

# *More About Aggregate Demand*

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- Develop the *IS-LM* model, the theory that yields the aggregate demand curve. Once we construct AD, then we are able to understand how AD moves about
- We focus on the short run and so we assume the price level is fixed. (P does not change)
- Focus on the closed-economy case. There are no exports. We 'open' up the economy in Chapter 12. (Just dealing with C, I, G)

# Now, we build up the intuition...

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- the  $IS$  curve, and its relation to
  - the Keynesian Cross
  - the Loanable Funds model
- the  $LM$  curve, and its relation to
  - the Theory of Liquidity Preference
- how the  $IS-LM$  model determines income and the interest rate in the short run when  $P$  is fixed

# The Keynesian Cross

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- A simple closed economy model in which income is determined by expenditure.  
*(John Maynard Keynes)*
- Notation:
  - $I$  = *planned* investment (consider fixed)
  - $E = C + I + G$  = planned expenditure
  - $Y$  = real GDP = actual expenditure
- Difference between actual & planned expenditure: unplanned inventory investment

# Elements of the Keynesian Cross

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

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

for now, planned  
investment is exogenous:

$$I = \bar{I}$$

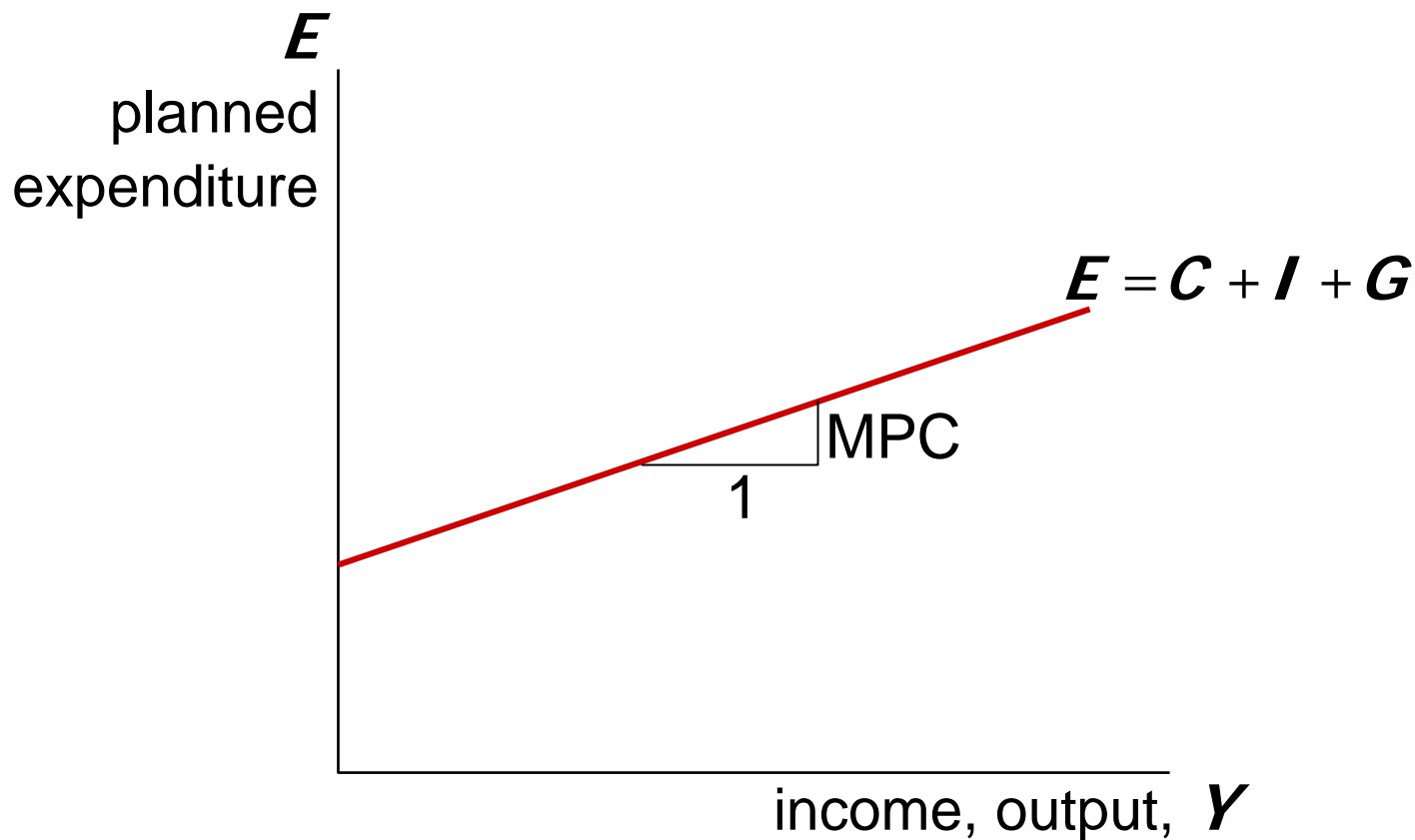
planned expenditure:  $E = C(Y - \bar{T}) + \bar{I} + \bar{G}$

Equilibrium condition:

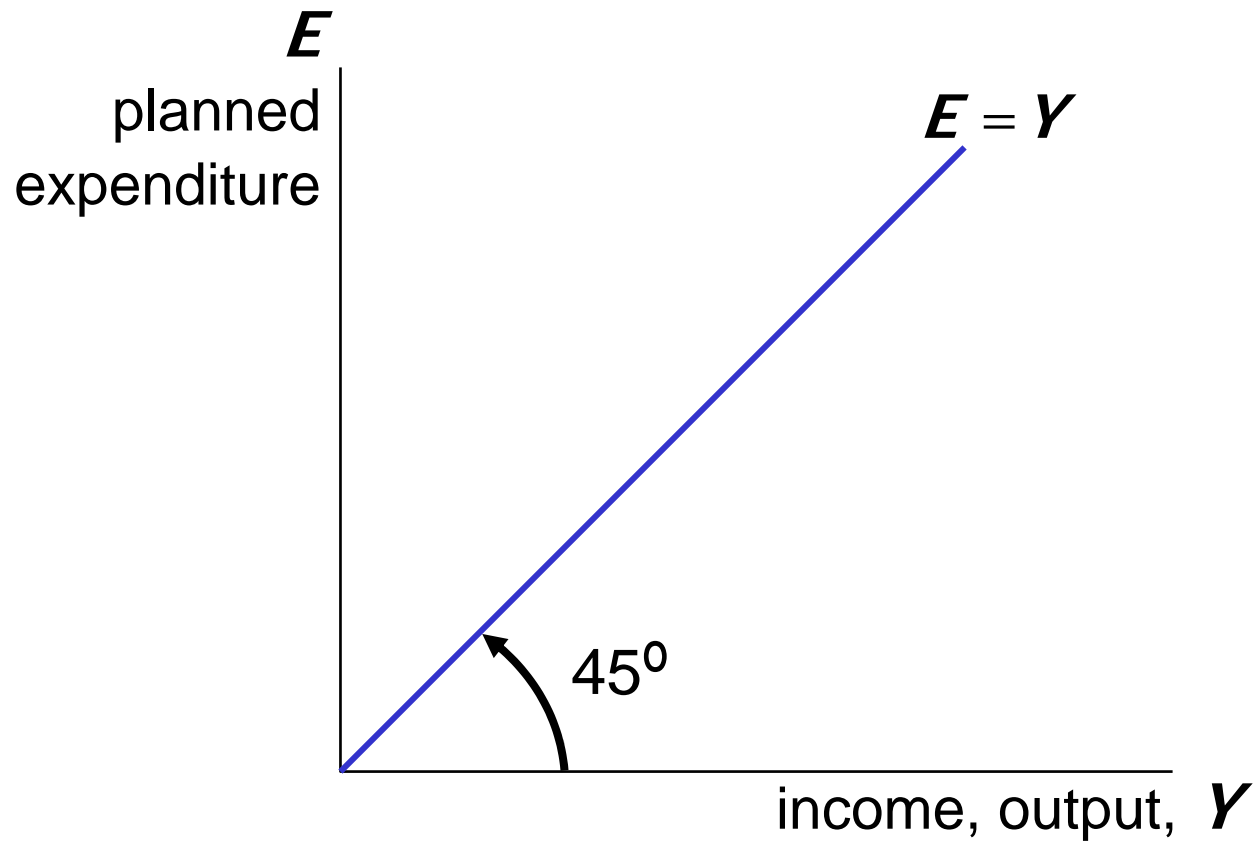
Actual expenditure = Planned expenditure

$$Y = E$$

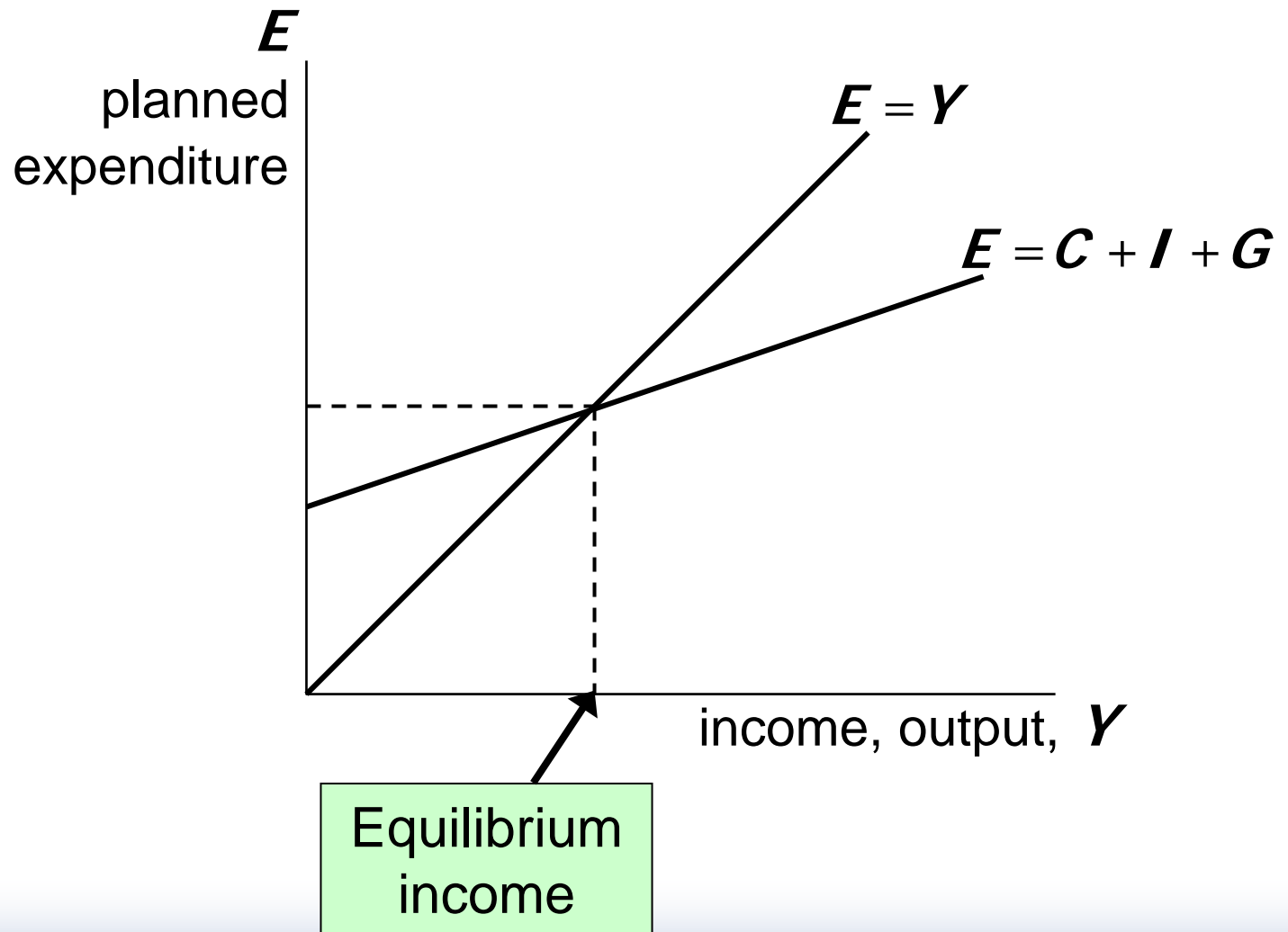
# Graphing planned expenditure



# Graphing the equilibrium condition



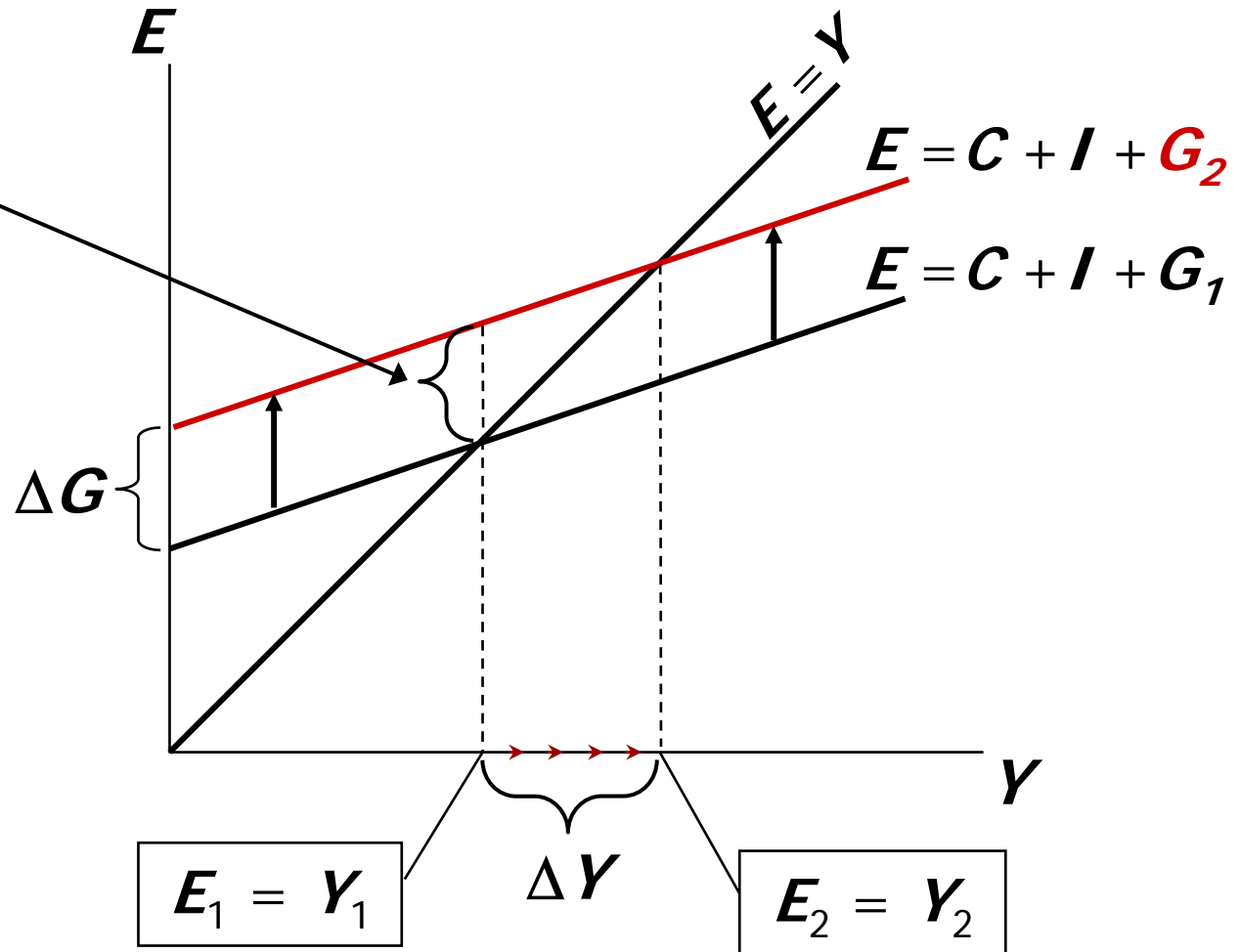
# The equilibrium value of income



# An increase in government purchases

At  $Y_1$ ,  
there is now an  
unplanned drop  
in inventory...

...so firms  
increase output,  
and income  
rises toward a  
new equilibrium



# Why the multiplier is greater than 1

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- Initially, the increase in  $G$  causes an equal increase in  $Y$ :  $\Delta Y = \Delta G$ .
- But  $\uparrow Y \Rightarrow \uparrow C$ 
  - $\Rightarrow$  further  $\uparrow Y$
  - $\Rightarrow$  further  $\uparrow C$
  - $\Rightarrow$  further  $\uparrow Y$
- So the final impact on income is much bigger than the initial  $\Delta G$ .

# Government Multiplier

$$Y = C + I + G$$

equilibrium condition

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

in changes

$$= \Delta C + \Delta G$$

because  $I$  exogenous

$$= \text{MPC} \times \Delta Y + \Delta G$$

because  $\Delta C = \text{MPC} \Delta Y$

Collect terms with  $\Delta Y$   
on the left side of the  
equals sign:

$$(1 - \text{MPC}) \times \Delta Y = \Delta G$$

Finally, solve for  $\Delta Y$ :

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

# The government purchases multiplier

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

In this model, the govt purchases multiplier equals 
$$\frac{\Delta Y}{\Delta G} = \frac{1}{1 - \text{MPC}}$$

Example: If  $\text{MPC} = 0.8$ , then

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

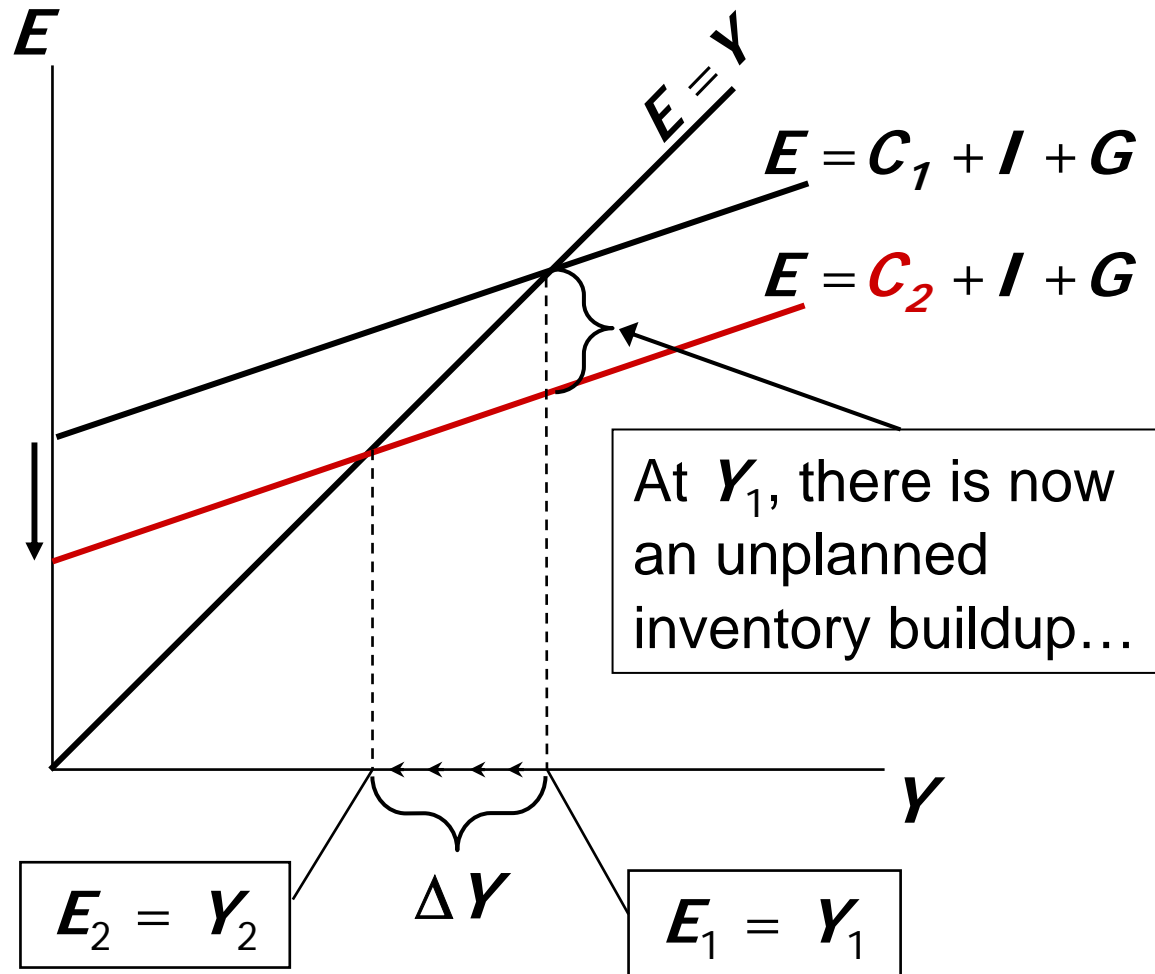
An increase in ***G*** causes income to increase by 5 times as much!

# An increase in taxes

Initially, the tax increase reduces consumption, and therefore  $E$ :

$$\Delta C = -\text{MPC} \Delta T$$

...so firms reduce output, and income falls toward a new equilibrium



# Tax Multiplier

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

eq'm condition in  
changes

$$= \Delta C$$

$I$  and  $G$  exogenous

$$= \text{MPC} \times (\Delta Y - \Delta T)$$

Solving for  $\Delta Y$ :  $(1 - \text{MPC}) \times \Delta Y = -\text{MPC} \times \Delta T$

Final result:

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

# The Tax Multiplier

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def: the change in income resulting from a \$1 increase in  $T$ :

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

If  $\text{MPC} = 0.8$ , 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

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...is *negative*:

A tax hike reduces consumer spending, which reduces income.

*There was a picture here, but it was very stupid*

...is *greater than one*

*(in absolute value)*:

A change in taxes has a multiplier effect on income.

...is *smaller than the govt 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**.

# The *IS* curve

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def: a graph of all combinations of  $r$  and  $Y$  that result in goods market equilibrium,

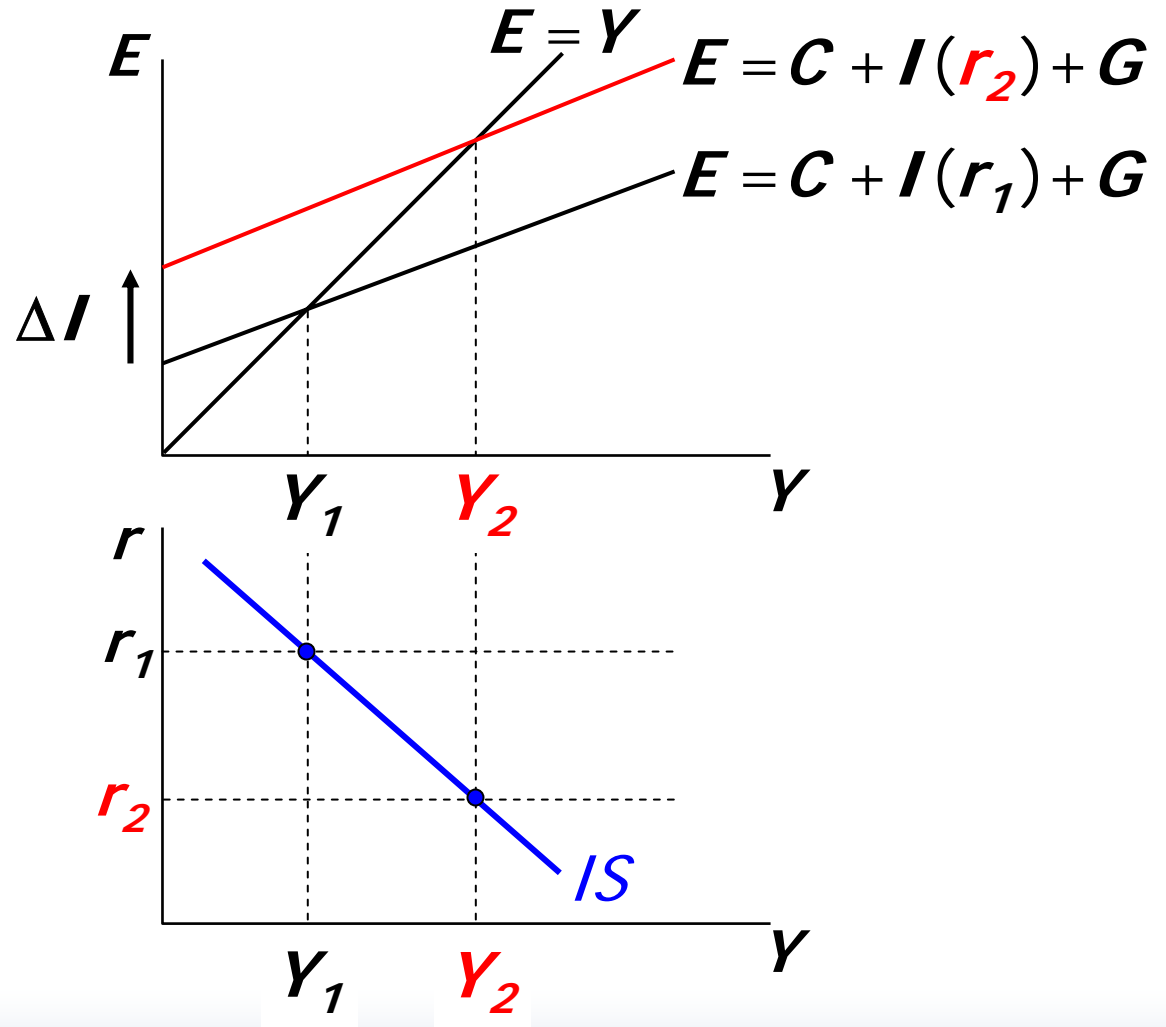
*i.e.* actual expenditure (output)  
= planned expenditure

The equation for the *IS* curve is:

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

# Deriving the IS curve

$\downarrow r \Rightarrow \uparrow I$   
 $\Rightarrow \uparrow E$   
 $\Rightarrow \uparrow Y$



# Why the *IS* curve is negatively sloped

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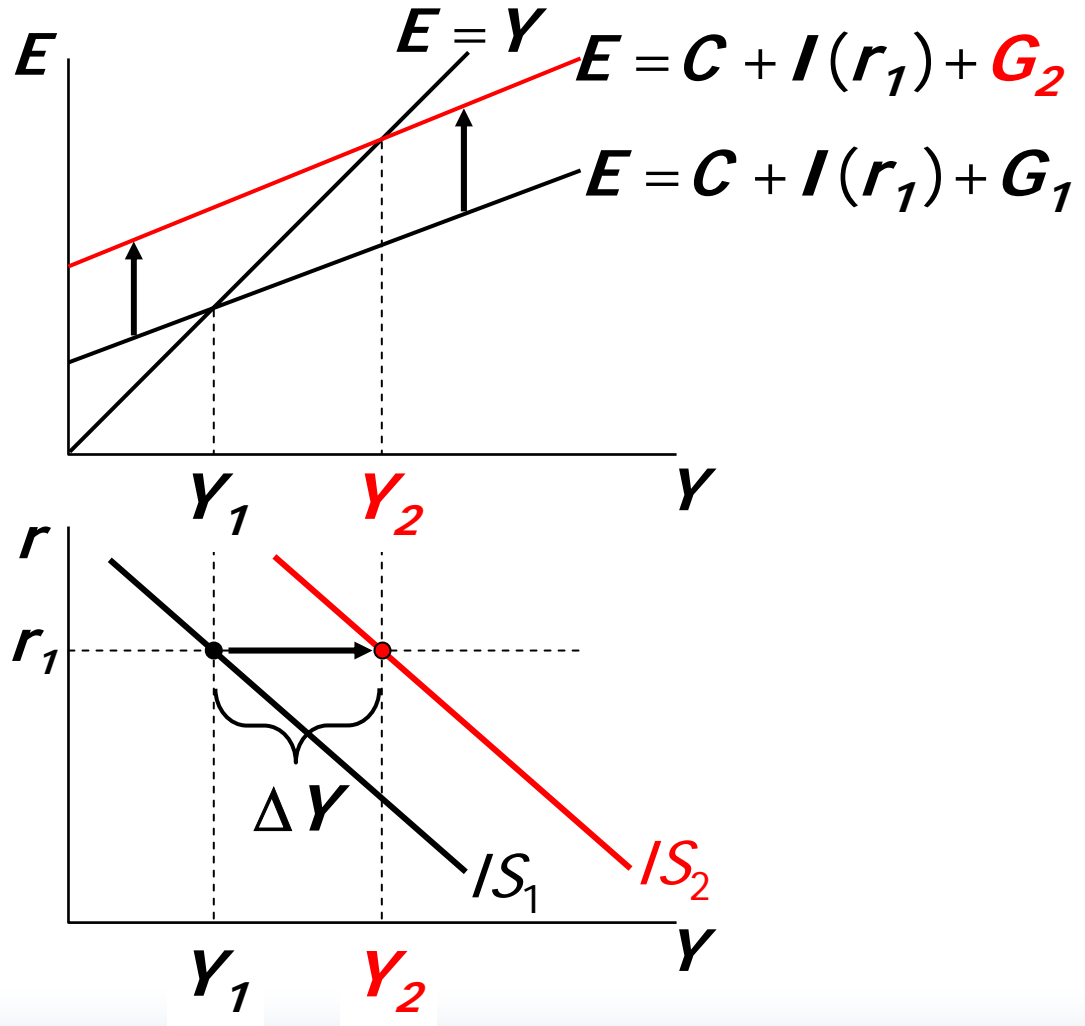
- A fall in the interest rate motivates firms to increase investment spending, which drives up total planned spending ( $E$ ).
- To restore equilibrium in the goods market, output (a.k.a. actual expenditure,  $Y$ ) must increase.

# Shifting the IS curve: $\Delta G$

At any value of  $r$ ,  
 $\uparrow G \Rightarrow \uparrow E \Rightarrow \uparrow Y$   
 ...so the IS curve  
 shifts to the right.

The horizontal  
 distance of the  
 IS shift equals

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



# The Theory of Liquidity Preference

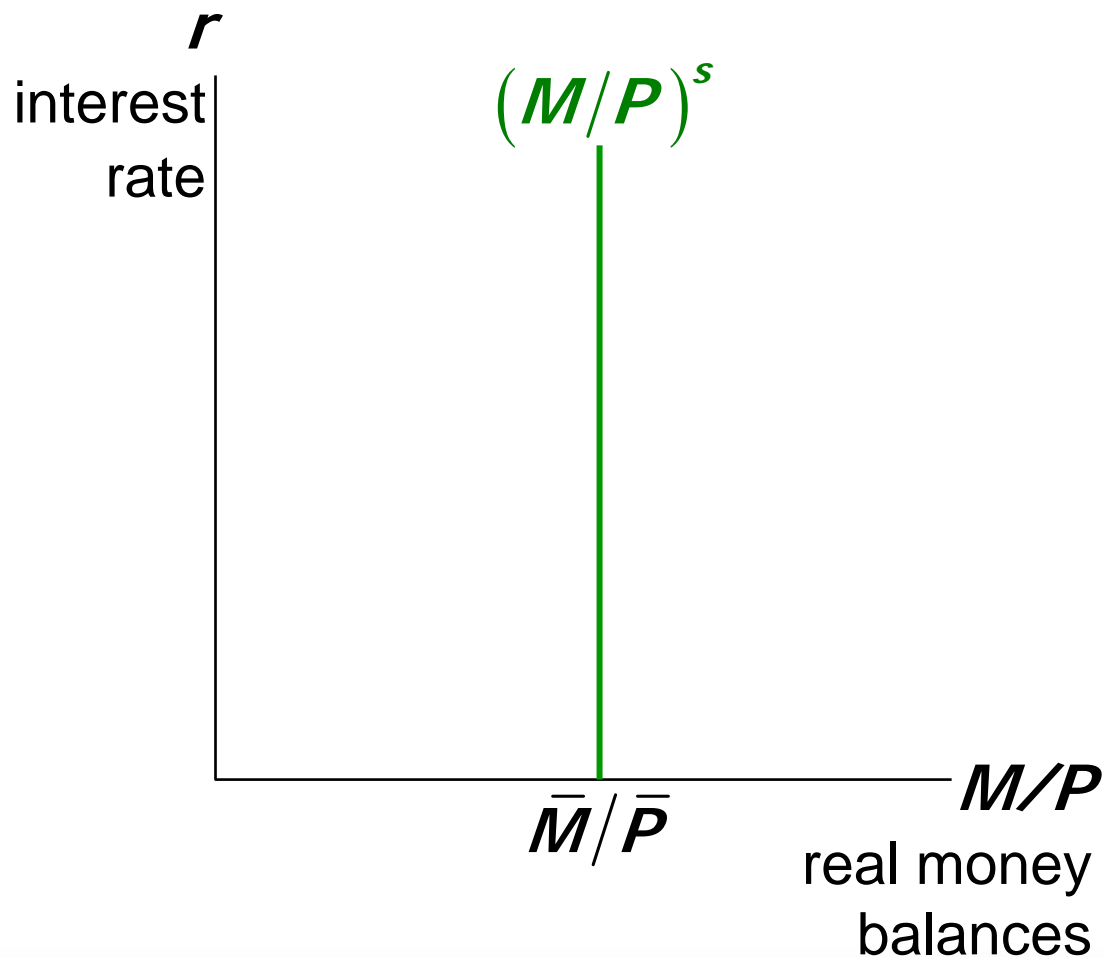
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- due to John Maynard Keynes.
- A simple theory in which the interest rate is determined by money supply and money demand.

# Money Supply

The supply of  
real money  
balances  
is fixed:

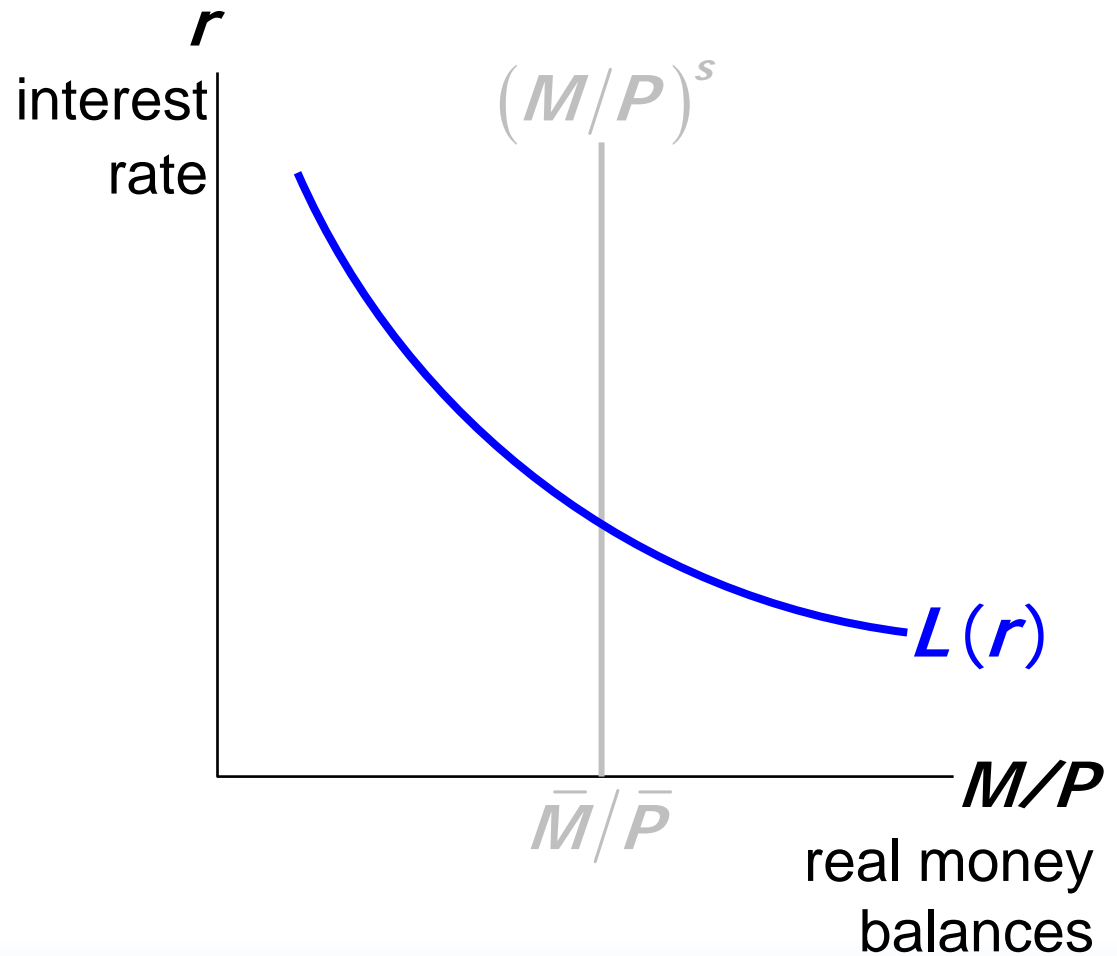
$$(M/P)^s = \bar{M}/\bar{P}$$



# Money Demand

Demand for  
real money  
balances:

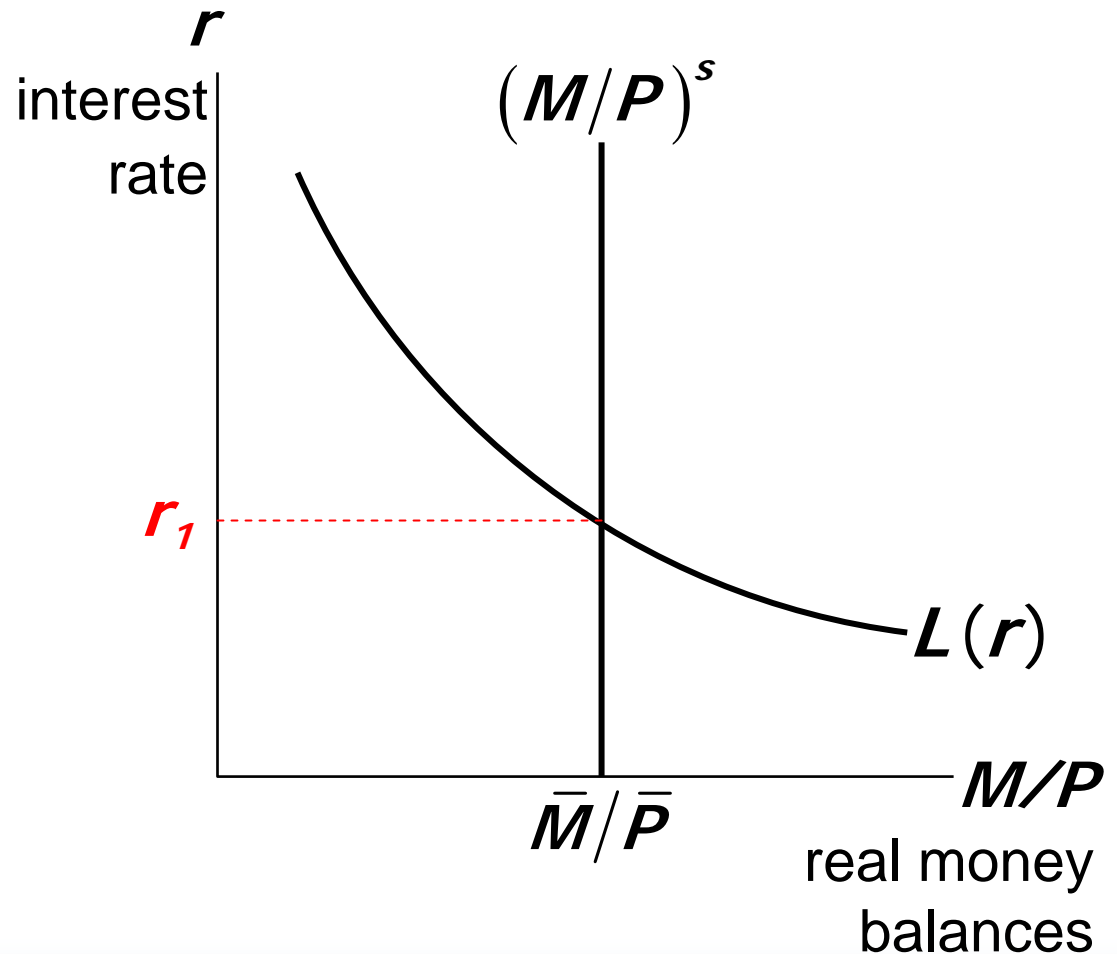
$$(M/P)^d = L(r)$$



# Equilibrium

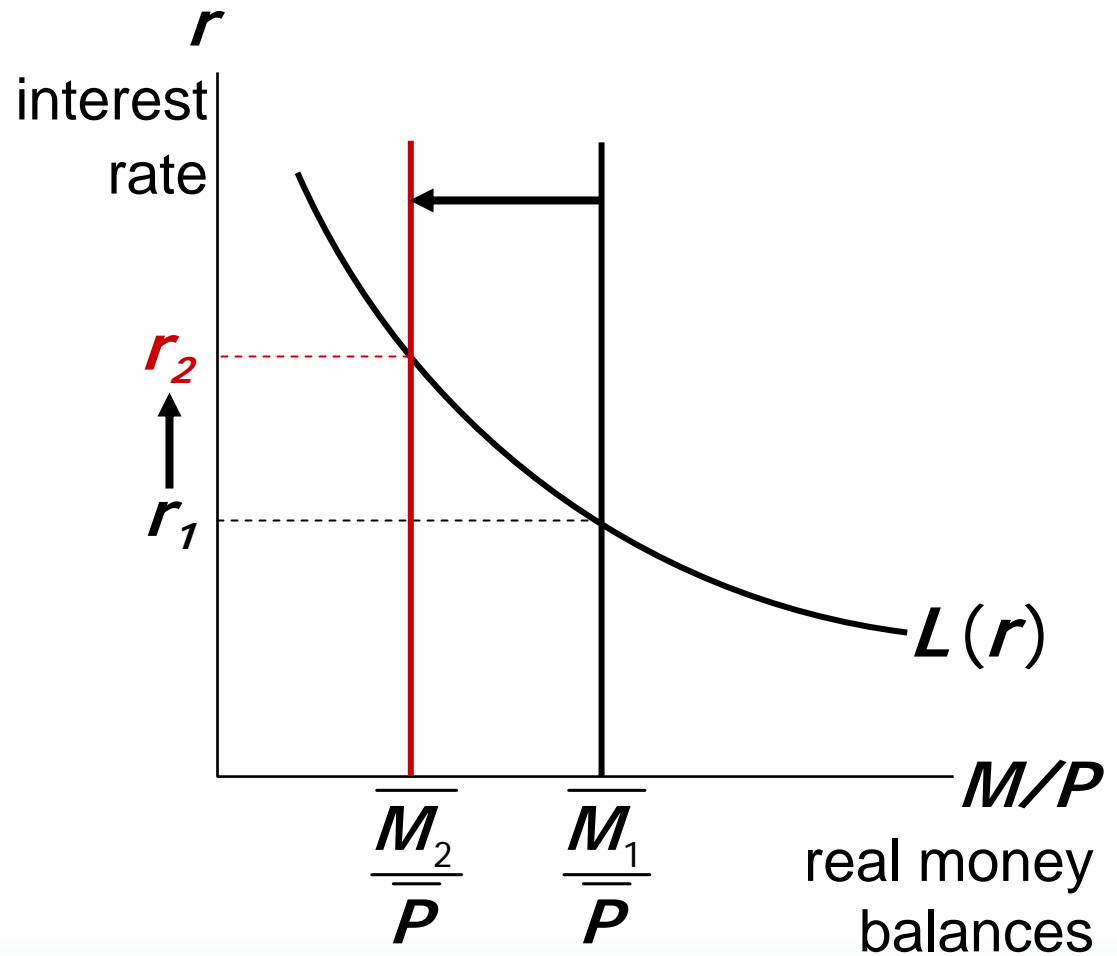
The interest rate adjusts to equate the supply and demand for money:

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



# How the Fed raises the interest rate

To increase  $r$ ,  
Fed reduces  $M$



# The LM curve

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

$$(M/P)^d = L(r, Y)$$

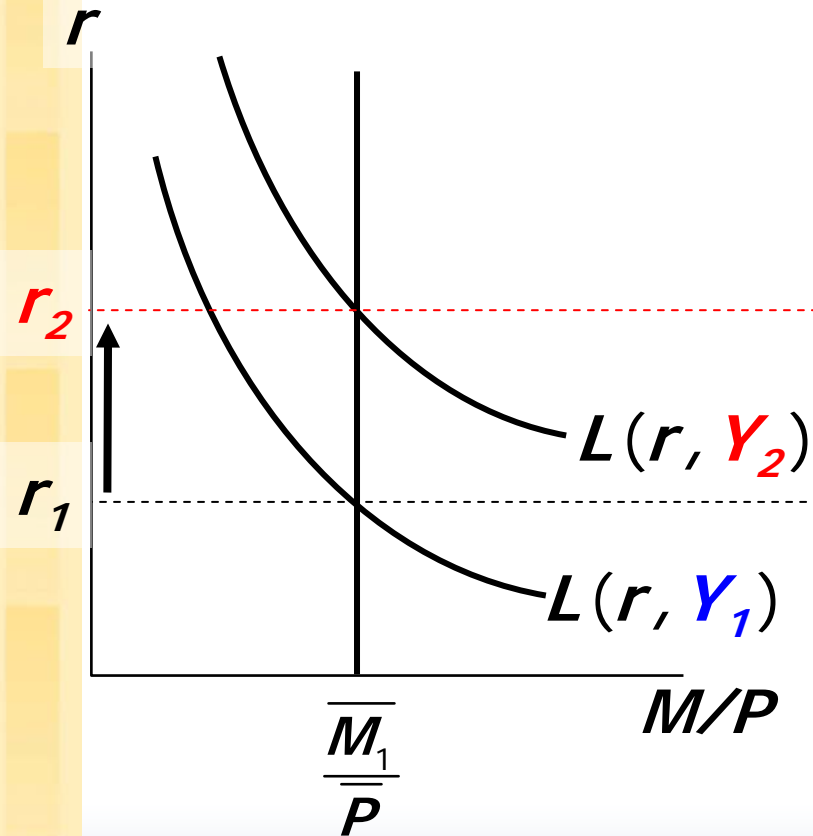
The **LM curve** is a graph of all combinations of  $r$  and  $Y$  that equate the supply and demand for real money balances.

The equation for the *LM* curve is:

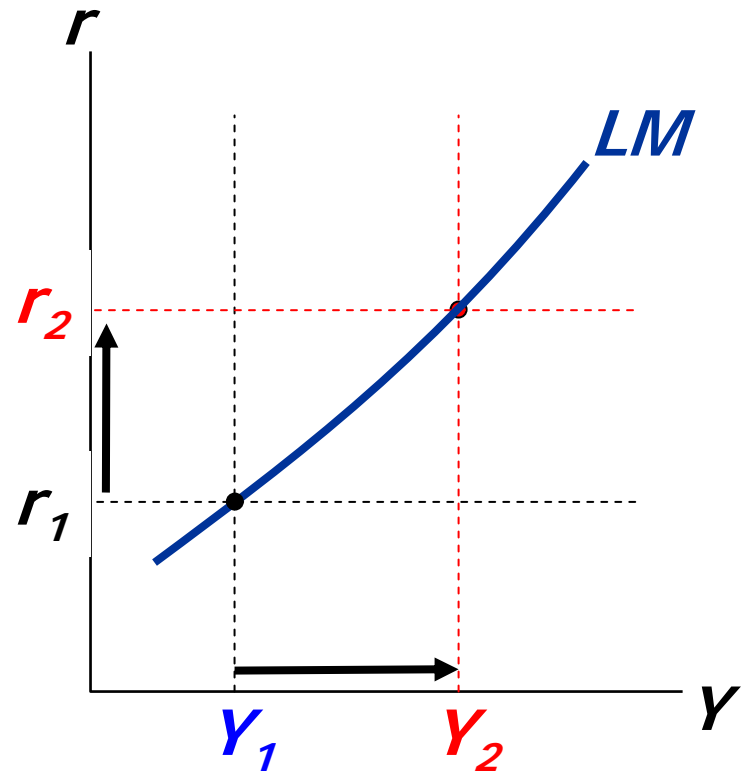
$$\bar{M}/\bar{P} = L(r, Y)$$

# Deriving the LM curve

(a) The market for real money balances



(b) The LM curve



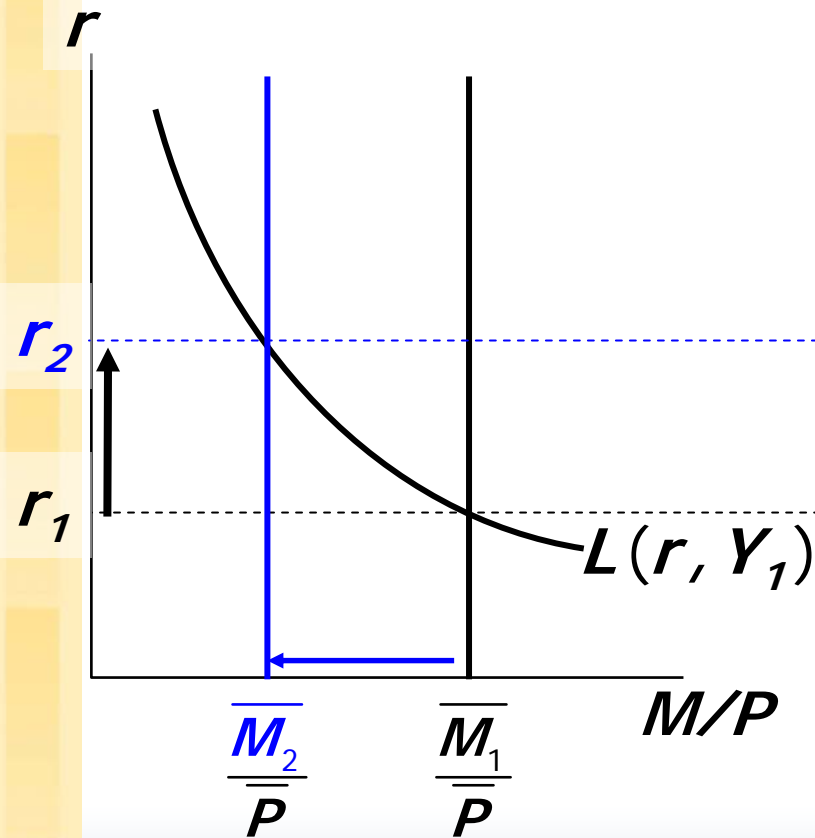
# Why the *LM* curve is upward-sloping

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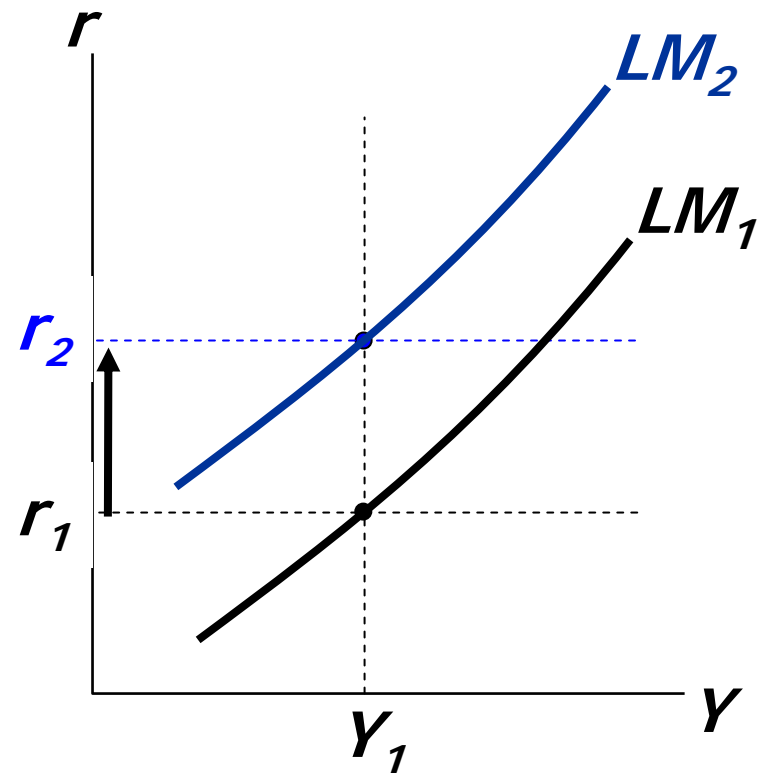
- An increase in income raises money demand.
- Since the supply of real balances is fixed, there is now excess demand in the money market at the initial interest rate.
- The interest rate must rise to restore equilibrium in the money market.

# How $\Delta M$ shifts the LM curve

(a) The market for real money balances



(b) The LM curve

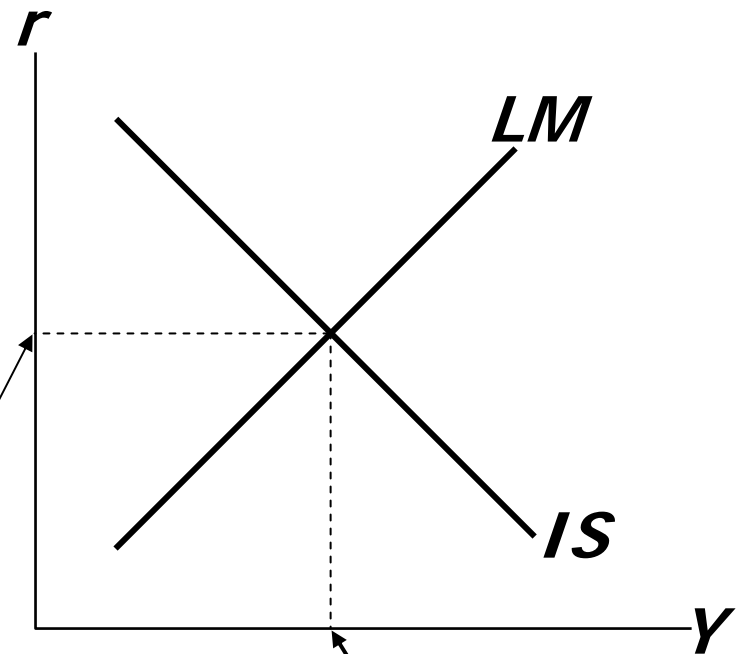


# The short-run equilibrium

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

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

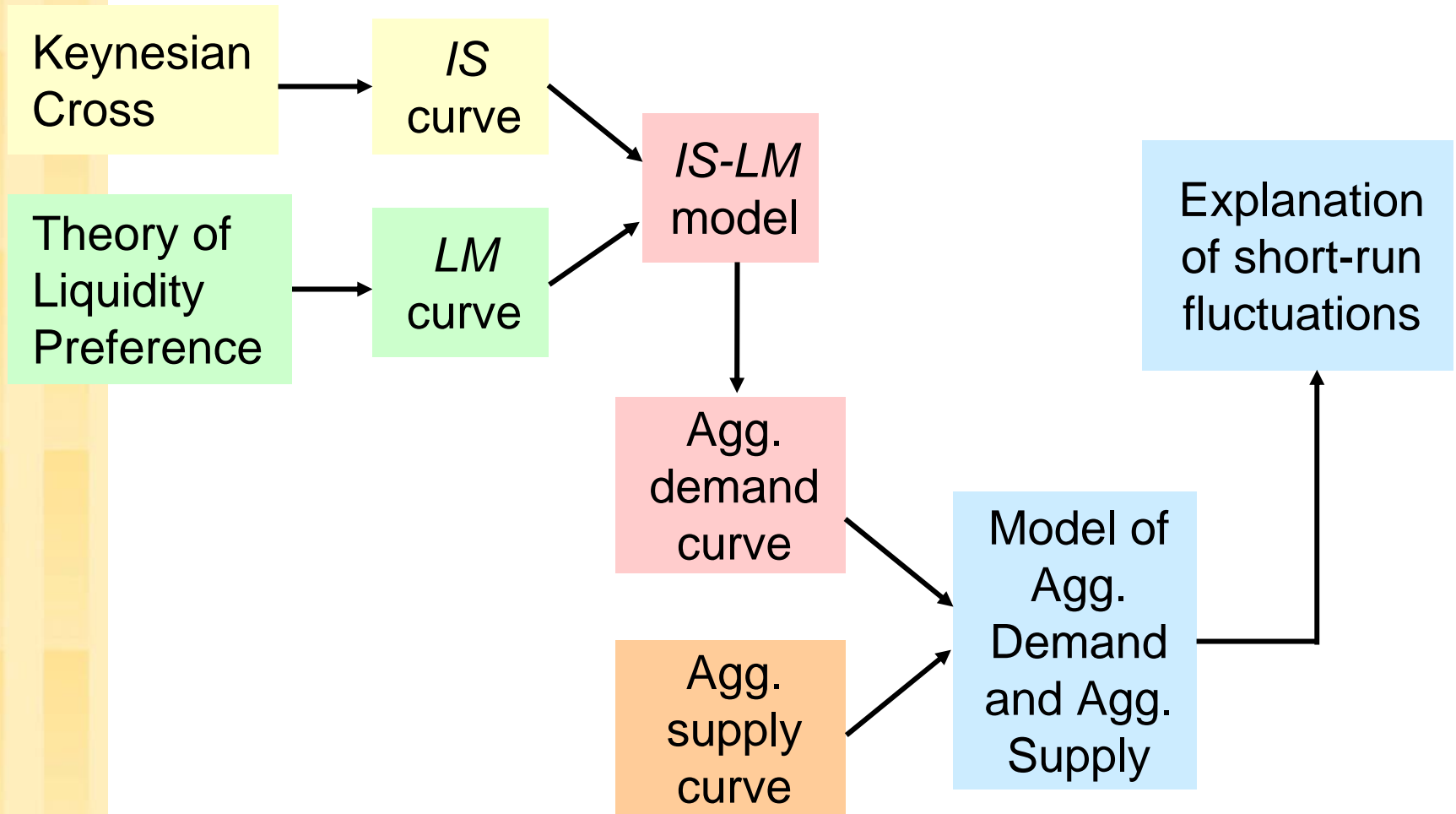
$$\bar{M}/\bar{P} = L(r, Y)$$



Equilibrium  
interest  
rate

Equilibrium  
level of  
income

# The Big Picture



# Summary 2

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## 1. Keynesian Cross

- basic model of income determination
- takes fiscal policy & investment as exogenous
- fiscal policy has a multiplier effect on income.

## 2. $IS$ 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 & services

# Summary 2

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## 3. Theory of Liquidity Preference

- basic model of interest rate determination
- takes money supply & price level as exogenous
- an increase in the money supply lowers the interest rate

## 4. $LM$ 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

# Chapter summary

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## 5. *IS-LM* model

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

# Preview of Chapter 11

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In Chapter 11, we will

- use the *IS-LM* model to analyze the impact of policies and shocks
- learn how the aggregate demand curve comes from *IS-LM*
- use the *IS-LM* and *AD-AS* models together to analyze the short-run and long-run effects of shocks
- use our models to learn about the Great Depression