10. Investment and Savings, Liquidity Preference and Money

Based on Mankiw, Chapter 13: *Aggregate Demand I: Building the IS—LM model*

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Recap of the *AD—AS* model

- The previous lecture introduced the model of aggregate demand and aggregate supply.
- ***Long run:***
  - prices flexible
  - output determined by factors of production and technology
  - unemployment equals its natural rate
- ***Short run:***
  - prices fixed
  - output determined by aggregate demand
  - unemployment negatively related to output

Context for this lecture

- This lecture develops the *IS–LM* model, the basis of the aggregate demand curve.
- We focus on the short run and assume the price level is fixed (so the *SRAS* curve is horizontal).
- We assume for the rest of the material that the economy is closed.

The Keynesian cross

- A simple closed-economy model in which income is determined by expenditure *(due to J.M. Keynes)*.
- Notation:

  I = planned investment

  PE = ***C*** + ***I*** + ***G*** = planned expenditure

  Y = real GDP = actual expenditure
- Difference between actual and planned expenditure = unplanned inventory investment

Elements of the Keynesian cross

Consumption function: $C = C(Y - T)$

Government policy variables: $G = \bar{G}, T = \bar{T}$

For now, planned investment is exogenous: $I = \bar{I}$

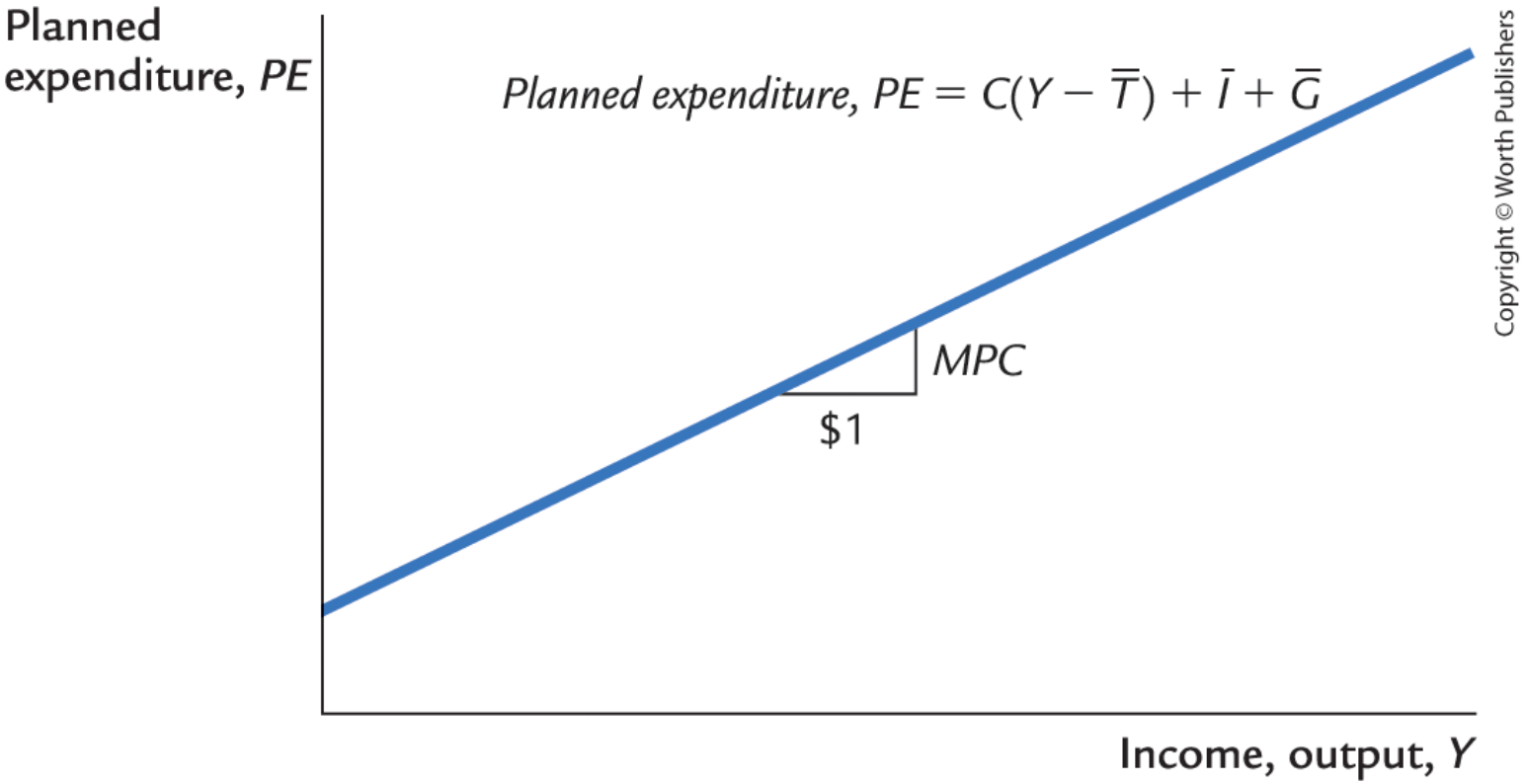
Planned expenditure: $PE = C\left(Y - \bar{T}\right) + \bar{I} + \bar{G}$

Equilibrium condition:

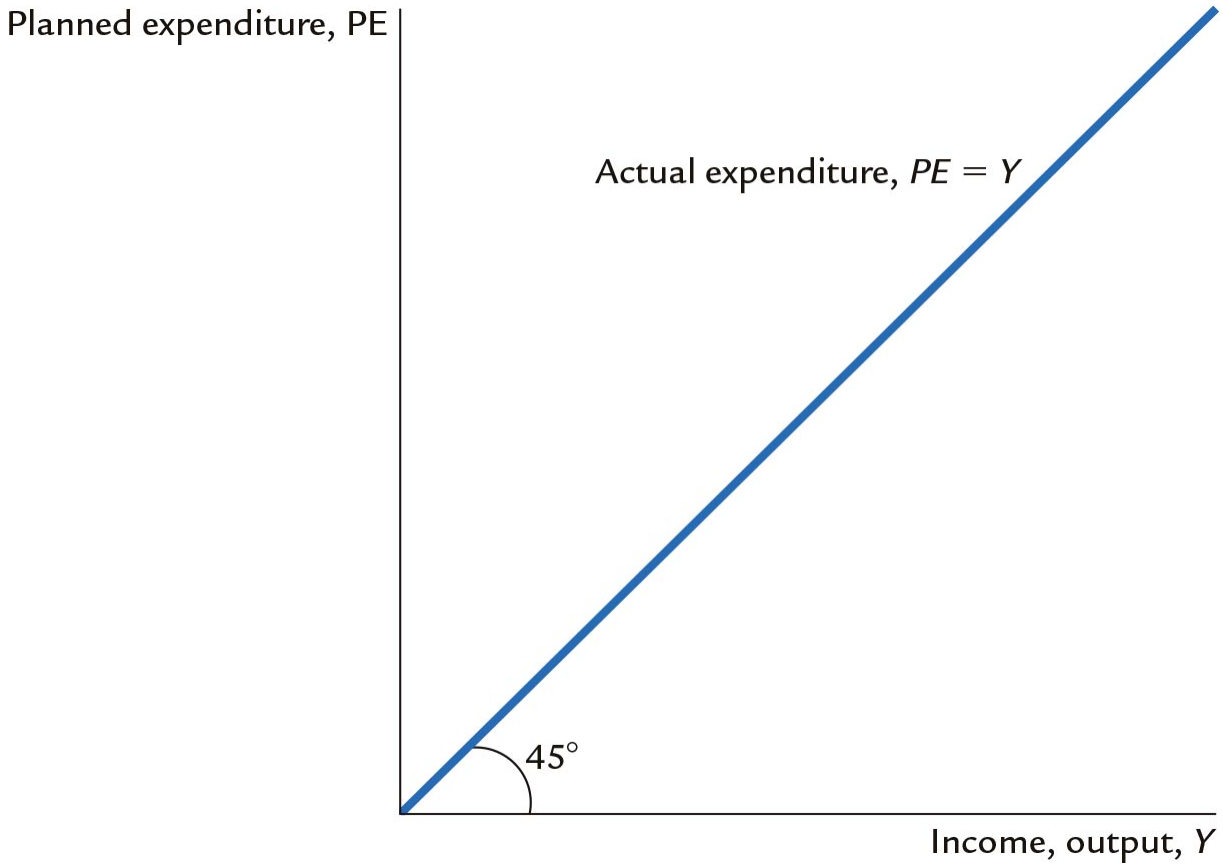
Actual expenditure = planned expenditure

$$Y = PE$$

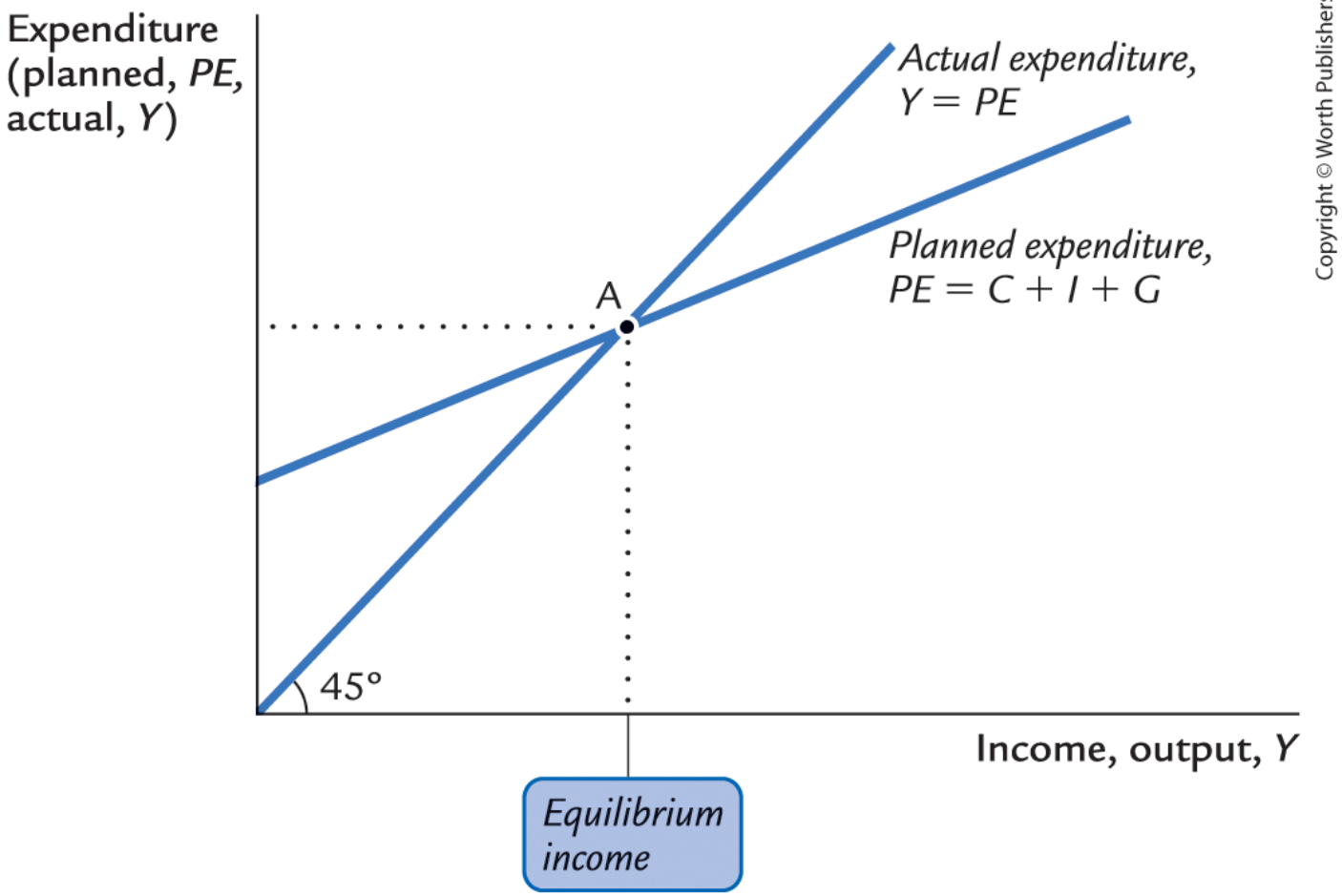
Graphing planned expenditure



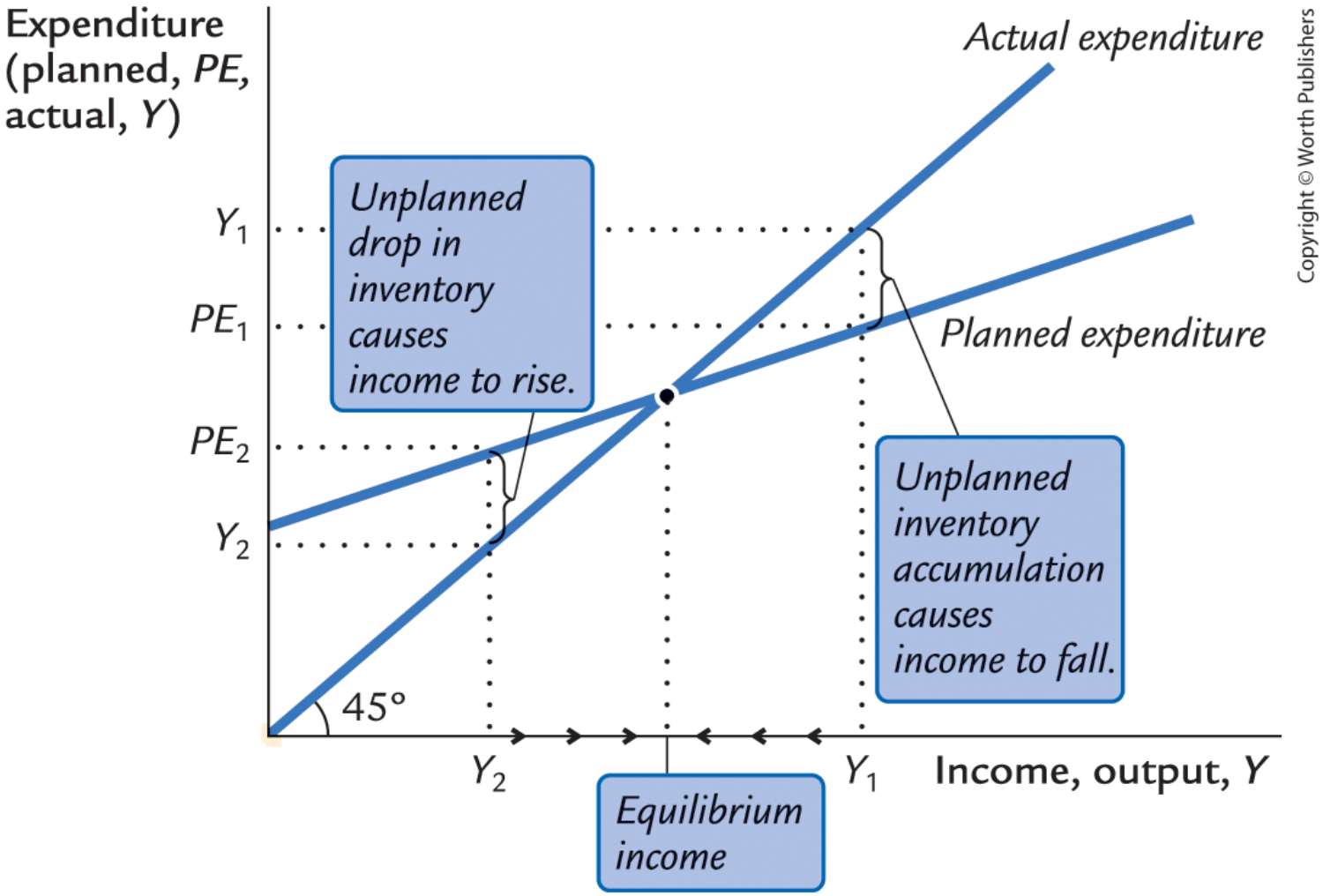
Graphing the equilibrium condition



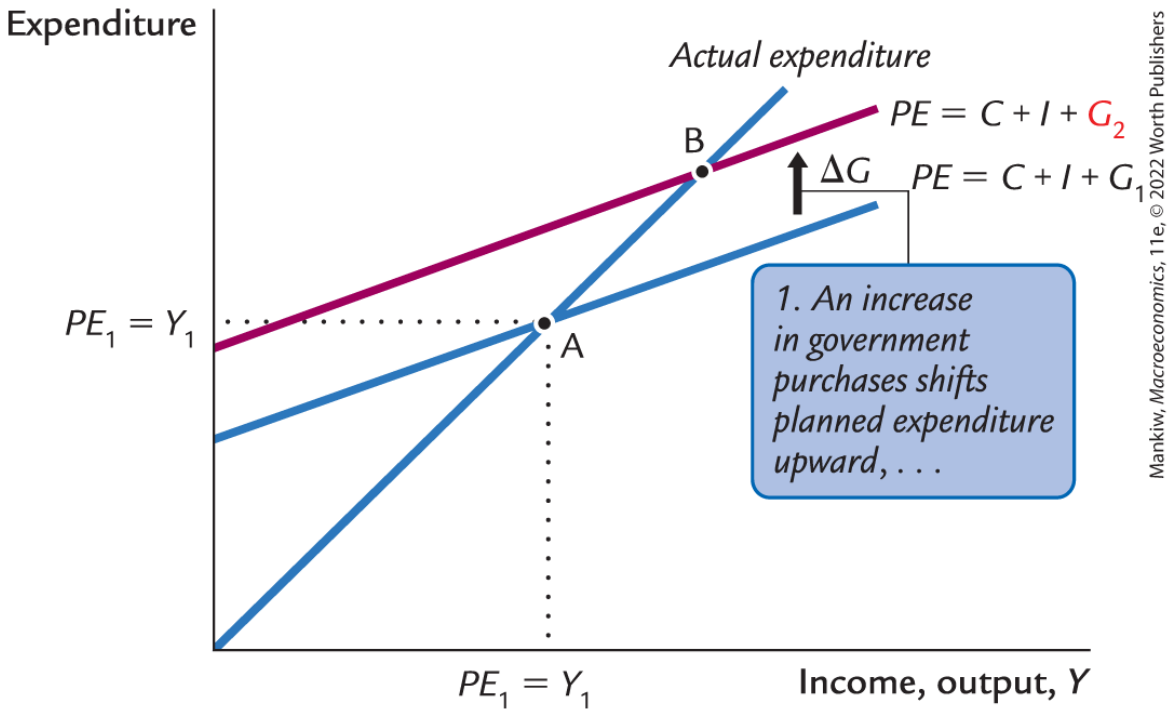
The equilibrium value of income



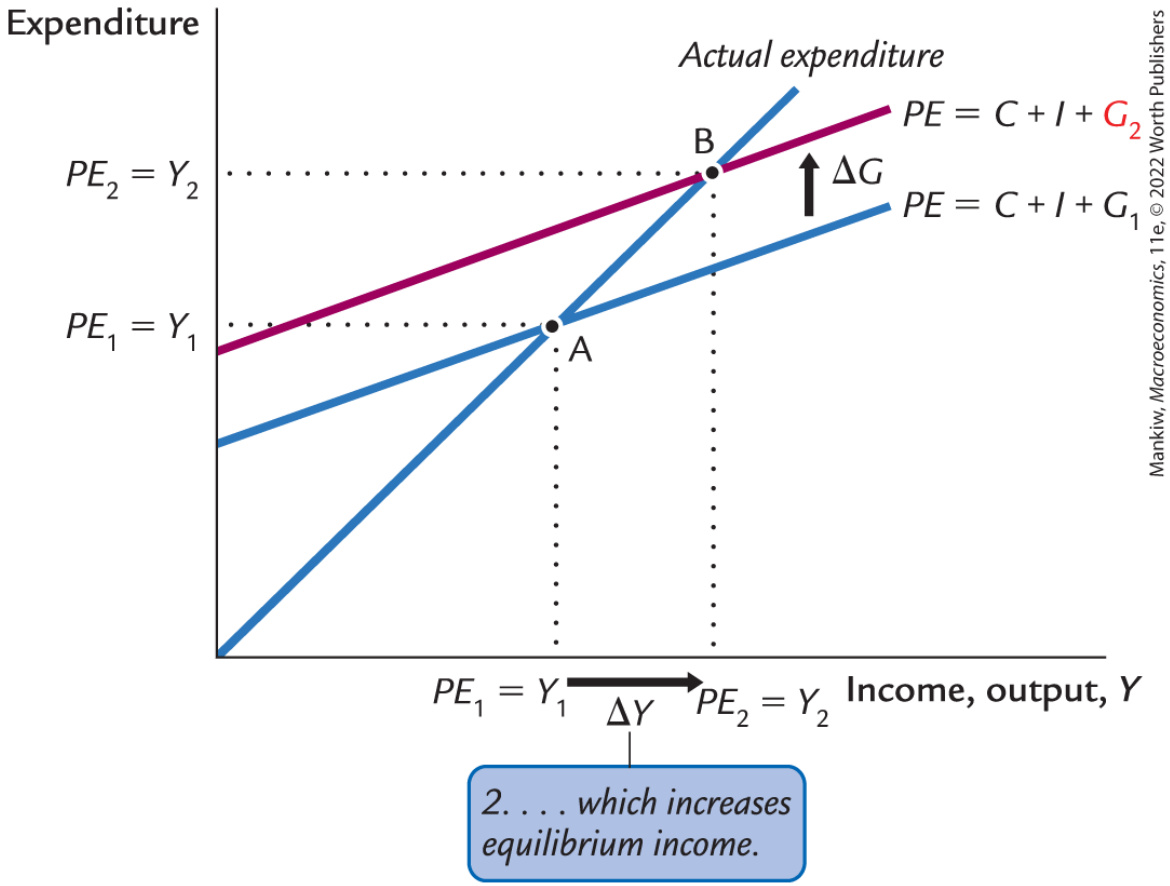
The adjustment to equilibrium



An increase in government purchases



An increase in government purchases



Solving for ΔY (1 of 2)

$Y = C + I + G$ equilibrium condition

$\Delta Y = \Delta C + \Delta I + \Delta G$ in changes

$= \Delta C + \Delta G$ (as I is fixed, i.e., $\Delta I = 0$)

$= (MPC \times \Delta Y) + \Delta G$ (as $\Delta C = MPC \times \Delta Y$)

Collect terms with ΔY on the left side of the equals sign: $(1 - MPC) \times \Delta Y = \Delta G$

Solve for ΔY :

$$\Delta Y = \left(\frac{1}{1 - MPC} \right) \Delta G$$

The government purchases multiplier

Definition: the increase in income resulting from a $1 increase in ***G***.

In this model, the government purchases multiplier equals

$$\frac{\Delta Y}{\Delta G} = \frac{1}{1 - MPC}$$

Example: If ***MPC*** = 0.8, then

$$\frac{\Delta Y}{\Delta G} = \frac{1}{1 - 0.8} = 5$$

An increase in ***G*** causes income to increase 5 times as much!

Why the multiplier is greater than 1

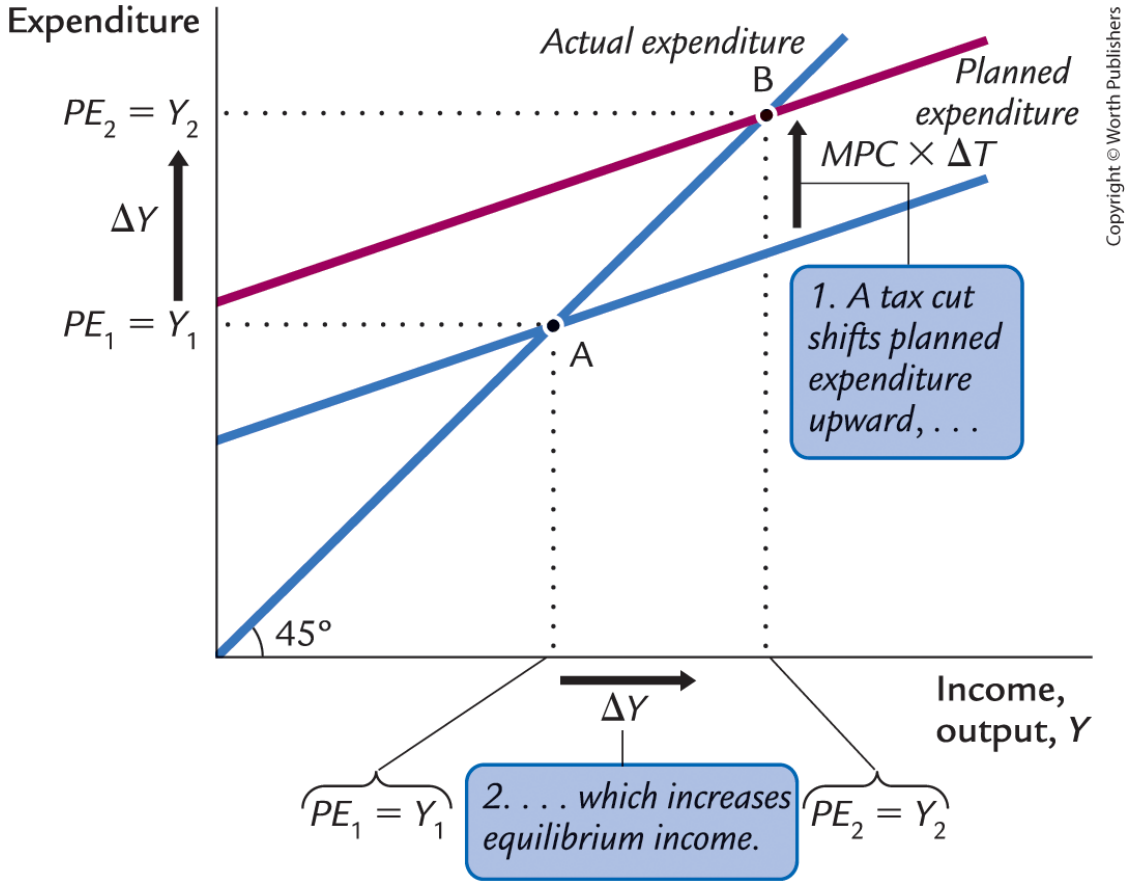
- Initially, the increase in ***G*** causes an equal increase in ***Y***: $\Delta Y = \Delta G$.
- But $\uparrow Y$ causes $\uparrow C$

  which causes further $\uparrow Y$

  which then causes further $\uparrow C$

  which then causes further $\uparrow Y$
- So the final impact on income is much bigger than the initial ΔG.

A decrease in taxes



Solving for ΔY (2 of 2)

$Y = C + I + G$ equilibrium condition

$\Delta Y = \Delta C + \Delta I + \Delta G$ in changes

$= \Delta C$ (as G and I are fixed)

$= MPC \times (\Delta Y - \Delta T)$ (as $\Delta C = MPC \times (\Delta Y - \Delta T)$)

Solving for ΔY: $(1 - MPC) \times \Delta Y = -MPC \times \Delta T$

Final result:

$$\Delta Y = \left(\frac{-MPC}{1 - MPC} \right) \Delta T$$

The tax multiplier, part 1

Definition: the change in income resulting from a $1 increase in ***T***:

$$\frac{\Delta Y}{\Delta T} = \frac{-MPC}{1 - MPC}$$

If ***MPC*** = 0.8, then the tax multiplier equals

$$\frac{\Delta Y}{\Delta T} = \frac{-0.8}{1 - 0.8} = \frac{-0.8}{0.2} = -4$$

The tax multiplier, part 2

. . . is *negative:*
A tax increase reduces ***C***, which reduces income.

. . . is *greater than one* (*in absolute value*) if ***MPC*** > 0.5:
A change in taxes has a multiplier effect on income.

. . . is *smaller than the government spending multiplier:*
Consumers save the fraction (1 – ***MPC***) of a tax cut, so the initial boost in spending from a tax cut is smaller than from an equal increase in ***G***.

NOW YOU TRY

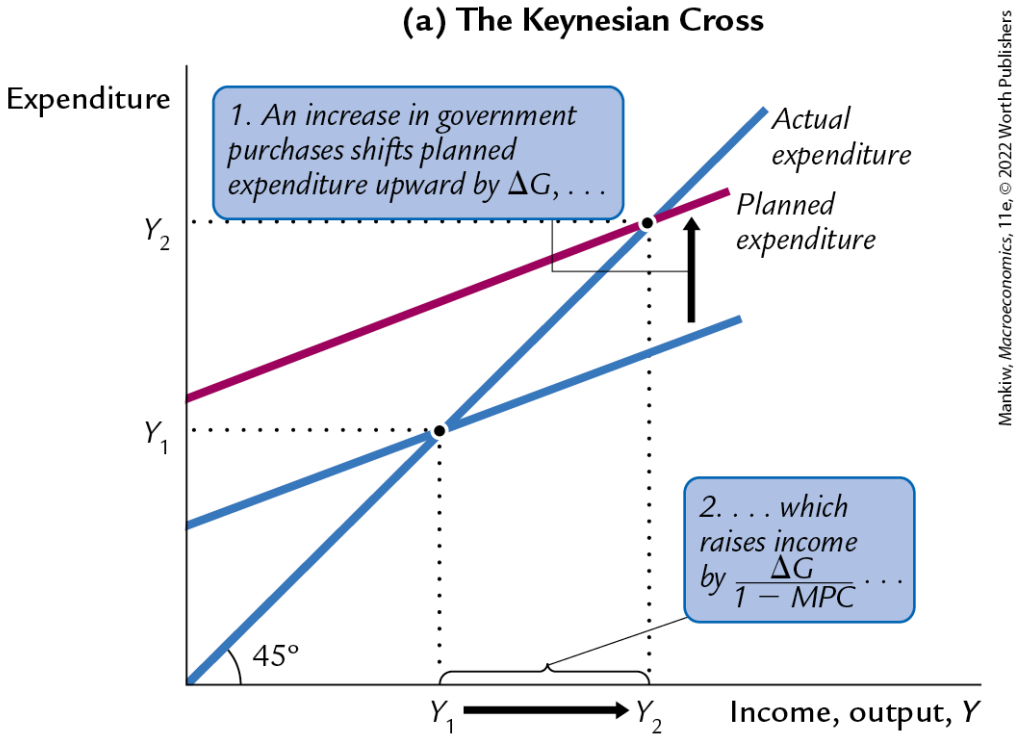
Practice with the Keynesian cross

Use a graph of the Keynesian cross to show the effects of an increase in planned investment on the equilibrium level of income/output.

NOW YOU TRY

Practice with the Keynesian cross, answer

An increase in planned investment increases planned expenditure (***PE***) by Δ***I***. Equilibrium moves from ***A*** to ***B***.



Same graph as with an increase in gov't purchases, but replace Δ***G*** with Δ***I***

The *IS* curve

Definition: a graph of all combinations of ***r*** and ***Y*** that result in goods market equilibrium

For example: actual expenditure (output)
= planned expenditure

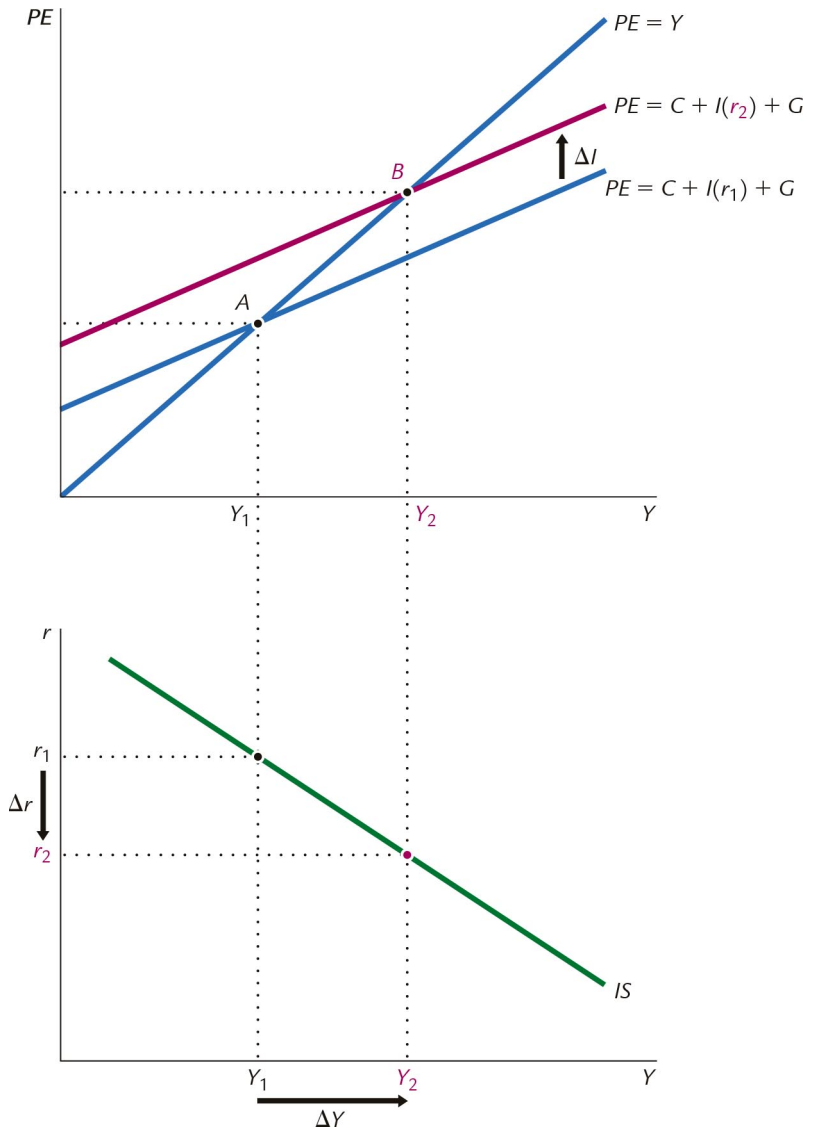
The equation for the *IS* curve is:

$$Y = C(Y - \overline{T}) + I(r) + \overline{G}$$

Deriving the *IS* curve

The real interest rate decreases from r_1 to r_2, causing planned investment to increase from $I(r_1)$ to $I(r_2)$. The increase in planned investment increases income from Y_1 to Y_2.

The *IS* curve summarizes the relationship between the interest rate and income: the lower the interest rate, the higher the level of income.



When the *IS* curve is negatively sloped

- A fall in the interest rate motivates firms to increase investment spending, which drives up total planned spending (***PE***).
- To restore equilibrium in the goods market, output (a.k.a. actual expenditure, ***Y***) must increase.

Fiscal policy and the *IS* curve

- We can use the *IS*–*LM* model to see how fiscal policy (***G*** and ***T***) affects aggregate demand and output.
- Let's start by using the Keynesian cross to see how fiscal policy shifts the *IS* curve . . .

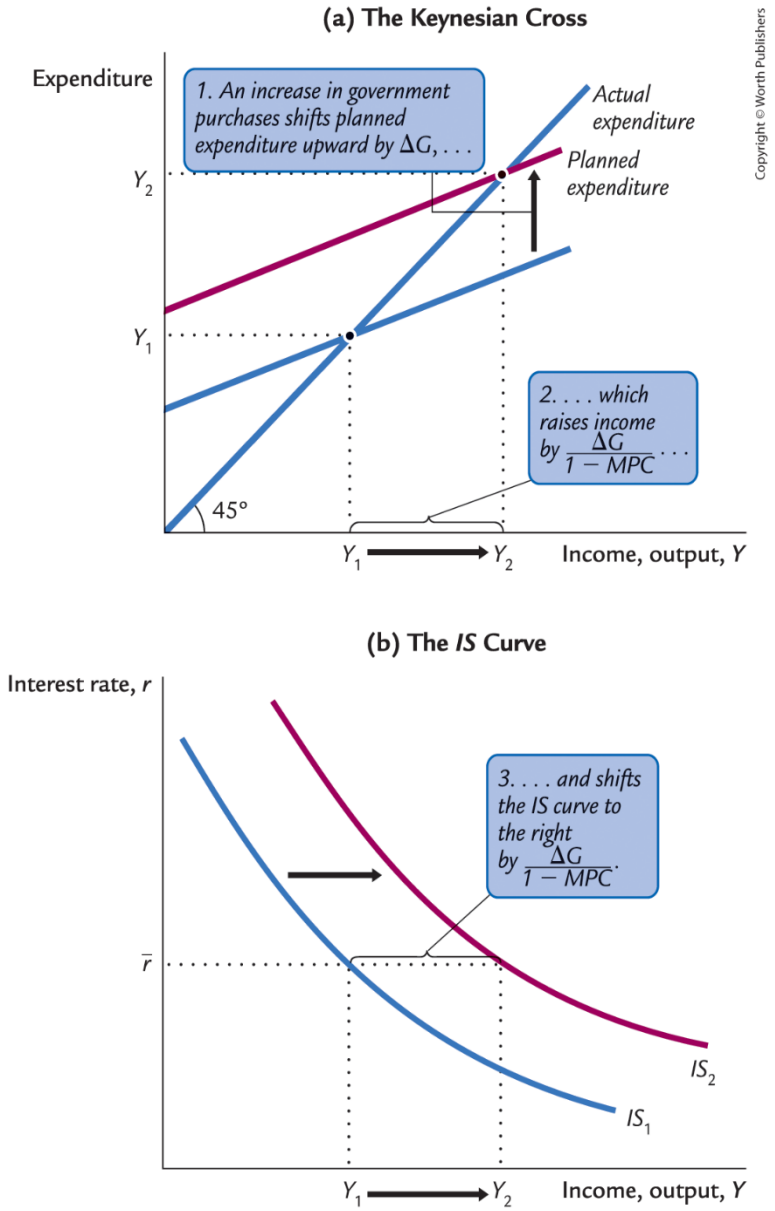
Shifting the *IS* curve: ΔG

At any value of ***r***,
$\uparrow G \rightarrow \uparrow PE \rightarrow \uparrow Y$

. . . so the *IS* curve shifts to the right.

The horizontal distance of the *IS* shift equals

$$\Delta Y = \frac{1}{1 - MPC} \Delta G$$



NOW YOU TRY

Shifting the *IS* curve: Δ*T*

- Use the diagram of the Keynesian cross or loanable funds model to show how an increase in taxes shifts the *IS* curve.
- If you can, determine the size of the shift.

NOW YOU TRY

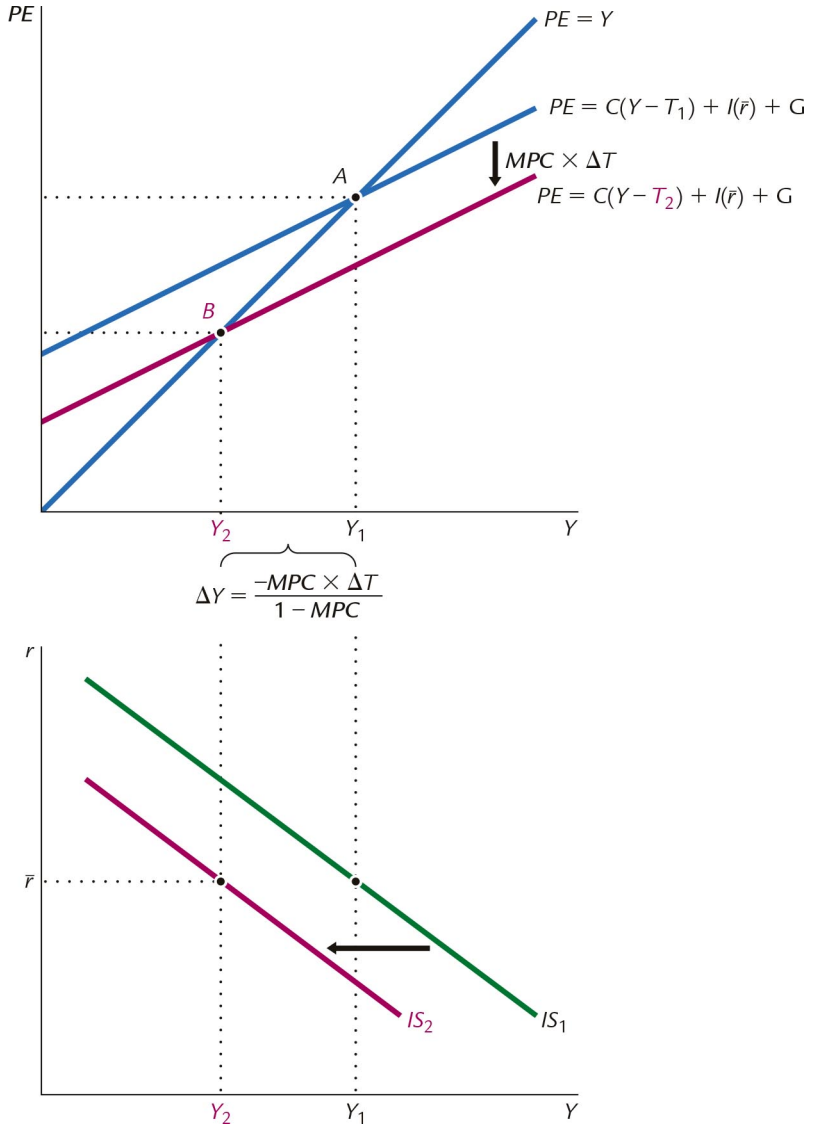
Shifting the *IS* curve: Δ*T*, answer

At any value of ***r***, ↑***T*** → ↓***C*** → ↓***PE***

. . . so the *IS* curve shifts to the left.

The horizontal distance of the *IS* curve shift equals

$$\Delta \boldsymbol{Y} = \frac{-\text{MPC}}{1-\text{MPC}}\,\Delta \boldsymbol{T}$$



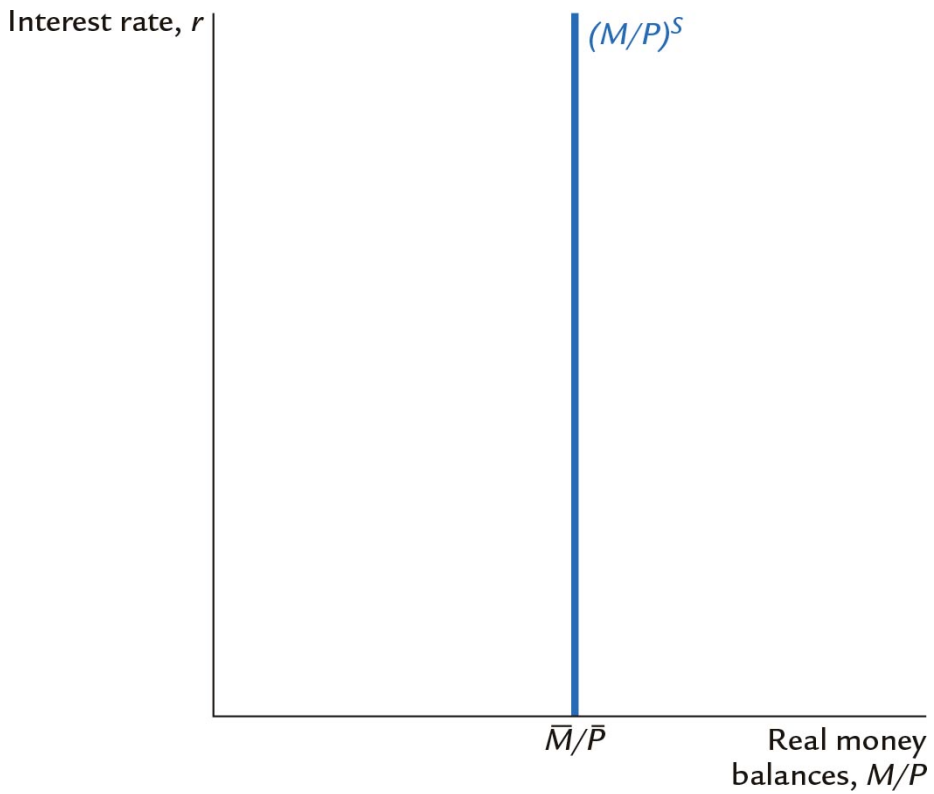
The theory of liquidity preference

- Due to John Maynard Keynes
- A simple theory in which the interest rate is determined by money supply and money demand

Money supply

The supply of real money balances is fixed:

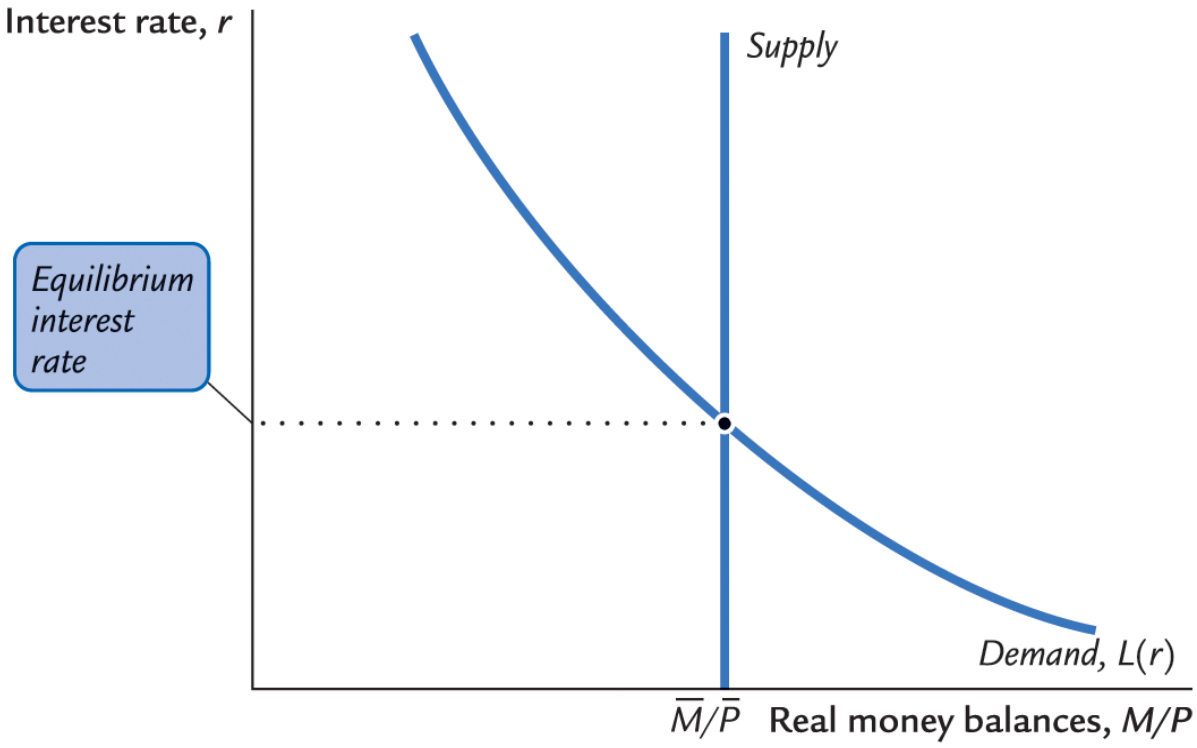
$$\left(M/P\right)^{S} = \bar{M}/\bar{P}$$



Money demand

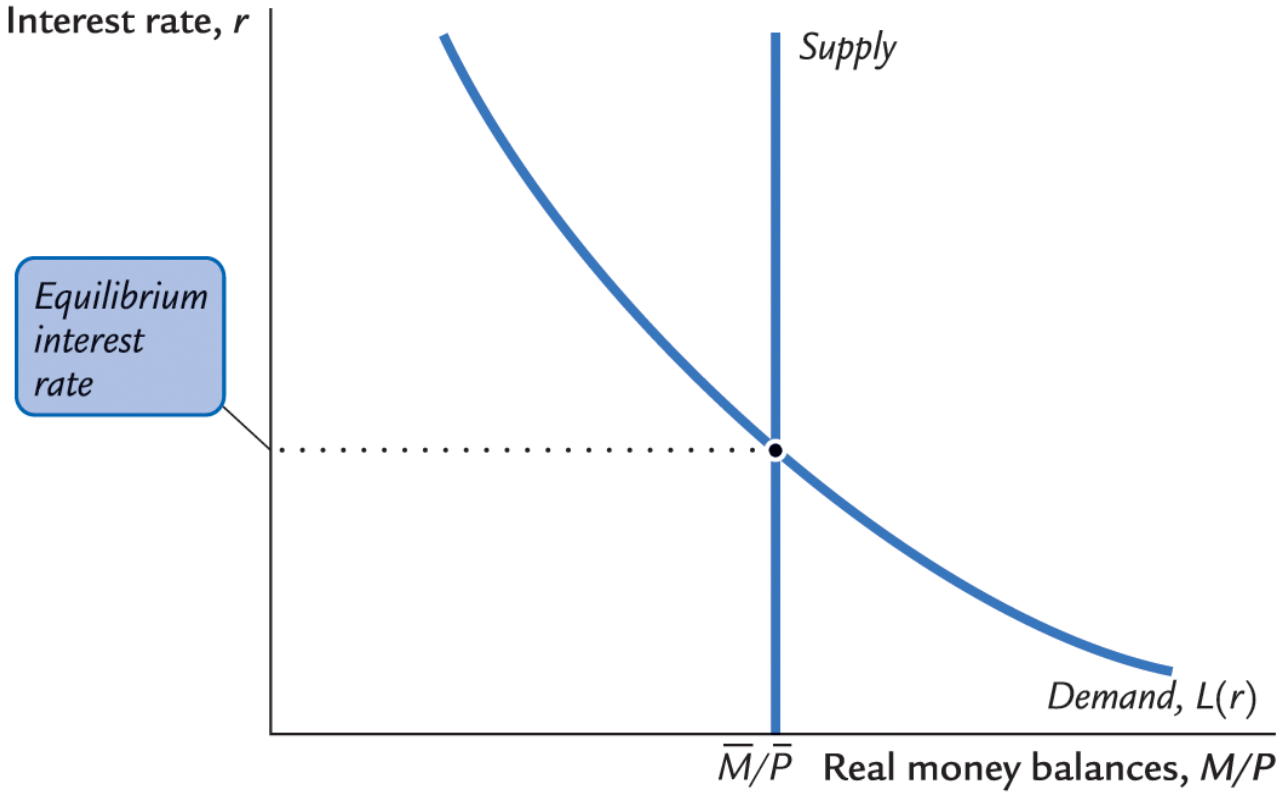
Demand for real money balances:

$$\left(M/P\right)^d = L(r)$$



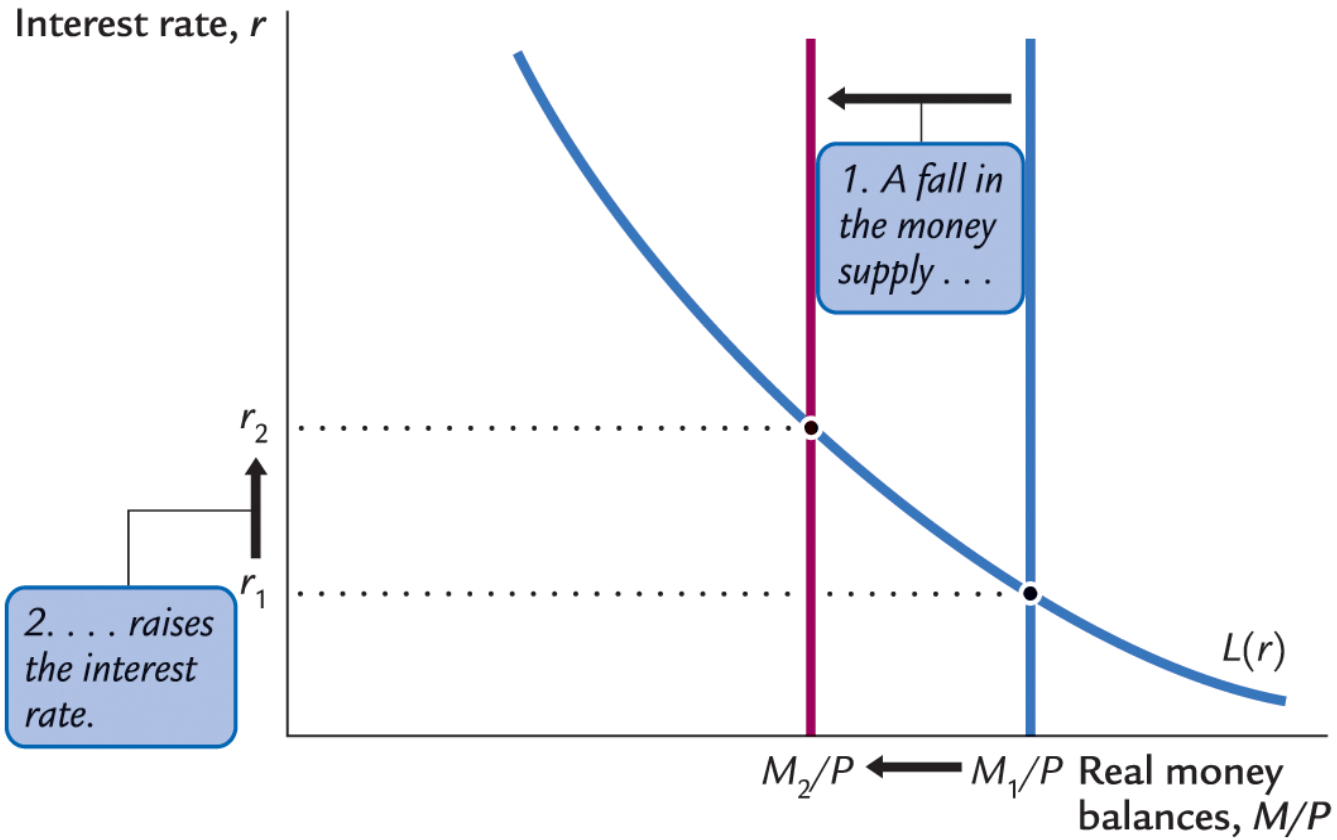
Equilibrium

Resulting in an equilibrium interest rate at ***r****



How the Fed raises the interest rate

A fall in the money supply shift *M/P* in, which raises the interest rate



The *LM* curve

Now let's put ***Y*** back into the money demand function:

$$\left(M/P\right)^{d} = L(r, Y)$$

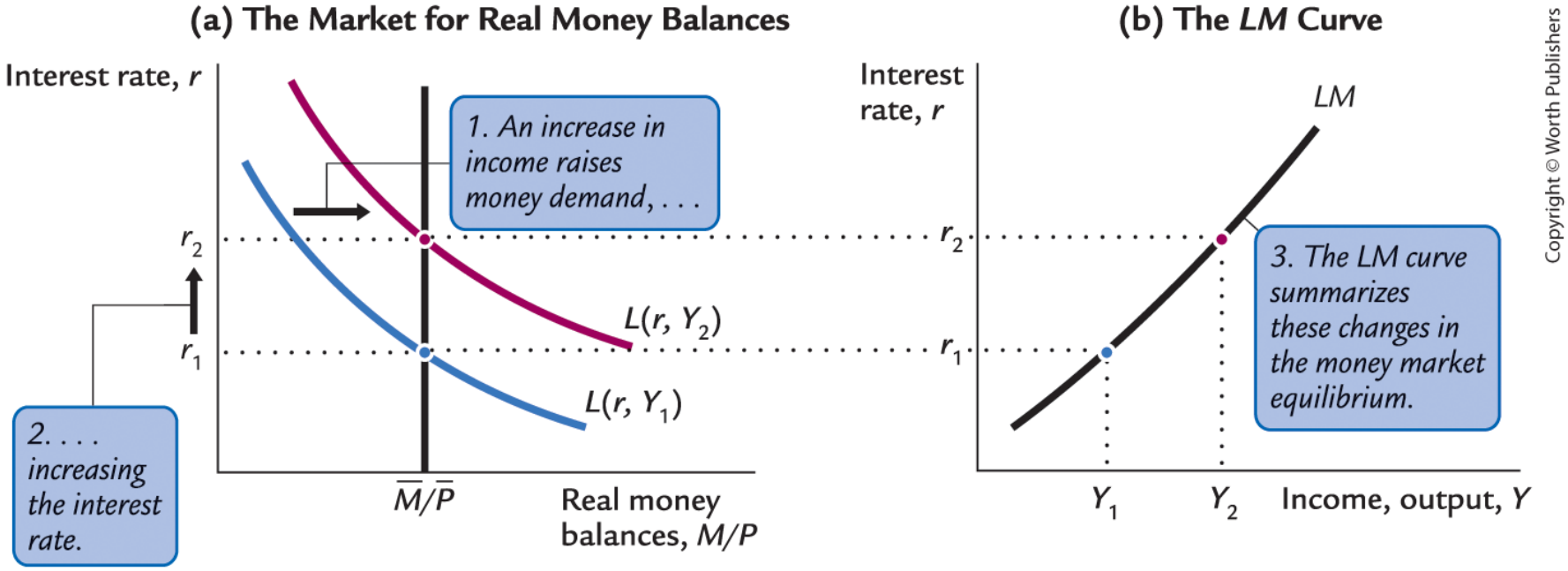
The ***LM* curve** is a graph of all combinations of ***r*** and ***Y*** that equate the supply and demand for real money balances.

The equation for the *LM* curve is:

$$\bar{M}/\bar{P} = L(r, Y)$$

Deriving the *LM* curve

As income increases from Y_1 to Y_2, money demand shifts out, increasing the interest rate. The *LM* curve summarizes these changes in the money-market equilibrium.

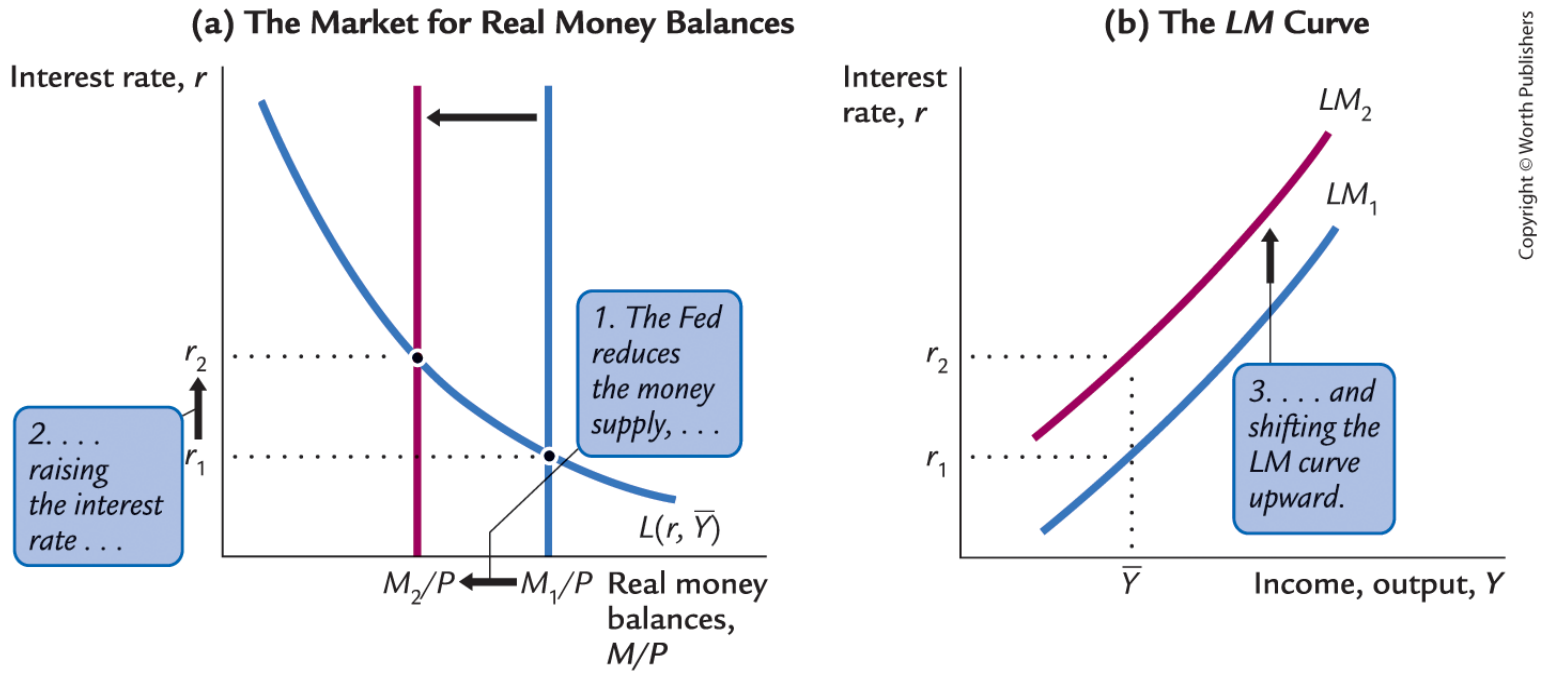


Why the *LM* curve is upward sloping

- An increase in income raises money demand.
- Since the supply of real balances is fixed, there is now excess demand in the money market at the initial interest rate.
- The interest rate must rise to restore equilibrium in the money market.

How ΔM shifts the *LM* curve

The Fed reduces the money from M_1 to M_2, causing interest rates to rise. This then results in the *LM* curve shifting up to LM_2.

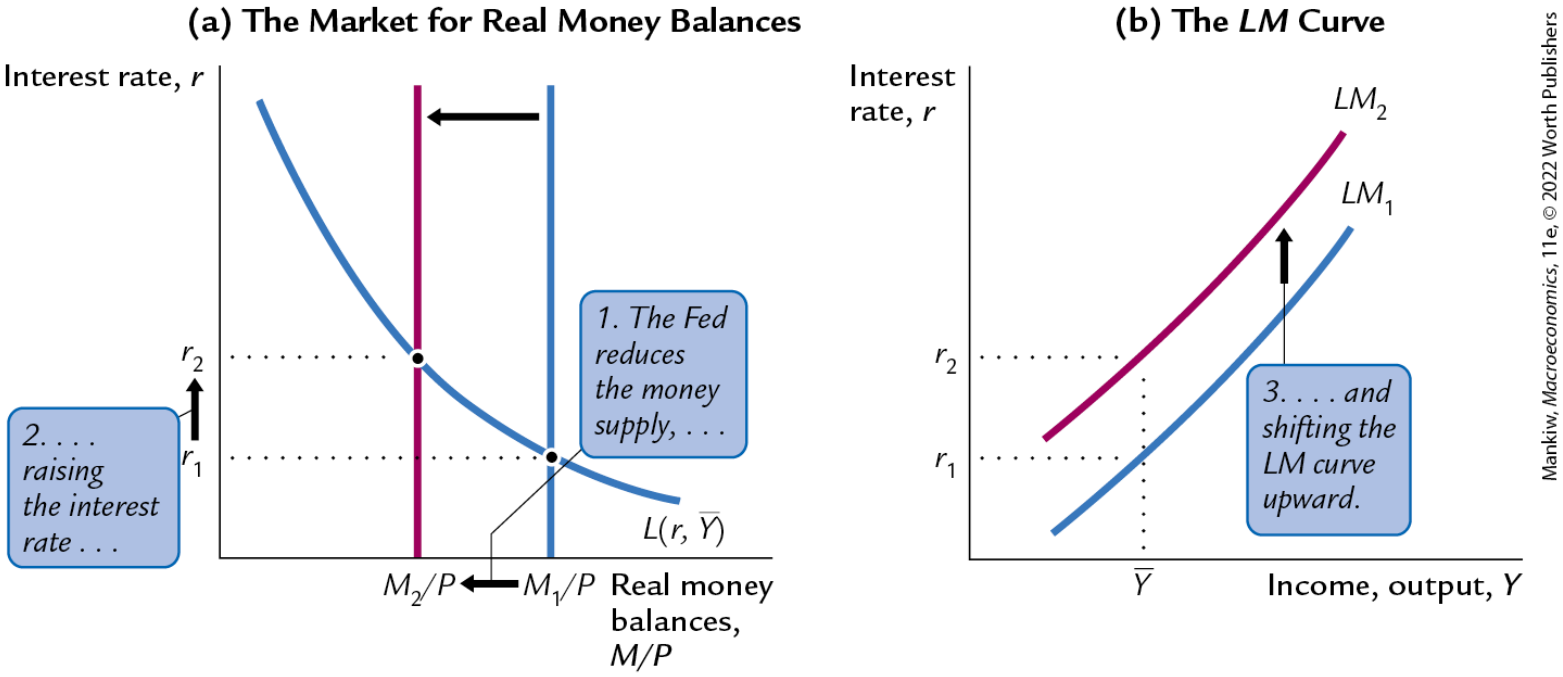


NOW YOU TRY
Shifting the *LM* curve

- Due to safety precautions during Covid-19, companies requested/required customers not to use cash for their payments.
- Use the liquidity preference model to show how these events shift the *LM* curve.

NOW YOU TRY Shifting the *LM* curve, answer

Consumers use cash less frequently, and money demand will decrease from $L_1(r, Y)$ to $L_2(r, Y)$, causing interest rates to fall. This then results in the *LM* curve shifting to the left to LM_2.

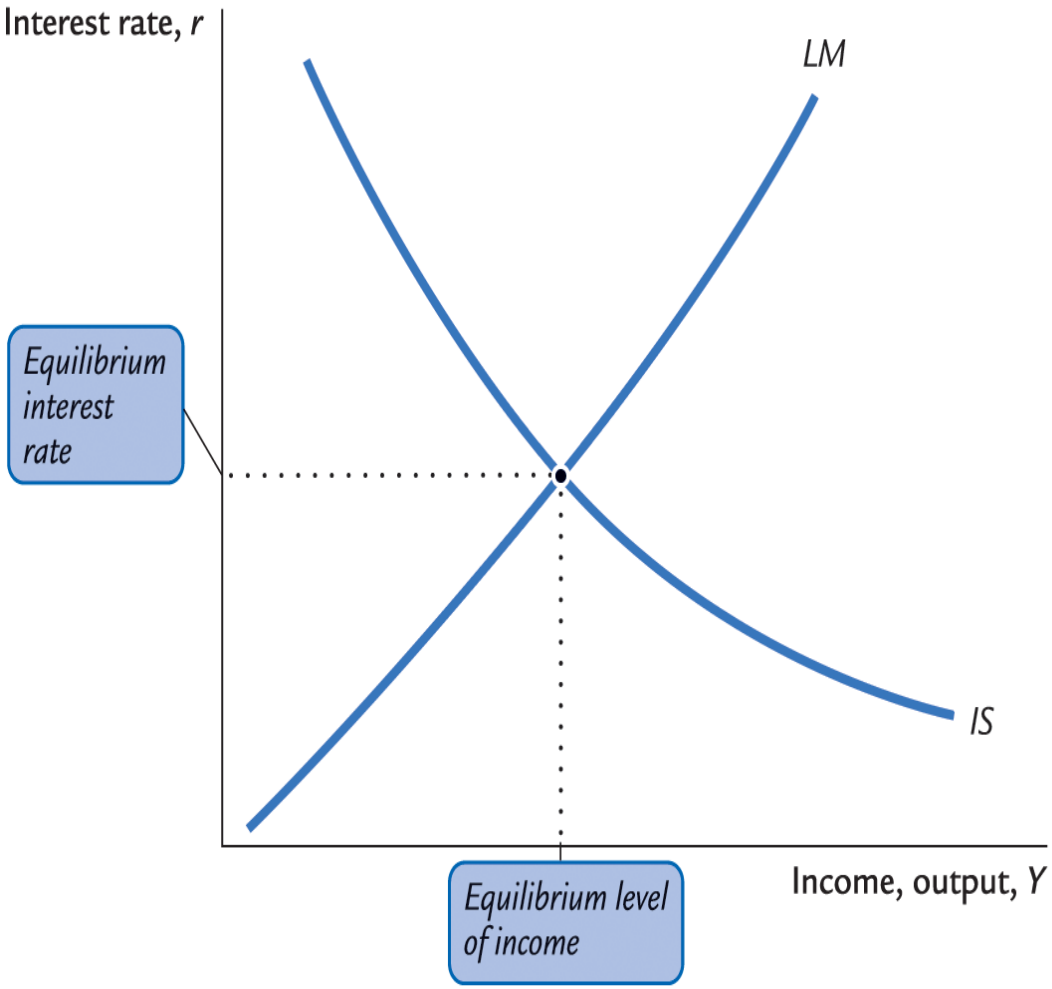


The short-run equilibrium

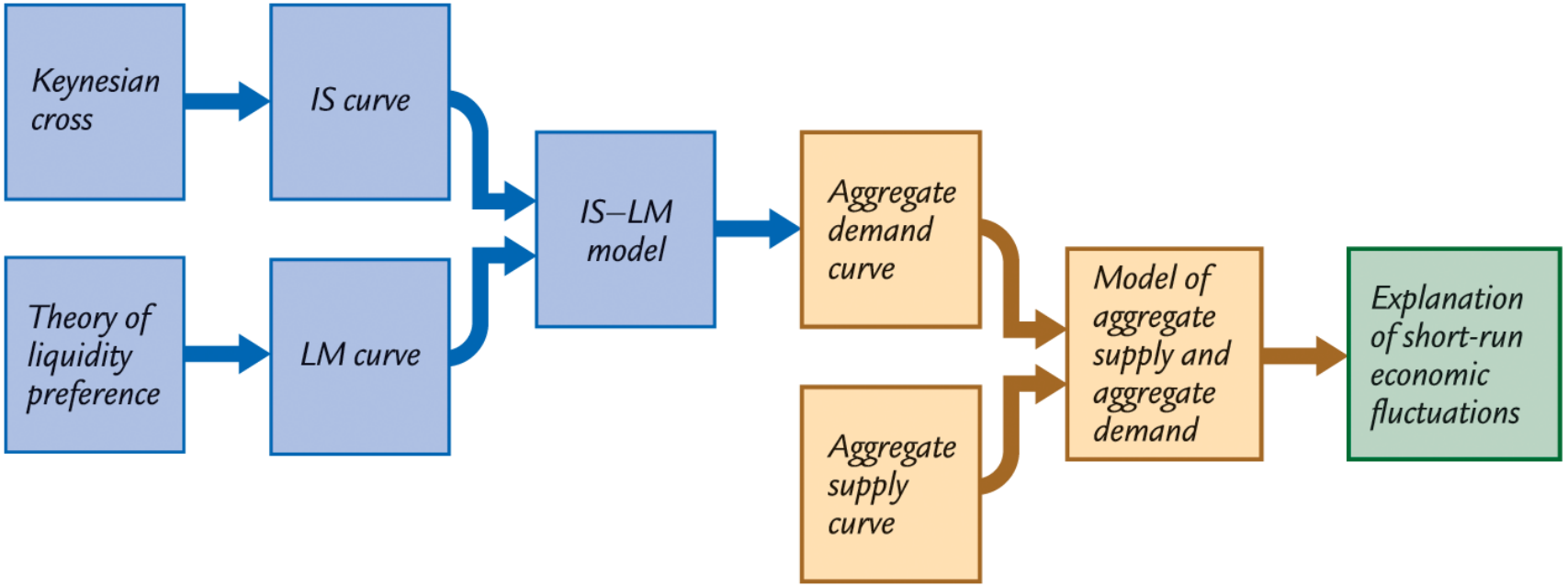
The short-run equilibrium is the combination of ***r*** and ***Y*** that simultaneously satisfies the equilibrium conditions in the goods and money markets:

$$Y = C(Y - \bar{T}) + I(r) + \bar{G}$$

$$\bar{M}/\bar{P} = L(r, Y)$$



The big picture



SUMMARY, PART 1

- Keynesian cross
  - basic model of income determination
  - takes fiscal policy and investment as exogenous
  - fiscal policy has a multiplier effect on income
- IS curve
  - comes from Keynesian cross when planned investment depends negatively on interest rate
  - shows all combinations of ***r*** and ***Y*** that equate planned expenditure with actual expenditure on goods and services

SUMMARY, PART 2

- Theory of liquidity preference
  - basic model of interest rate determination
  - takes money supply and price level as exogenous
  - an increase in the money supply lowers the interest rate
- *LM* curve
  - comes from liquidity preference theory when money demand depends positively on income
  - shows all combinations of ***r*** and ***Y*** that equate demand for real money balances with supply

SUMMARY, PART 3

- *IS–LM* model
  - The intersection of the *IS* and *LM* curves shows the unique point (***Y***, ***r***) that satisfies equilibrium in both the goods and money markets.