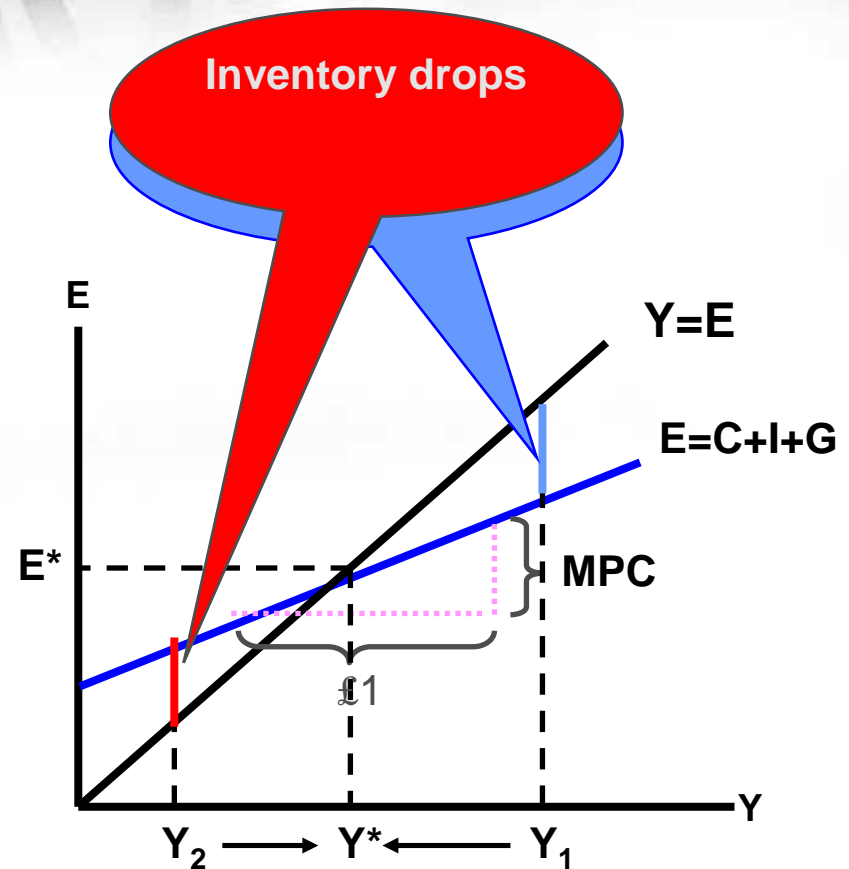




**The IS-LM Model**  
**Ing. Mansoor Maitah Ph.D.**

## Constructing the Keynesian Cross

- Equilibrium is at the point where  $Y = C + I + G$ .
- If firms were producing at  $Y_1$  then  $Y > E$
- Because actual expenditure exceeds planned expenditure, inventory accumulates, stimulating a reduction in production.
- Similarly at  $Y_2$ ,  $Y < E$
- Because planned expenditure exceeds actual expenditure, inventory drops, stimulating an increase in production.



## Investment, Sales (Y), and the Interest Rate (i)

- Now, we no longer assume I (investment) is constant
- We capture the effects of two factors affecting investment:
  - The level of sales/income (+)
  - The interest rate (-)

$$I = I(Y, i)$$



## The Goods Market and the *IS* Relation

- Equilibrium in the goods market exists when production,  $Y$ , is equal to the demand for goods,  $Z$ .
- In the simple model, the interest rate did not affect the demand for goods. The equilibrium condition was given by:

$$Y = C(Y - T) + I + G$$



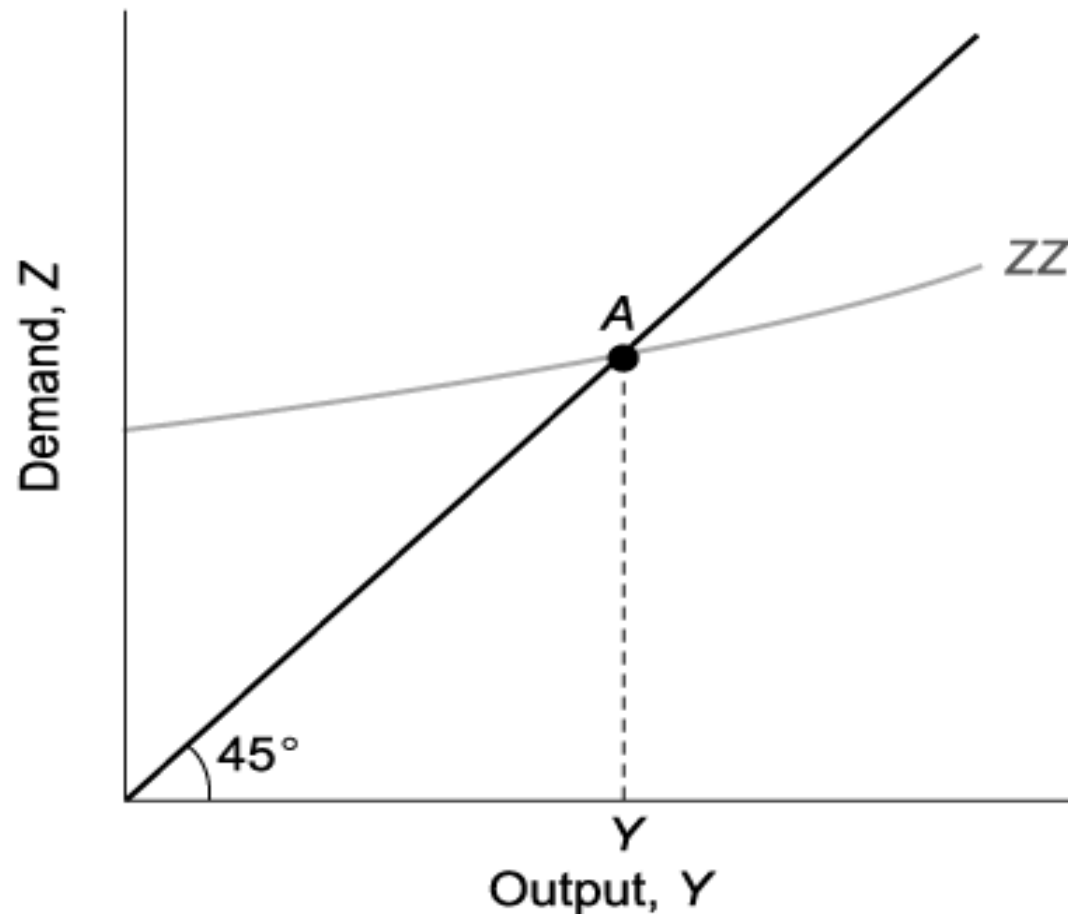
## The Determination of Output

- Taking into account the investment relation above, the equilibrium condition in the goods market becomes:

$$Y = C(Y - T) + I(Y, i) + G$$

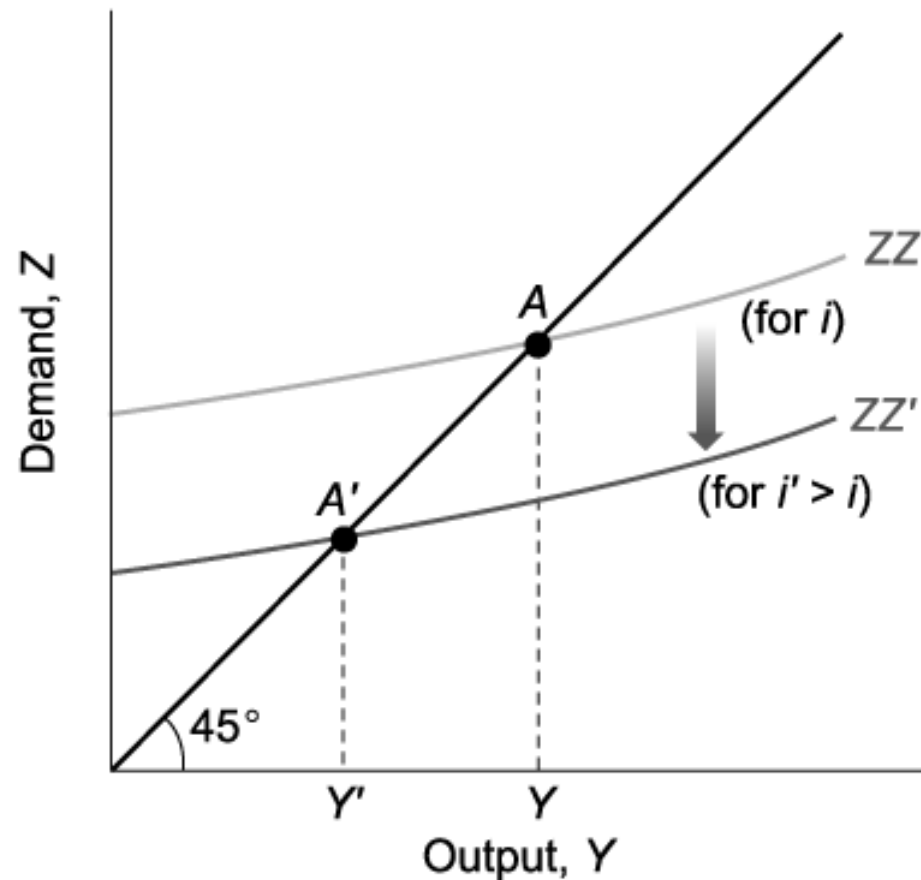
## *Equilibrium in the Goods Market*

The demand for goods is an increasing function of output. Equilibrium requires that the demand for goods be equal to output.



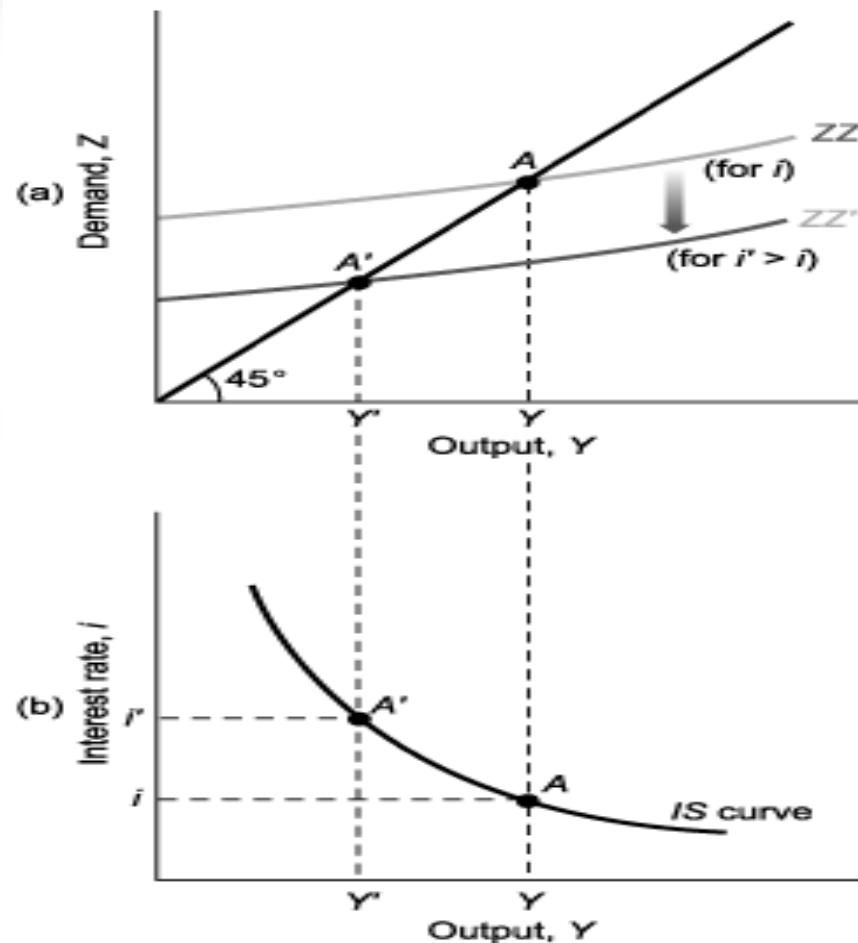
## Deriving the IS curve

An increase in the interest rate decreases the demand for goods at any level of output.



## Deriving the IS curve

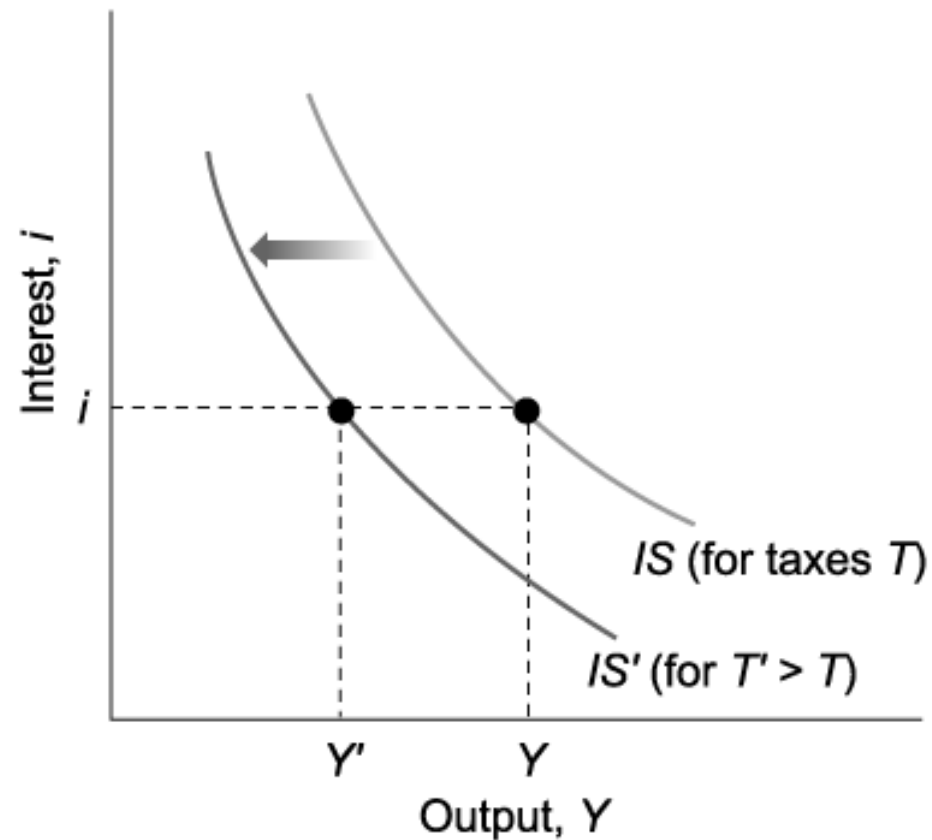
- Equilibrium in the goods market implies that an increase in the interest rate leads to a decrease in output. The **IS curve** is downward sloping.





## Deriving the IS curve

- An increase in taxes shifts the *IS* curve to the left.

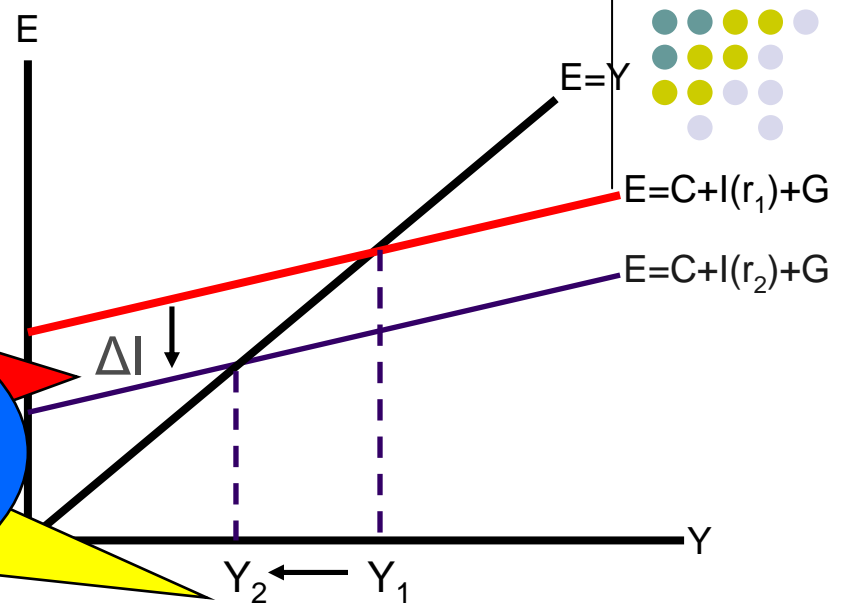




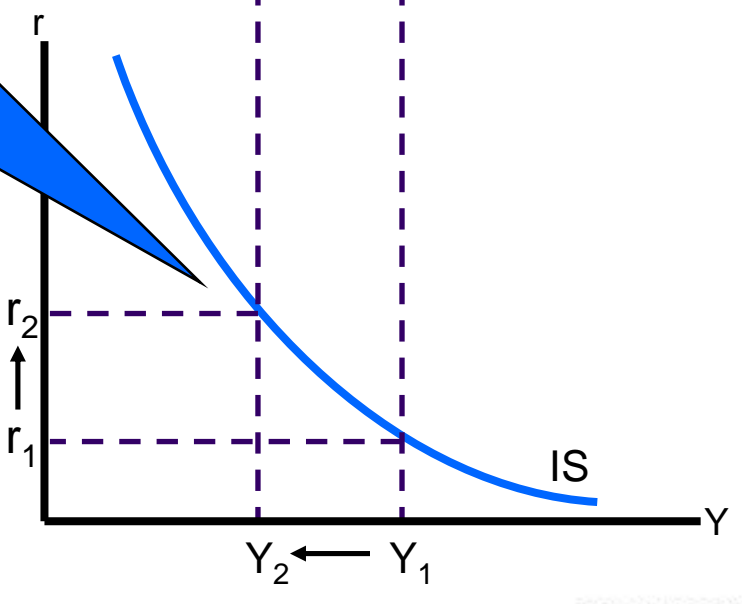
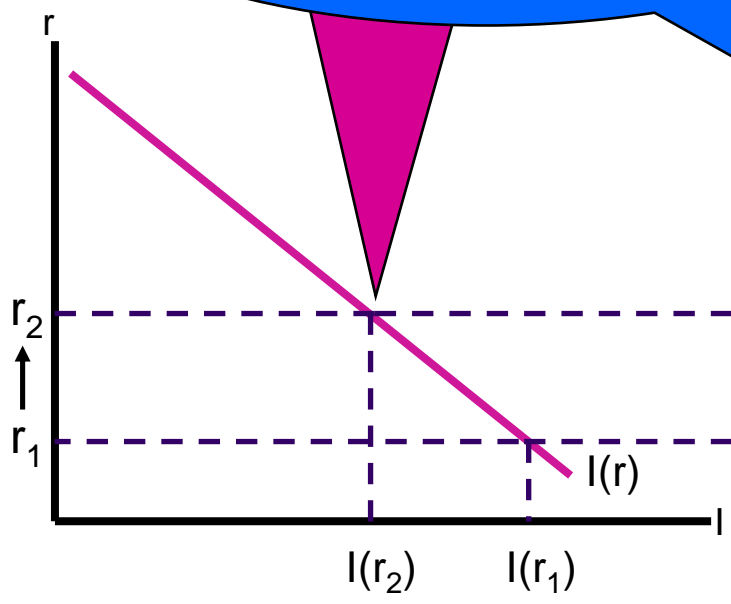
## What is the IS curve?

“The IS curve shows the combinations of the interest rate and the level of income that are consistent in the market for goods and services. The IS curve is drawn for a given fiscal policy. Changes in fiscal policy that raise the demand for goods and services shift the IS curve to the right. Changes in fiscal policy that reduce the demand for goods and services shift the IS curve to the left.”

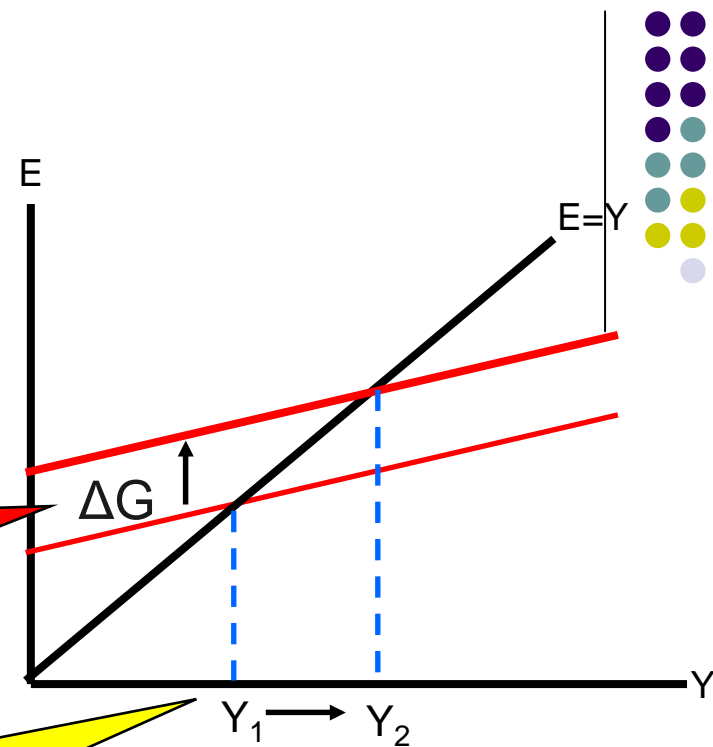
- The IS curve maps the relationship between  $r$  and  $Y$  for the goods market.



The IS curve maps out this relationship between the interest rate,  $r$ , and output (or income)  $Y$ .



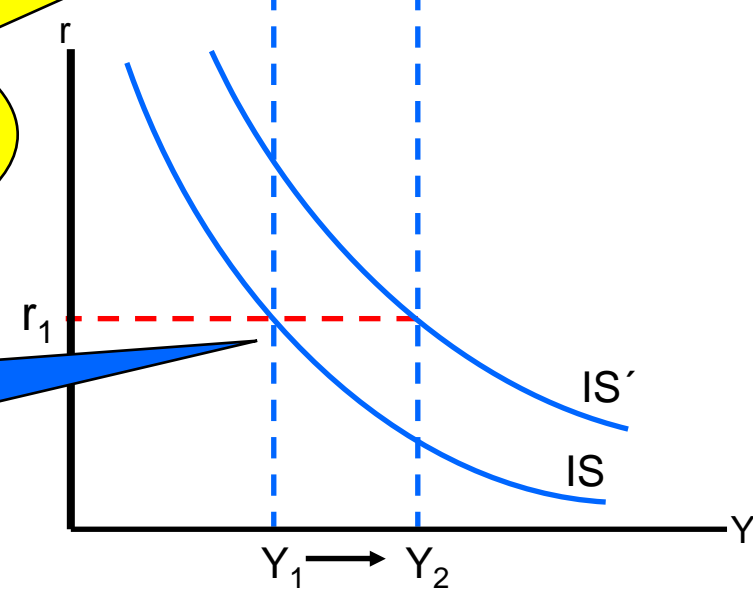
- While changing  $r$  allows us to map out the IS curve, changes in  $G$ ,  $T$ , or  $MPC$  cause  $Y$  to change for any level of  $r$ . This causes a shift in the IS curve.



Suppose an increase in  $G$  causes planned expenditure to shift up by  $\Delta G$ .

For any  $r$  the increase in  $G$  causes an increase in  $Y$  of  $\Delta G$  times the government expenditure multiplier.

Therefore, the IS curve shifts to the right by this amount.



## Financial Markets and the *LM* Relation

- The interest rate is determined by the equality of the supply of and the demand for money:

$$M = \$YL(i)$$

$M$  = nominal money stock

$L(i)$  = demand for money

$\$Y$  = nominal income

$i$  = nominal interest rate

# Real Money, Real Income, and the Interest Rate

Recall that **Nominal GDP = Real GDP multiplied by the GDP deflator:**

$$\frac{\$Y}{P} = Y$$

$$\$Y = YP$$

- **The *LM* relation:** In equilibrium, the real money supply is equal to the real money demand, which depends on real income,  $Y$ , and the interest rate,  $i$ :

$$\frac{M}{P} = YL(i)$$

Recall: before, we had the same equation but in nominal instead of real terms (nominal income and nominal money supply). Dividing both sides by  $P$  (the price level) gives us the equation above.



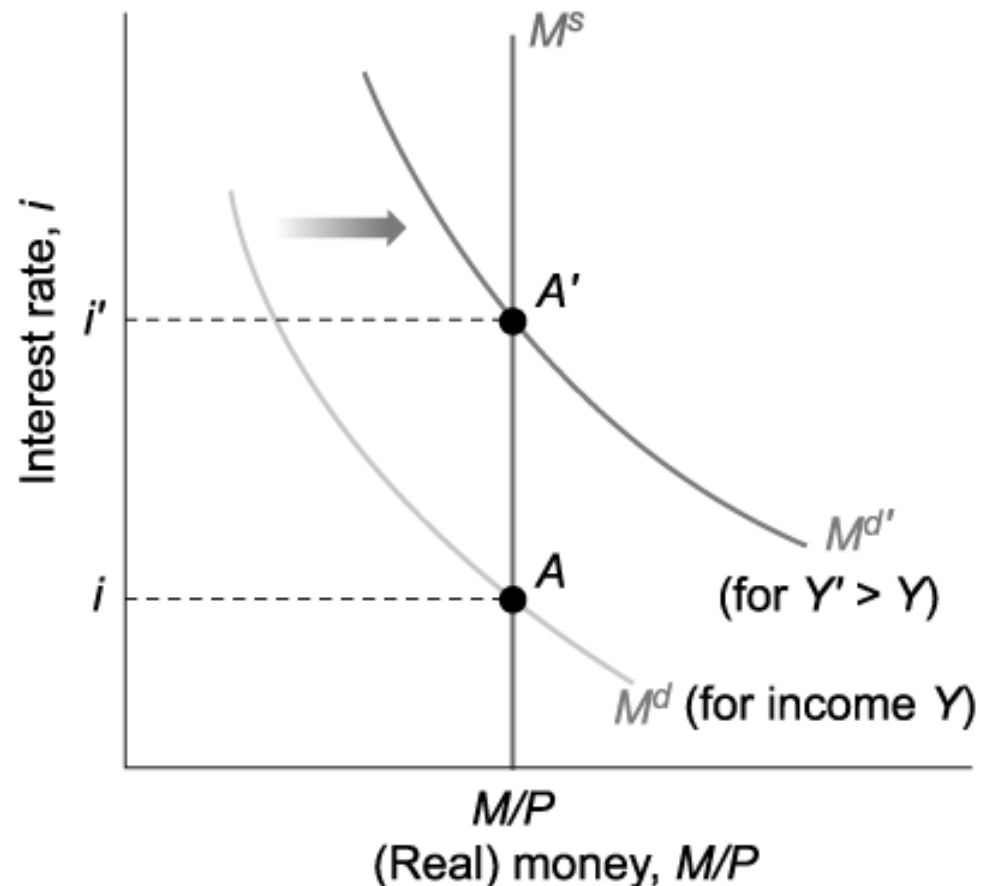
## Money Demand

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

The quantity of real money balances demanded is negatively related to the interest rate (because  $r$  is the opportunity cost of holding money) and positively related to income (because of transactions demand).

## The Effects of an Increase in Income on the Interest Rate

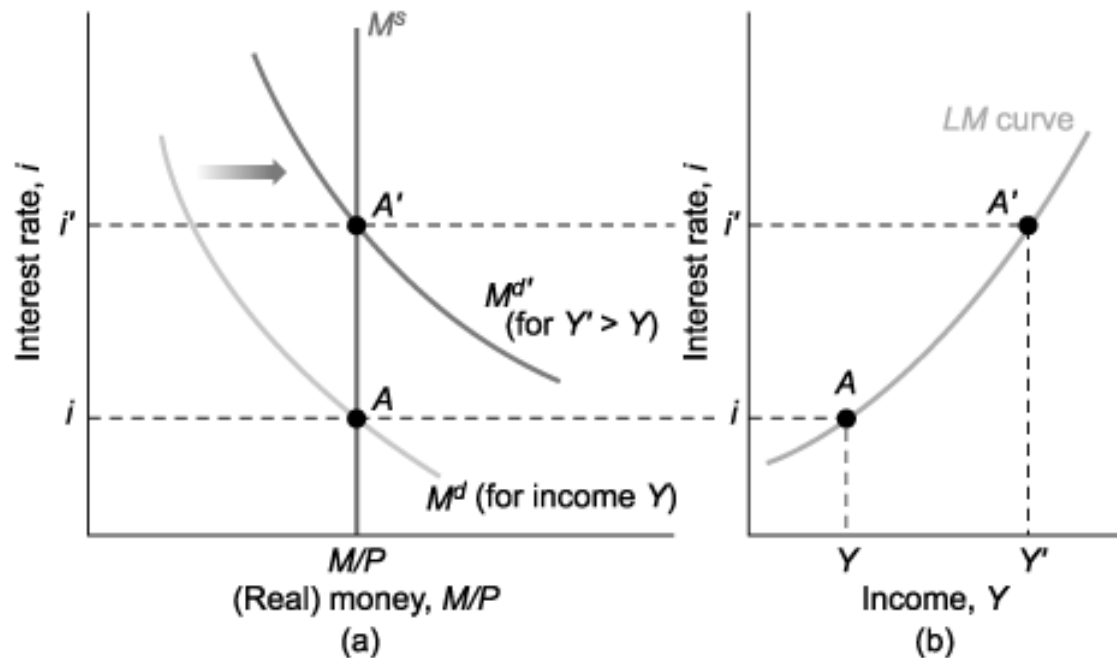
- An increase in income leads, at a given interest rate, to an increase in the demand for money, this is called an increase in *transactions demand for money*, this leads to an increase in the equilibrium interest rate.





## Deriving the *LM* Curve

- Equilibrium in financial markets implies that an increase in income leads to an increase in the interest rate. The *LM* curve is upward-sloping.



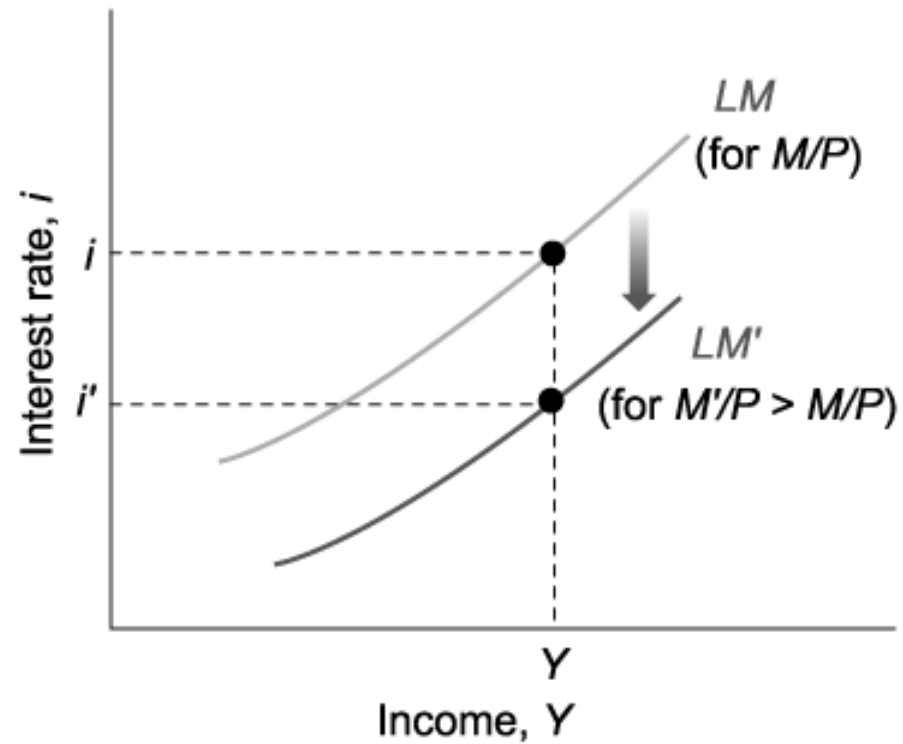


## What is the LM curve?

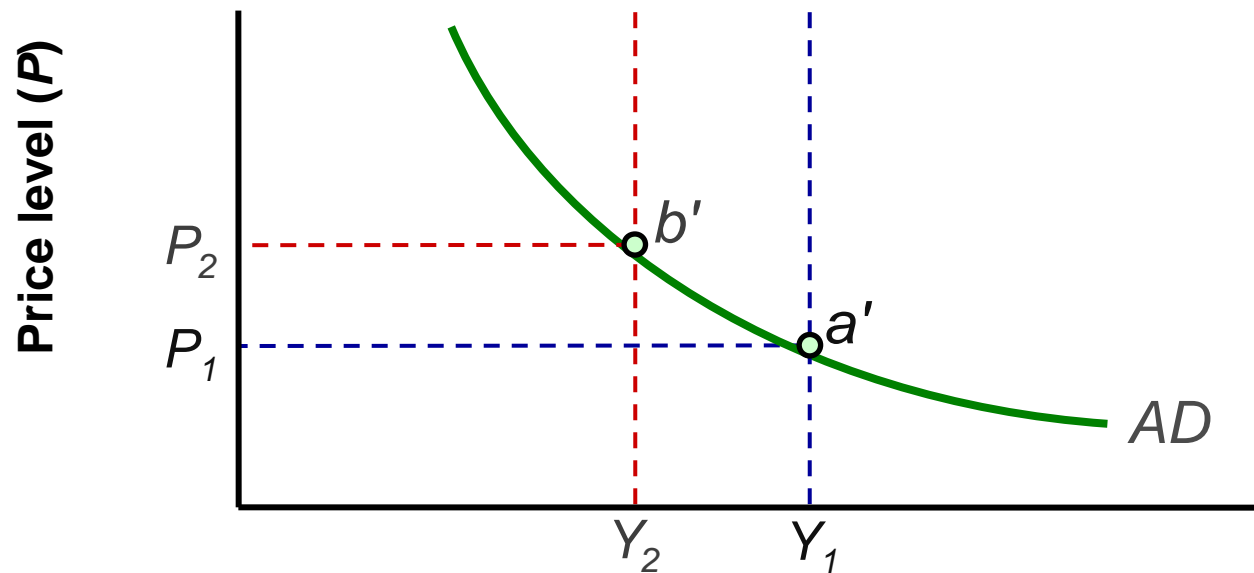
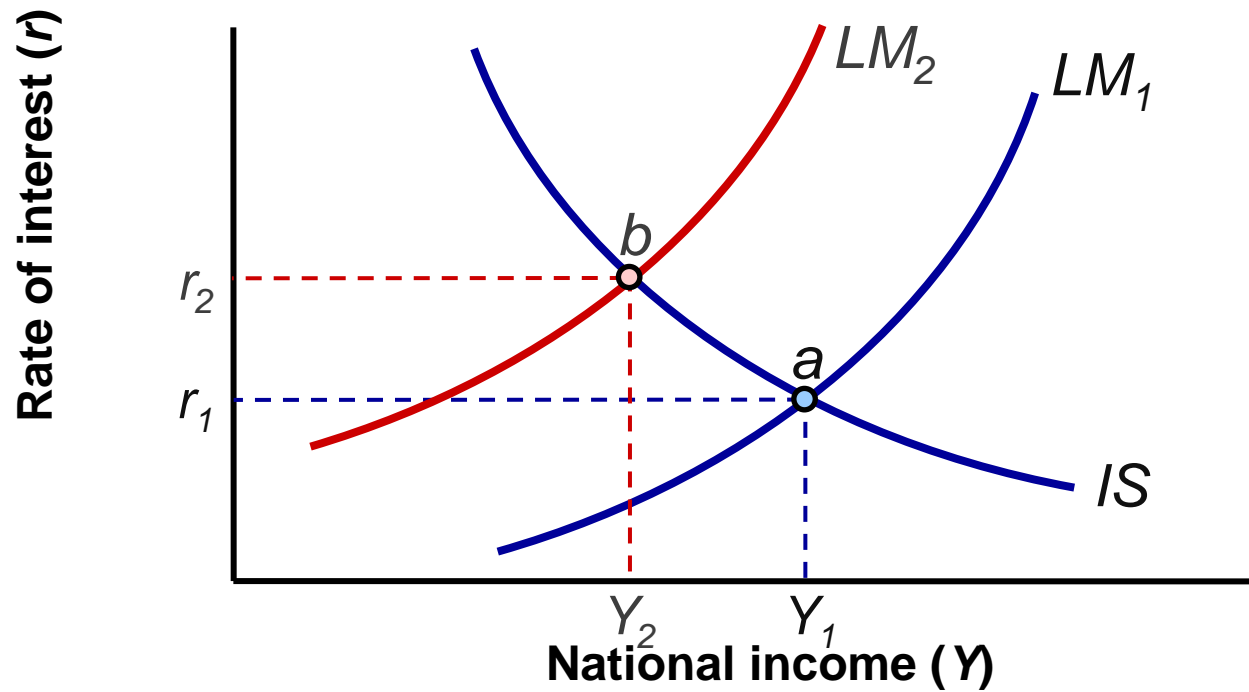
LM curve shows the relationship between interest rate and income and when the money market is in equilibrium for a given supply of money. A decrease in the supply of real money balances shifts the LM curve upward, and vice versa an increase shifts the curve downward.

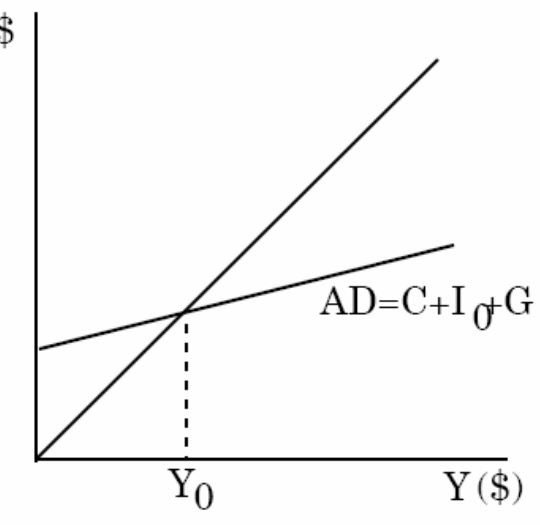
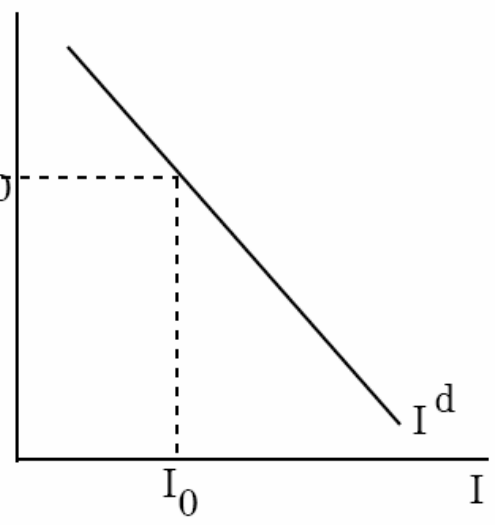
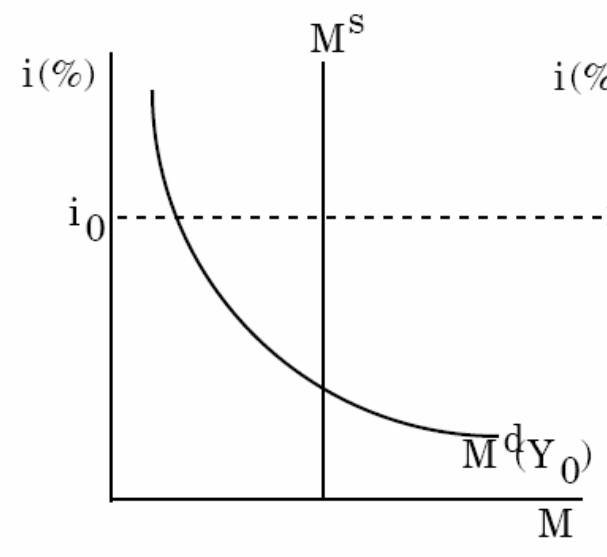
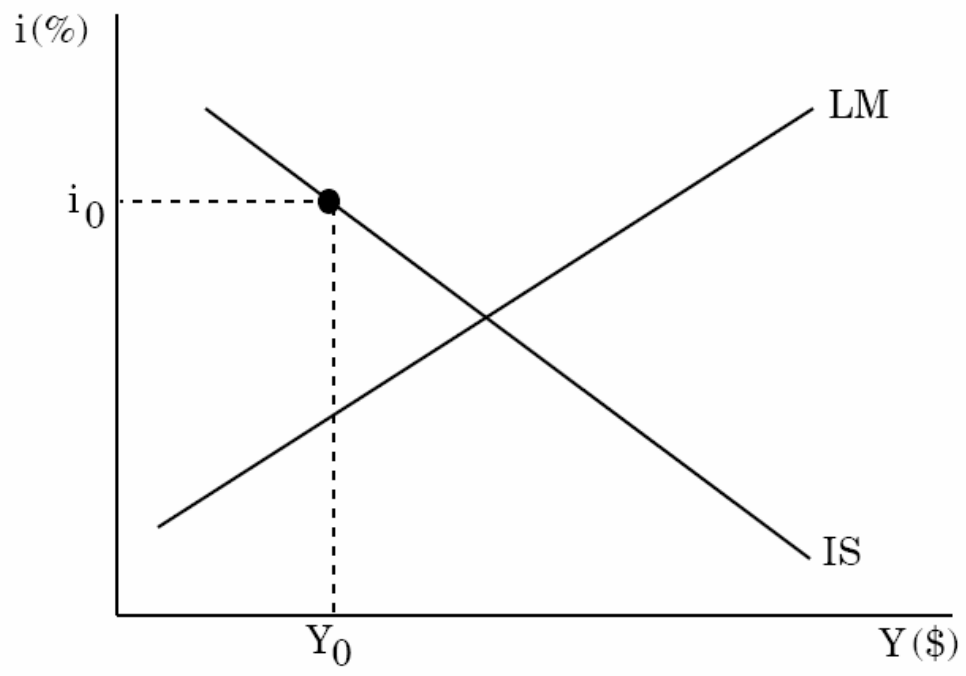
## Shifts of the LM Curve

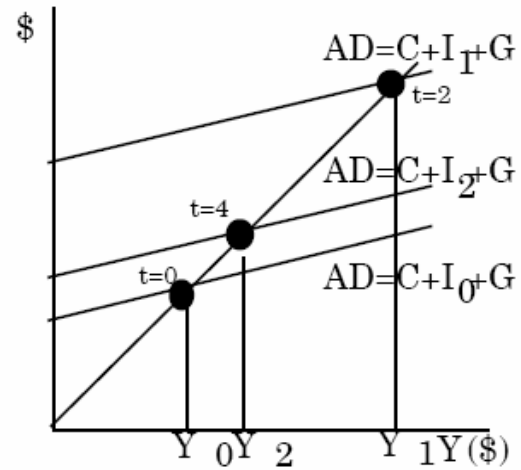
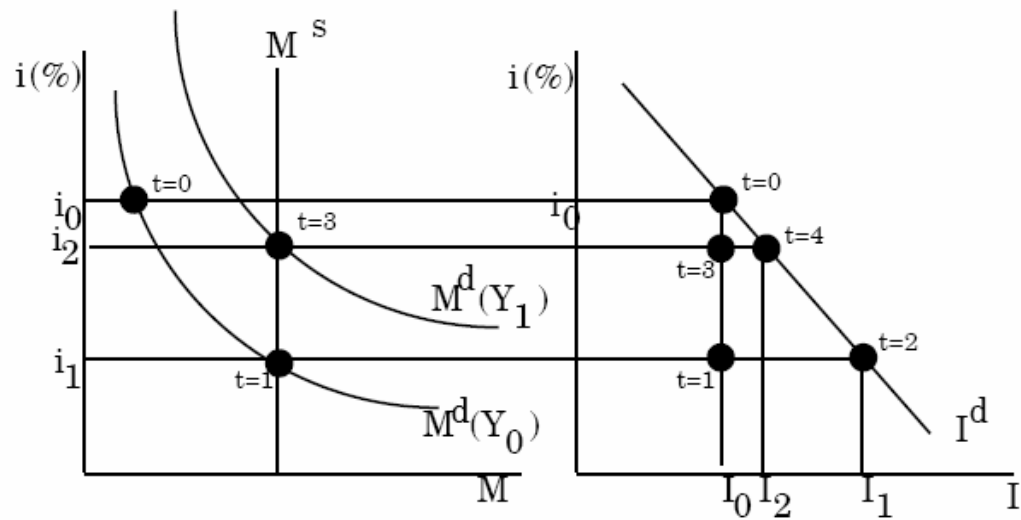
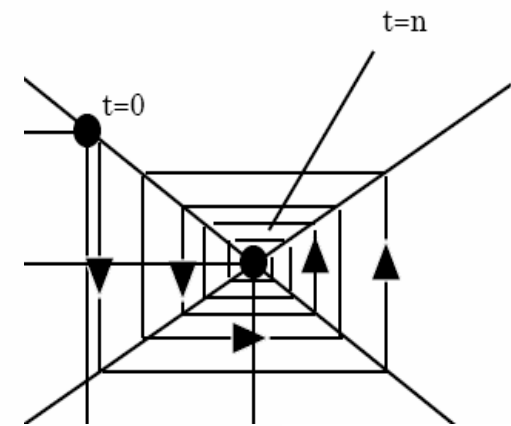
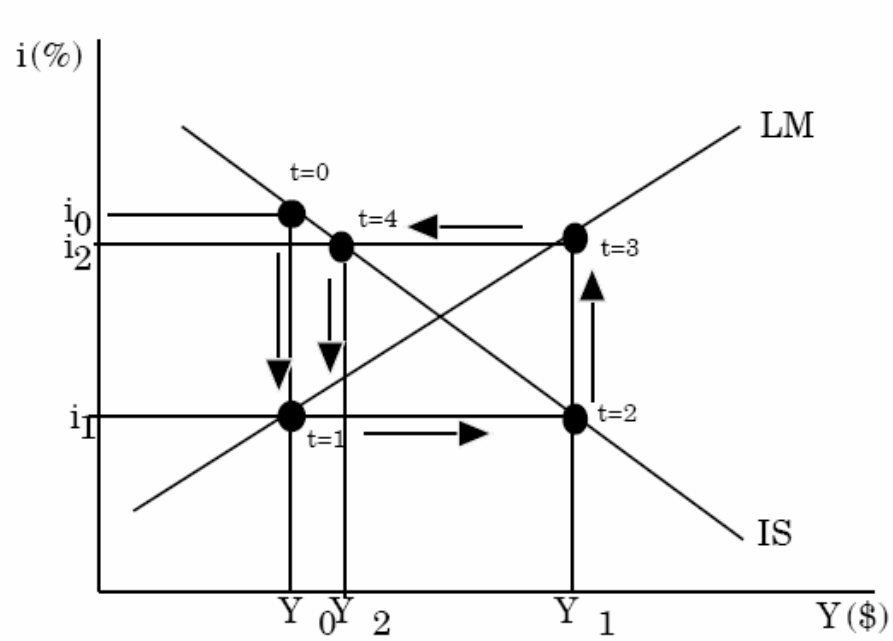
An increase in money causes the LM curve to shift down



# A Financial Market Interpretation





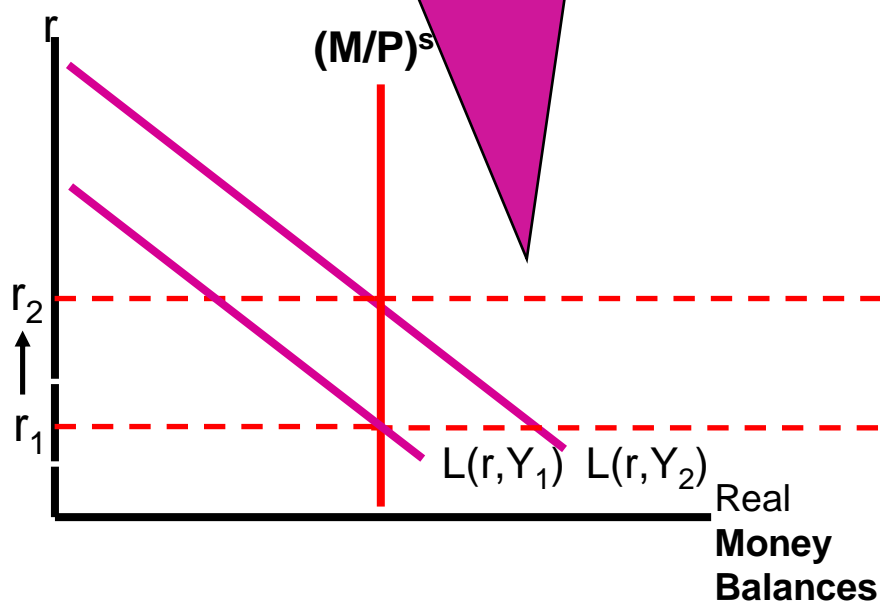


# Building the LM curve

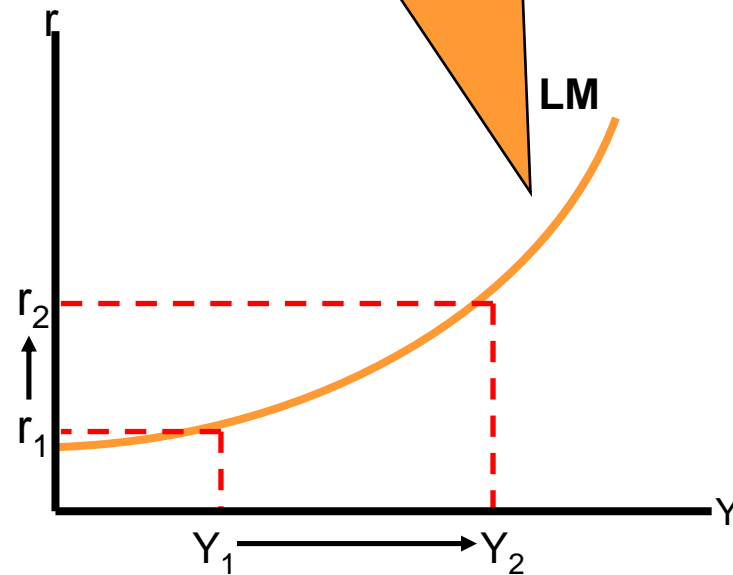
- The LM curve maps the relationship between  $r$  and  $Y$  for the money market.



Given money supply and money demand suppose an increase in income raises money demand.



The LM curve maps out this relationship between  $r$  and  $Y$ .



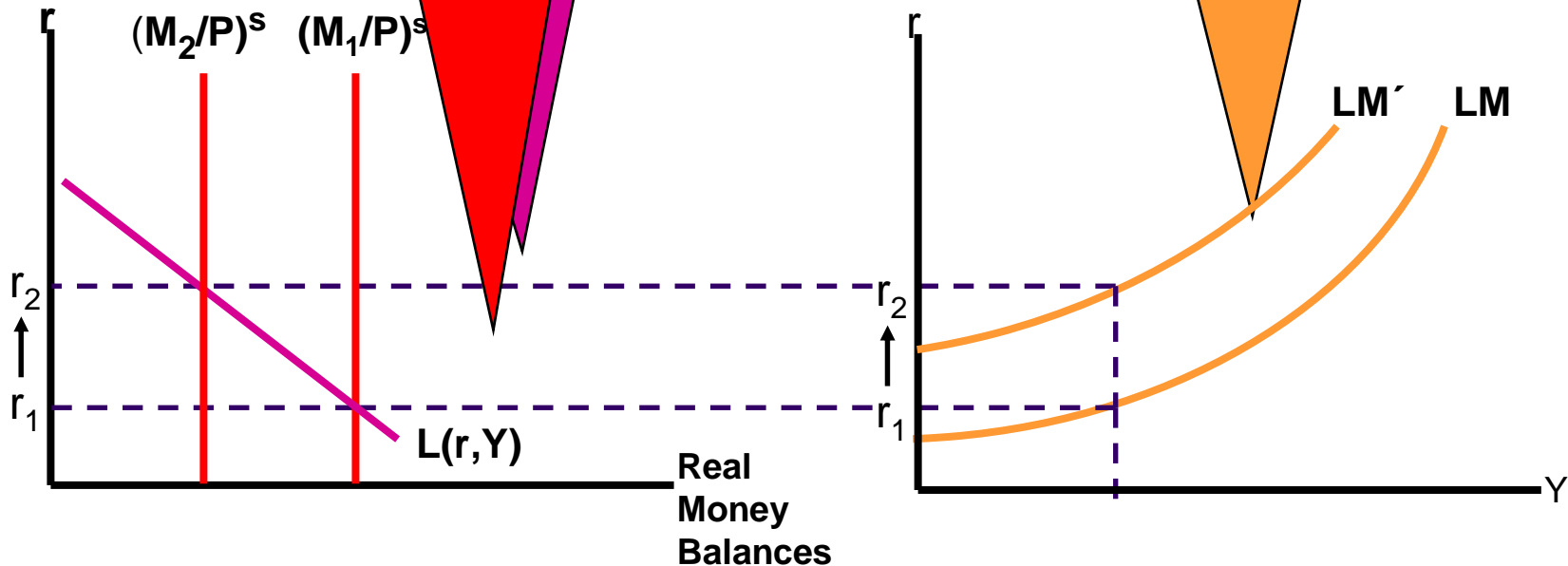
# Shifting the LM curve

- While changing money demand allows us to map out the LM curve, changes in  $M$  or  $P$  cause  $r$  to change for any level of  $Y$ . This causes a shift in the LM curve.



Now there is a higher real interest rate for the current level of output.

The LM curve shifts up so that at the same level of output the interest rate is higher.







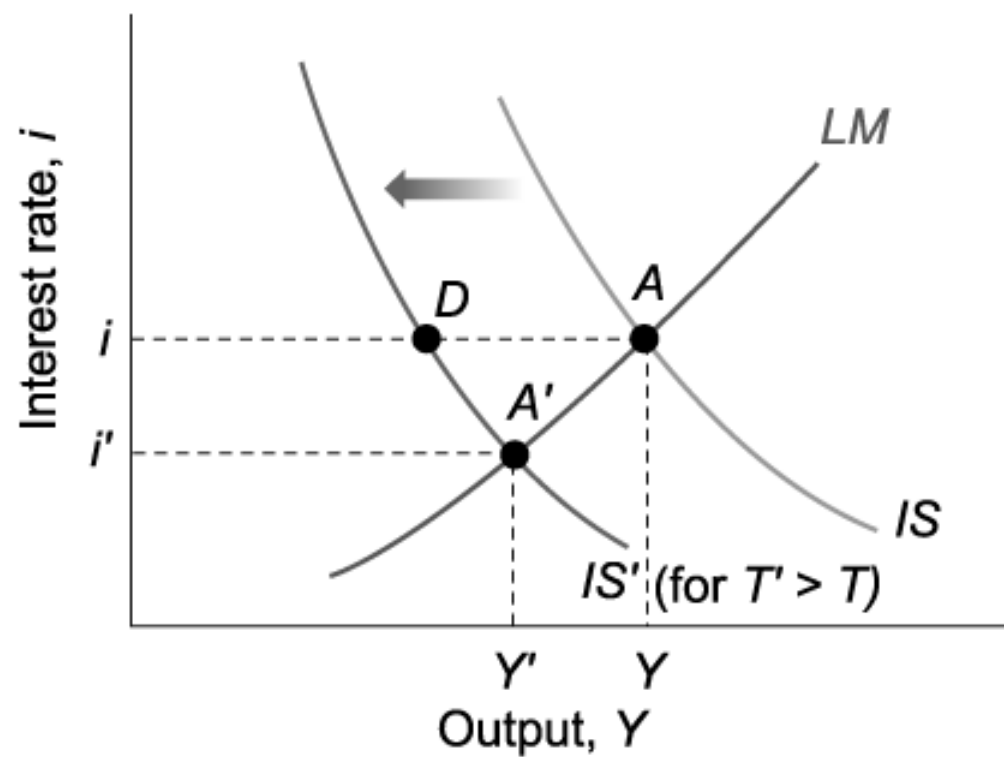
## Investment

- Investment = Private saving + Public saving

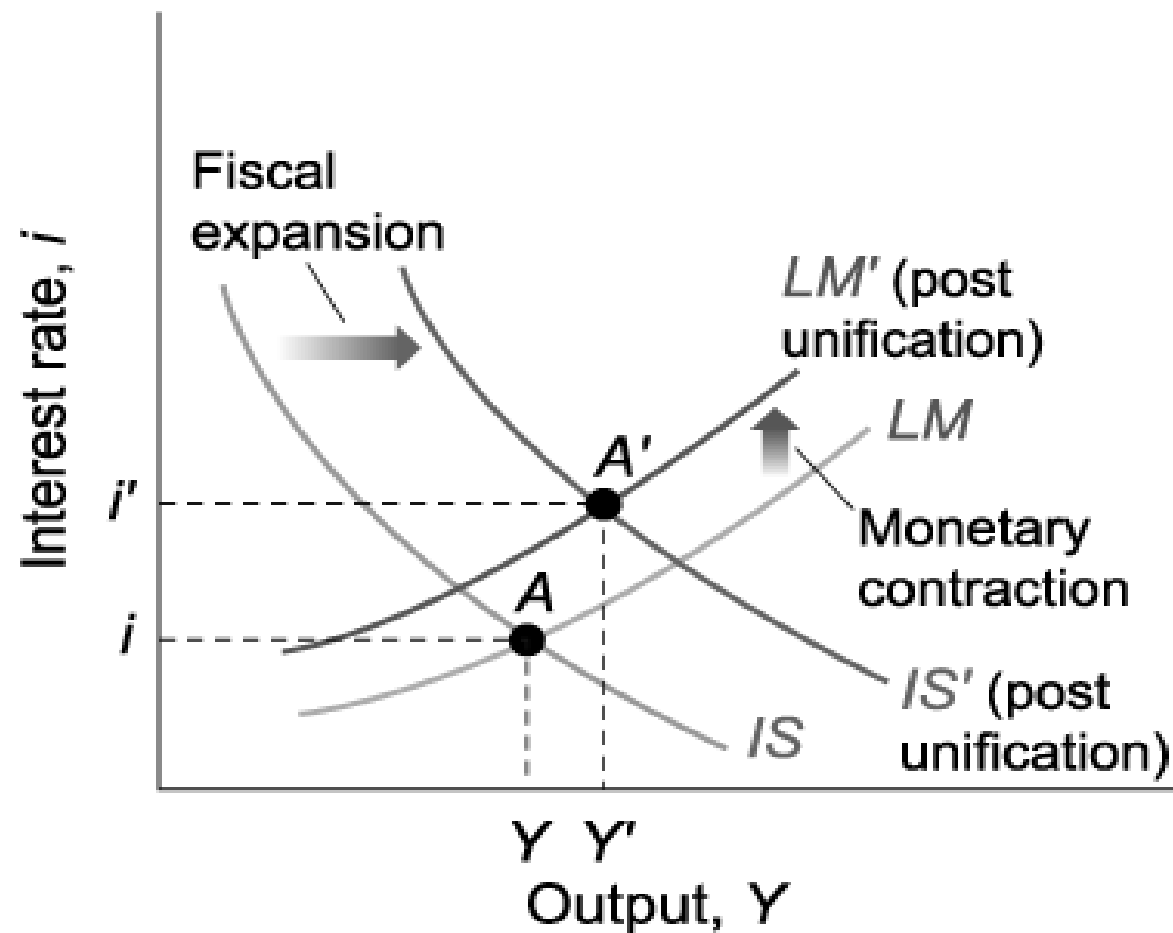
- $I = S + (T - G)$

- A fiscal contraction may decrease investment. Or, looking at the reverse policy, a fiscal expansion—a decrease in taxes or an increase in spending—may actually increase investment.

## Fiscal Policy, the Interest Rate and the IS Curve



## Shifting of IS and LM



## Using a Policy Mix

### The Effects of Fiscal and Monetary Policy

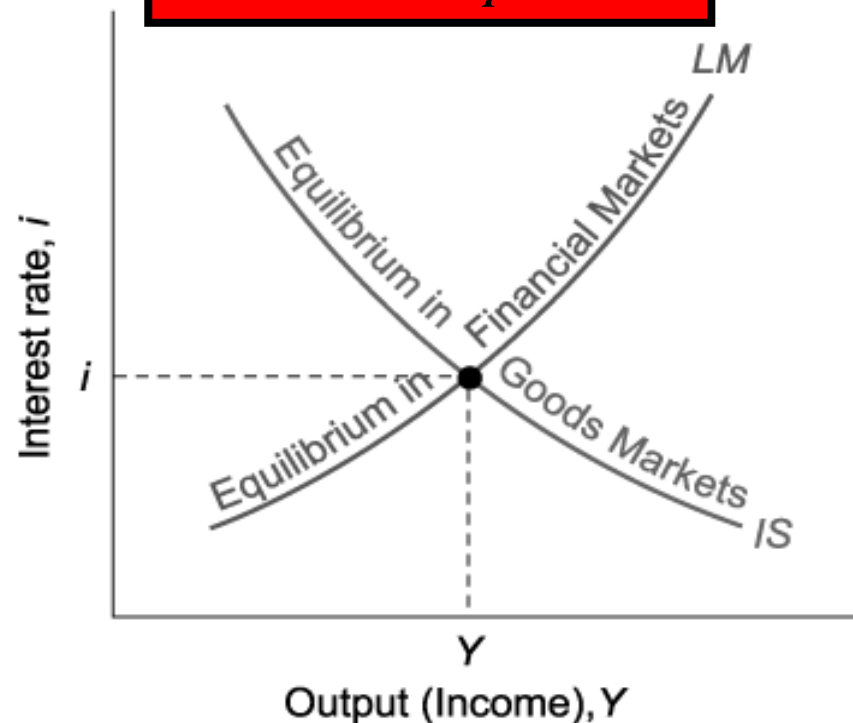
	Shift of IS	Shift of LM	Movement of Output	Movement in Interest Rate
<b>Increase in taxes</b>	<b>left</b>	<b>none</b>	<b>down</b>	<b>down</b>
<b>Decrease in taxes</b>	<b>right</b>	<b>none</b>	<b>up</b>	<b>up</b>
<b>Increase in spending</b>	<b>right</b>	<b>none</b>	<b>up</b>	<b>up</b>
<b>Decrease in spending</b>	<b>left</b>	<b>none</b>	<b>down</b>	<b>down</b>
<b>Increase in money</b>	<b>none</b>	<b>down</b>	<b>up</b>	<b>down</b>
<b>Decrease in money</b>	<b>none</b>	<b>up</b>	<b>down</b>	<b>up</b>

## The IS and the LM Relations Together

•Equilibrium in the goods market implies that an increase in the interest rate leads to a decrease in output. Equilibrium in financial markets implies that an increase in output leads to an increase in the interest rate. When the *IS* curve intersects the *LM* curve, both goods and financial markets are in equilibrium.

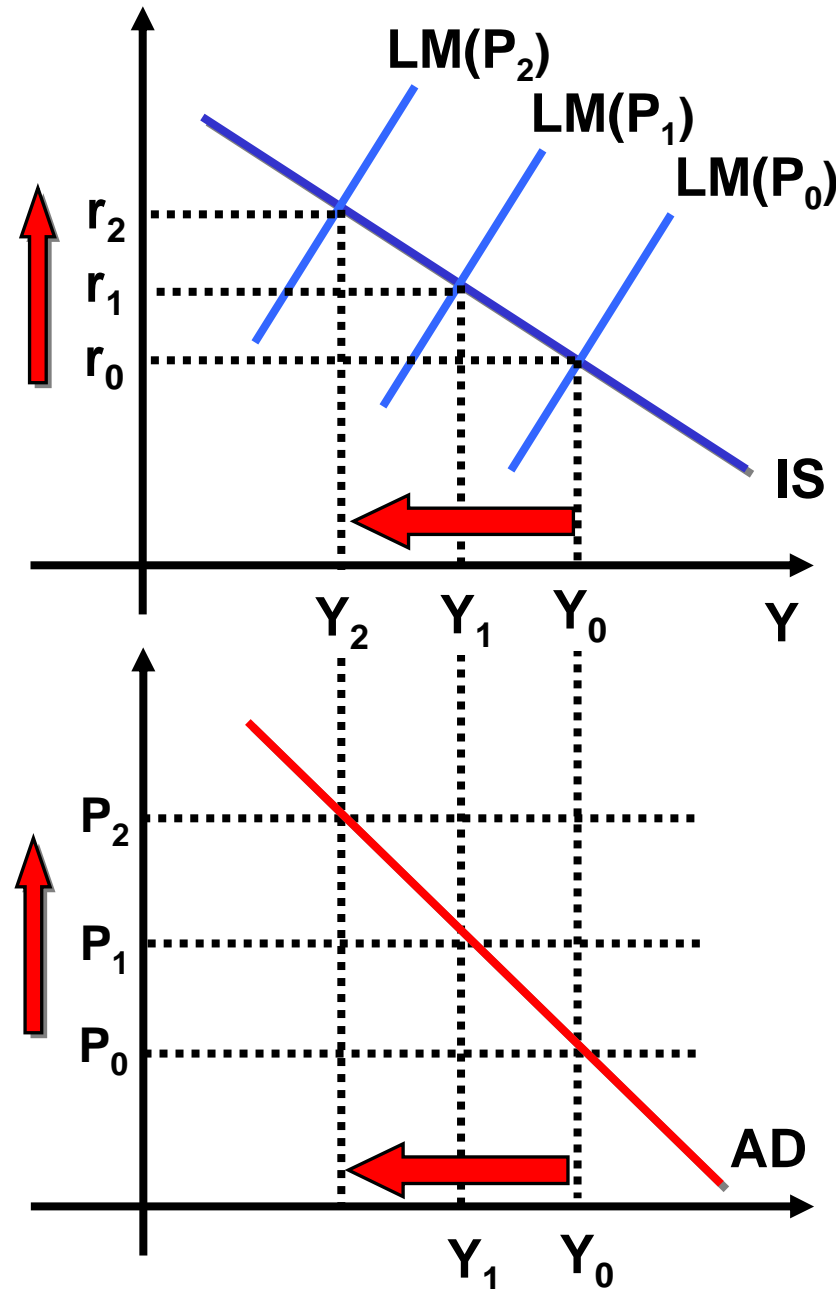
$$IS \text{ relation: } Y = C(Y - T) + I(Y, i) + G$$

$$LM \text{ relation: } \frac{M}{P} = YL(i)$$



## AD from IS-LM

1. Price levels are increased, with  $P_0 < P_1 < P_2$ .
2. LM shifts to the left with increasing  $P$  because real money balances decline.
3. Interest rates rise.
4. Investment and durable goods expenditures fall as interest rates rise.
5. Plot price levels against the resulting output ( $Y$ ) levels.
7. Thus AD is embedded in the logic of IS-LM.





*Thank You for your Attention*





# Literature

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- 2 - Fernando Quijano and Yvonn Quijano: Introduction to Macroeconomics
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- 7- Yamin Ahmed: Principles of Macroeconomics, 2005
- 8 - Olivier Blanchard: Principles of Macroeconomics, 1996