

# Intermediate Macroeconomics II

## Lecture 2: From RBC to IS–LM

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Spring 2026

# Today: why we move from RBC to IS–LM

- Last time (RBC): output and the **real interest rate** are pinned down by **real** constraints and intertemporal choices.
- This semester's focus: **inflation and the price level** — so we must add a **nominal side**.
- IS–LM is our **first bridge model**:
  - IS = goods market equilibrium (a reduced-form view of intertemporal demand)
  - LM = money market equilibrium (how nominal variables enter)

## What you should be able to do after Lecture 2

Explain how **goods demand** and **money demand** jointly determine  $(Y, r)$  in the short run, and how policy shifts the system.

# Recap: what RBC gives us

# RBC in one slide: what we learned (and what we did *not*)

- **RBC core idea:** flexible prices  $\Rightarrow$  markets clear  $\Rightarrow$  output is tied to productivity and factor supply.
- The key intertemporal price is the **real rate**  $r_t$ :

$$1 = \beta \mathbb{E}_t \left[ \frac{u'(C_{t+1})}{u'(C_t)} (1 + r_t) \right].$$

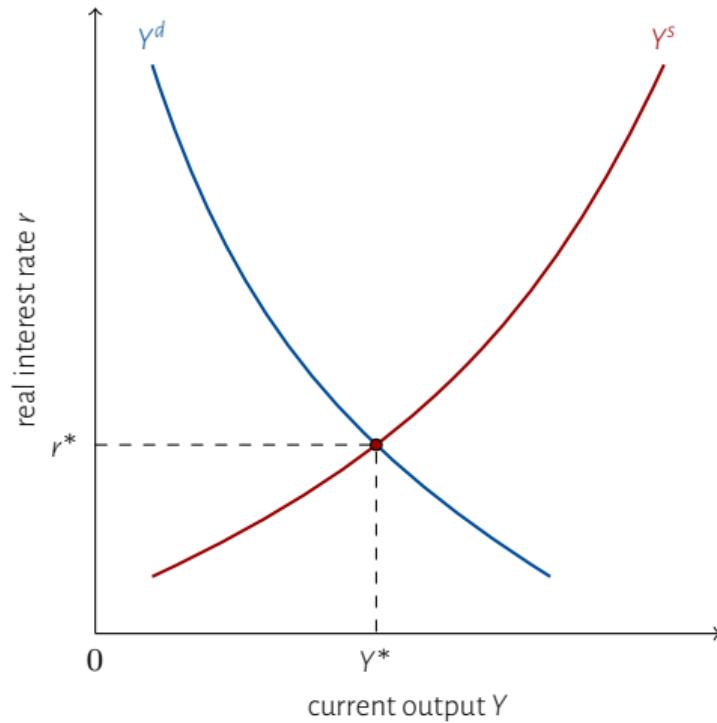
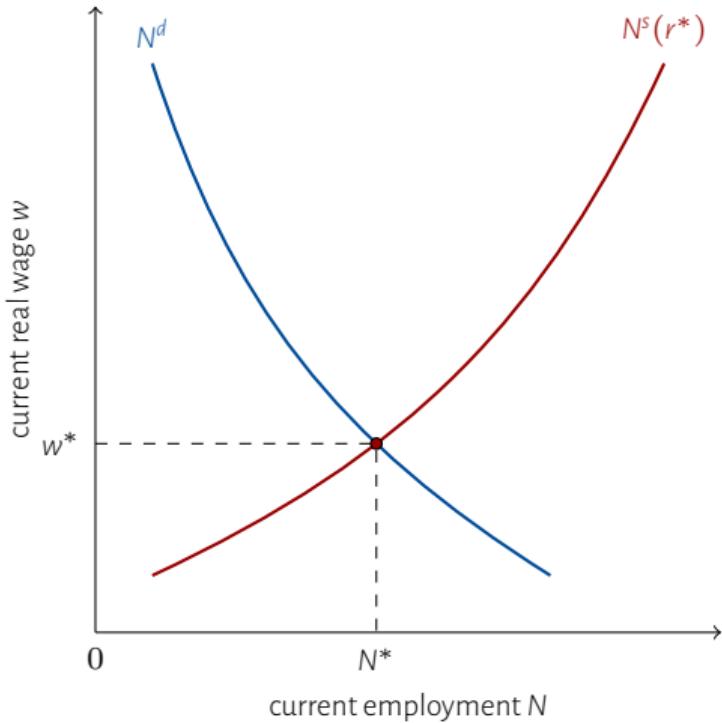
- In that world, monetary variables are typically **neutral** for real allocations (classical dichotomy logic).

So why add IS–LM?

Because once we care about **nominal interest rates, money demand, and the price level**, we need equations that speak to them explicitly.

# Competitive Equilibrium

Figure 11.21 The Complete Real Intertemporal Model



# A clean map: same economy, more markets on the board

Think of the macro economy as **two big clearing conditions** plus a policy rule:

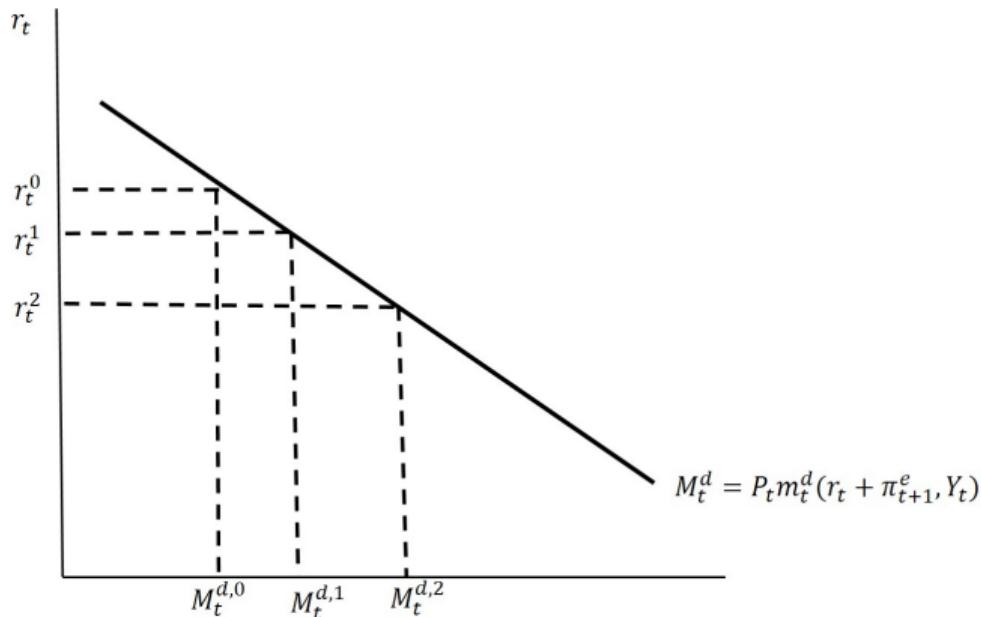
- **Goods market:** planned spending equals production (IS logic).
- **Money market:** money supplied equals money demanded (LM logic).
- **Policy:** central bank and fiscal authority pick instruments / regimes.

## Important perspective

IS–LM is a **different representation** that highlights **demand** and **nominal variables**. Later we replace its weak spots with NK microfoundations.

# Money market and LM

## Step 1: Money demand (why people hold money)



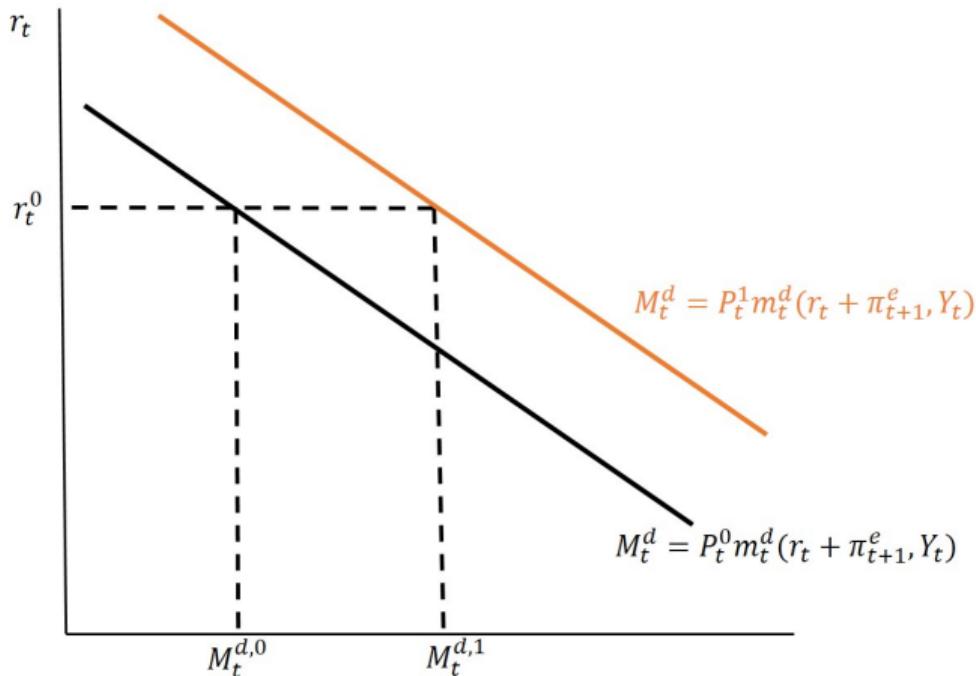
- Money provides **liquidity** (transactions/convenience).
- Holding money has an **opportunity cost**: the interest you could earn on bonds.
- A standard reduced form:

$$\frac{M_t^d}{P_t} = L(Y_t, i_t), \quad L_Y > 0, \quad L_i < 0.$$

### Connection to inflation

Later:  $i_t \approx r_t + \mathbb{E}_t \pi_{t+1}$  (Fisher). Expected inflation raises the nominal opportunity cost of money.

# Money demand shifts I: higher price level means higher *nominal* money demand

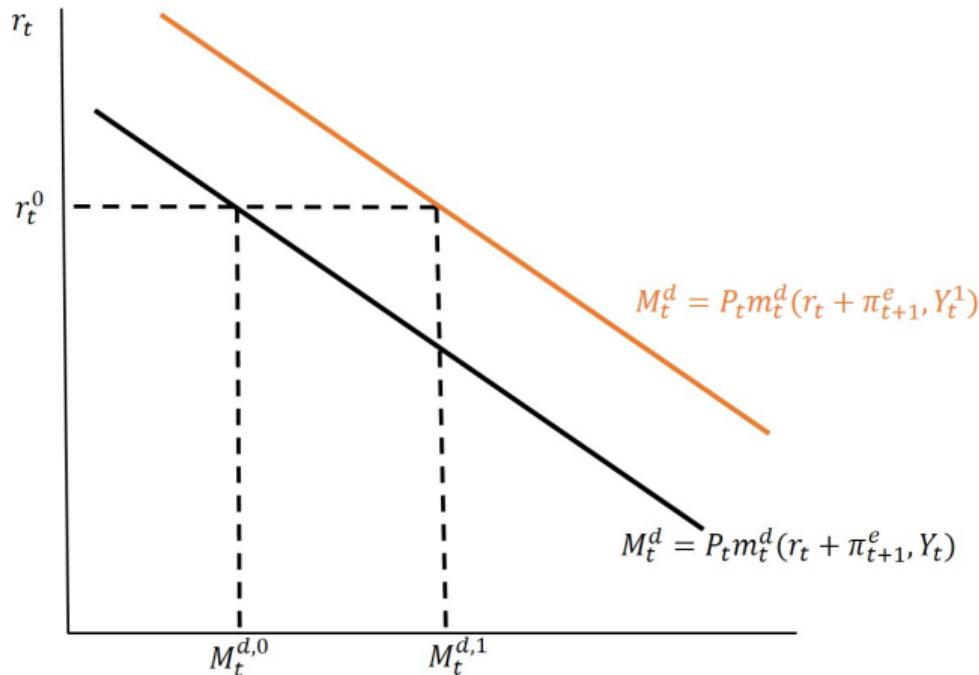


- Real balances are what matter for transactions:  $M/P$ .
- If  $P$  rises, then to keep the same real balances you need **more nominal money**.
- So for given  $(Y, i)$ , the **nominal** money demand curve shifts outward.

## Why this matters

Because later, the price level  $P$  will be one of the key objects we want to understand.

## Money demand shifts II: higher income means more transactions

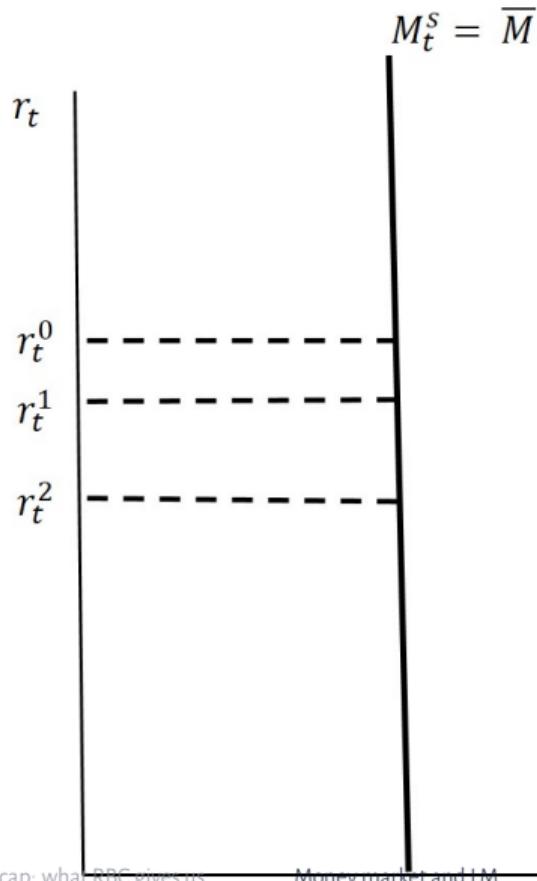


- Higher  $Y$  means more purchases, payroll, invoices, etc.
- That raises desired transaction balances.
- So money demand increases with output.

### Preview

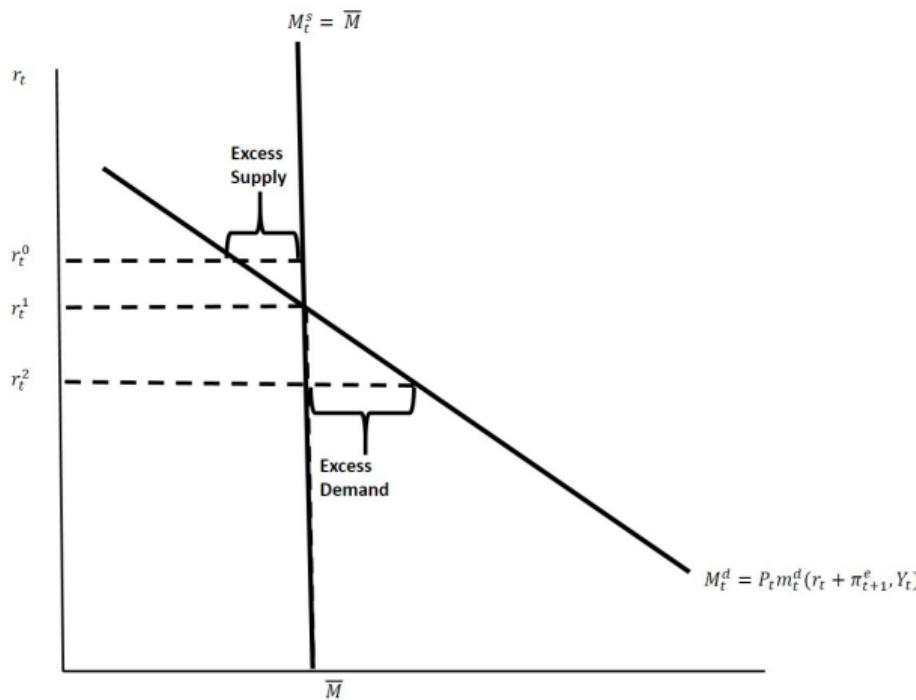
This positive  $Y \rightarrow M^d$  link is what will make the LM curve slope upward in  $(Y, i)$  space.

## Money supply: the central bank side (first pass)



- Textbook IS–LM starts by treating  $M_t^S$  as a policy choice.
- Modern institutions often set an **interest rate** instead.
- We start with  $M$ -supply to build intuition, then switch to rate rules (Taylor) in NK.

# Money market equilibrium: where $M^s = M^d$

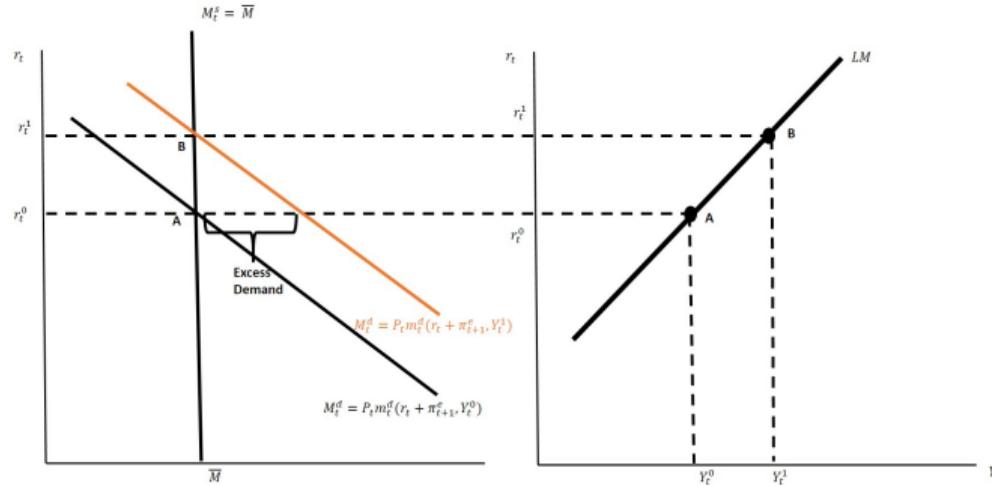


- Equilibrium nominal rate  $i$  adjusts so that money demand equals money supply.
- At a higher  $i$ , people hold less money.
- At a higher  $Y$ , people want more money.

## Key takeaway

Money market equilibrium is a restriction linking  $(Y, i)$  given  $(M, P)$ .

# From money market equilibrium to the LM curve

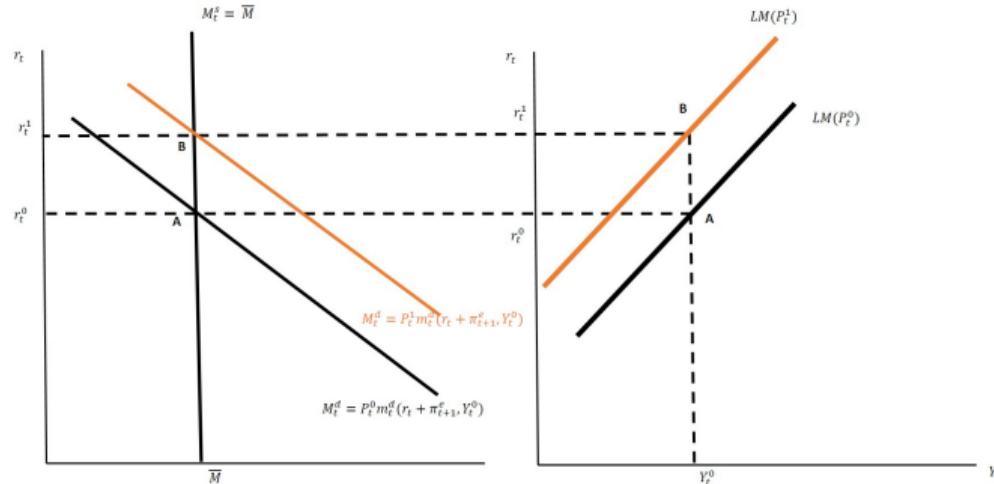


- Start at point A:  $(Y^0, i^0)$  clears the money market.
- Raise output to  $Y^1$ :
  - transaction demand rises  $\Rightarrow$  excess money demand at  $i^0$
  - interest rate must rise to reduce money demand
- Connecting such equilibria gives an **upward-sloping LM**.

## LM equation (reduced form)

$$M_t^s = M_t^d = P_t \cdot m_t^d(Y_t, r_t + \pi_{t+1}^e).$$

# How LM shifts I: higher $P$ shifts LM left

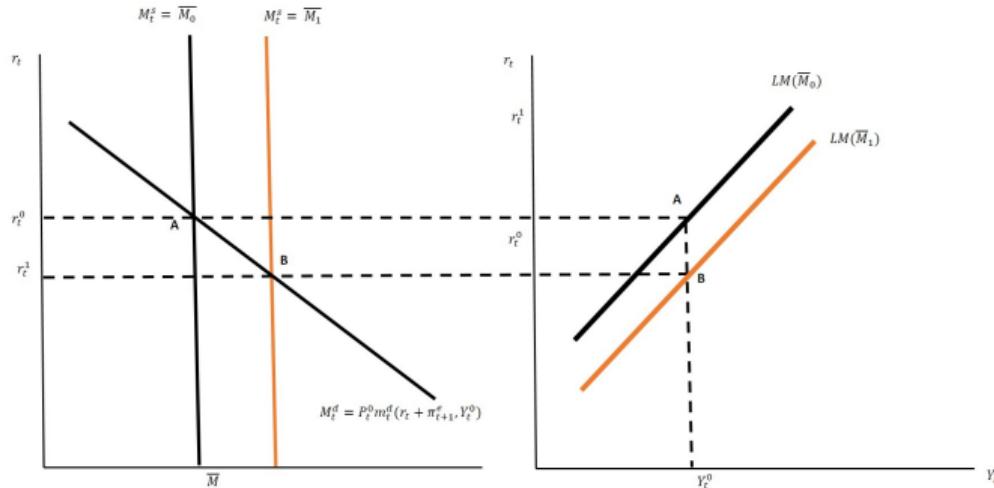


- If  $P$  rises, then at a given  $(Y, i)$  people need **more nominal money** to support the same real balances.
- With  $M^s$  fixed, equilibrium requires a **higher** interest rate (to discourage money holding).
- So the LM curve shifts **up/left**.

## Interpretation

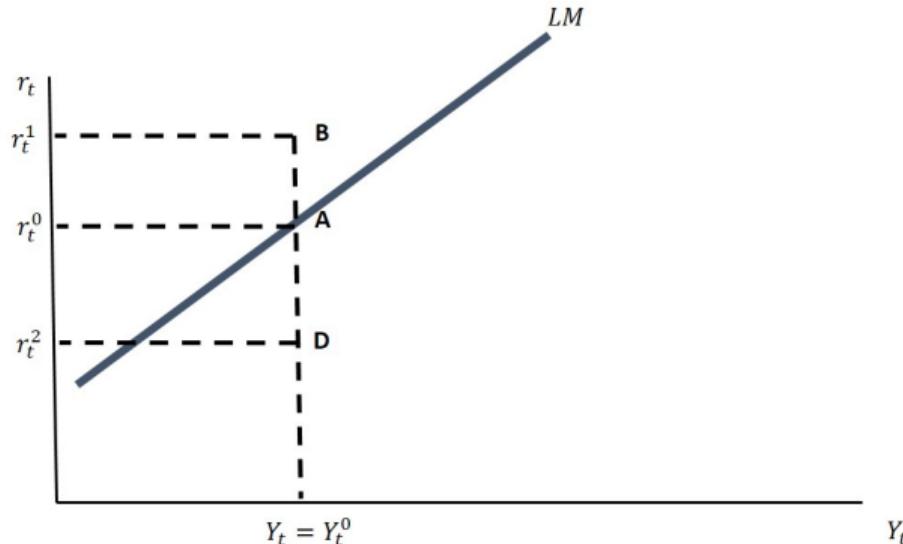
Inflation/price level changes affect money market tightness.

## How LM shifts II: higher $M^s$ shifts LM right



- Raise money supply (holding  $P$  fixed).
- At the old interest rate, there is excess money supply.
- The nominal rate falls until people are willing to hold the extra money.
- So LM shifts **down/right**.

# What LM is (and is not): avoid a common confusion



- **On LM:** money market clears.
- **Off LM:** excess money demand or supply.
- LM does *not* mean “money market alone determines  $i$ .”
- It is one equilibrium condition inside a general equilibrium system.

## Good habit

Whenever you see a point in  $(Y, i)$  space, ask: does it clear the money market?

# Goods market and IS

# IS: goods market equilibrium (bridge from RBC to textbook)

- In RBC, the intertemporal Euler equation is the foundation.
- IS-LM uses a reduced-form but keeps the same comparative statics:

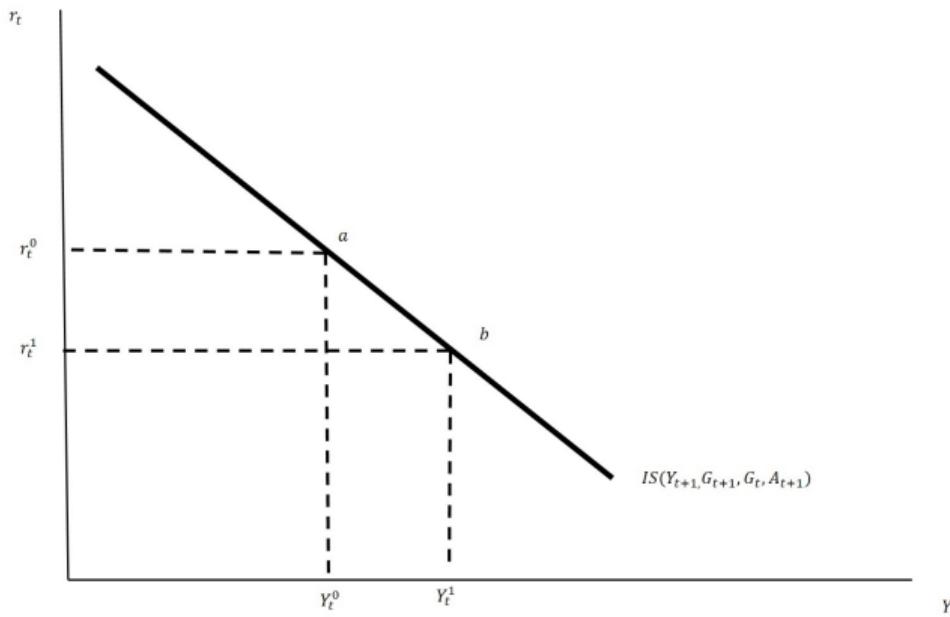
$$Y_t = C(Y_t - T_t, i_t) + I(i_t) + G_t.$$

- Lower interest rates stimulate spending (especially investment)  $\Rightarrow$  higher goods demand.

## Interpretation

IS is a schedule of  $(Y, i)$  pairs where the **goods market clears**.

# IS curve (visual): why it slopes downward



- Move down along IS:  $i$  falls.
- Lower  $i$  raises investment and interest-sensitive spending.
- To clear the goods market, output must rise to meet higher demand.

## Connection to RBC

Think “intertemporal substitution in demand,” but represented in a static  $(Y, i)$  diagram.

# Shifts in IS: what moves goods demand

- **Fiscal expansion** ( $G \uparrow$  or taxes  $\downarrow$ ) shifts IS right.
- **Optimism / higher expected income** shifts IS right (consumption rises today).
- **Higher uncertainty / tighter credit** shifts IS left (spending falls).

## What IS is not

IS is not “Keynesian by assumption.” It is a **reduced-form representation** of intertemporal demand that we will later microfound (NK IS / Euler equation).

# Putting IS and LM together

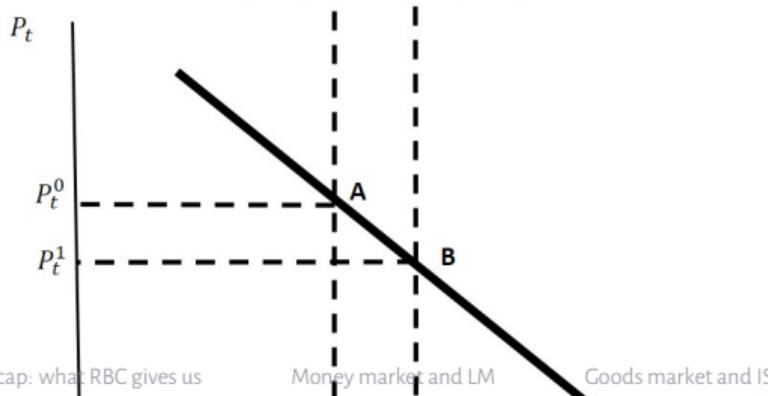
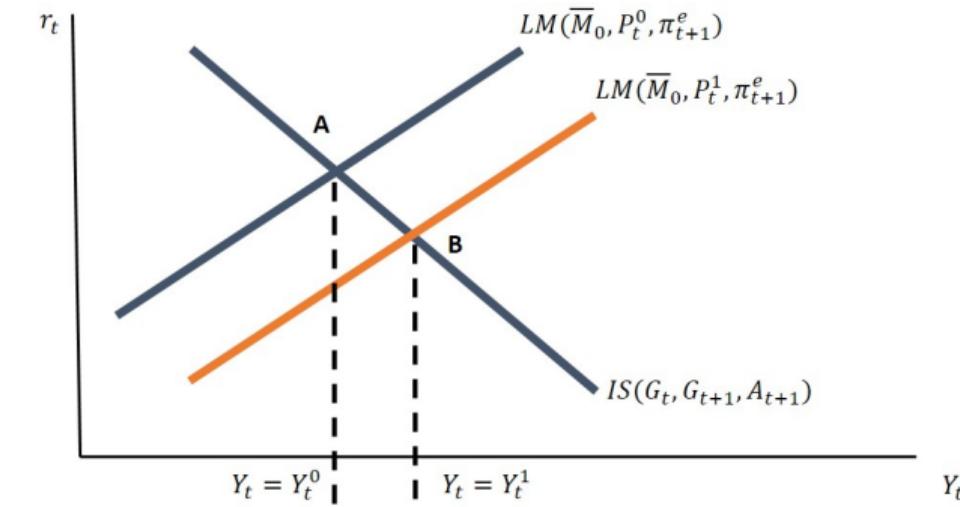
# IS–LM equilibrium: one point that clears two markets

- IS: goods market clearing  $\Rightarrow$  a relation between  $(Y, i)$ .
- LM: money market clearing  $\Rightarrow$  another relation between  $(Y, i)$ .
- Their intersection gives  $(Y, i)$  consistent with both markets.

## Why this is the “bridge model”

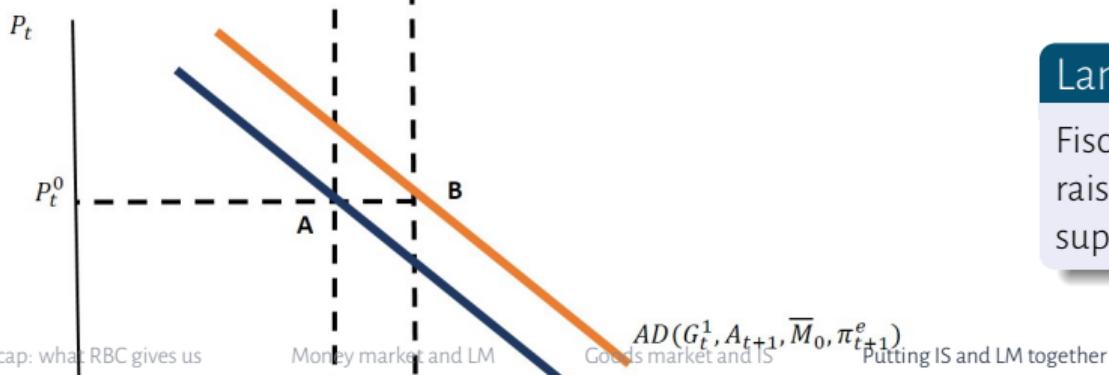
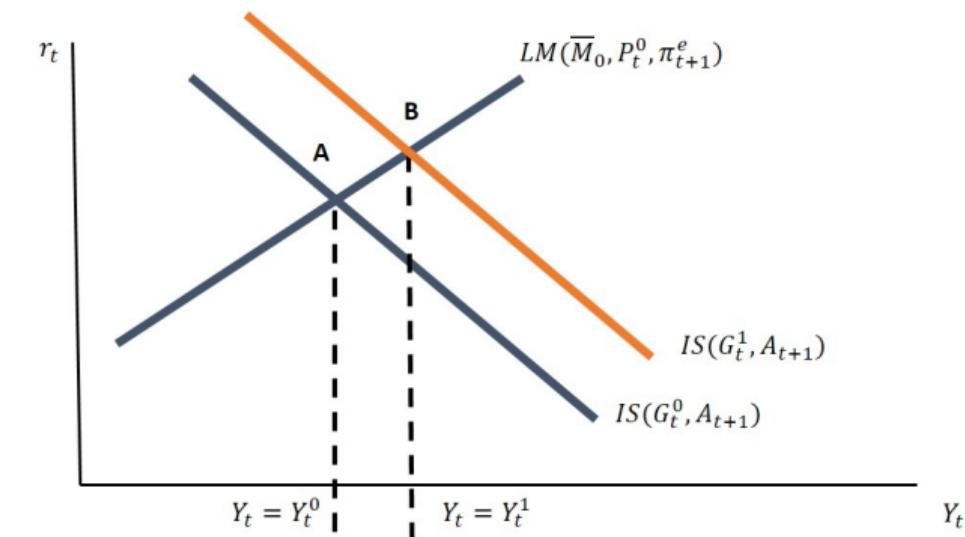
RBC emphasized **real** equilibrium. IS–LM adds a **money market** so we can start talking about nominal rates and (soon) the price level.

# From IS–LM to Aggregate Demand: why AD slopes down



- Hold  $M$  fixed and lower  $P$ :
  - real balances  $M/P$  rise
  - money market becomes “looser”  $\Rightarrow$  LM shifts right
- New IS–LM intersection has higher  $Y$ .
- Therefore: lower  $P$  corresponds to higher  $Y \Rightarrow$  AD slopes down.

# Policy experiment I: fiscal expansion shifts AD right

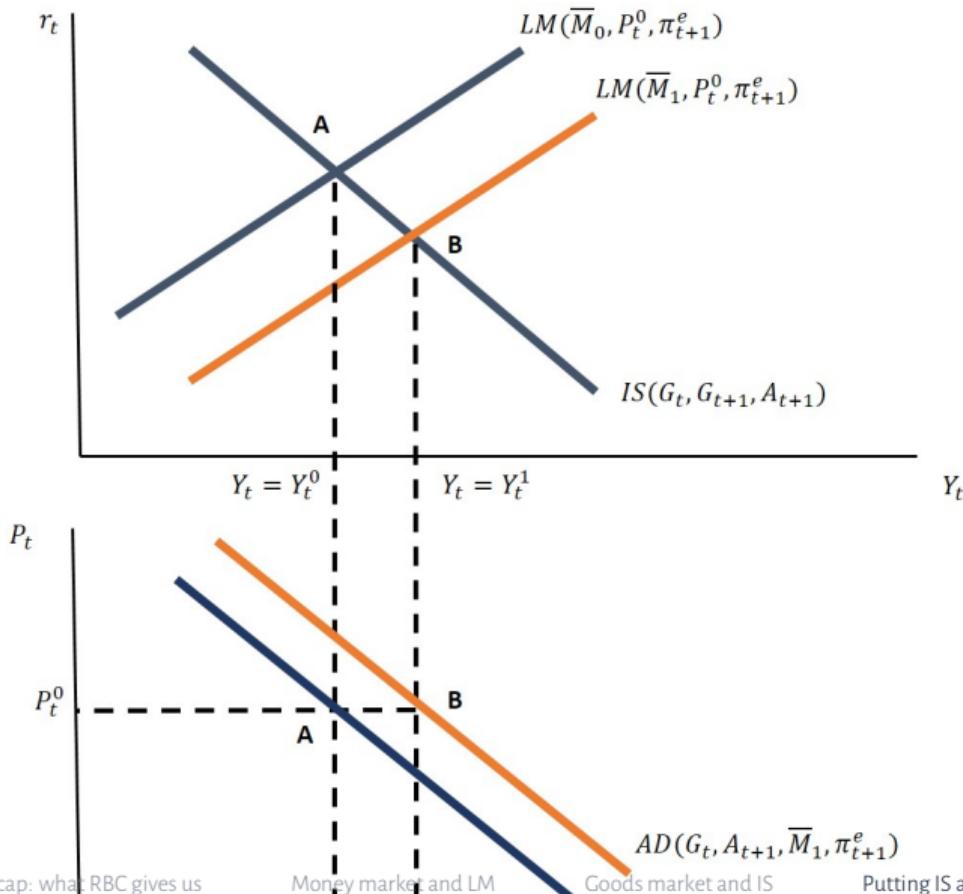


- $G \uparrow$  shifts IS right.
- For a given price level  $P$ , equilibrium output rises.
- In  $(P, Y)$  space: AD shifts right.

Language students should learn

Fiscal policy raises demand; how much it raises *output* versus *prices* depends on the supply side (next lectures).

## Policy experiment II: monetary expansion shifts AD right



- $M^s \uparrow$  shifts LM right.
- For a given price level  $P$ , equilibrium output rises.
- In  $(P, Y)$  space: AD shifts right.

But modern central banks...

...often move  $i$  directly rather than  $M$ . This is why we will transition to **Taylor rules** and the NK model.

# Where we go next

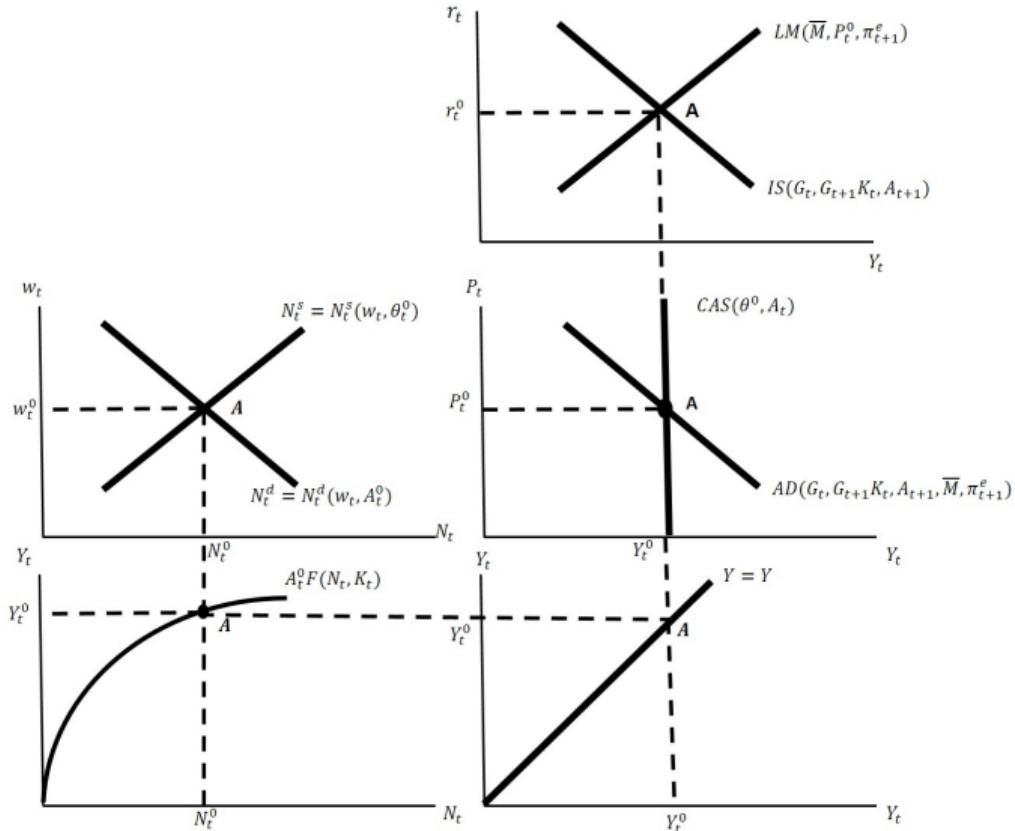
# Why IS-LM is useful (and why we won't stop here)

- **Useful:** great for quick comparative statics and building intuition.
- **Limitations:**
  - Inflation expectations and credibility are awkward.
  - Central banks target interest rates, not money supply.
  - Price setting is not microfounded (no Phillips curve discipline).

## Next step

Replace “LM + ad hoc IS” with the **New Keynesian triad**: NK IS (Euler), NK Phillips curve, Taylor rule.

# Preview: the AD–AS view (one slide teaser)



- IS–LM gives us **AD**.
- To talk about inflation, we need a theory of **AS** (price setting).
- AD–AS is the next “bridge” before NK.

## Big picture

RBC (real core) → IS–LM (add money) → NK (expectations + sticky prices) → inflation + price level regimes.

## Next time

- AD–AS: what moves inflation vs what moves output?
- Short run vs long run: when do we get “crowding out” versus “inflation” ?
- Then: New Keynesian model as the modern workhorse.