

Topic 10:  
**Aggregate Demand II**  
(chapter 11) updated 11/15/06

macroeconomics  
fifth edition

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by Ron Cronovich

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### Equilibrium in the IS-LM Model

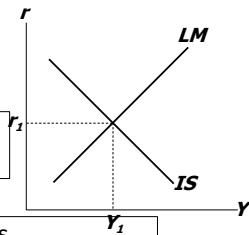
The *IS* curve represents equilibrium in the goods market.

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

The *LM* curve represents money market equilibrium.

$$M/P = L(r, Y)$$

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



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### Policy analysis with the IS-LM Model

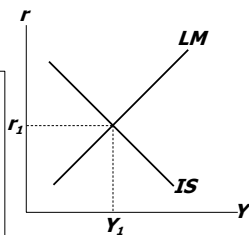
$$Y = C(Y - \bar{T}) + I(r) + \bar{G}$$

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

Policymakers can affect macroeconomic variables with

- fiscal policy: *G* and/or *T*
- monetary policy: *M*

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



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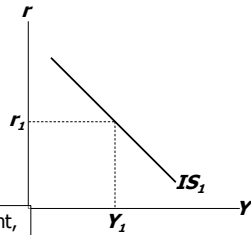
### An increase in government purchases

1.  $IS$  curve shifts right

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



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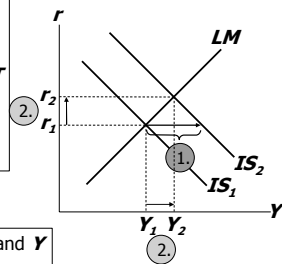
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### A tax cut

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

1. \_\_\_\_\_

2. ...so the effects on  $r$  and  $Y$  are \_\_\_\_\_



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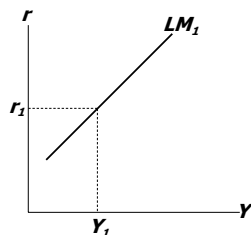
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### Monetary Policy: an increase in $M$

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.



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## Shocks in the *IS-LM* Model

**IS shocks:** exogenous changes in the \_\_\_\_\_.

Examples:

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

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## Shocks in the *IS-LM* Model

**LM shocks:** exogenous changes in the \_\_\_\_\_.

Examples:

- a wave of credit card fraud increases demand for money
- more ATMs or the Internet reduce money demand

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### CASE STUDY

#### The U.S. economic slowdown of 2001

*~What happened~*

1. Real GDP growth rate  
1994-2000: 3.9% (average annual)  
2001: 1.2%
2. Unemployment rate  
Dec 2000: 4.0%  
Dec 2001: 5.8%

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**CASE STUDY**

**The U.S. economic slowdown of 2001**

*~Shocks that contributed to the slowdown~*

1. \_\_\_\_\_  
From Aug 2000 to Aug 2001: -25%  
Week after 9/11: -12%
2. The terrorist attacks on 9/11
  - increased uncertainty
  - \_\_\_\_\_

*Both shocks reduced spending and*

\_\_\_\_\_.

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**CASE STUDY**

**The U.S. economic slowdown of 2001**

*~The policy response~*

1. Fiscal policy
  - large long-term \_\_\_\_\_,
  - immediate \$300 rebate checks
  - \_\_\_\_\_:
  - aid to New York City & the airline industry,
  - war on terrorism
2. \_\_\_\_\_
  - Fed lowered its Fed Funds rate target
  - 11 times during 2001, from 6.5% to 1.75%
  - Money growth increased, interest rates fell

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**What is the Fed's policy instrument?**

*What the newspaper says:*

"the Fed lowered interest rates by one-half point today"

*What actually happened:*

The Fed conducted expansionary monetary policy to shift the LM curve to the right until the interest rate fell 0.5 points.

*The Fed targets the Federal Funds rate:  
it announces a target value,  
and uses monetary policy to shift the LM curve  
as needed to attain its target rate.*

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## 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.

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## 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 the  $LM$  curve and therefore affect  $Y$ .
- The \_\_\_\_\_  
(introduced in chap. 9) captures this relationship between  $P$  and  $Y$

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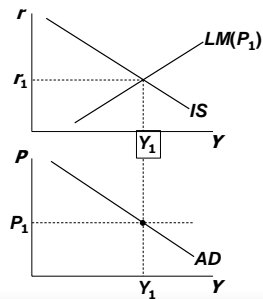
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## Deriving the AD curve

Intuition for slope of  $AD$  curve:

- $\uparrow P \Rightarrow \downarrow (M/P)$   
 $\Rightarrow LM$  shifts left  
 $\Rightarrow \uparrow$   
 $\Rightarrow \downarrow$   
 $\Rightarrow \downarrow$



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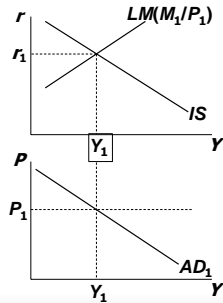
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## Monetary policy and the AD curve

The Fed can increase aggregate demand:

$\uparrow M \Rightarrow LM$  shifts right  
 $\Rightarrow \downarrow$   
 $\Rightarrow \uparrow$   
 $\Rightarrow \uparrow$



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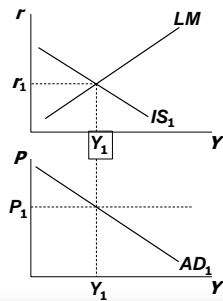
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## Fiscal policy and the AD curve

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

$\downarrow T \Rightarrow \uparrow$   
 $\Rightarrow$   
 $\Rightarrow \uparrow Y$  at each value of  $P$



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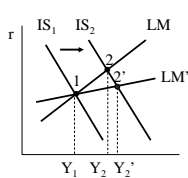
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## Policy Effectiveness

Fiscal policy is effective ( $Y$  will rise much) when:



As the rise in  $G$  raises  $Y$ , the increase in money demand so investment is not crowded out as much.

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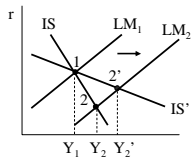
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## Policy Effectiveness

Monetary policy is effective ( $Y$  will rise much) when:



As a rise in  $M$  lowers the interest rate ( $r$ ), \_\_\_\_\_ in response to the fall in  $r$  so output rises more.

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## Optional material:

### Deriving AD curve with algebra

Suppose the expenditure side of the economy is characterized by:

$$C = \bar{C} + b(Y - T) \quad 0 < b < 1$$

$$I = \bar{I} - dr \quad d > 0$$

$$G = \bar{G}, \quad T = \bar{T}$$

where:  $b$  &  $d$  are some numbers,

$\bar{C}$  is the 'autonomous part of consumption'

and  $\bar{I}$  is 'autonomous investment'

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## Optional Material:

### Deriving AD curve with algebra

Use the goods market equilibrium condition

$$Y = C + I + G$$

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

Solve for  $Y$ :

$$Y - bY = \bar{C} - b\bar{T} + \bar{I} - dr + \bar{G}$$

$$(1 - b)Y = \bar{C} + \bar{I} + \bar{G} - b\bar{T} + \bar{I} - dr$$

$$\text{IS: } Y = \left( \frac{\bar{C} + \bar{I}}{1 - b} \right) + \left( \frac{1}{1 - b} \right) \bar{G} - \left( \frac{b}{1 - b} \right) \bar{T} - \left( \frac{d}{1 - b} \right) r$$

A line relating  $Y$  to  $r$  with slope  $-d/(1-b)$

Can see multipliers here: rise in  $Y$  taking  $r$  as given.

But  $r$  is an endogenous variable and it will change...

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**Optional Material:  
Deriving AD curve with algebra**

Use the money market to find a value for  $r$ .  
As done for the LM curve previously,  
suppose the money market is characterized by:

$$\begin{aligned} (M/P)^d &= eY - fr & e > 0, f > 0 \\ (M/P)^s &= \bar{M}/P \end{aligned}$$

Equilibrium in money market requires:

$$(M/P)^s = (M/P)^d$$

So LM:  $\bar{M}/P = eY - fr$   
or write as:  $r = \left(\frac{e}{f}\right)Y - \left(\frac{1}{f}\right)\frac{\bar{M}}{P}$

Line with slope =  $e/f$

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**Optional Material:  
Deriving AD curve with algebra**

Now combine the two, substituting in for  $r$ :

$$\text{IS: } Y = \left(\frac{\bar{C} + \bar{I}}{1-b}\right) + \left(\frac{1}{1-b}\right)\bar{G} - \left(\frac{b}{1-b}\right)\bar{T} - \left(\frac{d}{1-b}\right)r$$

$$\text{LM: } r = \left(\frac{e}{f}\right)Y - \left(\frac{1}{f}\right)\frac{\bar{M}}{P}$$

$$Y = \left(\frac{\bar{C} + \bar{I}}{1-b}\right) + \left(\frac{\bar{G}}{1-b}\right) - \left(\frac{b\bar{T}}{1-b}\right) - \left(\frac{d}{1-b}\right)\left[\left(\frac{e}{f}\right)Y - \left(\frac{1}{f}\right)\frac{\bar{M}}{P}\right]$$

Solve for  $Y$ . For convenience, define a term:

$$z = f/[f + de/(1-b)], \quad \text{so } 0 < z < 1$$

$$Y = z\left(\frac{\bar{C} + \bar{I}}{1-b}\right) + \left(\frac{z}{1-b}\right)\bar{G} + \left(\frac{-zb}{1-b}\right)\bar{T} + \left(\frac{d}{f(1-b) + de}\right)\frac{\bar{M}}{P}$$

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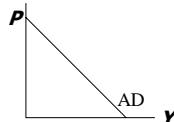
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**Optional Material:  
Deriving AD curve with algebra**

$$Y = z\left(\frac{\bar{C} + \bar{I}}{1-b}\right) + \left(\frac{z}{1-b}\right)\bar{G} + \left(\frac{-zb}{1-b}\right)\bar{T} + \left(\frac{d}{f(1-b) + de}\right)\frac{\bar{M}}{P}$$

where  $z = f/[f + de/(1-b)], \quad 0 < z < 1$

This implies a negative relationship between output ( $Y$ ) and price level ( $P$ ): an Aggregate Demand curve.



This math can help reveal under what conditions monetary and fiscal policies will be most effective...

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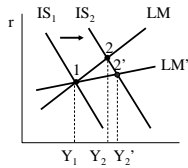
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### Optional Material: Policy Effectiveness

Fiscal policy is effective ( $Y$  will rise much) when:  
LM flatter ( $f$  large or  $e$  small, so  $z$  near 1)



As the rise in  $G$  raises  $Y$ ,  
the increase in money demand  
does not raise  $r$  much:  
-small  $e$ :  $M^d$  not responsive to  $Y$   
-large  $f$ :  $M^d$  is responsive to  $r$   
so investment is not crowded  
out as much.

$$Y = z \left( \frac{\bar{C} + \bar{I}}{1-b} \right) + \left( \frac{z}{1-b} \right) \bar{G} + \left( \frac{-zb}{1-b} \right) \bar{r} + \left( \frac{d}{f(1-b) + de} \right) \frac{\bar{M}}{P}$$

where  $z = f / [f + de / (1-b)]$ ,  $0 < z < 1$

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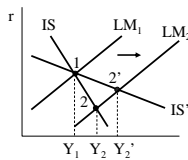
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### Optional Material: Policy Effectiveness

Monetary policy is effective ( $Y$  will rise much) when:  
IS flatter ( $d$  large: Investment is responsive to  $r$ )



As a rise in  $M$  lowers the  
interest rate ( $r$ ),  
investment rises more in  
response to the fall in  $r$ ,  
so output rises more.

$$Y = z \left( \frac{\bar{C} + \bar{I}}{1-b} \right) + \left( \frac{z}{1-b} \right) \bar{G} + \left( \frac{-zb}{1-b} \right) \bar{r} + \left( \frac{d}{f(1-b) + de} \right) \frac{\bar{M}}{P}$$

where  $z = f / [f + de / (1-b)]$ ,  $0 < z < 1$

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### IS-LM and AD-AS in the short run & long run

*Recall from Chapter 9:* 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
$Y > \bar{Y}$	rise
$Y < \bar{Y}$	fall
$Y = \bar{Y}$	remain constant

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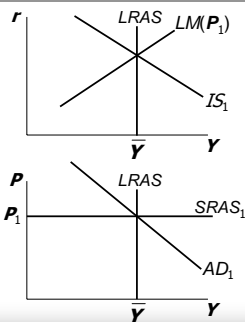
### The SR and LR effects of an IS shock

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

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

Over time *P* falls, which causes *M/P* to increase, causing *LM* to move down.

Economy eventually reaches a long-run equilibrium with  $Y = \bar{Y}$




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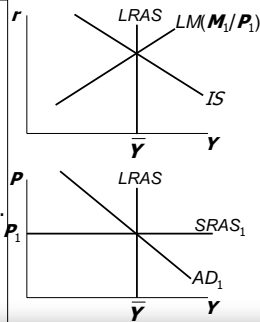
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### EXERCISE:

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

- Drawing the *IS-LM* and *AD-AS* diagrams as shown here,
- show the short run effect of a Fed increases in *M*. Label points and show curve shifts with arrows.
- Show what happens in the transition from the short run to the long run. Label points.
- How do the new long-run equilibrium values compare to their initial values?




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What Happened During the Great Depression?

Year	Unemployment Rate (%)	Real GNP (2)	Consumption (3)	Investment (4)	Government Purchases (5)
1929	3.1	205.6	138.8	48.4	18.4
1930	8.8	183.5	138.4	27.4	17.7
1931	16.3	169.5	126.1	16.8	26.6
1932	24.1	144.2	114.8	4.7	24.7
1933	25.2	131.3	112.8	5.3	13.2
1934	23.8	134.5	118.1	3.8	12.6
1935	20.3	168.8	123.3	18.0	27.5
1936	17.9	193.2	138.4	34.0	20.8
1937	14.1	263.2	183.1	35.9	44.2
1938	19.1	182.9	148.2	17.0	17.7
1939	17.2	209.6	148.2	34.7	26.7
1940	14.8	227.2	158.7	53.8	14.7

Source: Historical Statistics of the United States, Colonial Times to 1957, Part I and II (Washington, DC: U.S. Department of Commerce, Bureau of Census, 1957).

Note: (1) The unemployment rate is an annual rate. (2) Real GNP, consumption, investment, and government purchases are in 1982 dollars. (3) and (4) are measured in billions of 1982 dollars. (5) The source uses the term "Government Purchases."

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**The Spending Hypothesis:  
Reasons for the IS shift**

1.
  - Oct-Dec 1929: S&P 500 fell 17%
  - Oct 1929-Dec 1933: S&P 500 fell 71%
2.
  - "correction" after overbuilding in the 1920s
  - widespread bank failures made it harder to obtain financing for investment
3.
  - in the face of falling tax revenues and increasing deficits, politicians raised tax rates and cut spending

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**The Money Hypothesis:  
A Shock to the LM Curve**

- asserts that the Depression was largely due to huge fall in the money supply
- evidence:
  
- Argument:

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**A revision to the Money Hypothesis**

- There was a big deflation:  $P$  fell 25% 1929-33.
- A sudden fall in expected inflation means the ex ante real interest rate rises for any given nominal rate ( $i$ )

$$\begin{matrix} \uparrow & & \downarrow \\ \text{ex ante real interest rate} & = & i - \pi^e \end{matrix}$$

- This could have discouraged the investment expenditure and helped cause the depression.
- Since the deflation likely was caused by fall in  $M$ , monetary policy may have played a role here.

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### Why another Depression is unlikely

- Policymakers (or their advisors) now know much more about macroeconomics:
  - The Fed knows better than to \_\_\_\_\_, especially during a contraction.
  - Fiscal policymakers know better than to \_\_\_\_\_.
- Federal deposit insurance makes widespread bank failures very unlikely.
- \_\_\_\_\_ make fiscal policy expansionary during an economic downturn.

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### Chapter summary

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

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### Chapter summary

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

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