The Short-Run: IS/LM

Prof. Lutz Hendricks

Econ520

January 10, 2023

Objectives

In this section, we are concerned with the short-run IS-LM model

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

All of this is review of material you previously learned in Intermediate Macro.

IS-LM Model

Key assumptions:

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

Think: economy in recession, with lots of unemployed resources.

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)

Modeling Choices

Why does the model have these ingredients?

We want to talk about monetary and fiscal policies

- ▶ main instruments for business cycle stabilization

Main outcome of interest: output Y

- ▶ so we need aggregate demand for goods

Monetary policy mainly works by changing interest rates i

- ▶ so we need the money / bond market

Fixed prices are for simplicity only.

The Goods Market: IS Curve

Aggregate Demand

Start from an accounting 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

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

$Y_D = Y - T$: 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, expected incomes, etc.

▶ these are stuffed into c_0

Investment function

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

Investment depends on:

- ▶ interest rate i: cost of capital
- ▶ output Y: aggregate demand
- ▶ expectations etc (again stuffed into the intercept $\bar{I}$)

Government

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

Aggregate Demand

$$Z = C + I + G \tag{3}$$
$$= [c_0 + c_1(Y - T)] + [\bar{I} + b_1 Y - b_2 i] + G \tag{4}$$
$$= \underbrace{[c_0 + \bar{I} + G - c_1 T]}_{\bar{Z}} + (c_1 + b_1)Y - b_2 i \tag{5}$$

$\bar{Z}$: autonomous spending / demand

In words / intuition ...

Isn't this completely arbitrary?

Yes, it is arbitrary.

- ▶ We just made up a consumption function from introspection.
- ▶ Shouldn't we use data?

Is this "bad"?

- ▶ It depends on the purpose of the model.

A simple model is a story told through math.

The IS/LM story

This model roughly tells the following story.

The government has three ways of affecting AD

1. Buy goods (G)
2. Tax income (T)
   because AD depends on after tax income.
3. Change interest rates (i)
   because the interest rate affects saving (C) and borrowing for investment (I)

There are complicated interactions because

- ▶ i depends on AD (money market clearing)
- ▶ AD depends on income (a multiplier effect)

Goods Market Clearing

Assumption: supply is perfectly elastic
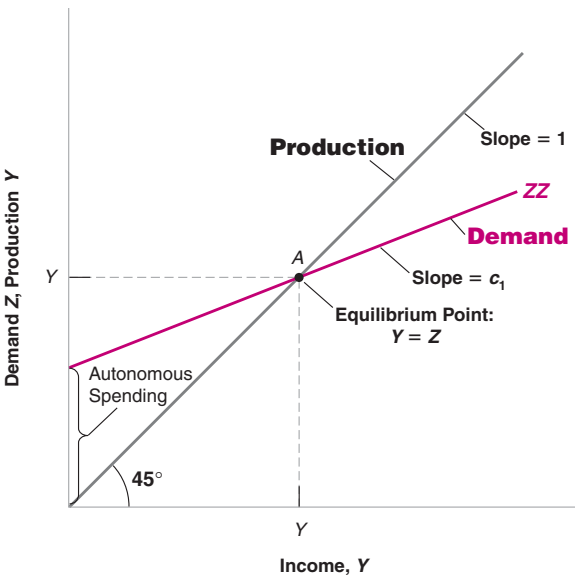
$$Y = Z = \bar{Z} + (c_1 + b_1)Y - b_2 i \tag{6}$$

Rearrange to get the IS curve:

$$Y = \frac{\bar{Z} - b_2 i}{1 - c_1 - b_1} \tag{7}$$

Key assumption: marginal propensity to spend $c_1 + b_1 < 1$.

▶ otherwise we have serious problems...
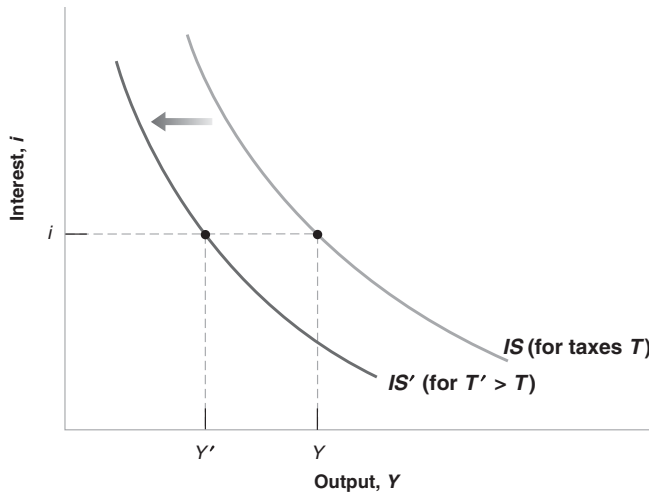
Goods Market Clearing

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

What happens when the interest rate i rises?

IS Curve

IS collects all (Y, i) for which the goods market clears.

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!
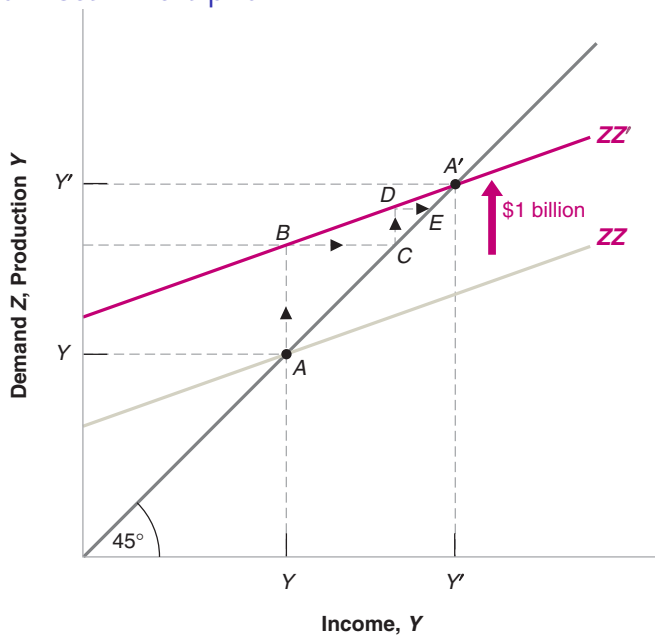
The Fiscal Multiplier

$$Y = \frac{\bar{Z} - b_2 i}{1 - c_1 - b_1} \tag{8}$$

Increasing government spending by \$1 $\implies$ 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:

$$S = Y_D - C = Y - T - C \qquad (9)$$

Public saving:

$$S^P = T - G \qquad (10)$$

Total saving equals investment:

$$I = \underbrace{Y - T - C}_{S} + \underbrace{T - G}_{S^P} \qquad (11)$$

This yields goods market clearing

$$Y = C + I + G \qquad (12)$$

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
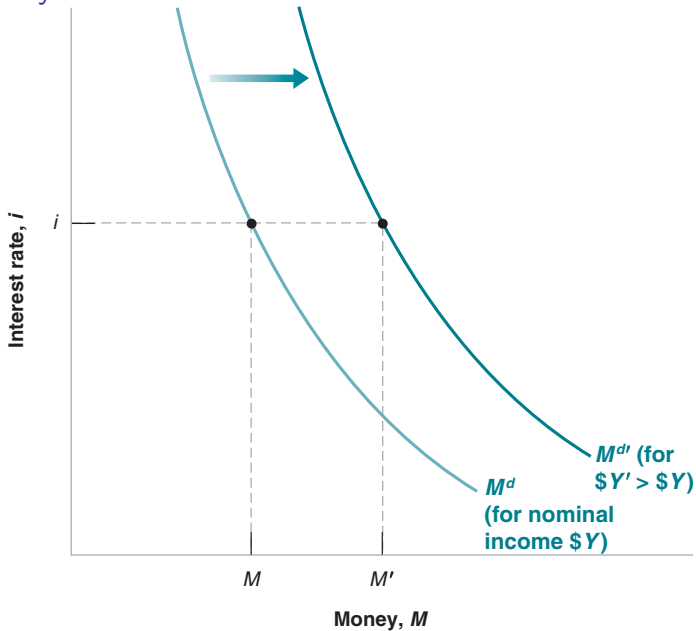▶ Bonds: interest benefit

Division depends on

▶ transactions volume (nominal income)
▶ interest rate

Money demand can then be written as

$$M^d = \$Y \times L(i) \qquad (13)$$

$\$Y$ is nominal income (in dollars)

Money Demand

Interest rate, *i*

i

M^d (for nominal income $Y)

$M^{d'}$ (for $Y' > Y)

M M'

Money, *M*

Money Supply

Real world: money = [currency] + [checkable deposits] + [more?]

Currency: controlled by CB

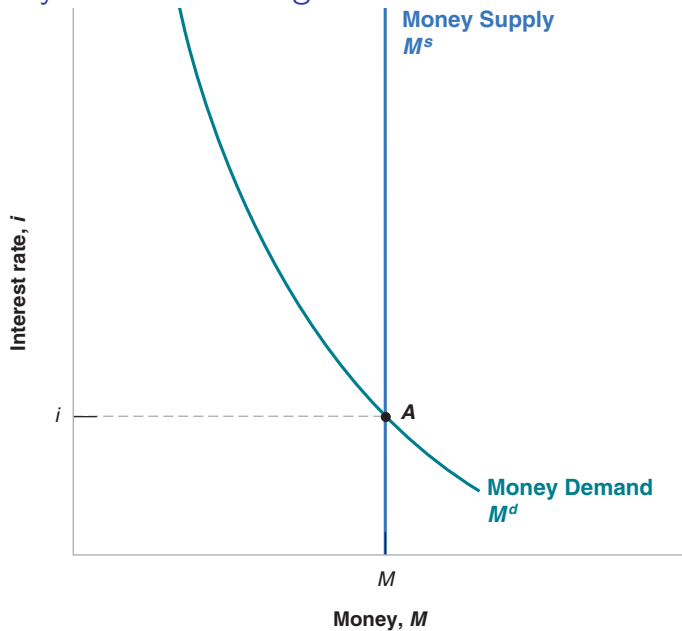Checkable deposits: created by banks (**not** controlled by CB)

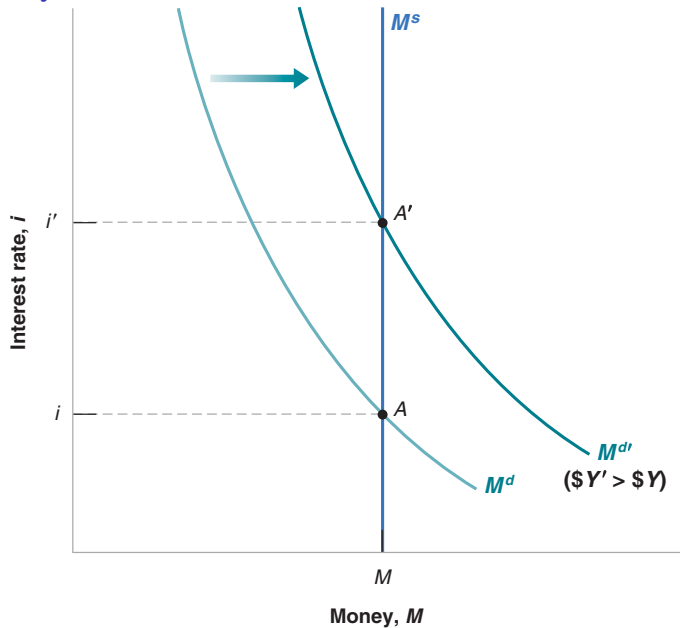For now: assume that CB controls money supply

$$M = M^s \tag{14}$$

Money market clearing:
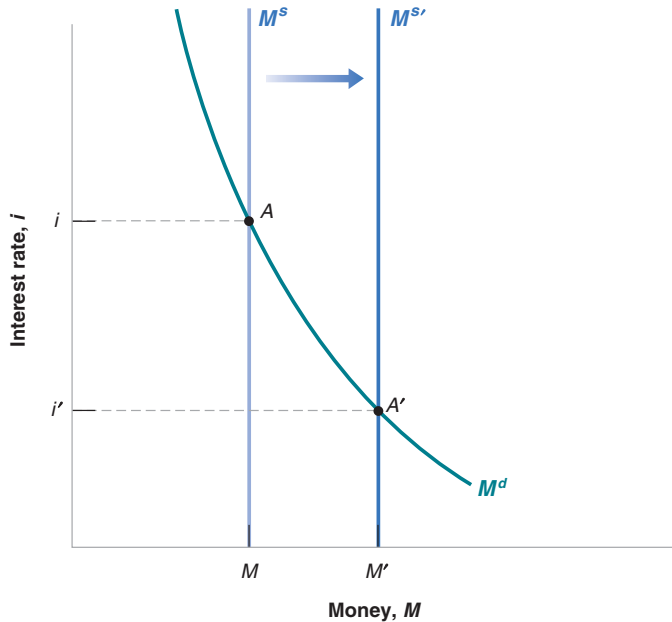
$$M^s = \$YL(i) \tag{15}$$

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

Reading

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