Intermediate Macroeconomics II
Lecture 2: From RBC to IS–LM

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- 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:

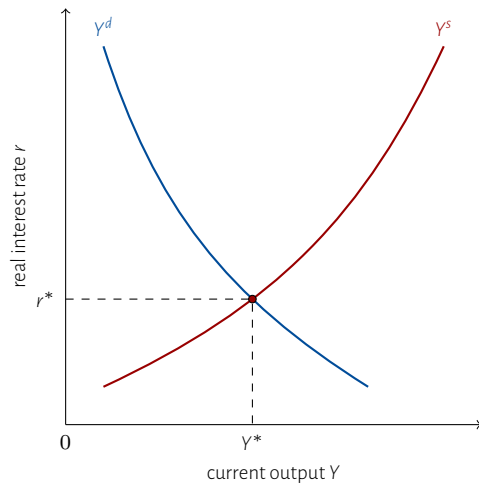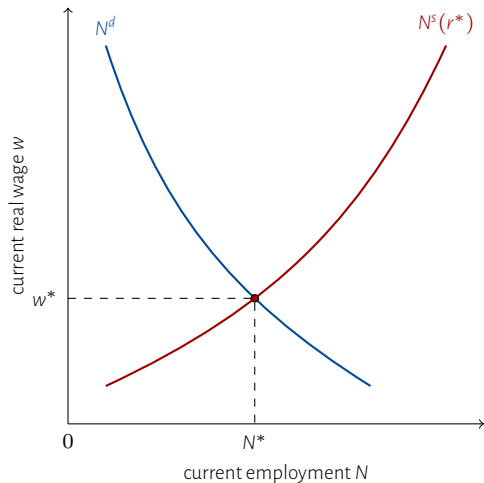$$1 = \beta \, \mathbb{E}_t \left[\frac{u'(C_{t+1})}{u'(C_t)} (1 + r_t) \right].$$

- 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.

Figure 11.21 The Complete Real Intertemporal Model

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

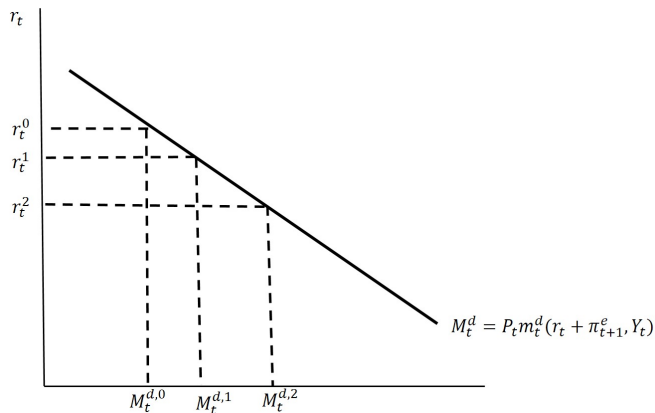Think of the macro economy as **two big clearing conditions** plus a policy rule:

- **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

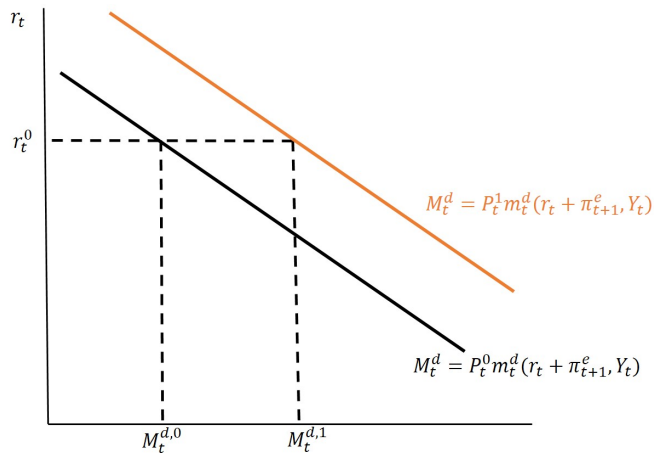# Step 1: Money demand (why people hold money)

- Money provides **liquidity** (transactions/convenience).

- Holding money has an **opportunity cost**: the interest you could earn on bonds.

- A standard reduced form:

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

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.

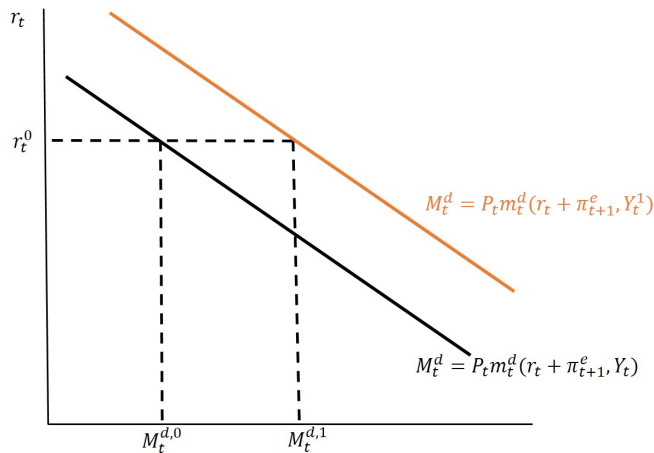# Money demand shifts I: higher price level means higher *nominal* money demand

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

$$M_t^d = P_t^0 m_t^d(r_t + \pi_{t+1}^e, Y_t)$$

- 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.

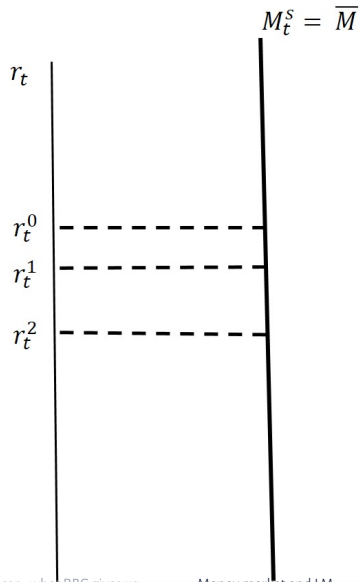# Money demand shifts II: higher income means more transactions

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

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

- Higher Y means more purchases, payroll, invoices, etc.

- That raises desired transaction balances.
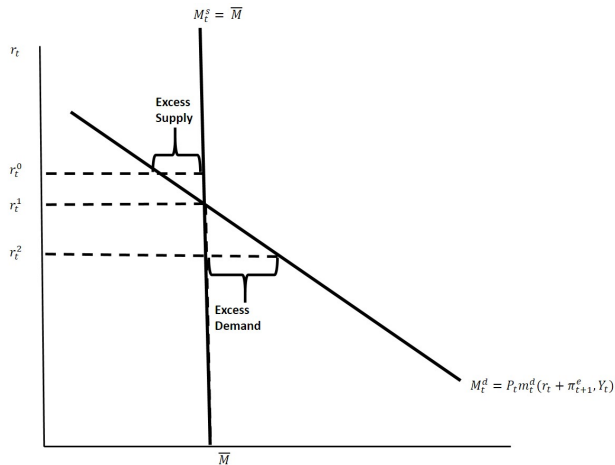
- So money demand increases with output.

Preview

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

$$M_t^s = \overline{M}$$

r_t

r_t^0

r_t^1

r_t^2

- 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.
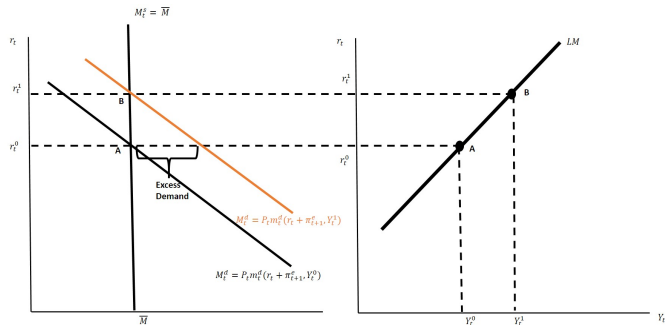
Money market equilibrium: where $M^s = M^d$

$M_t^s = \overline{M}$

r_t

Excess Supply

r_t^0

r_t^1

r_t^2

Excess Demand

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

$\overline{M}$

- 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).

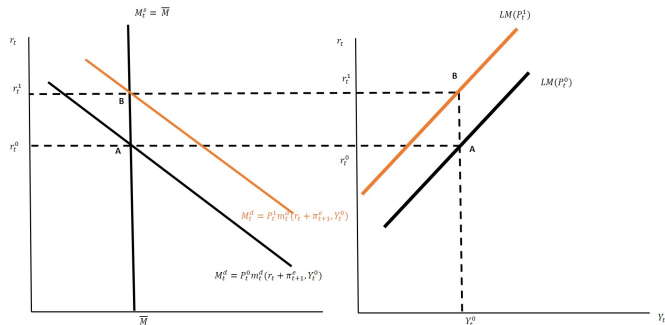# From money market equilibrium to the LM curve

- 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)

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

$M_t^s = \overline{M}$

$LM(P_t^1)$

$LM(P_t^0)$

r_t

r_t^1

B

r_t^0

A

$\overline{M}$

$M_t^d = P_t^1 m_t^d(r_t + \pi_{t+1}^e, Y_t^0)$

$M_t^d = P_t^0 m_t^d(r_t + \pi_{t+1}^e, Y_t^0)$

r_t
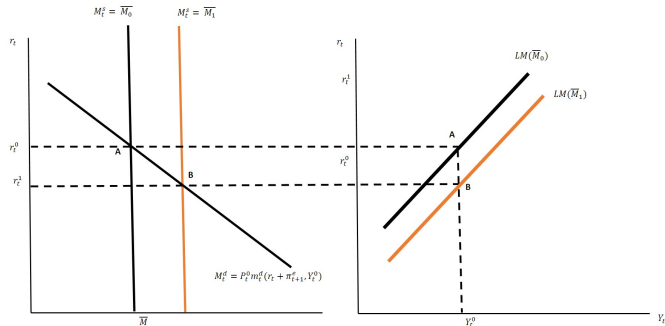
r_t^1

B

r_t^0

A

Y_t^0

Y_t

- 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**.
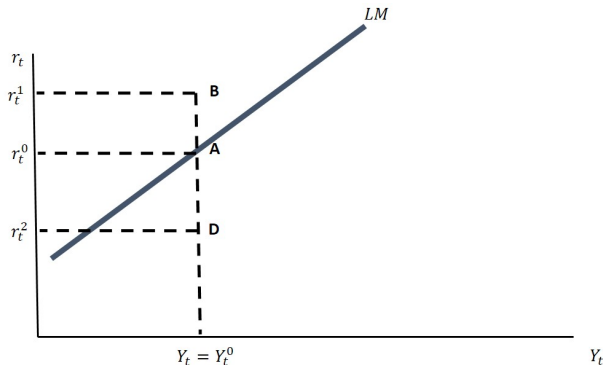
Interpretation

Inflation/price level changes affect money market tightness.

- 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.

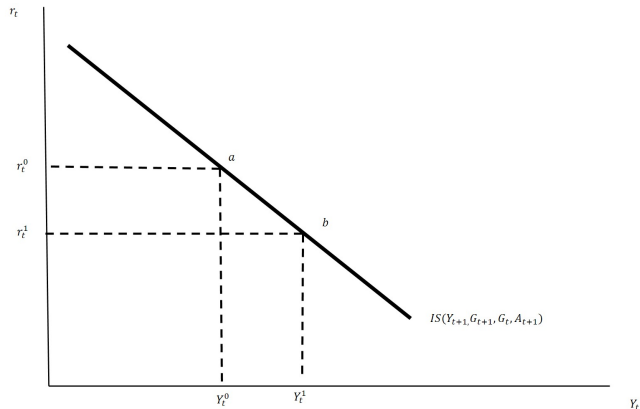- IS–LM uses a reduced-form but keeps the same comparative statics:

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

- 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).
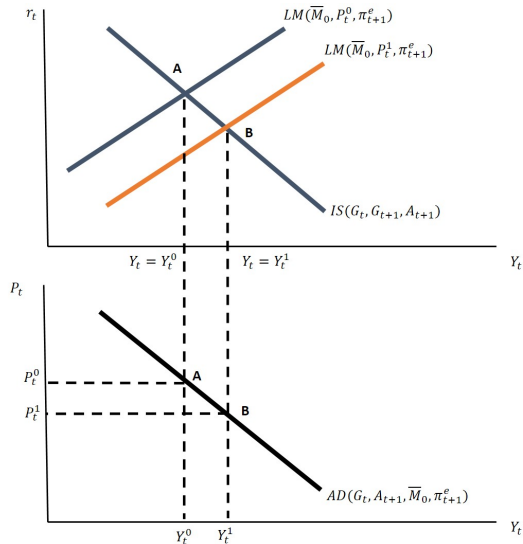
Putting IS and LM together

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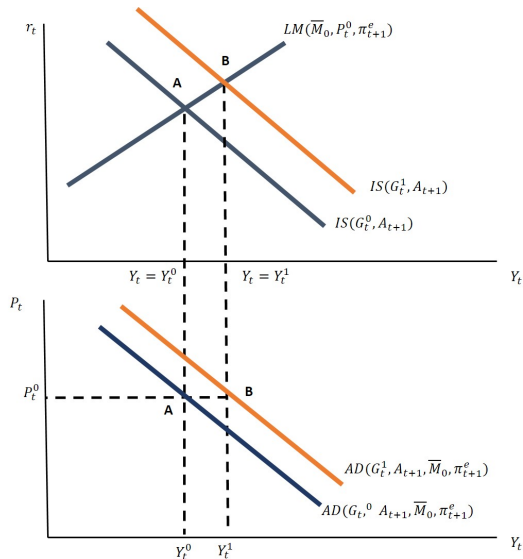
From IS–LM to Aggregate Demand: why AD slopes down

- 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.

Takeaway

Even before NK, IS–LM delivers a clean logic for a downward-sloping AD curve.

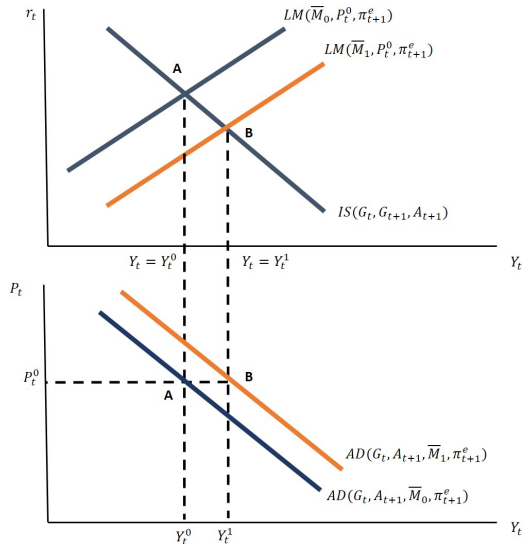# Policy experiment I: fiscal expansion shifts AD right

- $G \uparrow$ 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

$LM(\overline{M}_0, P_t^0, \pi_{t+1}^e)$

$LM(\overline{M}_1, P_t^0, \pi_{t+1}^e)$

$IS(G_t, G_{t+1}, A_{t+1})$

$Y_t = Y_t^0$ $Y_t = Y_t^1$

$AD(G_t, A_{t+1}, \overline{M}_1, \pi_{t+1}^e)$

$AD(G_t, A_{t+1}, \overline{M}_0, \pi_{t+1}^e)$

- $M^s \uparrow$ 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.
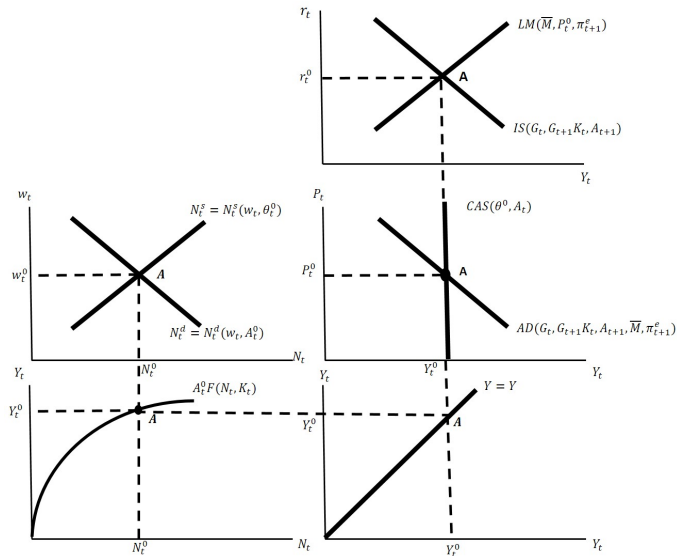
Where we go next

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.

- 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.

- 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.