IS-LM Equilibrium

Prof. Lutz Hendricks

Econ520

February 11, 2016

Objectives

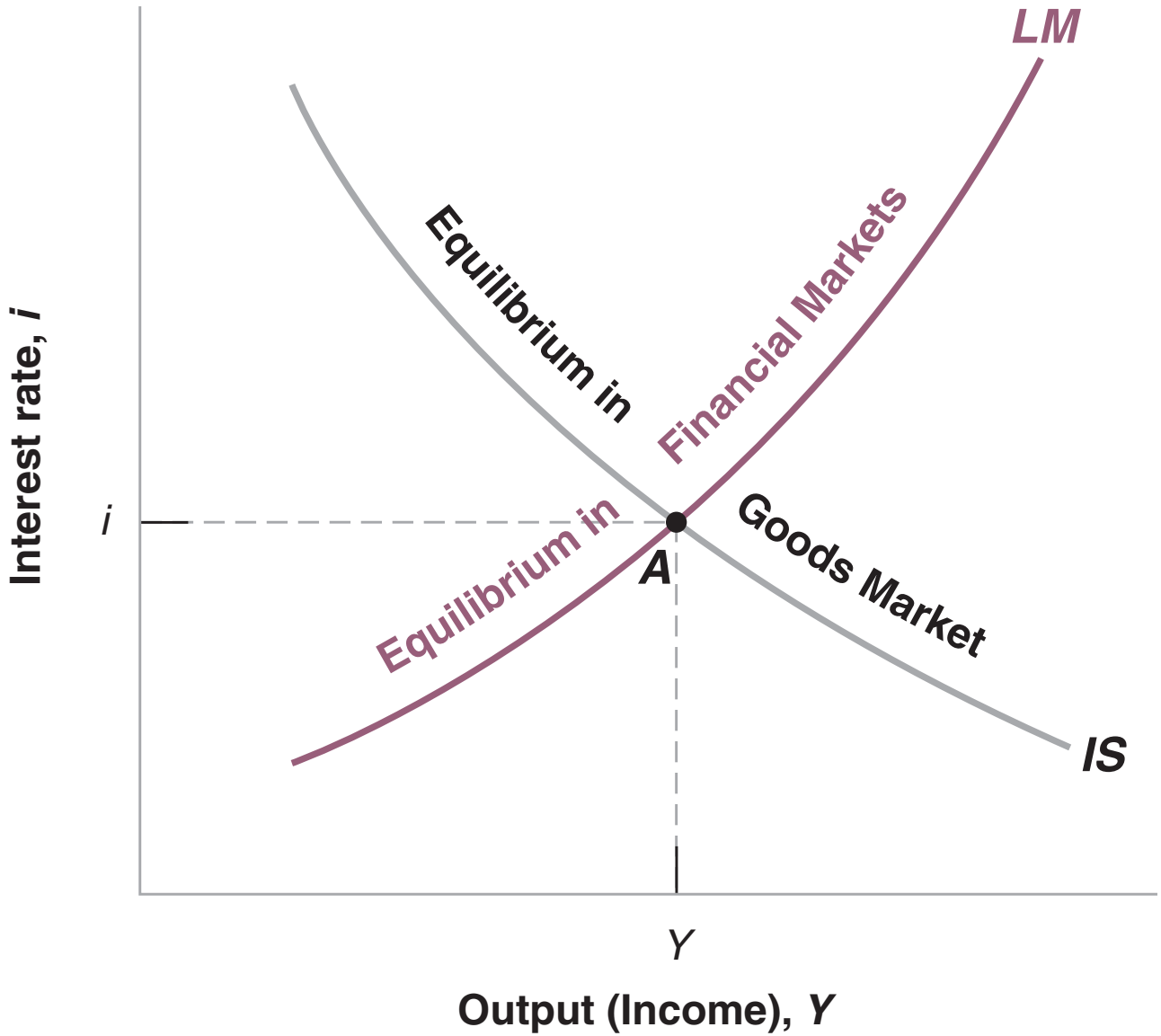
In this section you will learn how to

1. put IS and LM together and derive the equilibrium;
2. determine the effects of shocks and policies on equilibrium output and interest rate

Model Summary

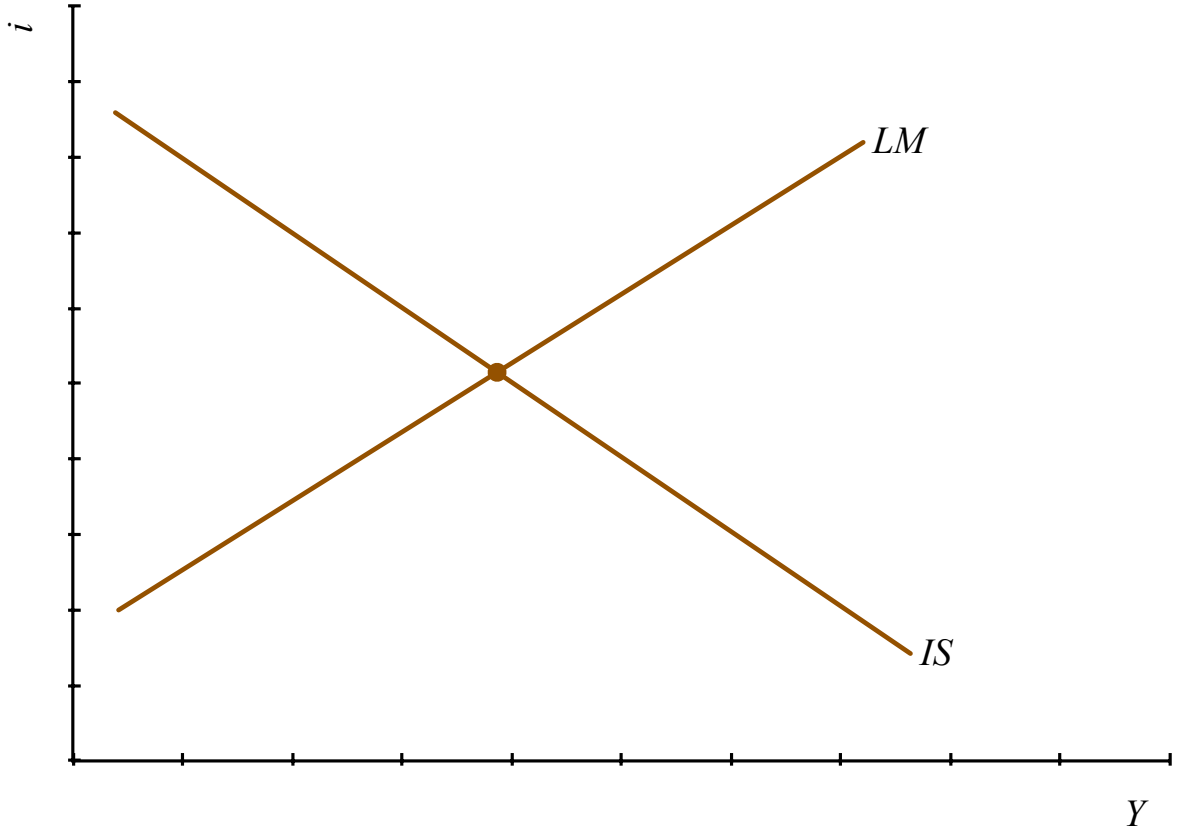
- Endogenous objects: Y, i
- Exogenous objects: $\bar{I}, c_0, G, T$
  - also M, which we take as controlled by CB for now
- Equations:
  - IS: $Y = C(Y - T) + I(Y, i) + G$
  - LM: $M/P = YL(i)$

IS-LM Graph


LM
Equilibrium in
Financial Markets
Interest rate, i
i
Equilibrium in
Goods Market
A
IS
Y
Output (Income), Y

Applications

Increasing Taxes



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

LM: $M/P = YL(i)$

The shock: $T \uparrow$

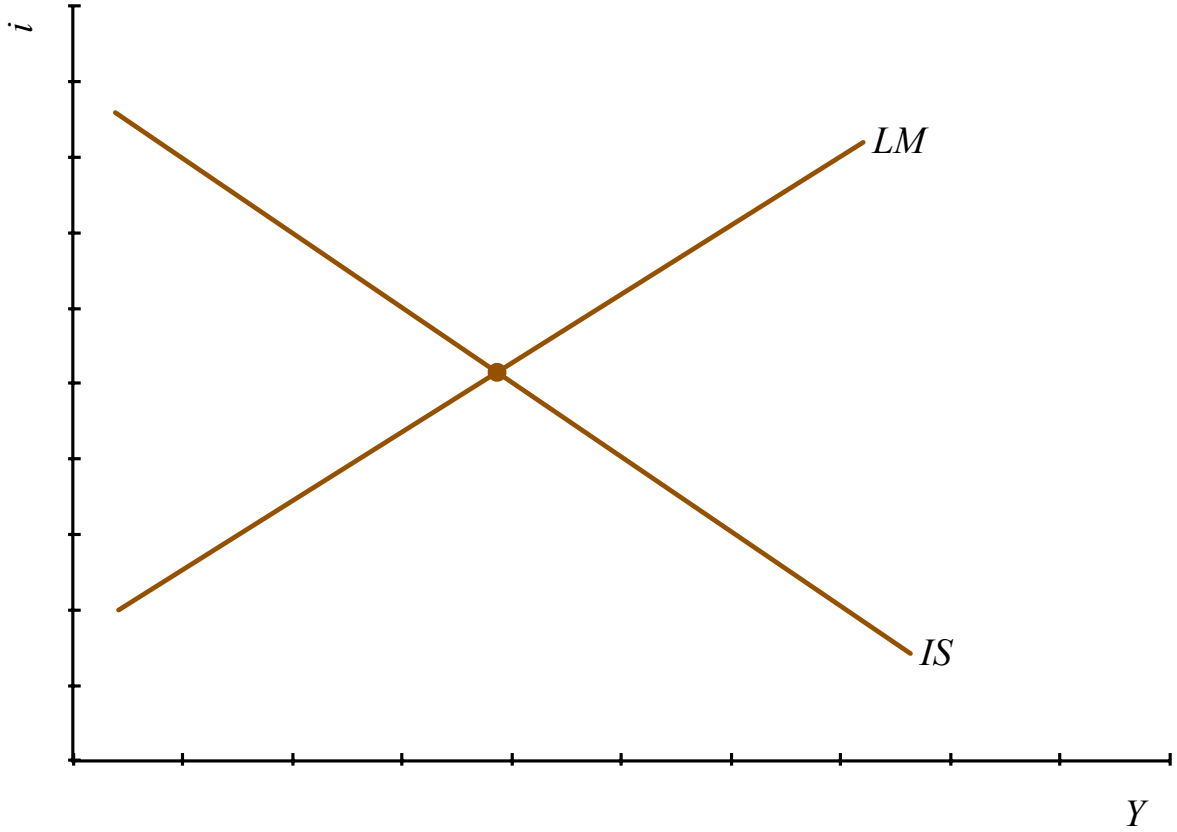
Taxes and Investment

- A common argument:
  - higher taxes reduce disposable income and saving
  - saving = investment
  - investment must fall
- Another common argument:
  - higher taxes reduce the government deficit
  - more money available for investment
- Which argument is right?

Increasing Taxes

What is missing in our analysis?

Monetary Expansion



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

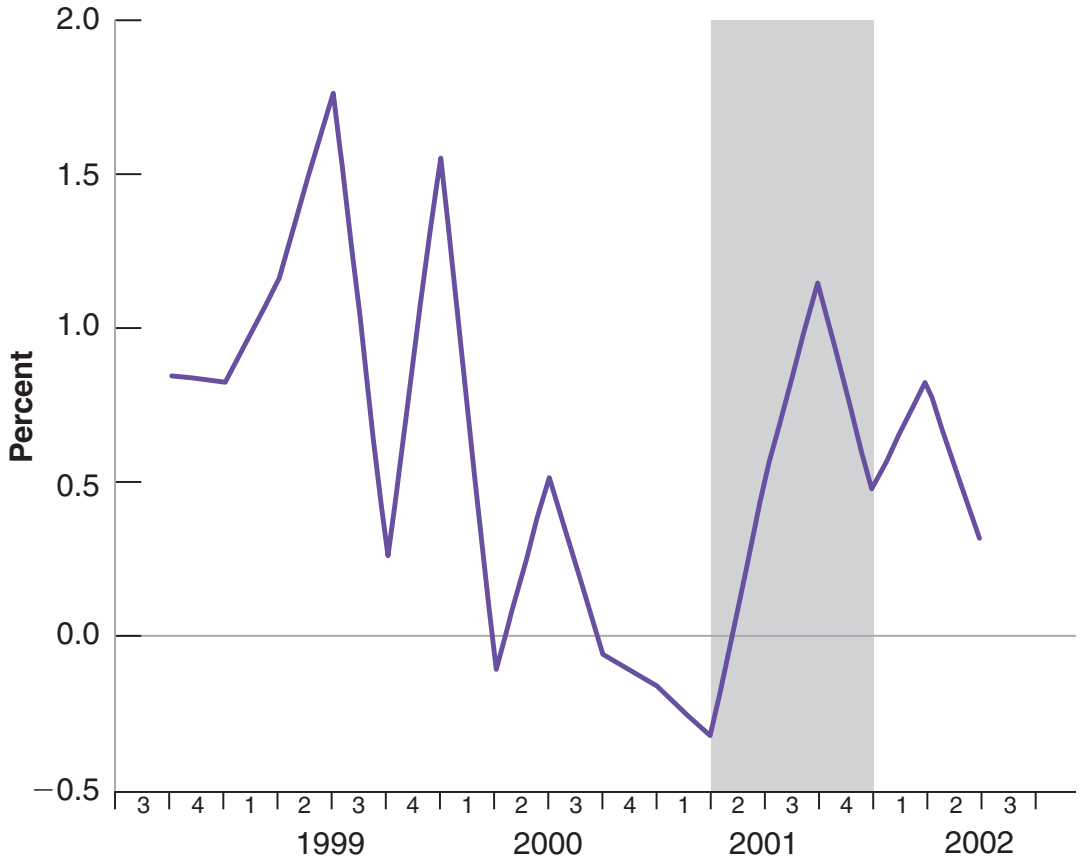
LM: $M/P = YL(i)$

The shock: $M \uparrow$

Policy Mix

- By combining monetary and fiscal policy, the government can, in principle, move Y and i independently.
- Monetary expansion: $Y \uparrow, i \downarrow$
- Fiscal expansion: $Y \uparrow, i \uparrow$
- Combination: $Y \uparrow, i$ unchanged
- In a typical recession, monetary and fiscal policies expand

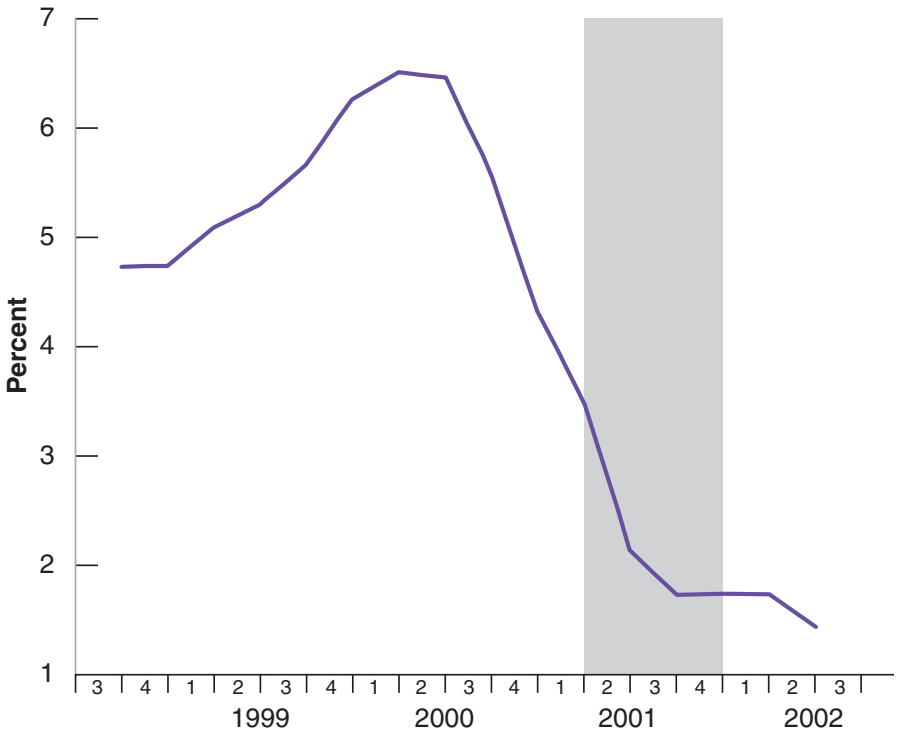
Example: 2001 Recession



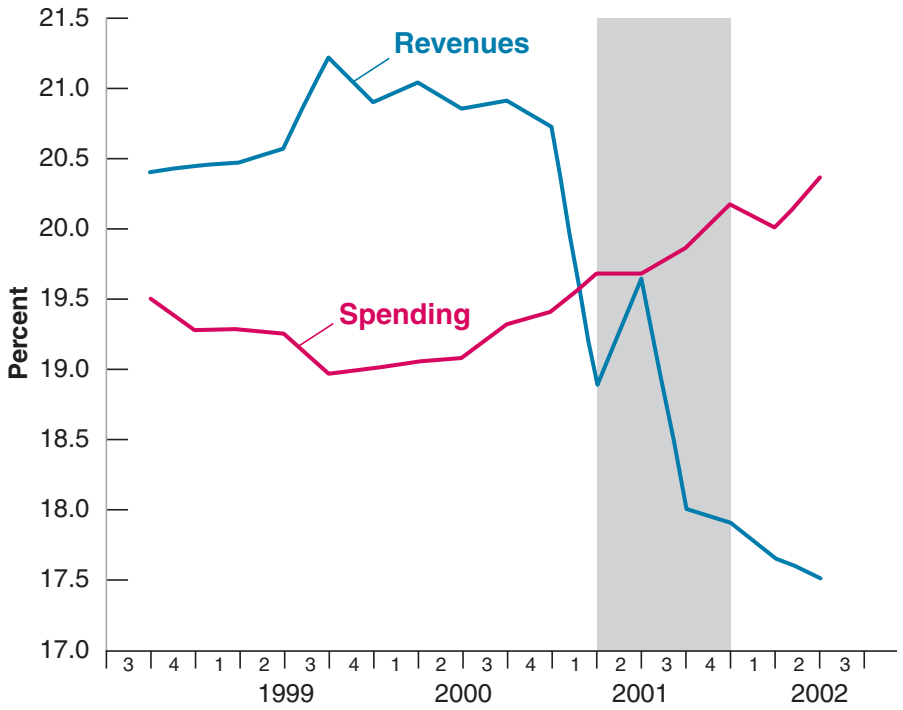
Growth rate of output

The shock: bursting of the tech bubble $\Longrightarrow I \downarrow$

Policy Responses

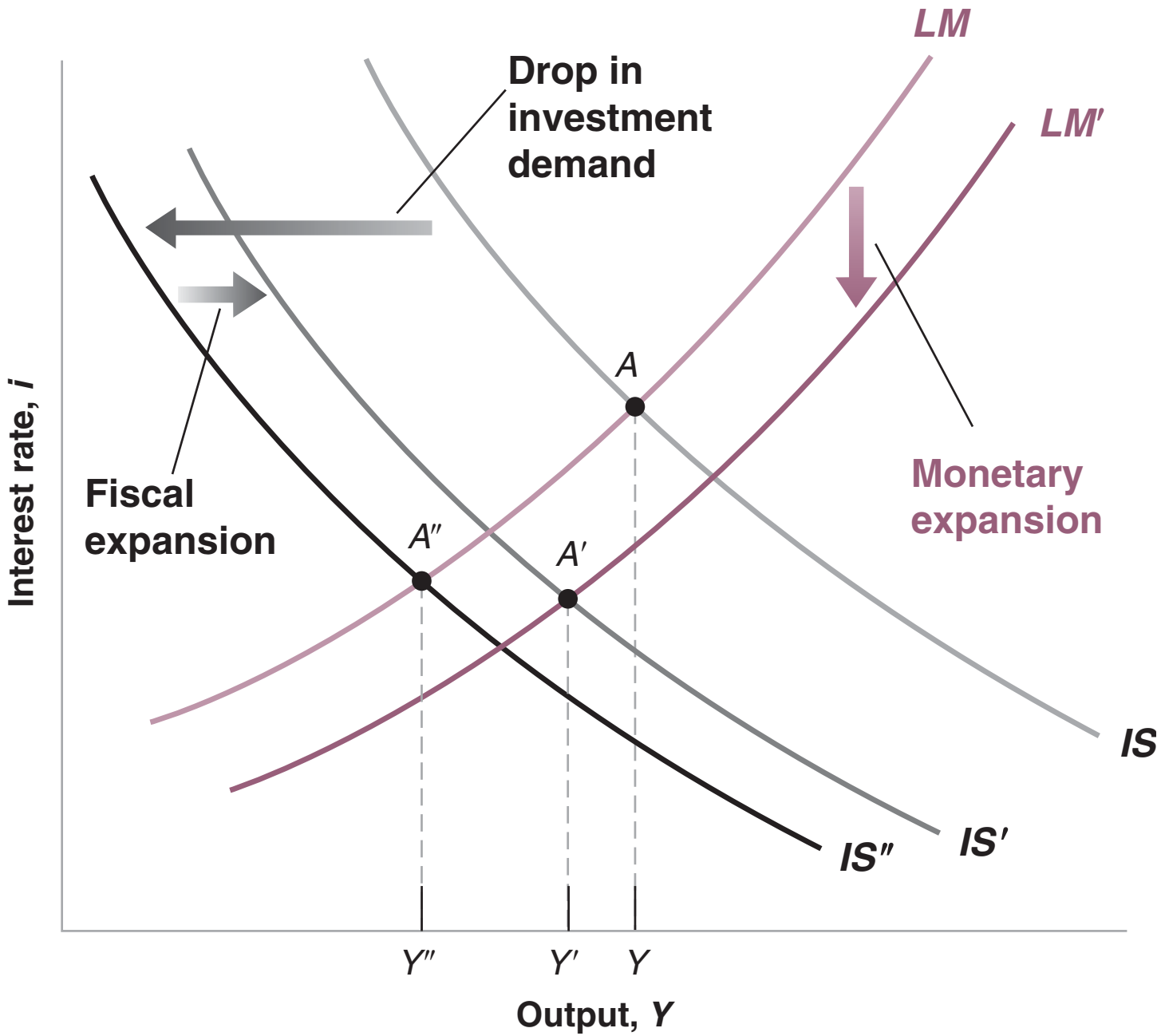


Federal funds rate



Government spending / revenue

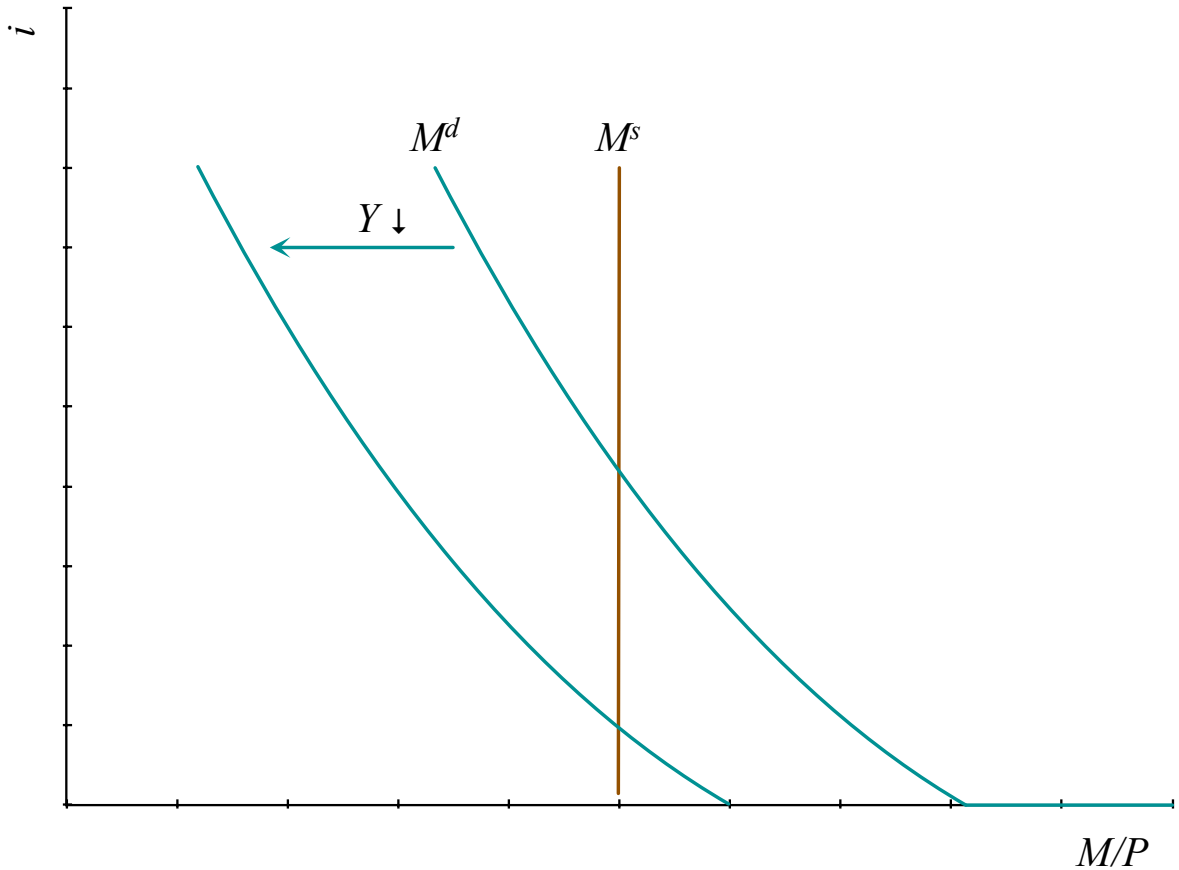
Analysis of the 2001 Recession



Liquidity Traps

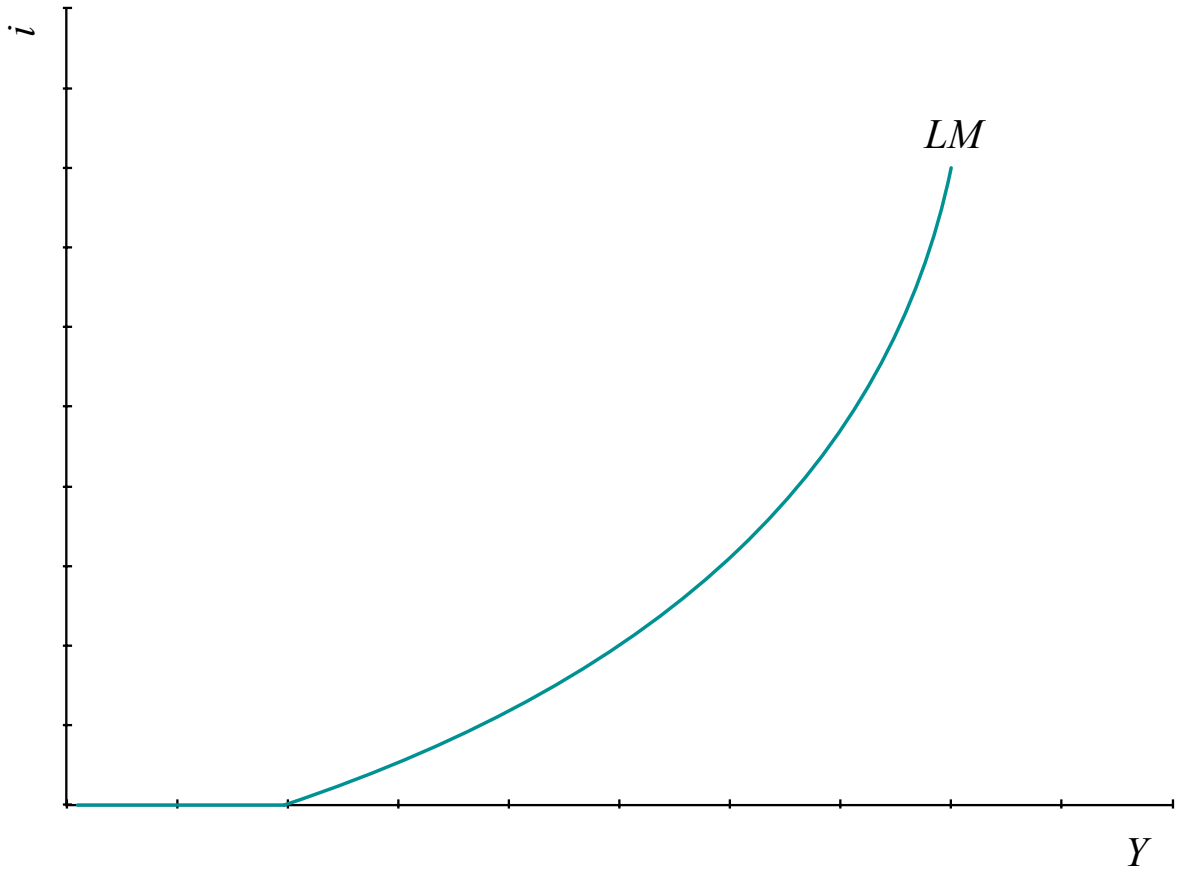
- Why do monetary policies have such a hard time pulling Japan out of recession?
- Real interest rates near zero
- Suggests flat LM curve
- "Liquidity trap"

Liquidity Trap



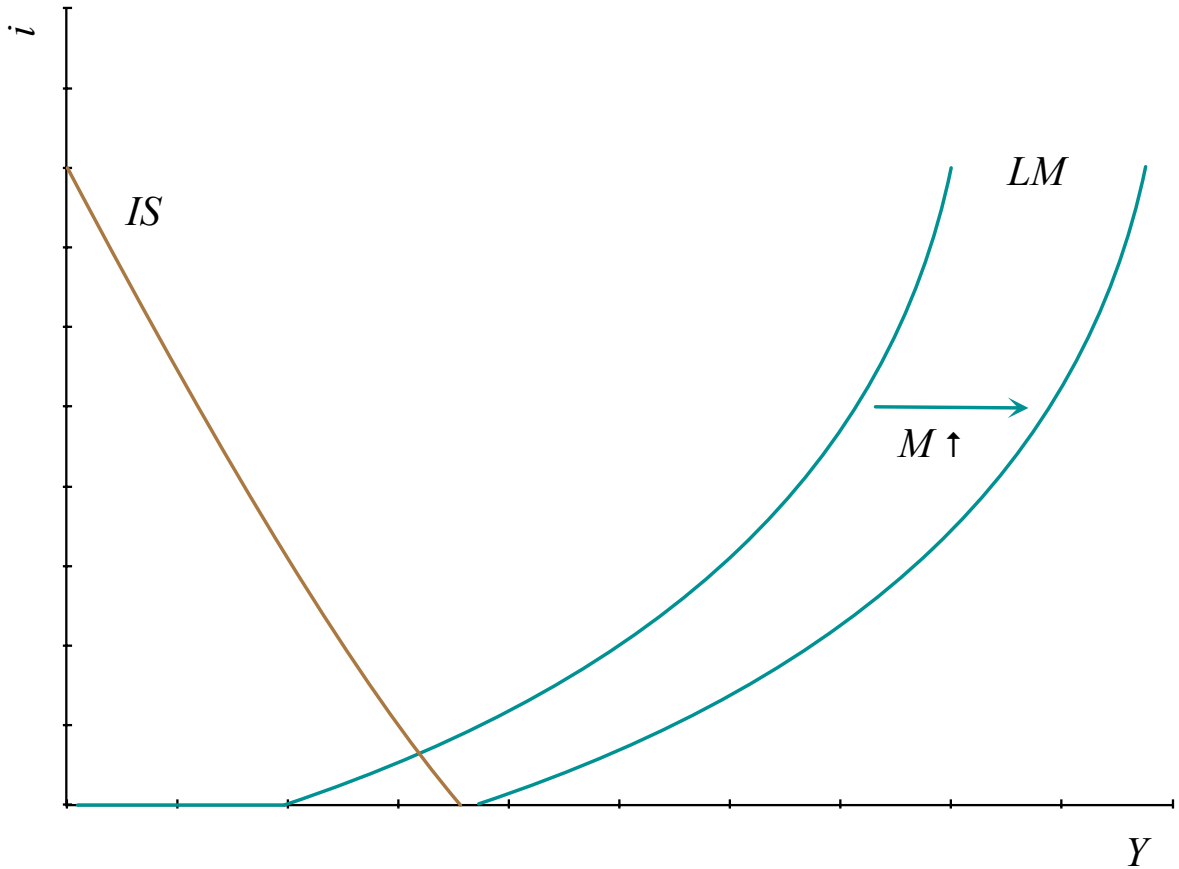
- The LM curve is derived by varying Y and tracing out $i, M/P$ points that clear the money market.
- For low Y the interest rate hits 0 and the LM curve becomes flat.

Liquidity Trap



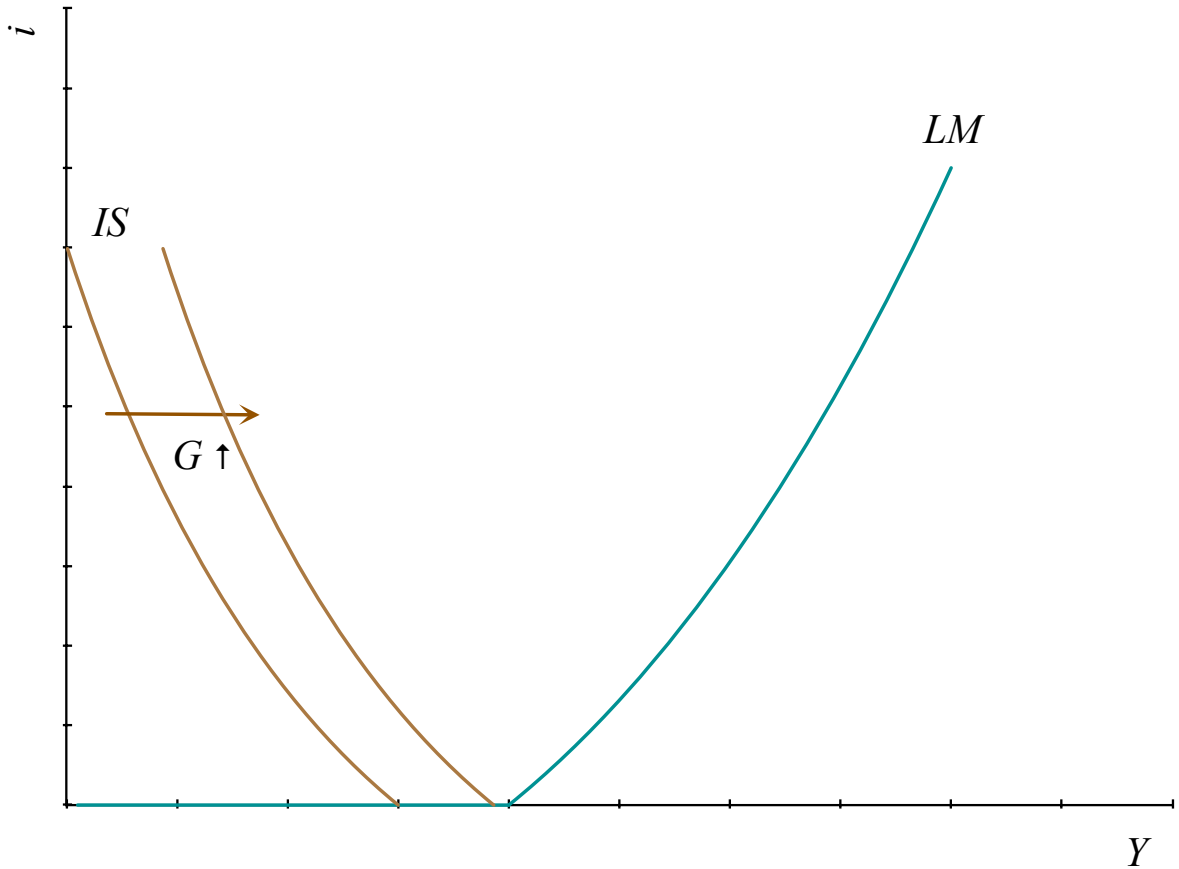
The LM curve is flat at 0 interest rates.

Liquidity Trap: Monetary Policy



Monetary policy becomes ineffective

Liquidity Trap: Fiscal Policy



Fiscal policy becomes highly effective

A Few Major Caveats

The IS-LM model makes the government look too powerful.

- By raising G it can achieve any level of Y.
- When is this a reasonable shortcut?

It looks like saving lowers output.

- What is missing?

Why Do We Still Have Recessions?

In the model, the government can stabilize output too easily.

Real world complications:

1. Big and variable lags until policies become effective
2. Lags in diagnosis and implementation of policies
3. Expansionary fiscal policies create debt
4. Expansionary monetary policies create inflation

An important point to remember

The IS-LM model makes strong assumptions: fixed prices, elastic supply, government can borrow without cost.

When applying the model, you need to consider how these assumptions modify the results.

(Or build a more comprehensive model)

Adding Banks

In the IS/LM model, the Fed looks very powerful.

- it controls i and thus investment.

In reality, the behavior of banks can undo monetary policy actions.

The role of banks

Banks take in deposits and turn them into loans.

A fraction of the deposits is held as **CB reserves**.

Reserves provide bank liquidity.

The Fed requires banks to hold about 10% of their deposits in reserves.

Adding Banks

Why do banks matter for monetary policy?

Suppose the Fed increases the supply of money.

- this is vague for now (how the Fed actually do this?)

Typically, this increases the amount of loans banks make, which drives down i.

In some situations, banks absorb the additional money without creating additional loans.

- they increase their CB reserves
- then monetary policy has no power to lower interest rates
  - example: 2008 financial crisis

The Money Multiplier

Money = currency + checkable deposits (+ perhaps other stuff)

- $M = CU + D$

The Fed does not directly control M.

It controls high powered money H

- supplied as currency CU or reserves central bank R.

How do we get from H to M?

- the answer is: via bank lending

Bank lending

In principle, banks do not need anything to make loans.

- you could make a loan right now

In principle, banks could make loans of unlimited size.

In practice, the **reserve requirement** limits bank lending

If the Fed requires that loans cannot exceed a fixed fraction $1/\bar{\theta}$ of reserves:

$$\bar{\theta} D \leq R \tag{1}$$

Typically, $\bar{\theta} \approx 0.1$.

Money Demand With Banks

- Households:

$$M^d = \$YL(i) \tag{2}$$

- Split into deposits D and currency CU.
- Assume: fraction c goes into currency

$$CU^d = cM^d \tag{3}$$

$$D^d = (1-c)M^d \tag{4}$$

- Banks: choose reserve ratio $\theta \geq \bar{\theta}$:

$$R^d = \theta D \tag{5}$$

$$= \theta(1-c)\$YL(i) \tag{6}$$

Money Market Clearing

$$H = CU^d + R^d \tag{7}$$
$$= [c + \theta(1-c)]\$YL(i) \tag{8}$$

With a fixed reserve ratio θ:

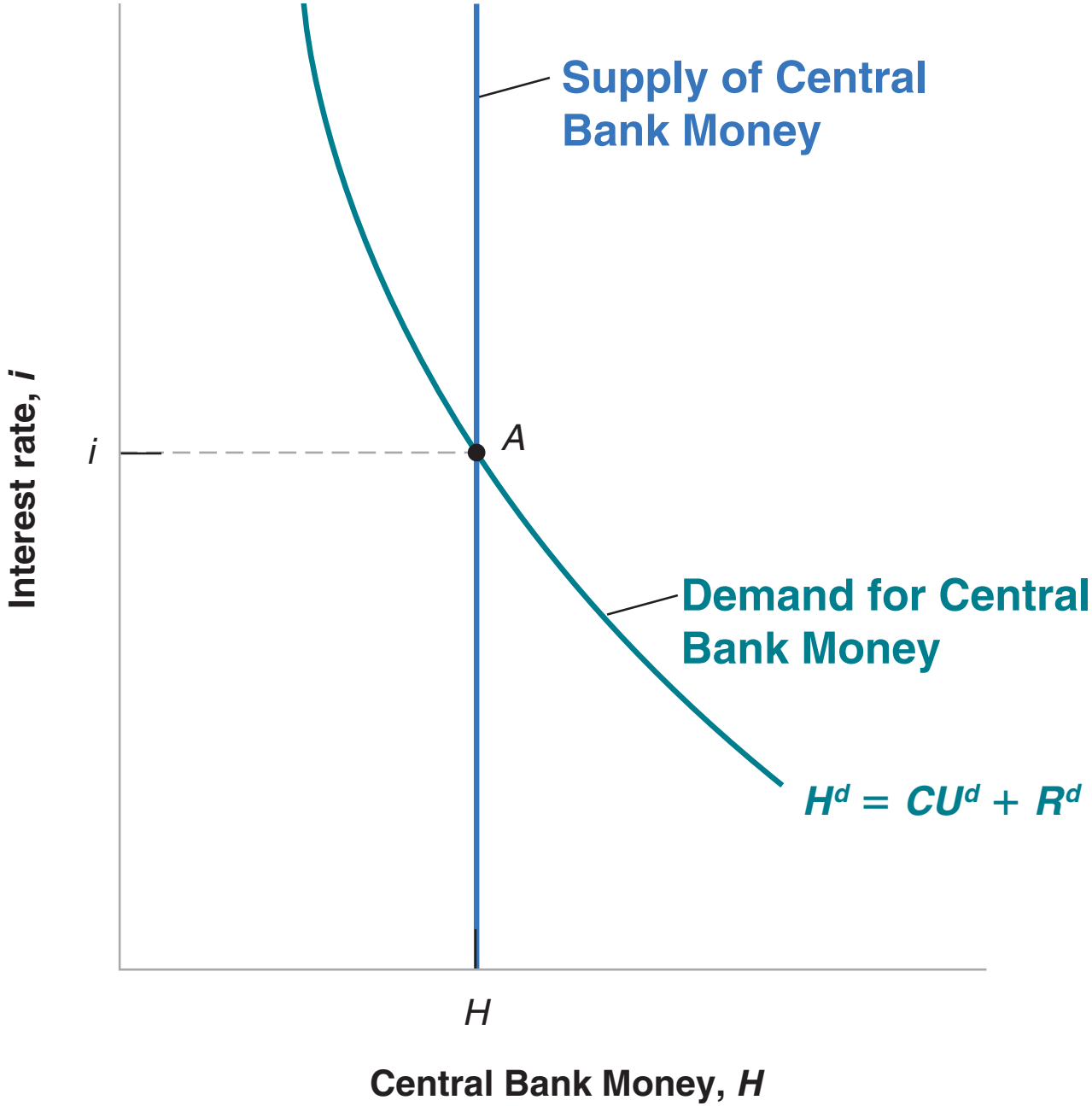
- higher $H \implies$ lower i

With variable θ:

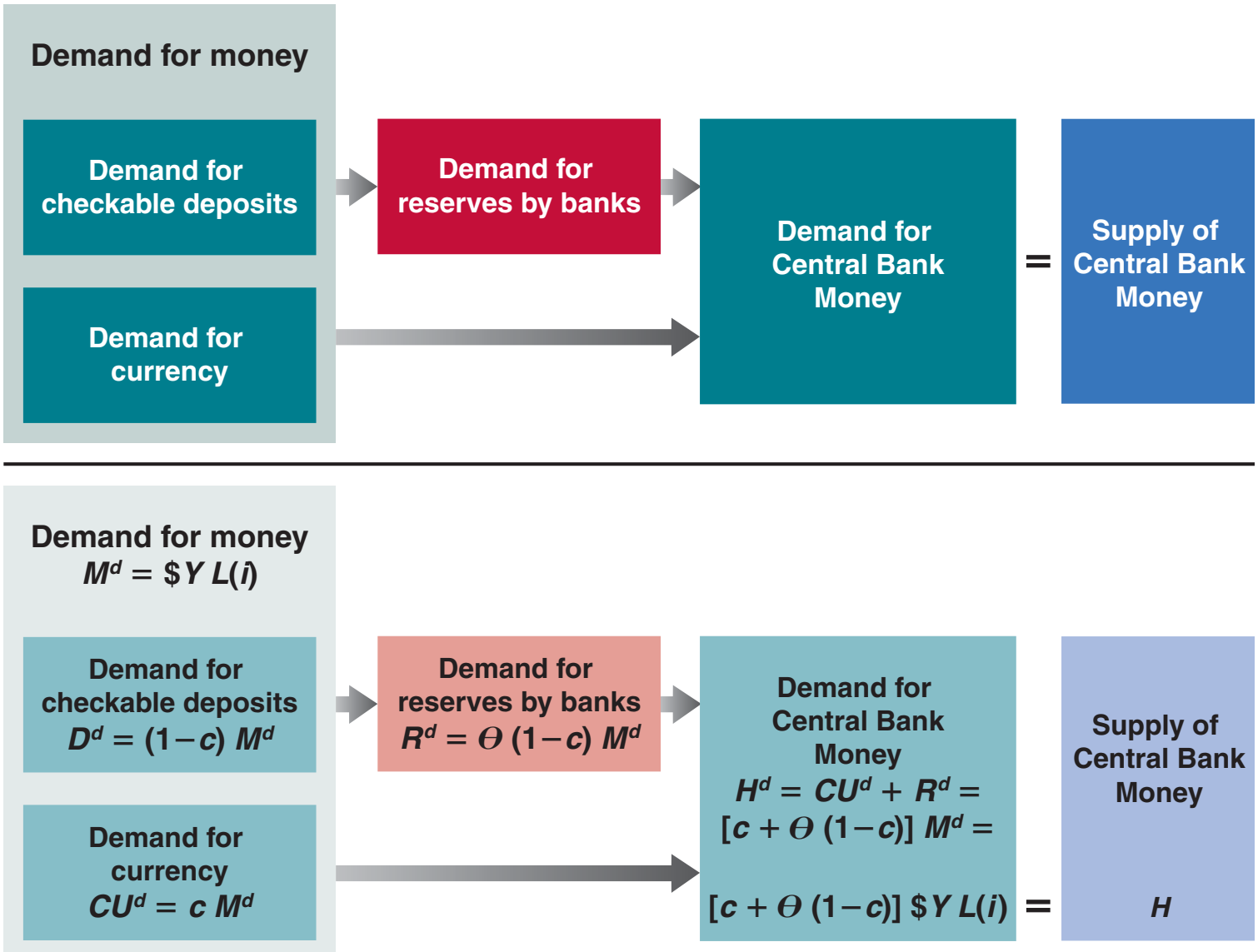
- bank actions can change the "effective" money supply and i even with constant H
- example: 2008. Banks raise θ to gain liquidity.

This is an important limitation of monetary policy.

Money Market Clearing



Money Market Clearing With Banks



The Money Multiplier

$$\frac{1}{c+\theta(1-c)}H = \$YL(i) \tag{9}$$

A \$1 increase in CB money supply increases money available to households by $\frac{1}{c+\theta(1-c)} > 1$

The lower the reserve ratio θ, the larger the multiplier

Intuition: each dollar of H can be lent out many times

- round 1: lend $(1-\theta)$ and put θ in reserves
- round 2: $(1-\theta)$ returns as new deposits and is lent out again
- round 3: ...

The Fed Funds Rate

Long ago, changing the reserve requirement $\bar{\theta}$ was an important tool of monetary policy

- this is no longer the case

Today, the main monetary policy tools is the **Federal Funds Rate**

- Banks lend reserves to each other over night at the Fed Funds Rate
- The Fed controls the FFR tightly by choosing available reserves

The mechanism:

- $H \downarrow \Longrightarrow R \downarrow \Longrightarrow i \uparrow$
- again, the complication is that banks may reduce θ which dampens the effect on i

Reading

- Blanchard / Johnson, Macroeconomics, 6th ed, ch. 5 and 9.2