IS-LM Equilibrium

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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:
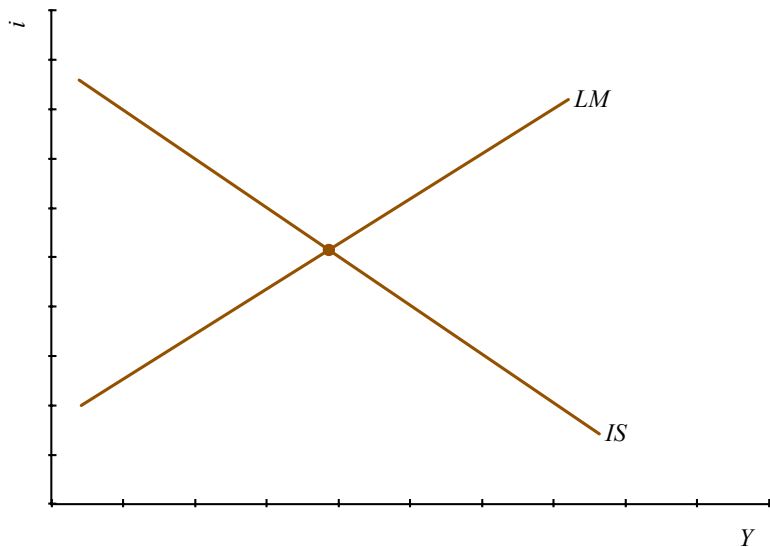   - IS: $Y = C(Y - T) + I(Y, i) + G$
    - LM: $M/P = YL(i)$

IS-LM Graph
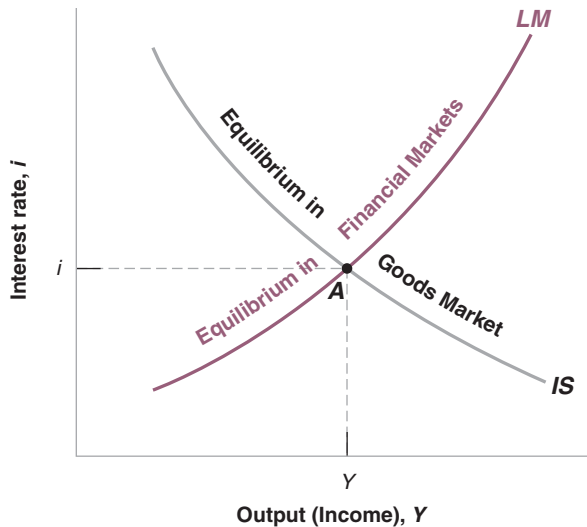
What happens in each market in each quadrant?

Applications

Increasing Taxes

IS: $Y = C(Y - T) + I(Y, i) + G$. LM: $M/P = YL(i)$. The shock: $T \uparrow$

Increasing Taxes: The Process

Key point:

- $Y \downarrow \Longrightarrow$ agents hold too much money.
- Selling money means buying bonds.
- This drives up bond prices.
- This drives down interest rates.
- This stimulates demand for goods.
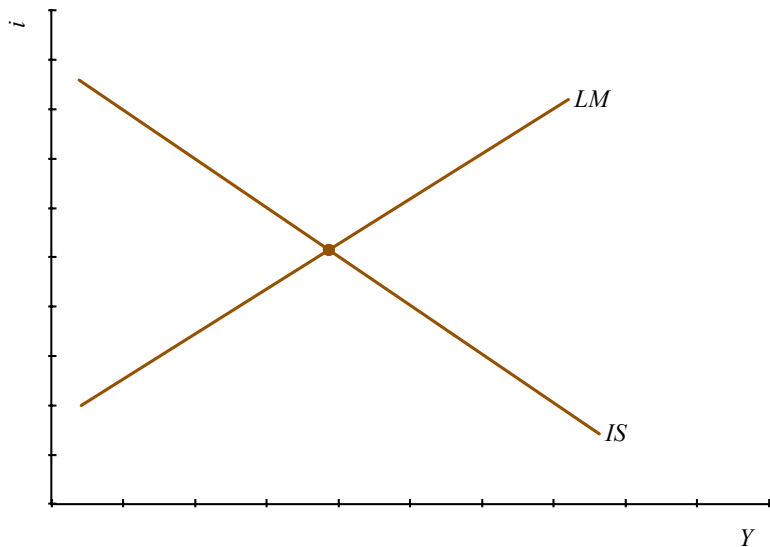
Taxes and Investment

- ▶ 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
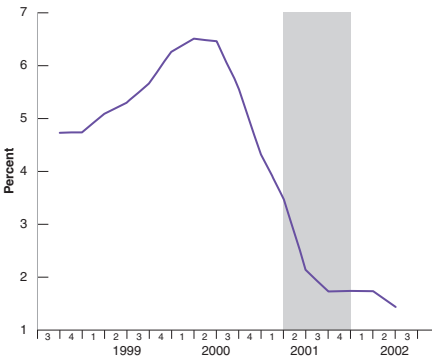- In a typical recession, monetary and fiscal policies expand

Example: 2001 Recession

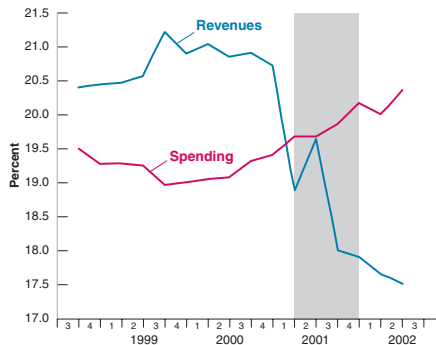Growth rate of output
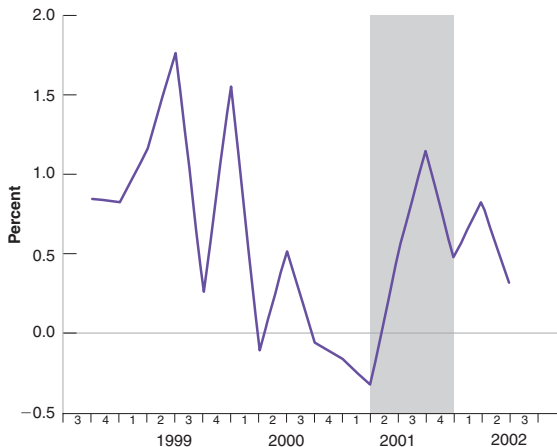
The shock: bursting of
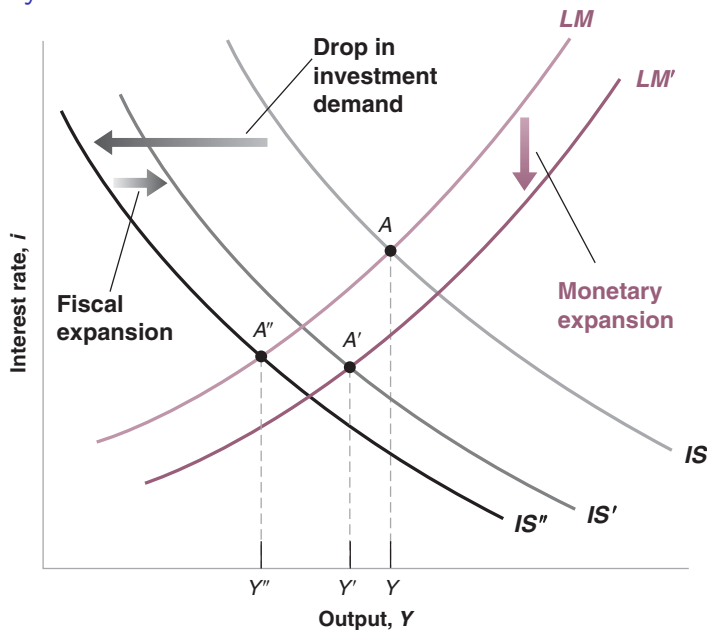the tech bubble $\implies I\downarrow$

Policy Responses

Federal funds rate

Government spending / revenue

Analysis of the 2001 Recession

How Effective are Tax Cuts?

IS: $Y = \bar{Z} + (b_1 + c_1)Y - c_1 T - b_2 i$

Solve for the interest rate:

$$i = \frac{\bar{Z} - c_1 T - (1 - b_1 - c_1)Y}{b_2} \qquad (1)$$

Key parameter: c_1 – the marginal propensity to consume.

Slope of IS: $(1 - b_1 - c_1)/b_2$

- ▶ high MPC implies flat IS
- ▶ intuition?

How Effective are Tax Cuts?

Shifter of IS (vertical): $di/dT = -c_1$

- ▶ high MPC implies large vertical shifted
- ▶ intuition?

Shifter of IS (horizontal): $dY/dT = -\frac{c_1}{1-b_1-c_1}$

- ▶ high MPC implies large horizontal shift
- ▶ unsurprising

Graph: **tax cuts are less effective when MPC is low**.

How Large is the MPC?

> *Empirical estimates of the aggregate marginal propensity to consume (MPC) in the U.S. range from 0.05 to 0.9 depending on the event and sample of the study. – Background: Marginal Propensities to Consume in the 2021 Economy —{} Penn Wharton Budget Model*

That's a pretty wide range!

Why so wide?

Key point

There is no one MPC.
Each person has their own MPC.
Each stimulus / shock has its own MPC.

A Simple Model

Assumptions:

▶ Households like smooth consumption

▶ They can borrow and lend freely

Budget constraint:

present value of consumption = present value of income + initial wealth

Why?

▶ We derive this later for the government

▶ The same logic applies to any household who can borrow and save

If you want to see the details in a more general model, see the slides from previous years.

A Simple Model

Simplifying assumption: households want **constant** consumption

▶ more general: smooth consumption, but the implications are the same

Simplifying assumption: the real interest rate is zero

▶ non-zero interest rates change the math, but not the message

Then the budget constraint is simply:

$$\sum_{t=1}^{T} c_t = T\bar{c} = \sum_{t=1}^{T} (y_t - T_t) + a_1 \qquad (2)$$

Marginal propensity to consume: $1/T$

▶ age 20; life-expectancy 85: MPC $= 1/65$
▶ age 50; life-expectancy 85: MPC $= 1/35$

Implications

The MPC should be small for most people.

- ▶ key, robust intution ...

But **permanent** tax cuts are very different.

- ▶ MPC = ...

Expectations of future income matter a lot.

- ▶ we come back to that point later.

So tax cuts are hopeles for stimulating the economy?

- ▶ who has a high MPC?

Implications

Tax cuts can be effective, but they need to target the right populations.

- ▶ tax cuts that benefit the rich are mostly saved
- ▶ tax cuts that benefit the poor are mostly consumed
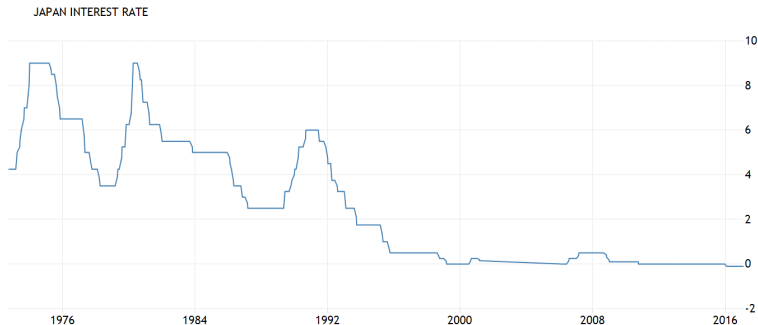
Liquidity Traps

- 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"

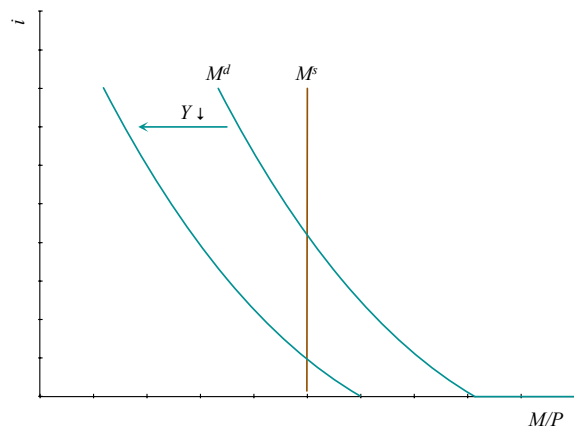# US Federal Funds Rate
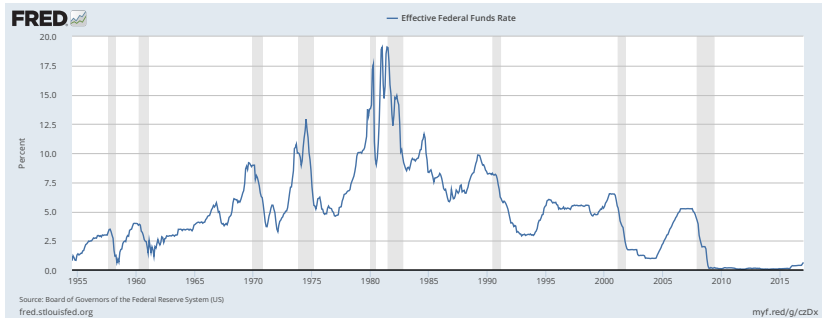
Soure: Fred

Japan's Central Bank Rate

JAPAN INTEREST RATE

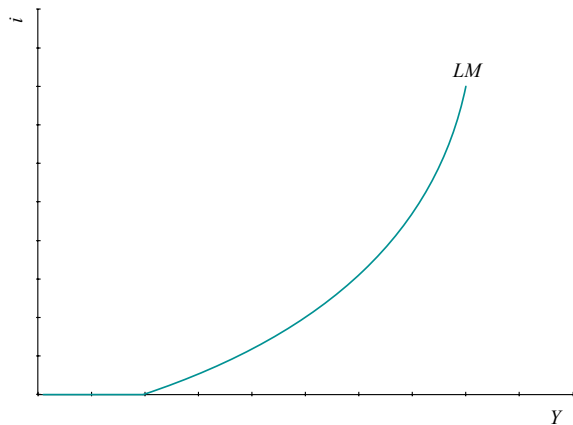SOURCE: WWW.TRADINGECONOMICS.COM | BANK OF JAPAN

Source: Trading Economics

Liquidity Trap

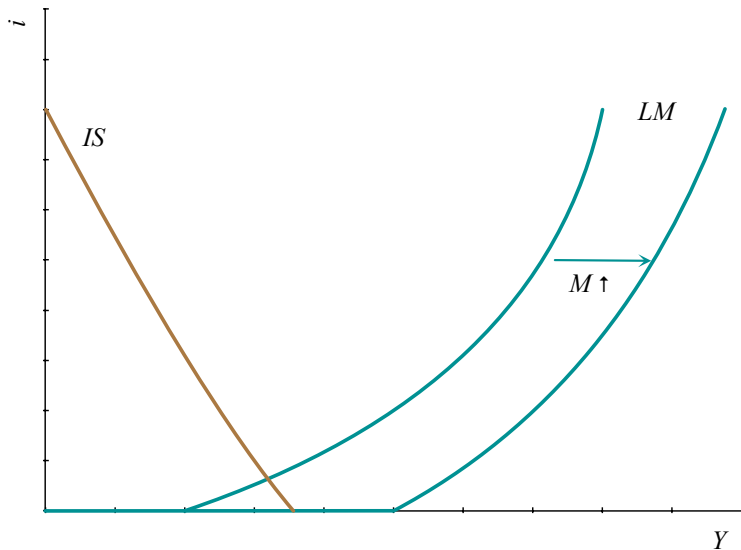- The LM curve is derived by varying Y and tracing out $i, M/P$ points that clear the money market.
- For low Y the interest rate hits 0 and the LM curve becomes flat.

Liquidity Trap

The LM curve is flat at 0 interest rates.
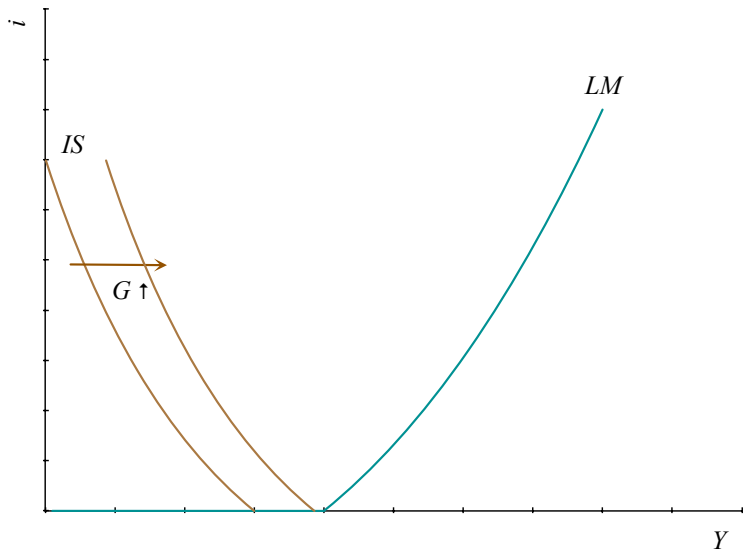
Liquidity Trap: Monetary Policy

Monetary policy becomes ineffective

Policy options in a liquidity trap

If the interest rate is zero, what can the Fed do?

Liquidity Trap: Fiscal Policy

Fiscal policy becomes highly effective

The Role of Expectations

Consumption and investment decisions are forward looking.

Future output increases today's spending.

Implications for policy:

1. Expectations become a policy tool.
2. Persistent policies are stronger than temporary ones.

Expectations: Monetary Policy

A monetary expansion now has 2 effects:

1. direct: $i \downarrow \implies LM$ shifts right
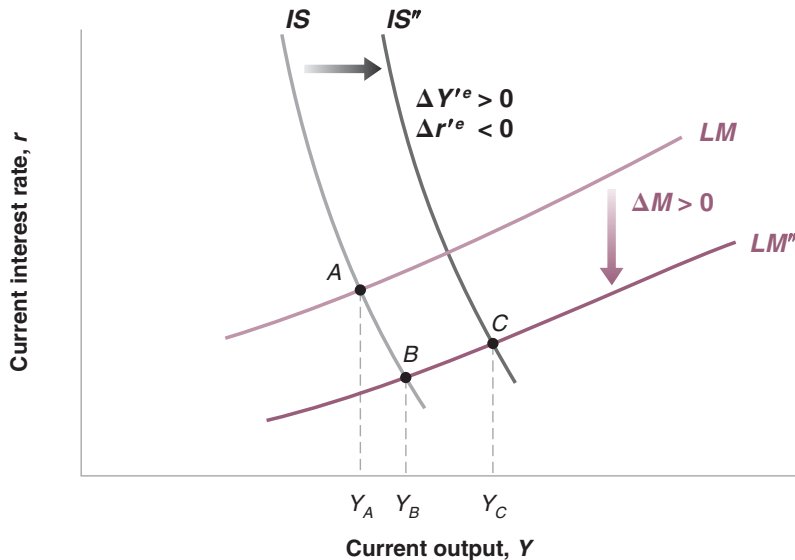2. indirect: expectations change

Transitory monetary expansion:

- ▶ no change in future Y', i' (primes denote future)
- ▶ small policy effect

Persistent monetary expansion:

- ▶ expect LM to stay shifted
- ▶ $Y' \uparrow$ and $i' \downarrow$
- ▶ IS shifts right as well

Expectations: Monetary Policy

Transitory $M \uparrow$: $A \to B$. Persistent $M \uparrow$: $A \to C$

Expectations: Monetary Policy

Key point

Monetary policy is more powerful, if it can change expectations.

Example

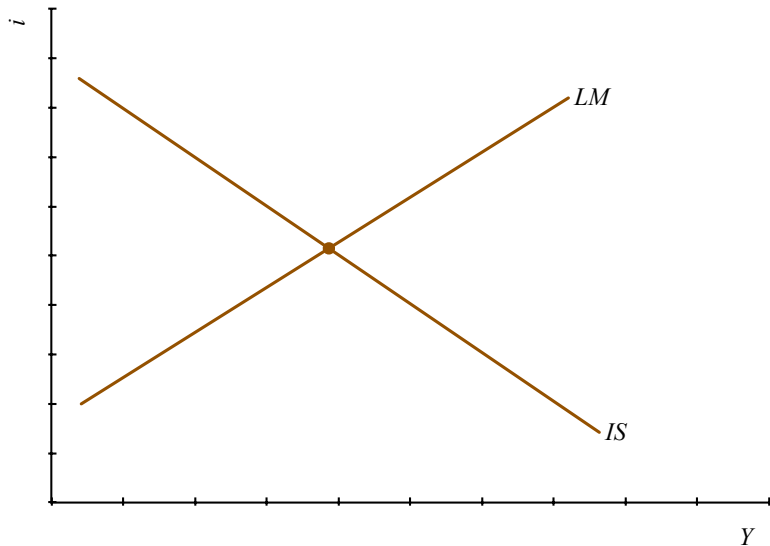Quantitative Easing
The Fed buys large amounts of long-term bonds.
Signals that interest rates will remain low for a long time.

Expectations: Fiscal Policy

Can a cut in government spending stimulate aggregate demand?

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)

Reading

Blanchard (2018), ch. 5 and 9.2; ch. 17 on expectations.

References I

Blanchard, O. (2018): *Macroeconomics*, Boston: Pearson, 8th ed.