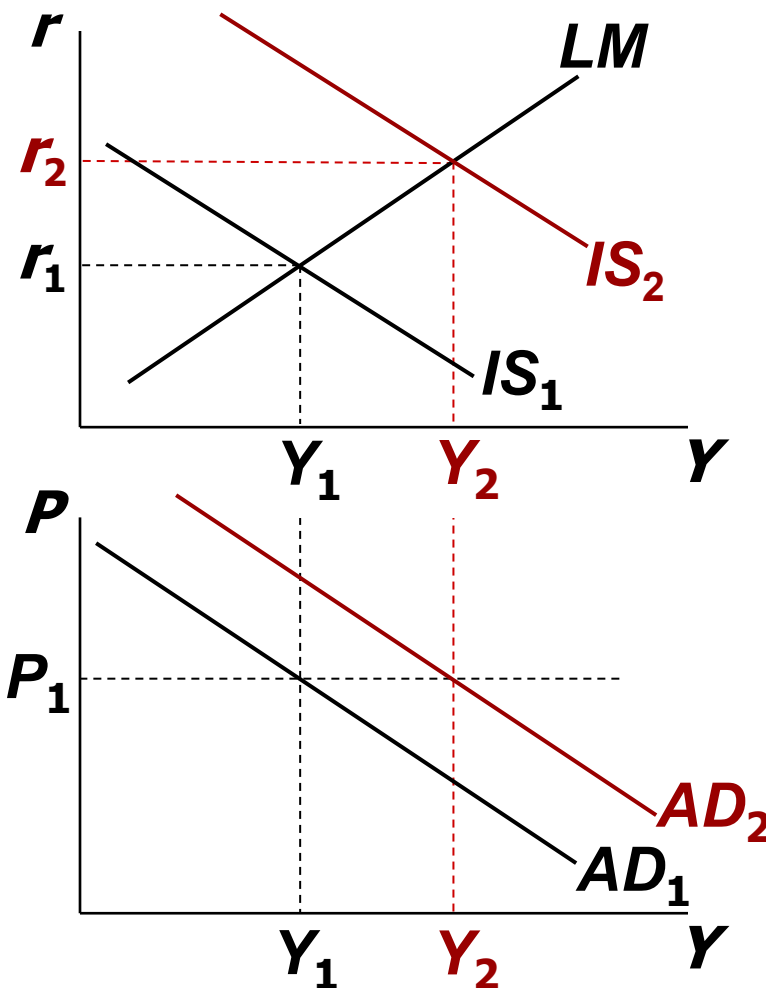
# Fiscal policy and the *AD* curve

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

$\downarrow \mathbf{T} \rightarrow \uparrow \mathbf{C}$

$\rightarrow$  *IS* shifts right

$\rightarrow \uparrow \mathbf{Y}$  at each  
value of  $\mathbf{P}$



# ***IS-LM and AD-AS***

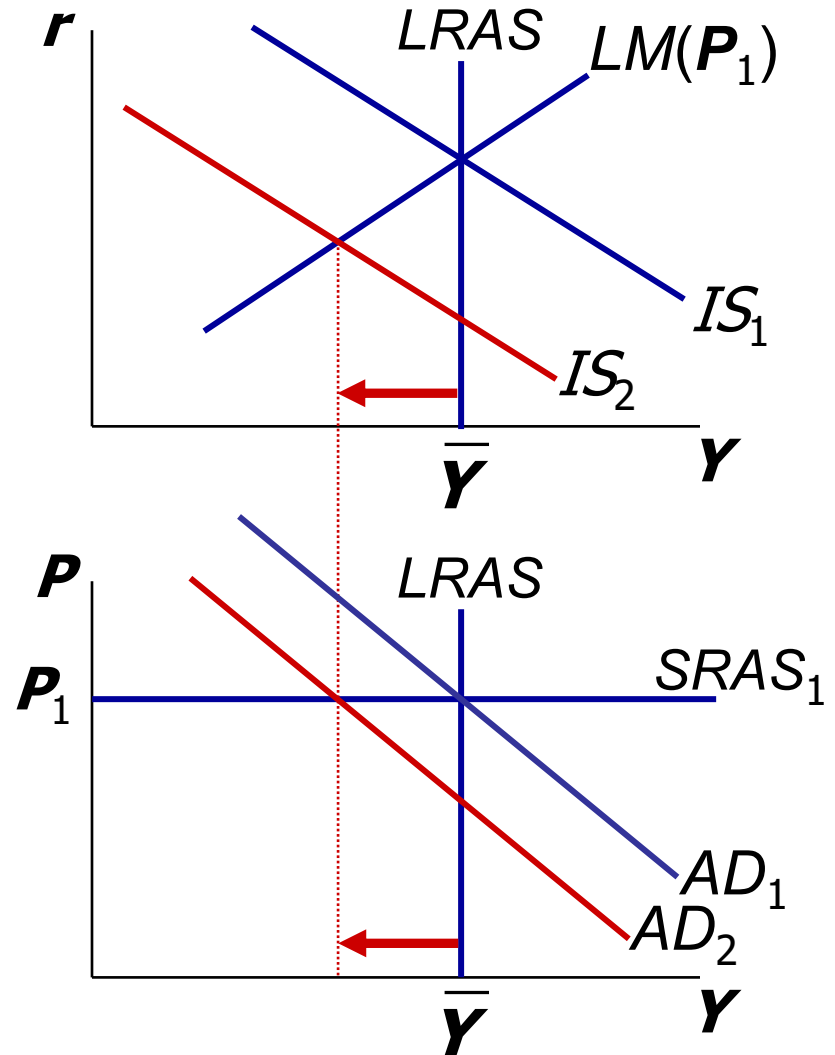
## **in the short run & long run**

Recall from Chapter 10: The force that moves the economy from the short run to the long run is the gradual adjustment of prices.

In the short-run equilibrium, if	then over time, the price level will
$\mathbf{Y} > \bar{\mathbf{Y}}$	rise
$\mathbf{Y} < \bar{\mathbf{Y}}$	fall
$\mathbf{Y} = \bar{\mathbf{Y}}$	remain constant

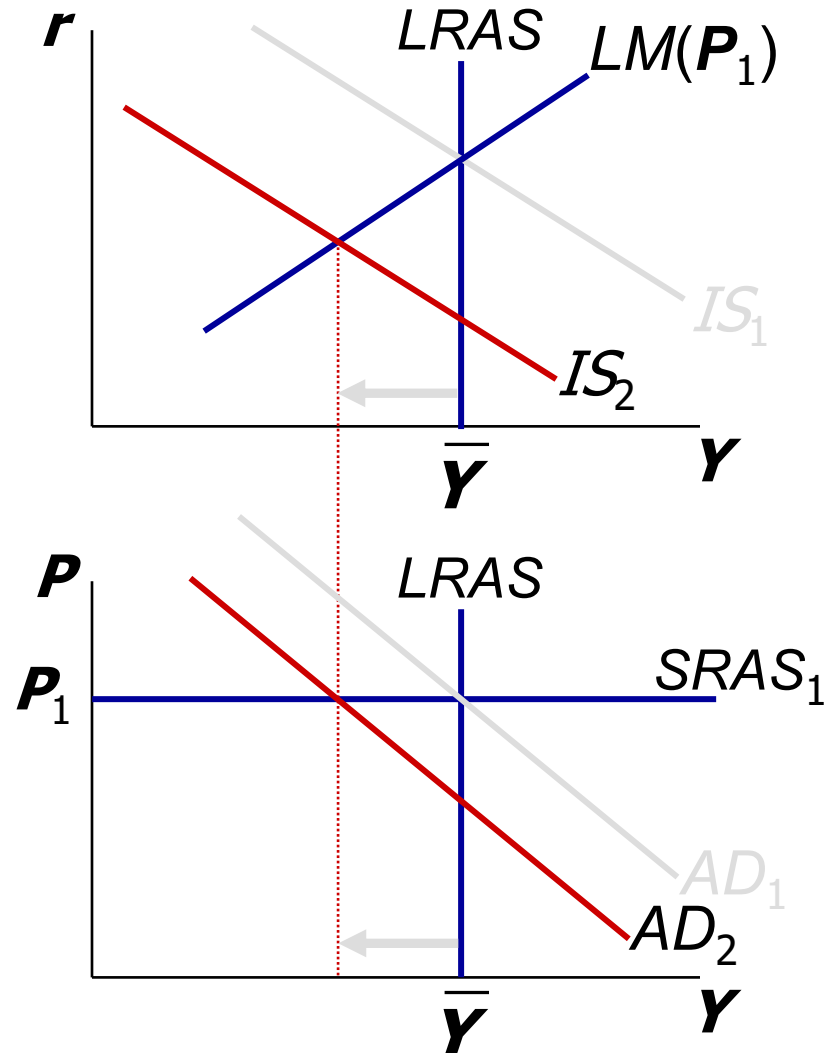
# The SR and LR effects of an *IS* shock

A negative *IS* shock shifts *IS* and *AD* left, causing *Y* to fall.



# The SR and LR effects of an *IS* shock

In the new short-run equilibrium,  $\mathbf{Y} < \bar{\mathbf{Y}}$

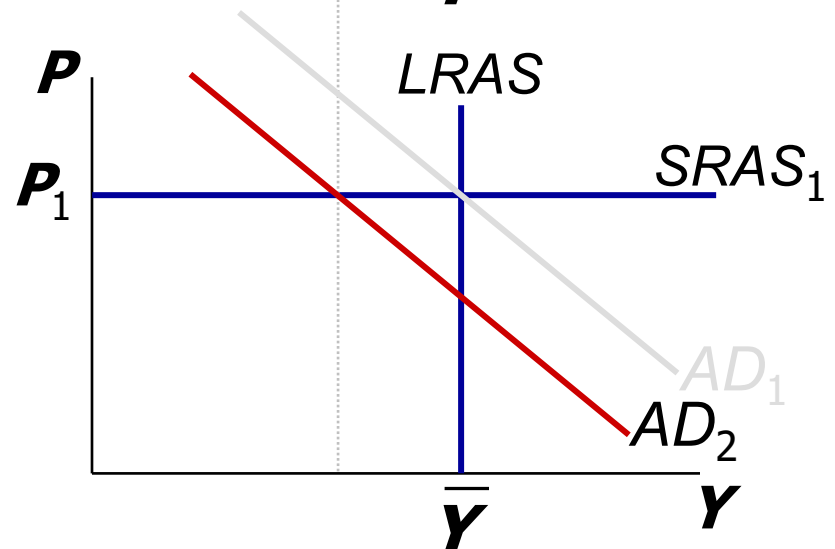
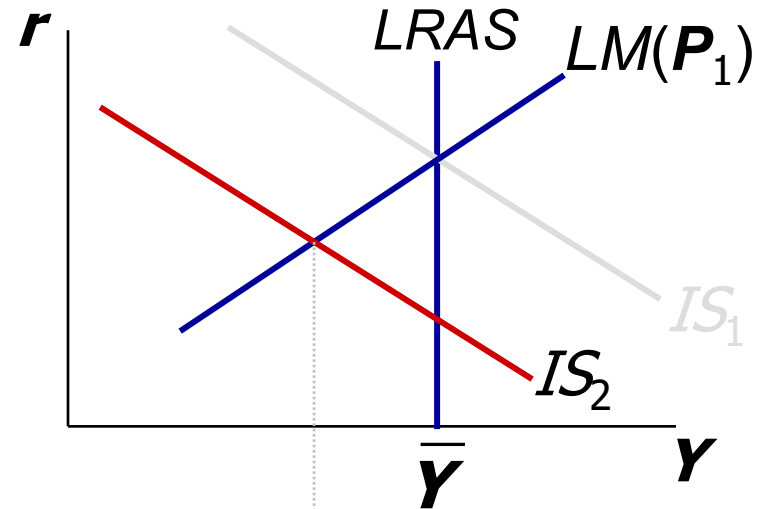


# The SR and LR effects of an *IS* shock

In the new short-run equilibrium,  $Y < \bar{Y}$

Over time,  $P$  gradually falls, causing:

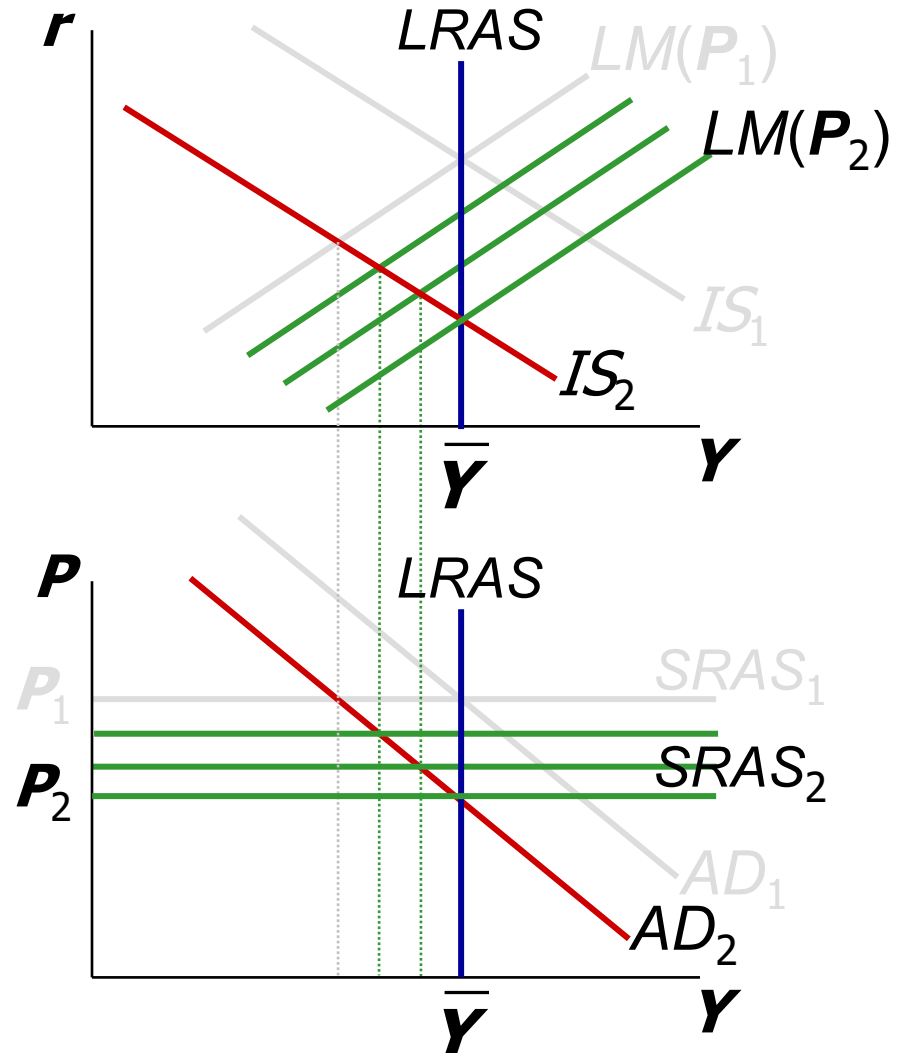
- *SRAS* to move down
- $M/P$  to increase, which causes *LM* to move down



# The SR and LR effects of an *IS* shock

Over time,  $P$  gradually falls, causing:

- $SRAS$  to move down
- $M/P$  to increase, which causes  $LM$  to move down

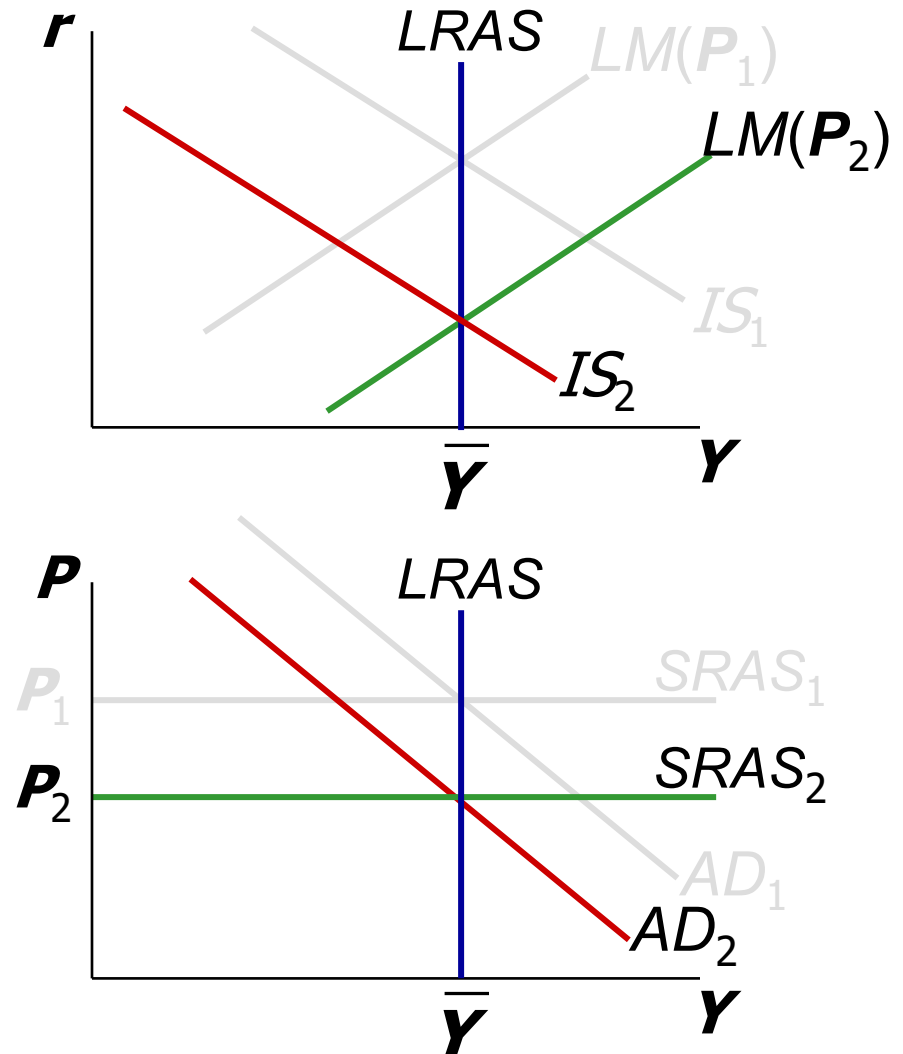




# The SR and LR effects of an *IS* shock

This process continues until economy reaches a long-run equilibrium with

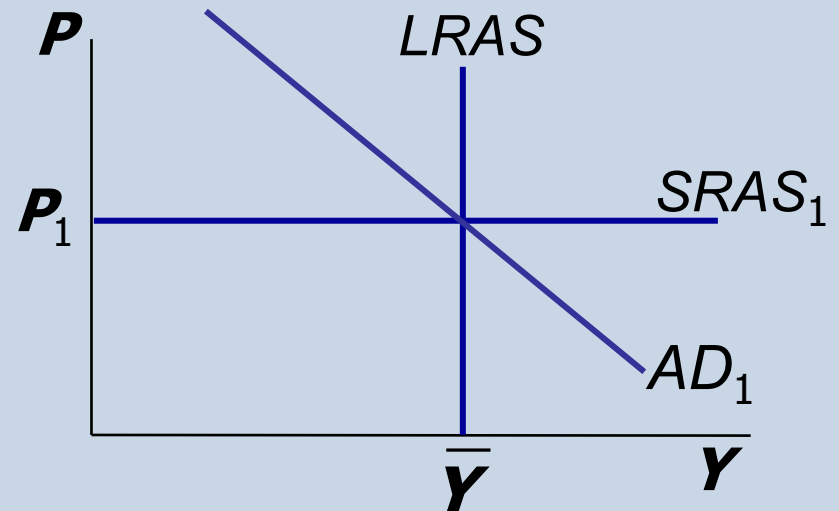
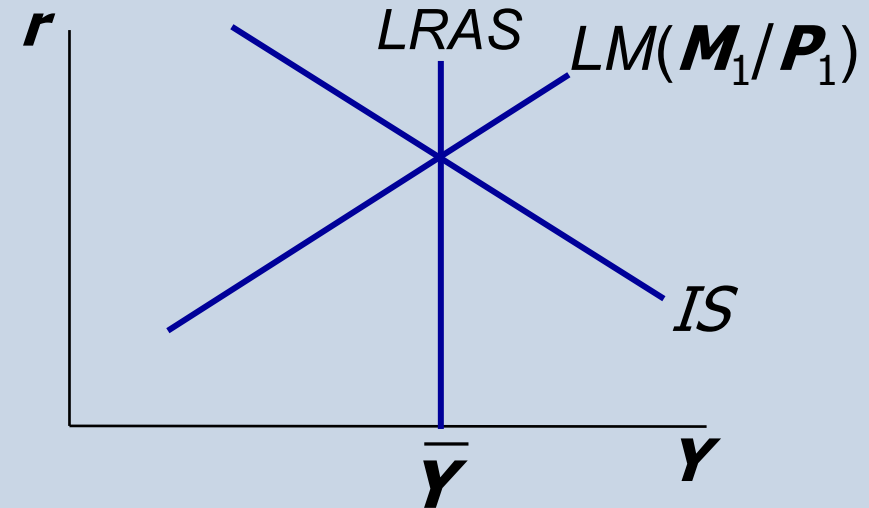
$$Y = \bar{Y}$$



## NOW YOU TRY

# Analyze SR & LR effects of $\Delta M$

- Draw the *IS-LM* and *AD-AS* diagrams as shown here.
- Suppose Fed increases  $M$ .** Show the short-run effects on your graphs.
- Show what happens in the transition from the short run to the long run.
- How do the new long-run equilibrium values of the endogenous variables compare to their initial values?

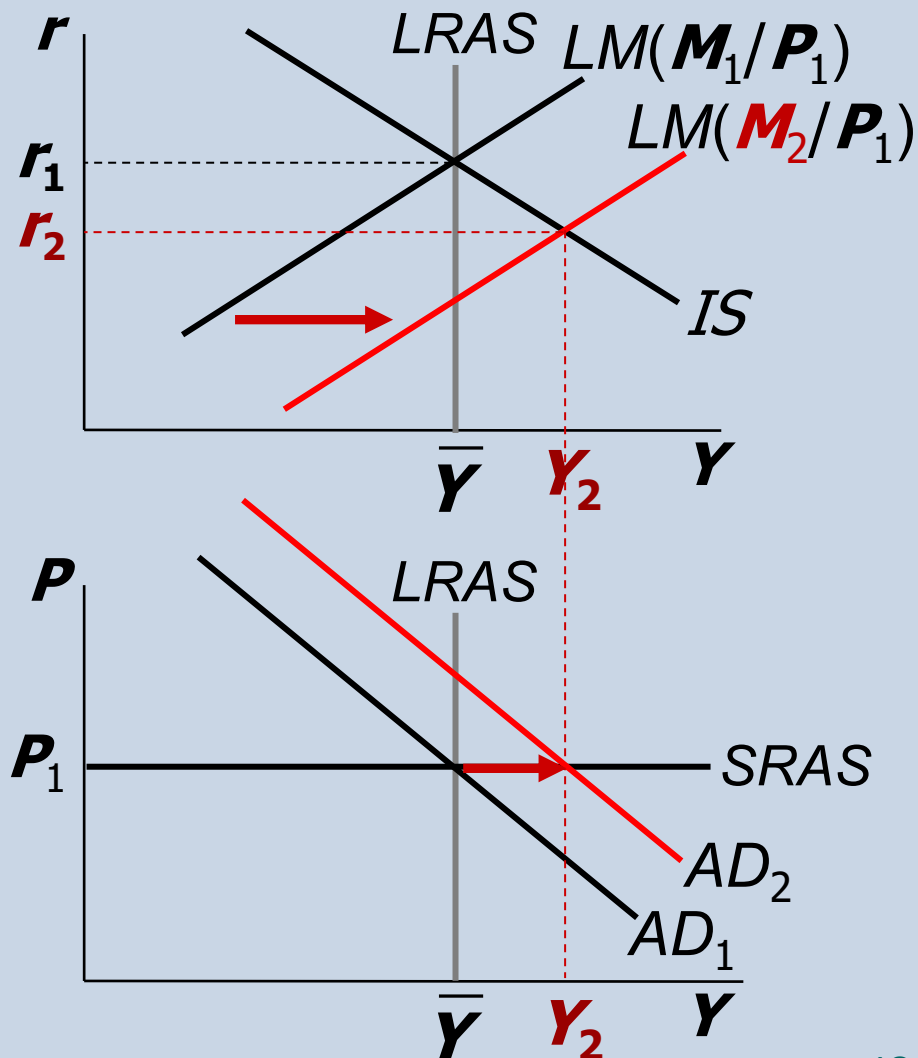


## ANSWERS, PART 1

### Short-run effects of $\Delta M$

$LM$  and  $AD$  shift right.

$r$  falls,  $Y$  rises above  $\bar{Y}$



## ANSWERS, PART 2

# Transition from short run to long run

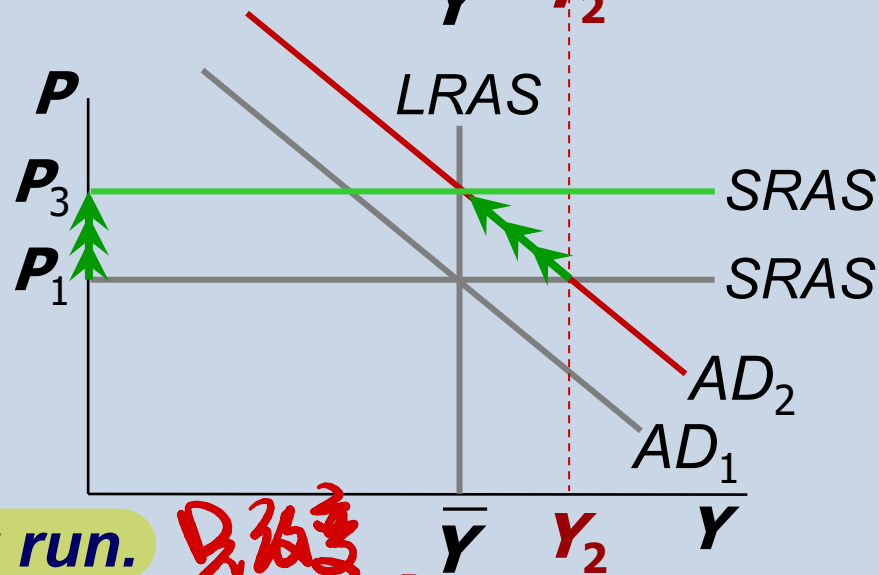
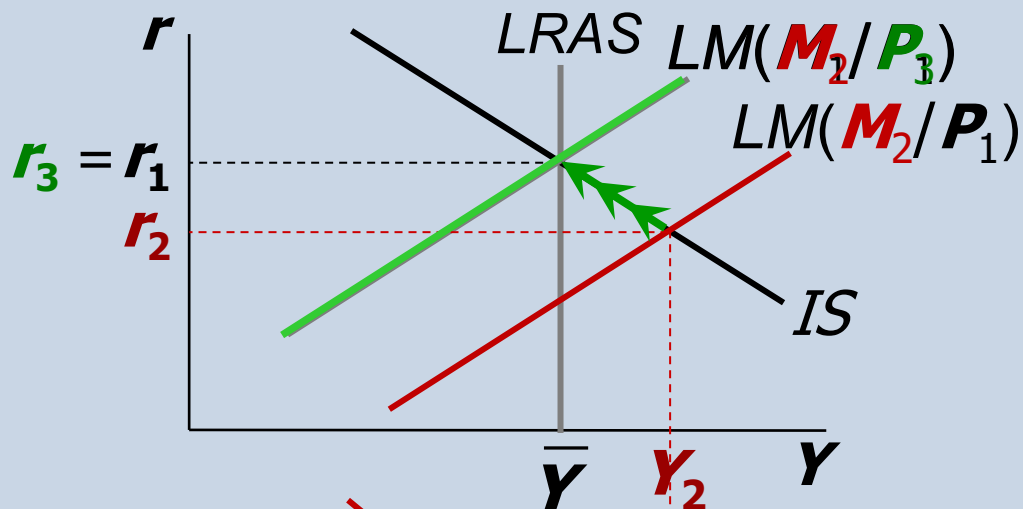
Over time,

- $P$  rises
- $SRAS$  moves upward
- $M/P$  falls
- $LM$  moves leftward

New long-run eq'm

- $P$  higher
- all *real* variables back at their initial values

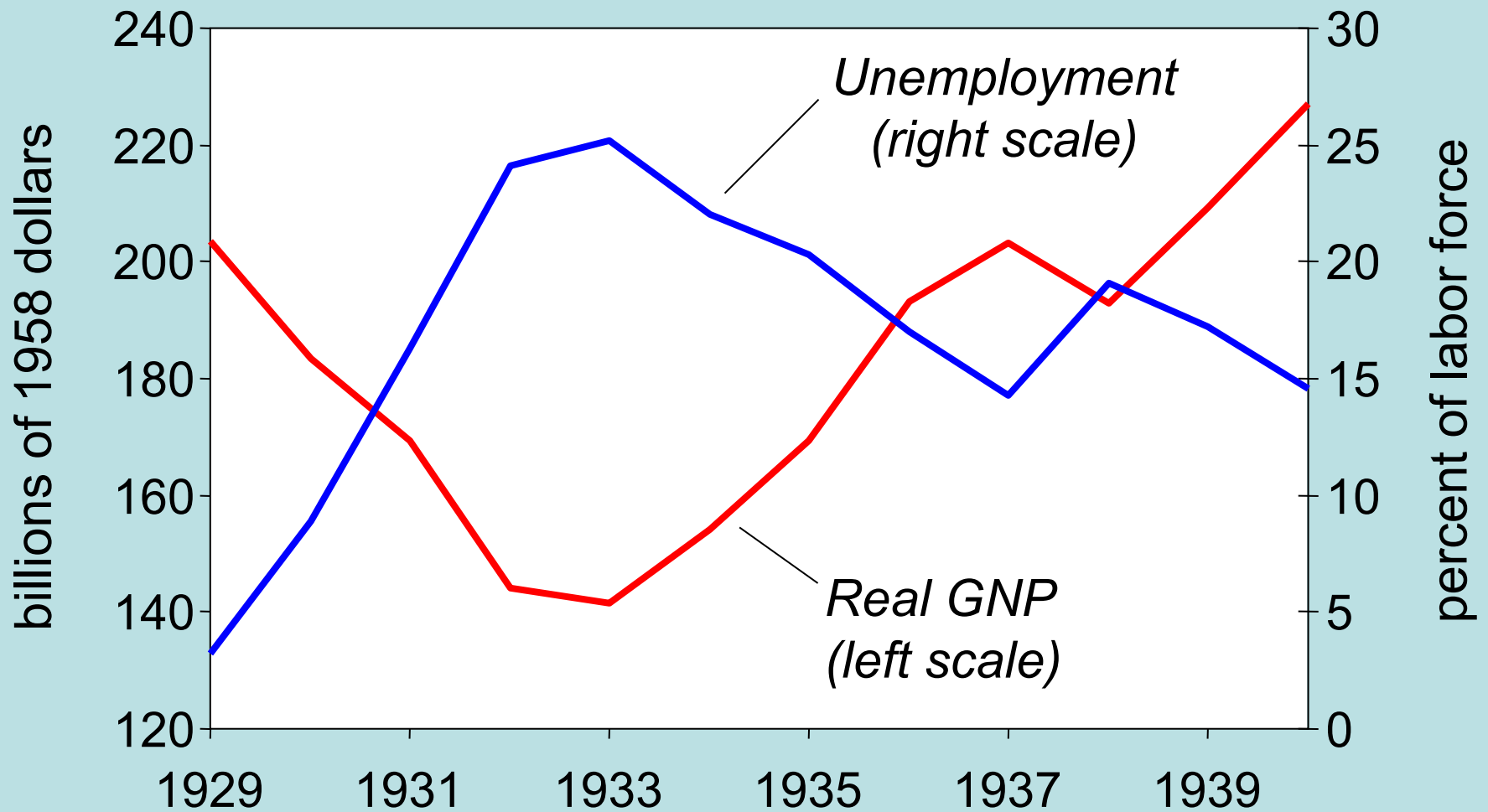
**Money is neutral in the long run.**



只改变  
价格水平

## 12.3 The Great Depression

# The Great Depression



# THE SPENDING HYPOTHESIS:

## Shocks to the *IS* curve

- Asserts the Depression was largely due to an exogenous fall in the demand for goods & services—a leftward shift of the *IS* curve.
- Evidence:  
output and interest rates both fell, which is what a leftward *IS* shift would cause.

# THE SPENDING HYPOTHESIS:

## Reasons for the *IS* shift

- Stock market crash reduced consumption
  - Oct 1929–Dec 1929: S&P 500 fell 17%
  - Oct 1929–Dec 1933: S&P 500 fell 71%
- Drop in investment
  - Correction after overbuilding in the 1920s.
  - Widespread bank failures made it harder to obtain financing for investment.
- Contractionary fiscal policy
  - Politicians raised tax rates and cut spending to combat increasing deficits.



# THE MONEY HYPOTHESIS:

## A shock to the *LM* curve

- Asserts that the Depression was largely due to huge fall in the money supply.
- Evidence:  
*M1* fell 25% during 1929–33.
- But, two problems with this hypothesis:
  - *P* fell even more, so *M/P* actually rose slightly during 1929–31.
  - nominal interest rates fell, which is the opposite of what a leftward *LM* shift would cause.

# THE MONEY HYPOTHESIS AGAIN:

## The effects of falling prices

- Asserts that the severity of the Depression was due to a huge deflation:  
 $P$  fell 25% during 1929–33.
- This deflation was **probably** caused by the fall in  $M$ , so **perhaps** money played an important role after all.
- In what ways does a deflation affect the economy?

# THE MONEY HYPOTHESIS AGAIN:

## The effects of falling prices

- The stabilizing effects of deflation:
- $\downarrow P \rightarrow \uparrow(M/P) \rightarrow LM \text{ shifts right} \rightarrow \uparrow Y$
- **Pigou effect:**
  - $\downarrow P \rightarrow \uparrow(M/P)$
  - $\rightarrow \text{consumers' wealth } \uparrow$
  - $\rightarrow \uparrow C$
  - $\rightarrow IS \text{ shifts right}$
  - $\rightarrow \uparrow Y$

# THE MONEY HYPOTHESIS AGAIN: The effects of falling prices

- The **destabilizing** effects of expected deflation:

$$\downarrow E\pi$$

→  $r \uparrow$  for each value of  $i$

→  $\mathbf{I} \downarrow$  because  $\mathbf{I} = \mathbf{I}(r)$

→ planned expenditure & agg. demand  $\downarrow$

→ income & output  $\downarrow$

# THE MONEY HYPOTHESIS AGAIN:

## The effects of falling prices

- The destabilizing effects of unexpected deflation:  
**debt-deflation theory**

↓ $P$  (if unexpected)

- transfers purchasing power from borrowers to lenders
- borrowers spend less, lenders spend more
- if borrowers' propensity to spend is larger than lenders', then aggregate spending falls, the  $IS$  curve shifts left, and  $Y$  falls

# Why another Depression is unlikely

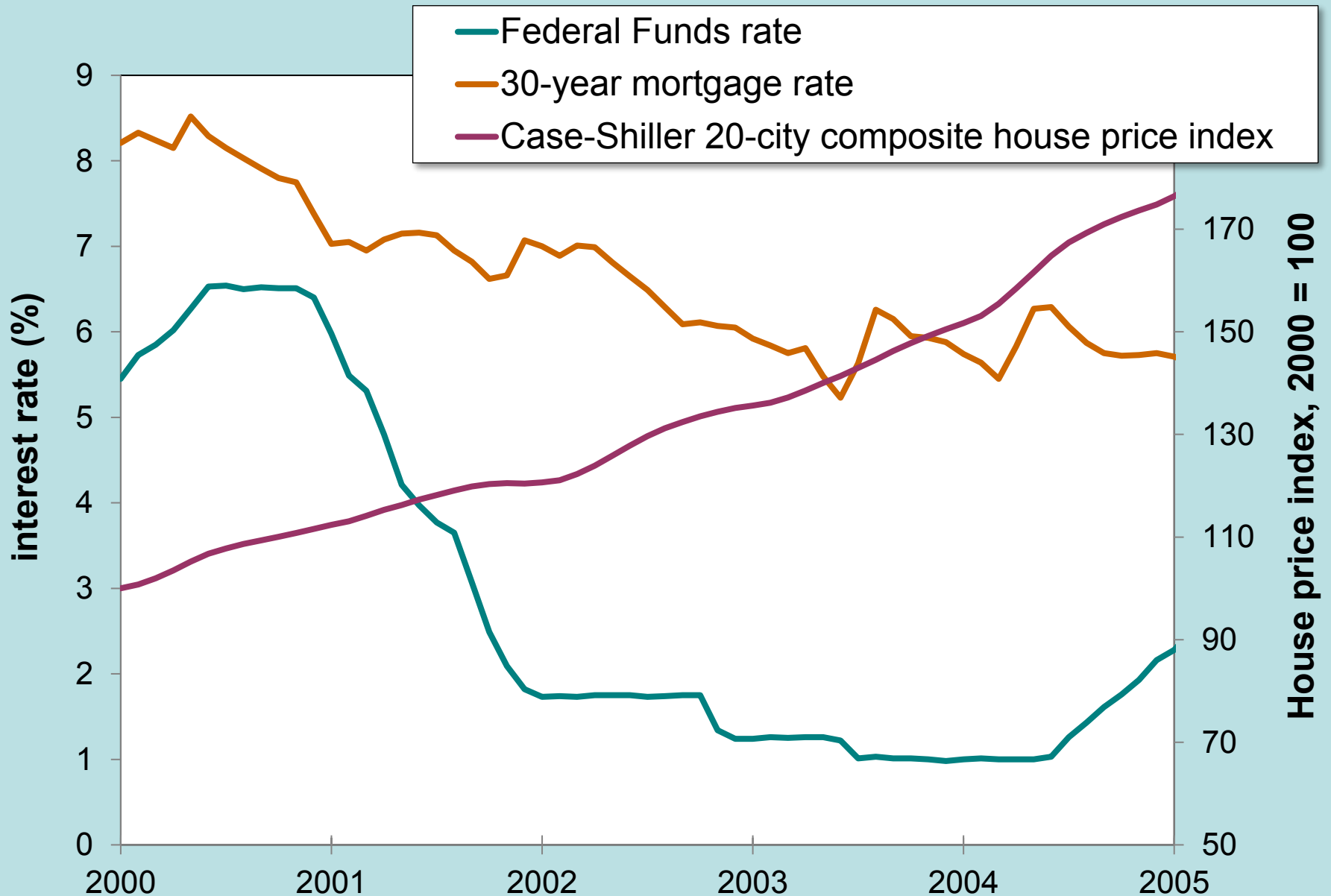
- Policymakers (or their advisers) now know much more about macroeconomics:
  - The Fed knows better than to let ***M*** fall so much, especially during a contraction.
  - Fiscal policymakers know better than to raise taxes or cut spending during a contraction.
- Federal deposit insurance makes widespread bank failures very unlikely.
- Automatic stabilizers make fiscal policy expansionary during an economic downturn.

# **CASE STUDY**

## **The 2008–09 financial crisis & recession**

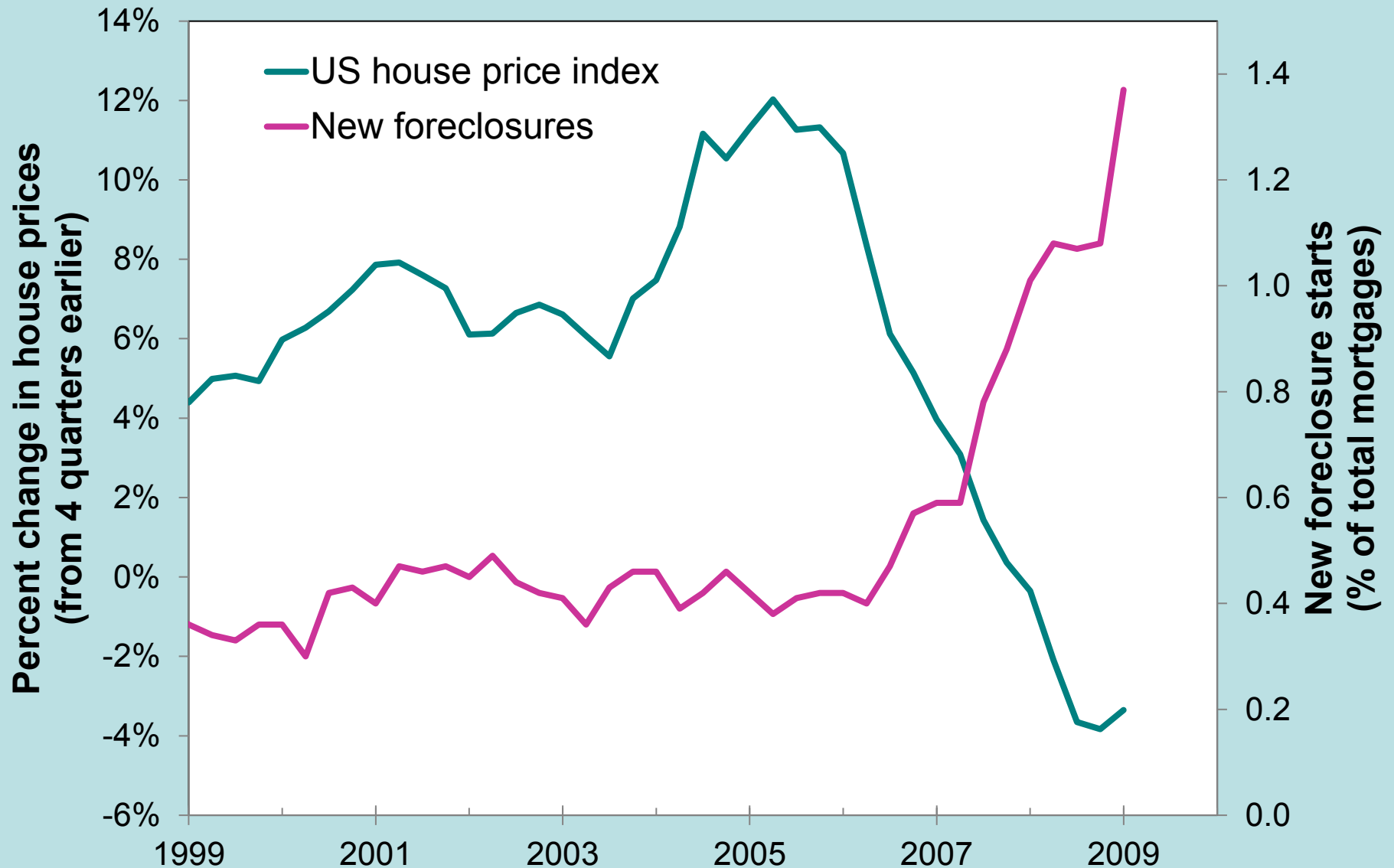
- 2009: Real GDP fell, u-rate approached 10%
- Important factors in the crisis:
  - early 2000s Federal Reserve interest rate policy
  - subprime mortgage crisis
  - bursting of house price bubble, rising foreclosure rates
  - falling stock prices
  - failing financial institutions
  - declining consumer confidence, drop in spending on consumer durables and investment goods

# Interest rates and house prices

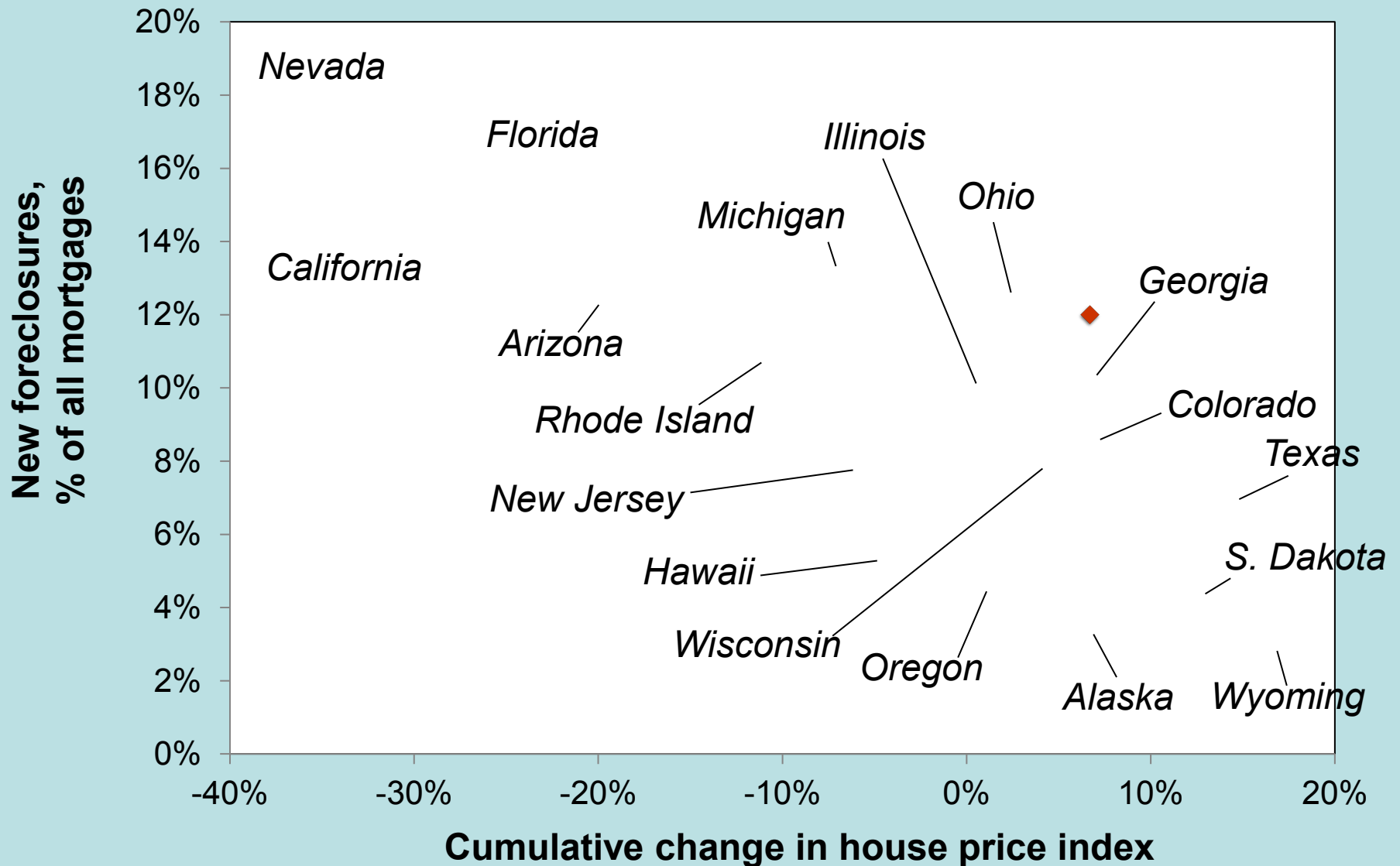




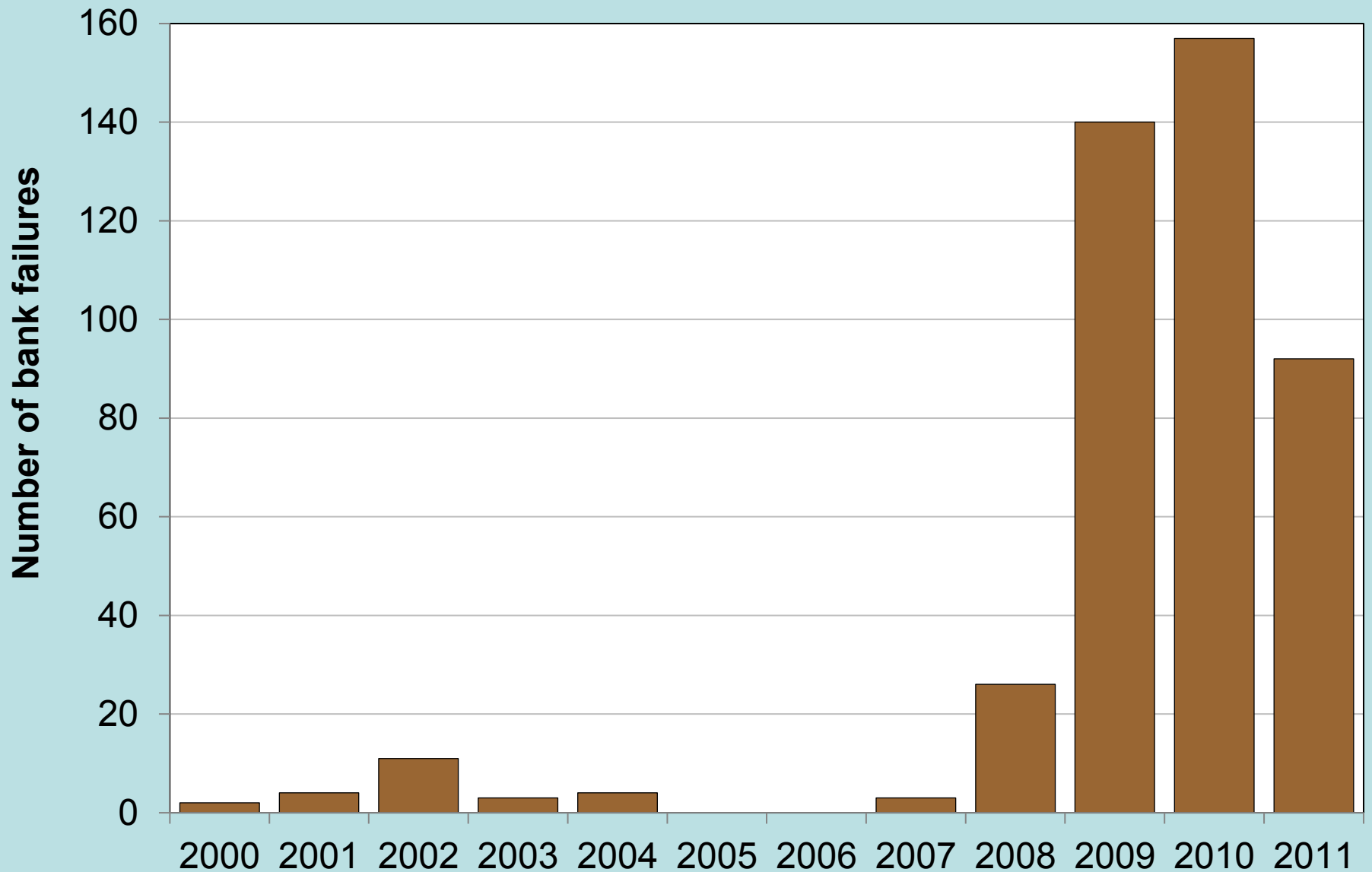
# Change in U.S. house price index and rate of new foreclosures, 1999–2009



# House price change and new foreclosures, 2006:Q3–2009:Q1

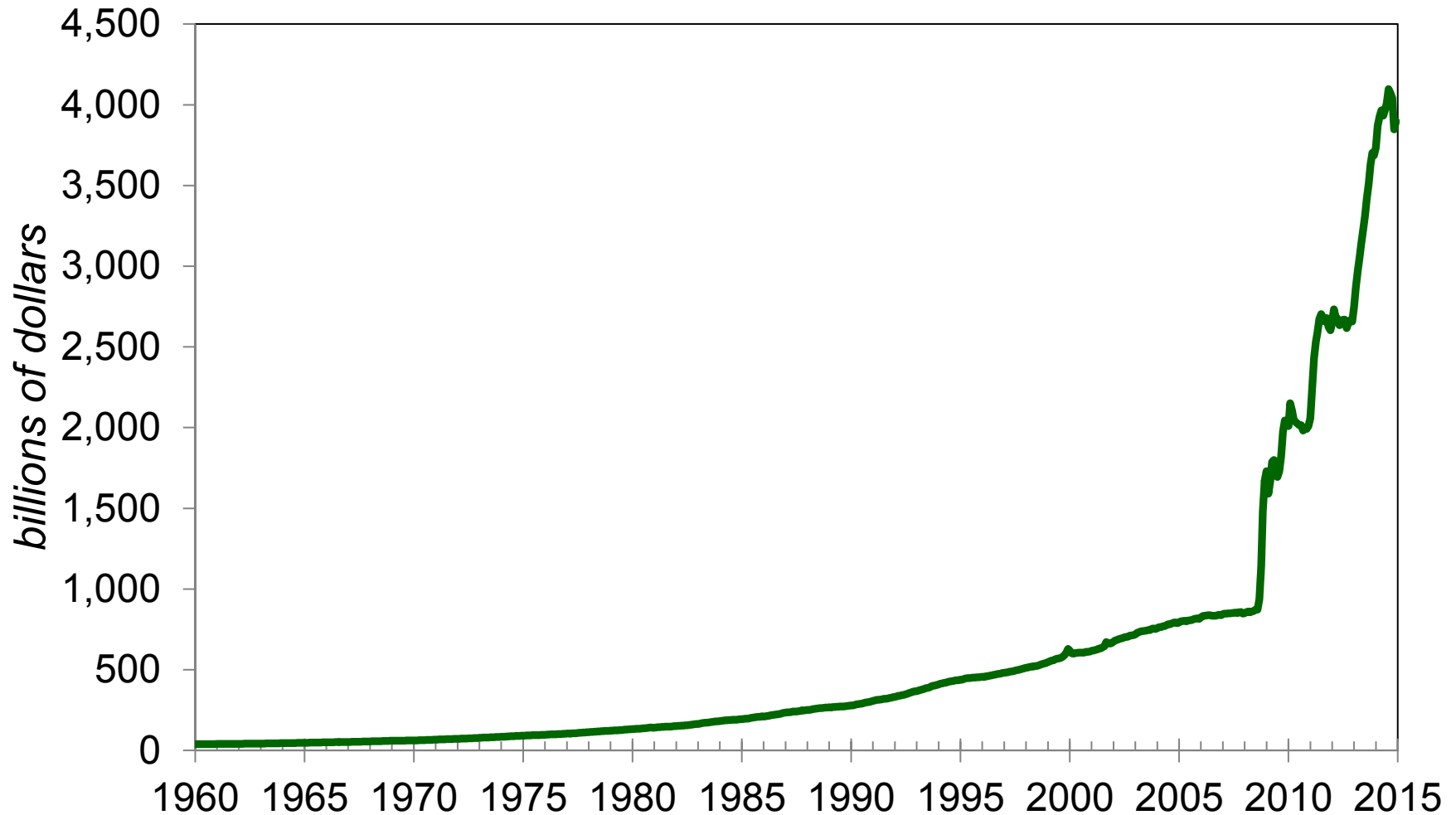


# U.S. bank failures by year, 2000–2011



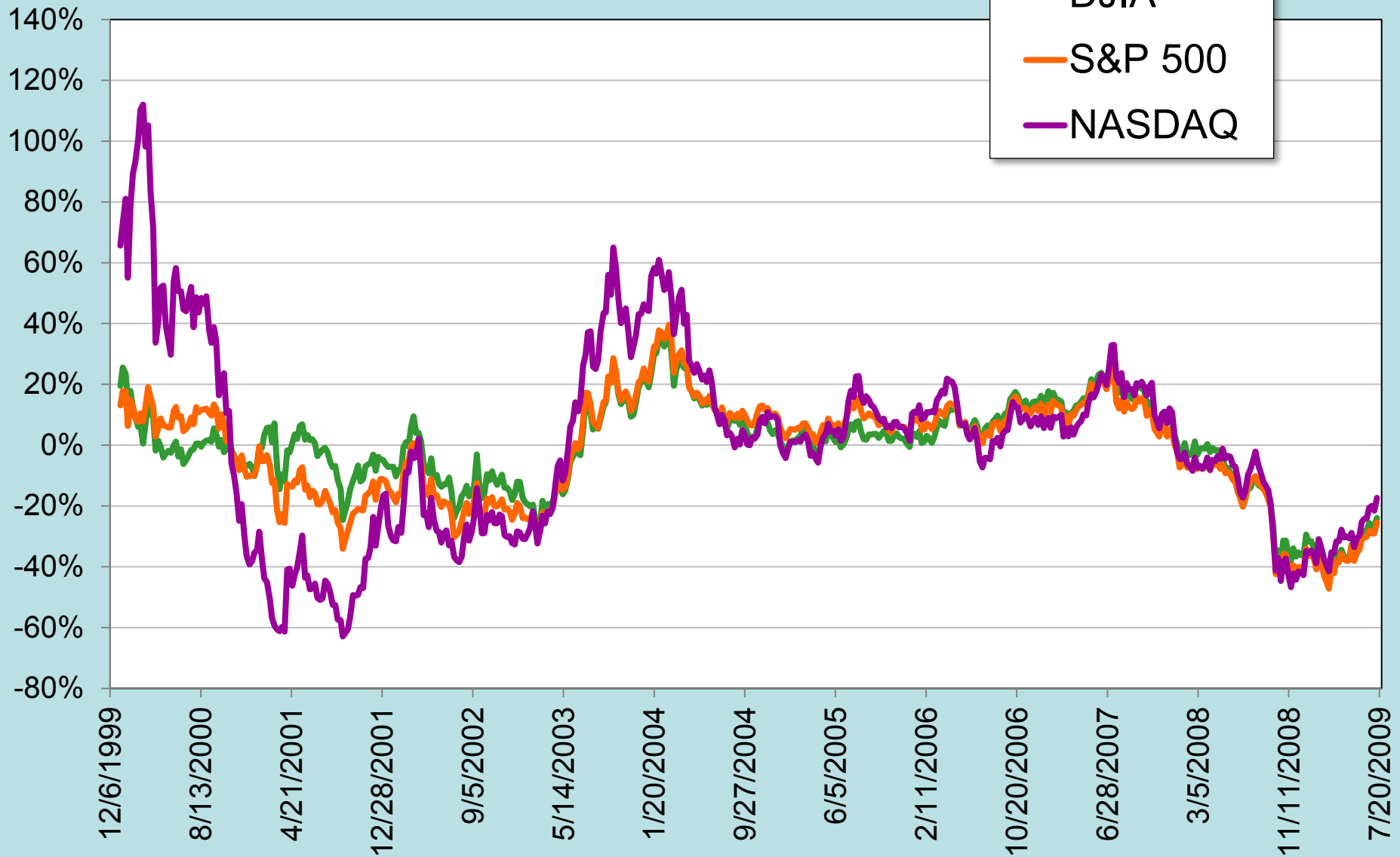
# CASE STUDY: (Ch 4)

## Quantitative Easing

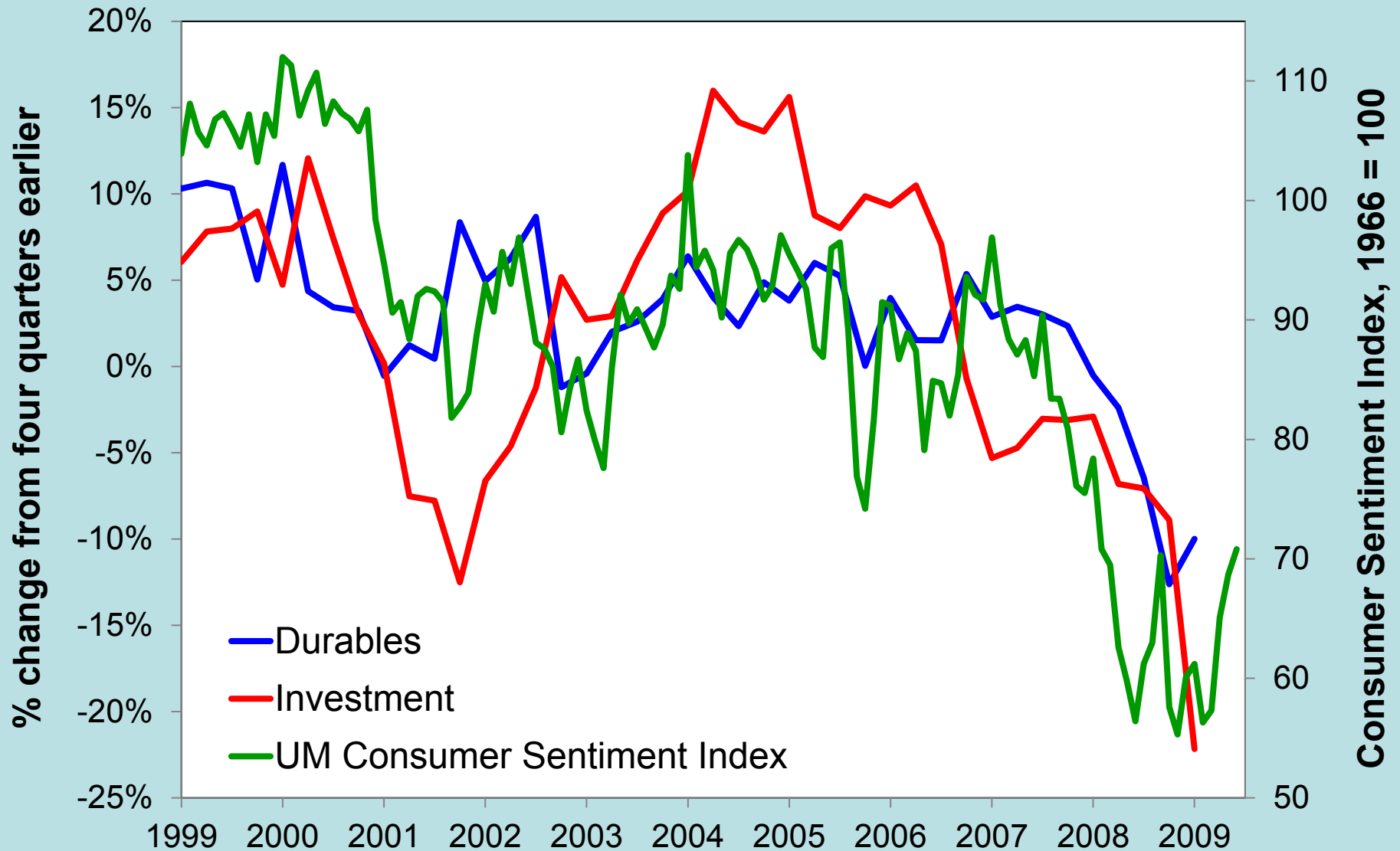


# Major U.S. stock indexes

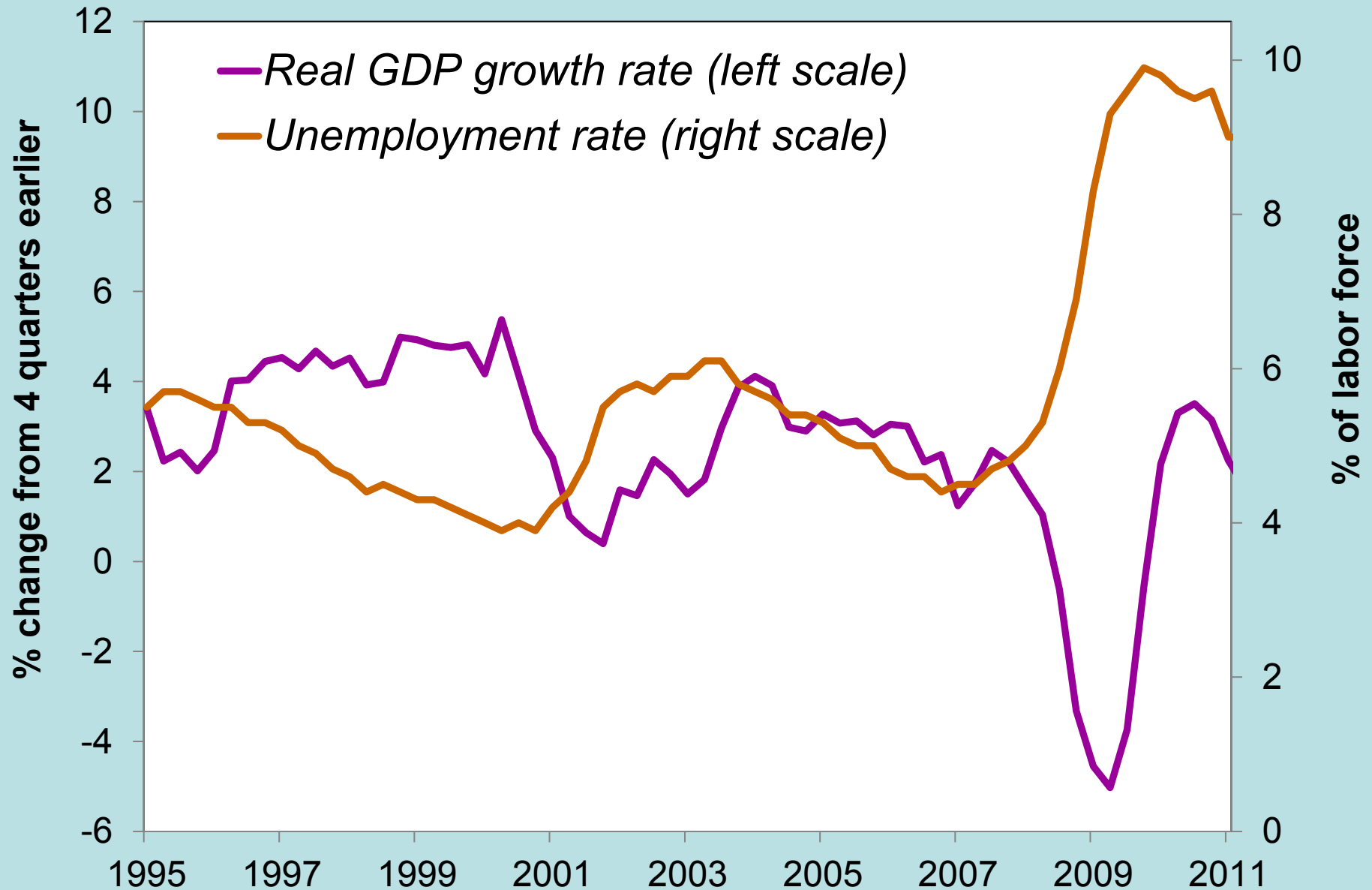
(% change from 52 weeks earlier)



# Consumer sentiment and growth in consumer durables and investment spending



# Real GDP growth and unemployment



# Liquidity Trap (Zero Lower Bound)

- Expansionary monetary policy works by reducing interest rates and stimulating investment spending.
- But if interest rates have already fallen almost to zero, then perhaps monetary policy is no longer effective.
- Nominal interest rates cannot fall below zero. Aggregate demand, production, and employment may be “trapped” at low levels.
- The liquidity trap is sometimes called the problem of the *zero lower bound*.



# Unconventional monetary policy

- Despite the zero lower bound, a central bank could try to lower longer-term interest rates.

---**Forward guidance**: announcing future monetary actions.

---**Quantitative easing**: conducting expansionary open-market operations in a larger variety of financial instruments than it normally does.

- Despite the zero lower bound, a central bank could cause the currency to lose value in the market for foreign-currency exchange.

# A higher target for the inflation?

- Under zero inflation, the real interest rate, like the nominal interest, can never fall below zero.
- But if the normal rate of inflation is, say, 4 percent, then the central bank can easily push the real interest rate to negative 4 percent by lowering the nominal interest rate toward zero.
- A higher target for the inflation rate means a higher nominal interest rate in normal times (recall the Fisher effect), which in turn gives the central bank more room to cut interest rates when the economy experiences recessionary shocks.

# CHAPTER SUMMARY

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## 1. *IS-LM* model

- a theory of aggregate demand
- exogenous:  $M$ ,  $G$ ,  $T$ ,  
 $P$  exogenous in short run,  $Y$  in long run
- endogenous:  $r$ ,  
 $Y$  endogenous in short run,  $P$  in long run
- *IS* curve: goods market equilibrium
- *LM* curve: money market equilibrium

# CHAPTER SUMMARY

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## 2. *AD* curve

- shows relation between  $P$  and the *IS-LM* model's equilibrium  $Y$ .
- negative slope because  
 $\uparrow P \rightarrow \downarrow (M/P) \rightarrow \uparrow r \rightarrow \downarrow I \rightarrow \downarrow Y$
- expansionary fiscal policy shifts *IS* curve right, raises income, and shifts *AD* curve right.
- expansionary monetary policy shifts *LM* curve right, raises income, and shifts *AD* curve right.
- *IS* or *LM* shocks shift the *AD* curve.

# ***The Big Picture***

