

The Short-Run: IS/LM

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Issues

- ▶ In the growth models we studied aggregate demand was irrelevant.
- ▶ We always assumed there is enough demand to employ all factors / sell all output.
- ▶ Why is this appropriate for long-run analysis?

The Short and the Long Run

- ▶ Macroeconomics distinguishes between short run, medium run, long run.
- ▶ Short run: supply is elastic
 - ▶ only demand matters
 - ▶ IS/LM model
- ▶ Medium run: supply depends on prices
 - ▶ demand and supply matter
 - ▶ price setting mechanisms push output towards trend
 - ▶ AS/AD model
- ▶ Long run: output is on its trend growth path
 - ▶ only supply matters
 - ▶ capital stock adjusts
 - ▶ growth models

Why Isn't There One Model?

- ▶ There actually is one model, but it's too complicated to teach.
- ▶ The model has “frictions” that give rise to unemployment, business cycles, ...
- ▶ Over longer horizons, price adjustments (mostly) overcome the frictions
- ▶ The economy moves towards a long-run trend path that is (mostly) independent of these frictions

Objectives

In this section you will learn:

1. how to set up and interpret the IS-LM model
2. what its limitations are
3. how to solve for the equilibrium
4. how to analyze the effects of shocks and policies

IS-LM Model

Key assumptions:

- ▶ Output is determined by aggregate demand
- ▶ There is no supply side
- ▶ Prices are fixed
- ▶ Closed economy

We relax all of these assumptions later.

IS-LM Model

Two markets

- ▶ Goods (IS). Money (LM)
- ▶ In the background there is also a bond market

Two endogenous variables

- ▶ Output (Y). Interest rate (i)

Two policy variables

- ▶ Government spending (G). Money supply (M)

The Goods Market: IS Curve

Aggregate Demand

Start from an identity

$$Z = C + I + G + X - IM$$

Z is aggregate demand / expenditure.

For now: closed economy with $X - IM = 0$.

Add behavioral assumptions to give it content.

Consumption function

$$C = C(Y_D) = c_0 + c_1 Y_D \quad (1)$$

$Y_D = Y - T$: disposable income (after taxes and transfers)

c_0 : “autonomous consumption” (intercept)

c_1 : marginal propensity to consume (slope)

$s = 1 - c_1$: marginal propensity to save

Consumption might also depend on wealth, interest rates, expected incomes, etc.

- ▶ these are stuffed into c_0

Investment function

$$I = I(Y, i) = \bar{I} + b_1 Y - b_2 i \quad (2)$$

Government

- ▶ Exogenous G and T .
- ▶ G is government consumption
- ▶ T is tax revenue net of transfer payments

Goods Market Clearing

Assumption: supply is perfectly elastic.

$$Y = C + I + G \quad (3)$$

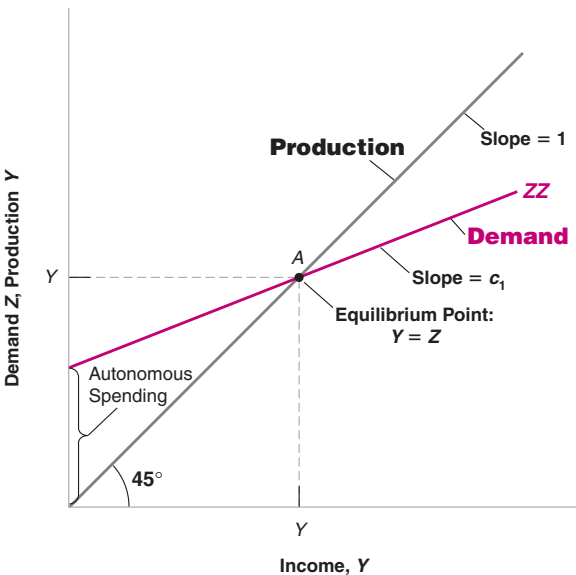
$$= \underbrace{[c_0 + \bar{I} + G - c_1 T]}_{\bar{Z}} + (c_1 + b_1)Y - b_2 i \quad (4)$$

\bar{Z} : autonomous spending / demand

Solve to get the IS curve:

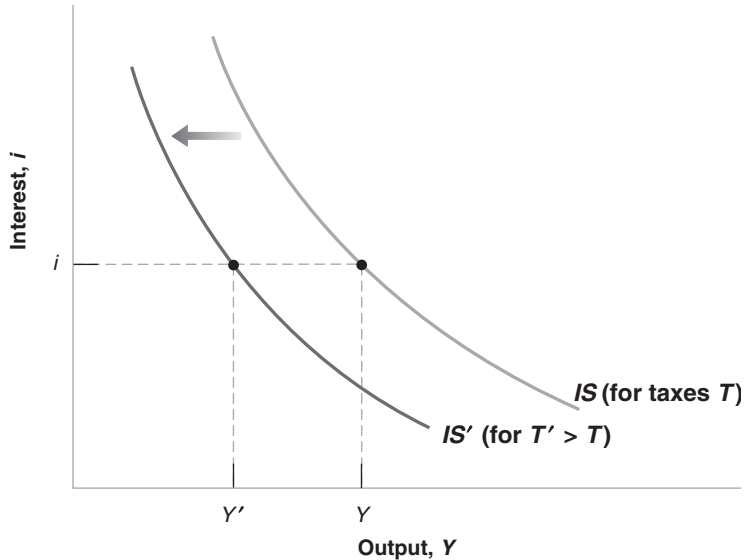
$$Y = \frac{\bar{Z} - b_2 i}{1 - c_1 - b_1} \quad (5)$$

Goods Market Clearing



What happens when the interest rate i rises?

IS Curve



Intuition: IS Curve

Why is IS downward sloping?

Shifting the IS Curve

Only autonomous demand \bar{Z} shifts IS

Example: $G \uparrow$

- ▶ Excess demand \rightarrow Need higher i to reduce I
- ▶ New IS curve shifted up

What else shifts IS?

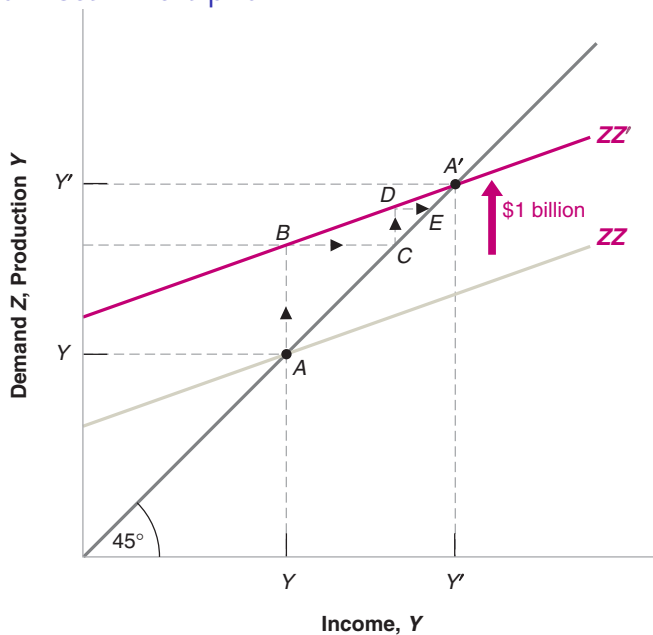
Clearly distinguish moving along the curve vs. shifting the curve!

The Fiscal Multiplier

$$Y = \frac{\bar{Z} - b_2 i}{1 - c_1 - b_1} \quad (6)$$

- ▶ Increasing government spending by \$1 \Rightarrow increasing Y by $1/(1 - c_1 - b_1)$.
- ▶ This holds the interest rate constant (which will not be true in equilibrium)
- ▶ Intuition:

The Fiscal Multiplier



Saving Equals Investment

- ▶ We can also think about goods market clearing as equating saving with investment.
- ▶ Private saving: $S = Y_D - C = Y - T - C$
- ▶ Public saving: $S^P = T - G$
- ▶ Total saving equals investment: $I = Y - T - C + T - G$
- ▶ This yields goods market clearing

$$Y = C + I + G \quad (7)$$

The Money / Bond Market: LM Curve

LM Curve

The LM curve equates supply and demand of “money.”

What is “money”?

Money Demand

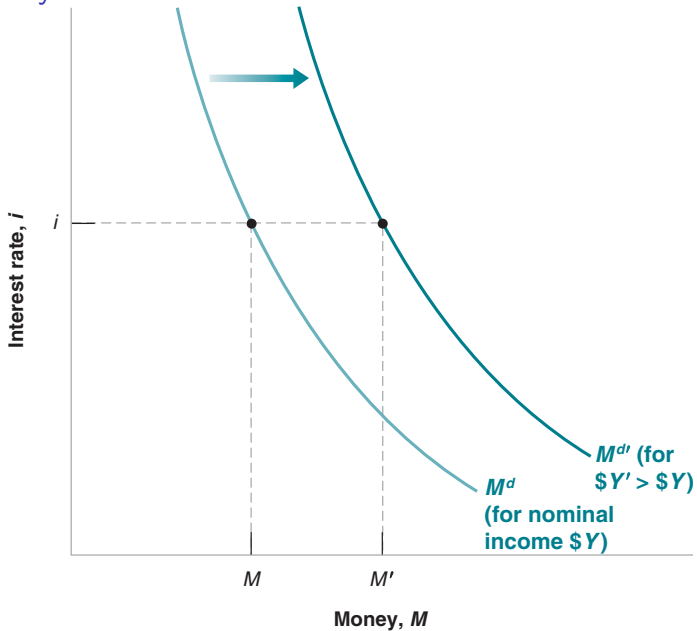
How to divide wealth between “money” and bonds?

- ▶ Money: liquidity benefit
- ▶ Bonds: interest benefit
- ▶ Division depends on
 - ▶ transactions volume (nominal income)
 - ▶ interest rate

Money demand can then be written as

$$M^d = \$Y \times L(i) \quad (8)$$

Money Demand



Money Supply

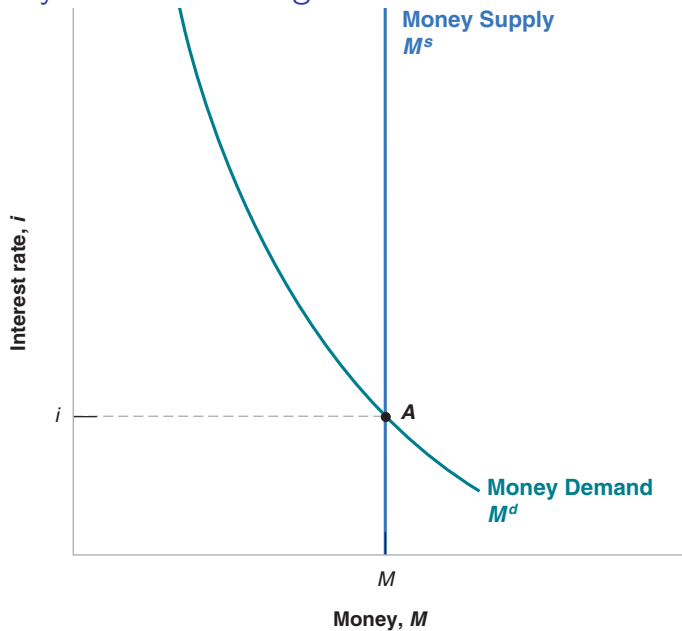
- ▶ Real world: money = [currency] + [checkable deposits]
- ▶ Currency: controlled by CB
- ▶ Checkable deposits: created by banks
- ▶ For now: assume that CB controls money supply

$$M = M^s \quad (9)$$

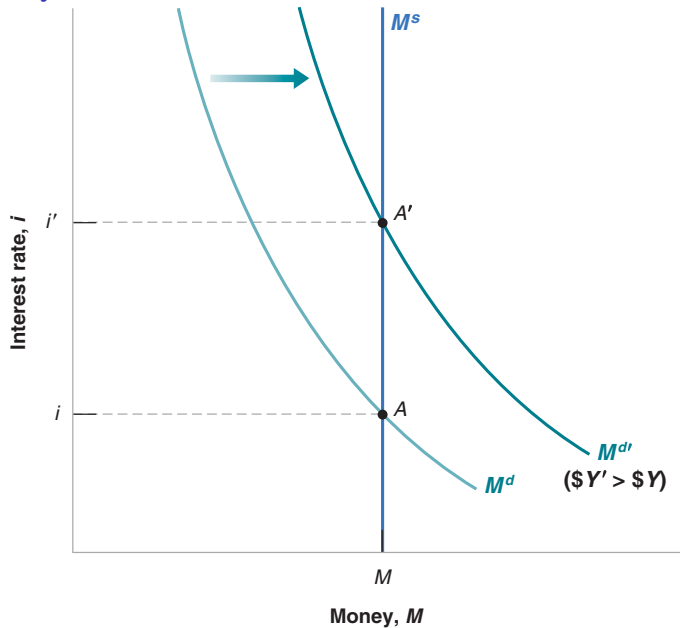
- ▶ Money market clearing:

$$M = YL(i) \quad (10)$$

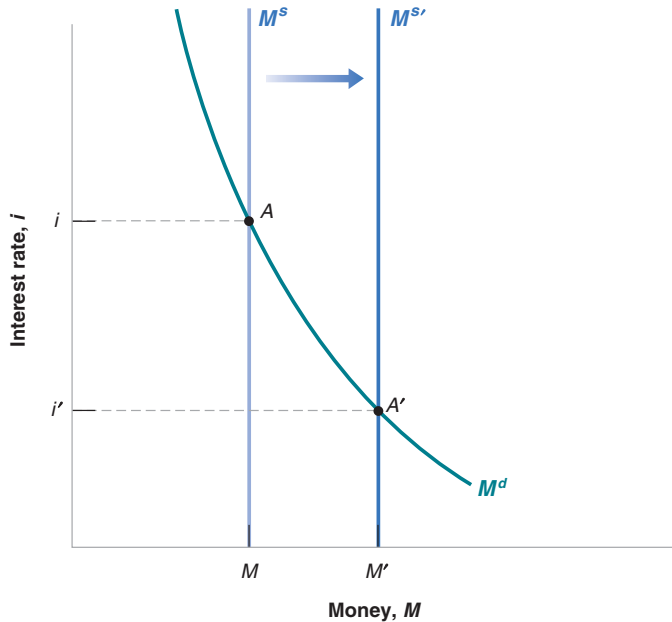
Money Market Clearing



Money Demand Increases



Money Supply Increases



Open Market Operations

- ▶ The markets for money and bonds are linked.
- ▶ To increase the money supply, the CB buy bonds and pays with currency.
- ▶ The price of bonds rises \implies the bond yield i falls.
- ▶ A complication: the CB has no direct control over the supply of bonds / the bond interest rate.
 - ▶ open market operations do not always work

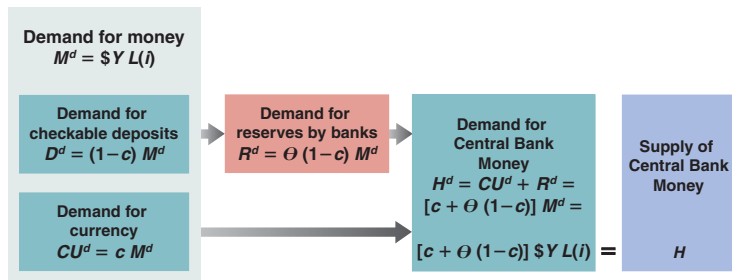
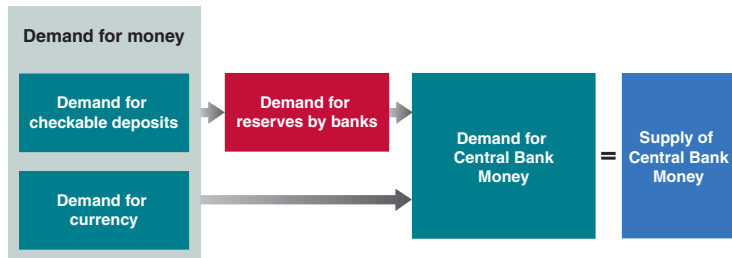
Adding Banks

- ▶ The behavior of banks can undo monetary policy actions.
- ▶ 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.
- ▶ 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 reserves
 - ▶ then monetary policy has no power to lower interest rates
 - ▶ example: 2008 financial crisis

Money Market Clearing With Banks



CB supplies high powered money H as currency CU or reserves R .

Money Demand With Banks

- ▶ Households:

$$M^d = \$YL(i) \quad (11)$$

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

$$CU^d = cM^d \quad (12)$$

$$D^d = (1 - c)M^d \quad (13)$$

- ▶ Banks: choose reserve ratio θ :

$$R^d = \theta D \quad (14)$$

$$= \theta(1 - c)\$YL(i) \quad (15)$$

Money Market Clearing

$$H = CU^d + R^d \quad (16)$$

$$= [c + \theta(1 - c)]\$YL(i) \quad (17)$$

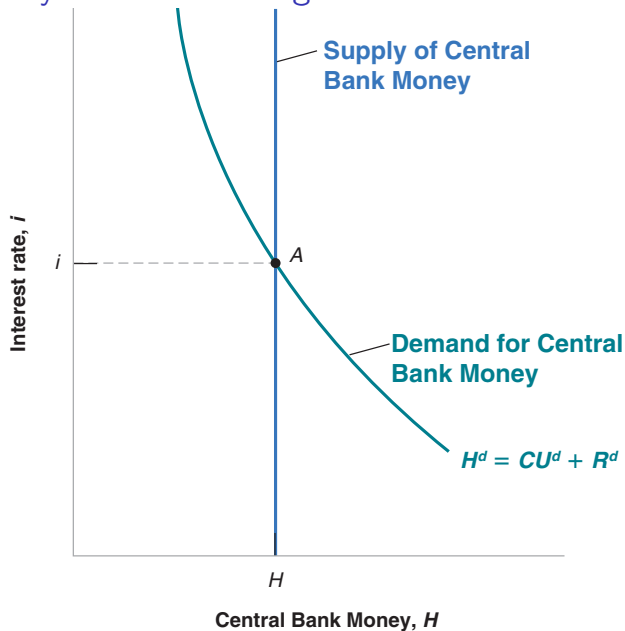
With a fixed reserve ratio θ :

- ▶ 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.

Money Market Clearing



The Money Multiplier

$$\frac{1}{c + \theta(1 - c)} H = \text{\$}YL(i) \quad (18)$$

- ▶ 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

- ▶ In the US, the main monetary policy tool 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:
 - ▶ $H \downarrow \implies R \downarrow \implies i \uparrow$
 - ▶ again, the complication is that banks may reduce θ which dampens the effect on i

Reading

- ▶ Blanchard / Johnson, Macroeconomics, ch. 3-4