




# IS-LM Model of Income Distribution

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# Introduction

- ▶ The IS-LM (**I**nvestment **S**aving – **L**iquidity Preference **M**oney Supply) model is a macroeconomic model that graphically represents two intersecting curves.
- ▶ It is used in macroeconomics to help explain the possible relationships between the interest rate and real GDP.
- ▶ The investment/saving (IS) curve is a variation of the income-expenditure model incorporating market interest rates (demand).
- ▶ While the liquidity preference/money supply equilibrium (LM) curve represents the amount of money available for investing (supply).
- ▶ The model explains the decisions made by investors when it comes to investments with the amount of money available and the interest they will receive. Equilibrium is achieved when the amount invested equals the amount available to invest.
- ▶ This tool is sometimes used not only to analyze economic fluctuations but also to suggest potential levels for appropriate stabilization policies.

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- ▶ Two equivalent interpretations are possible: first, the IS–LM model explains changes in **national income** when price level is fixed short-run; second, the IS–LM model shows why an **aggregate demand curve** can shift.
  - ▶ To determine the level of income, Hicks and Hansen develop two curves: The IS curve and the LM curve. Equilibrium income is determined when total investment equals total savings and total demand for money equals total supply of money.
  - ▶ The Keynesian model looks at income determination by arguing that income affects spending, which, in turn, determines output (GNP) and income (GNI).
  - ▶ J. R. Hicks and A.H. Hansen add the effects of interest rates on spending, and thus income and the independence of asset markets on income.
  - ▶ Higher income raises money demand and thus interest rates. Higher interest rates lower spending and thus income. Spending, interest rates and income are determined jointly by equilibrium in the goods and assets markets as shown in the figure..

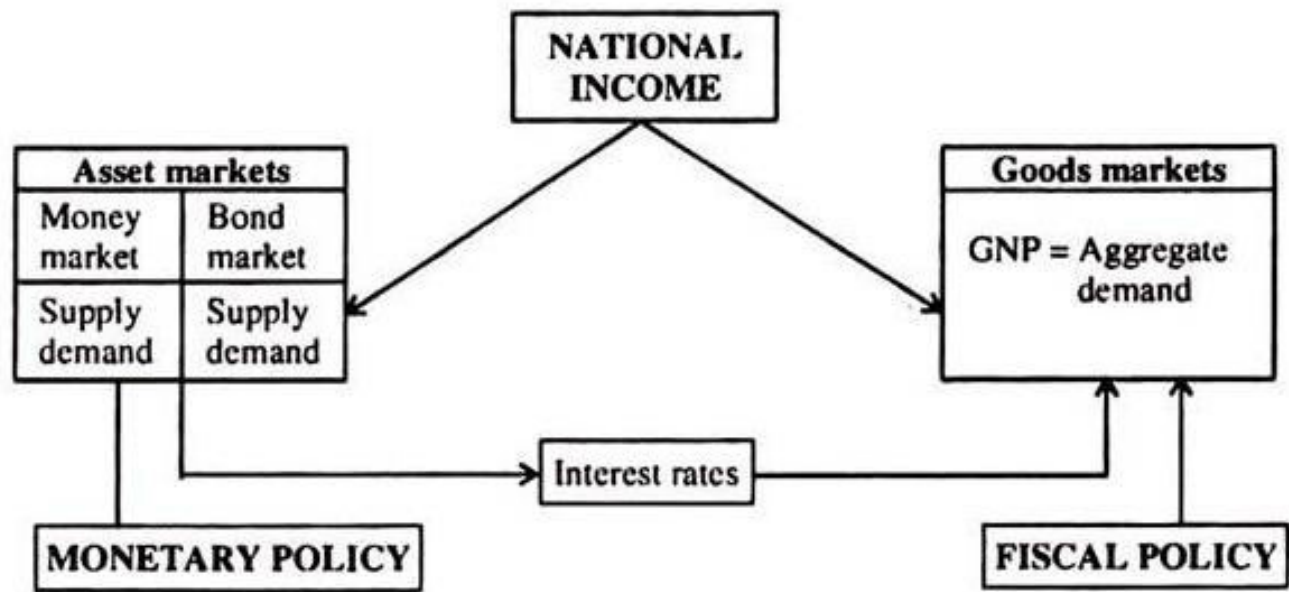
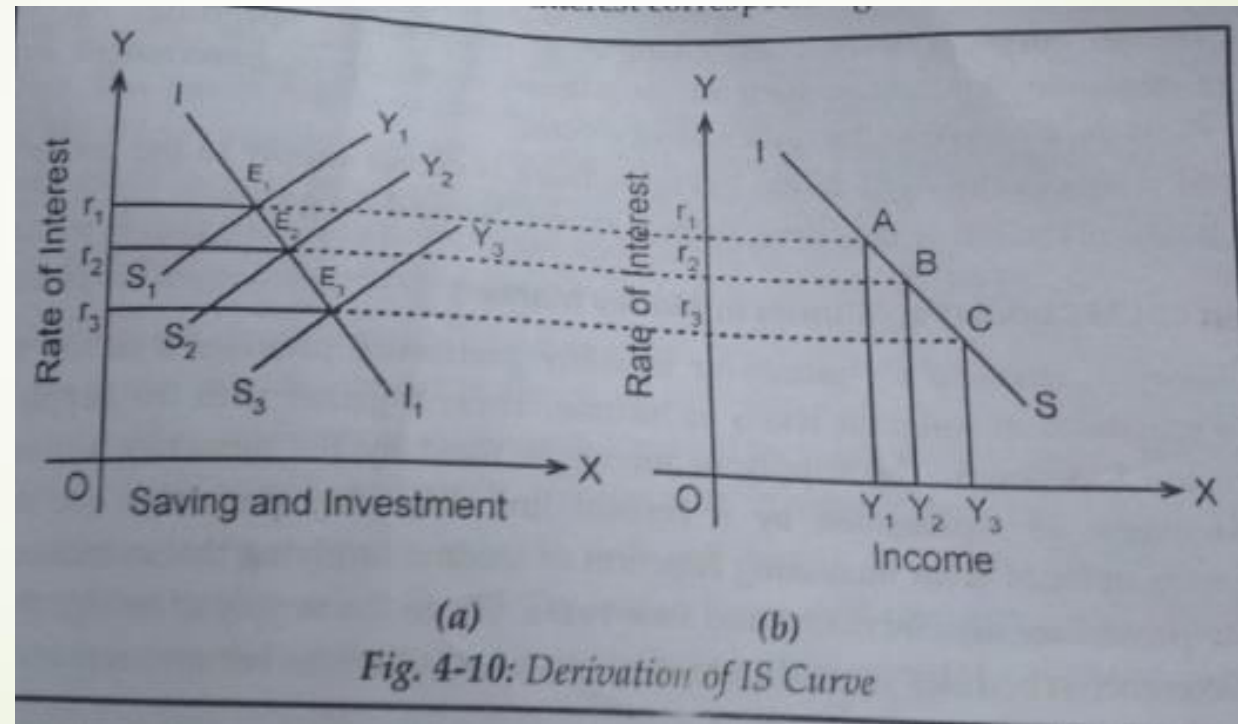



Fig. 9.1 The Basic Structure of the IS-LM curve model

# IS-LM Model with Two Sector Economy

- Derivation of IS Curve (Equilibrium in goods market)





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- ▶ IS curve explains that investment is a decreasing function of the rate of interest i.e at high interest rate , the investment is low and vice versa and saving is an increasing function of income i.e. when income increases, saving also increases and vice versa.
  - ▶ The above figure explains:
  - ▶ Let E1 is the initial equilibrium where investment equals to the saving at rate of interest  $r_1$  and level of income  $Y_1$ . When rate of interest falls from  $r_1$  to  $r_2$ , investment increases. As a result both income and saving increase. It is shown by new equilibrium point E2.
  - ▶ Similarly, new equilibrium is established at E3, where saving investment equality is maintained at the rate of interest  $r_3$  and income  $Y_3$ .
  - ▶ With the help of corresponding equilibrium points the IS curve can be derived. Based on equilibrium point E1, E2 and E3, saving investment equalities are maintained at various rates of interest  $r_1$ ,  $r_2$  and  $r_3$  and various level of income  $Y_1$ ,  $Y_2$  and  $Y_3$ .
  - ▶ Hence, by joining corresponding points A, B and C respectively, we derive IS curve.



# IS Curve Slopes Downward

- ▶ IS Curve slopes downward to the right. (negative slope)
- ▶ The reason is higher levels of income, saving is greater; greater the saving, lower will be the rate of interest; as the rate of interest falls, investment increases till it becomes equal to the higher savings. Thus, as income increases, the equality between saving and investment is established at a lower rate of interest.
- ▶ For example, if the interest rate falls, savings must fall (because people don't like the lower return) which means that real GDP must rise so that people can save more. The increase in  $Y$  will be caused by an increase in investment which must be matched by an increase in savings either from the private, public (government), or foreign sector.

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- ▶ The IS curve is shifted by changes in autonomous spending such as investment spending or government expenditure, shifts the IS curve towards right.
  - ▶ At points to the right of the IS curve = there is excess supply in the goods market;
  - ▶ At points to the left of the curve, there is excess demand for goods.

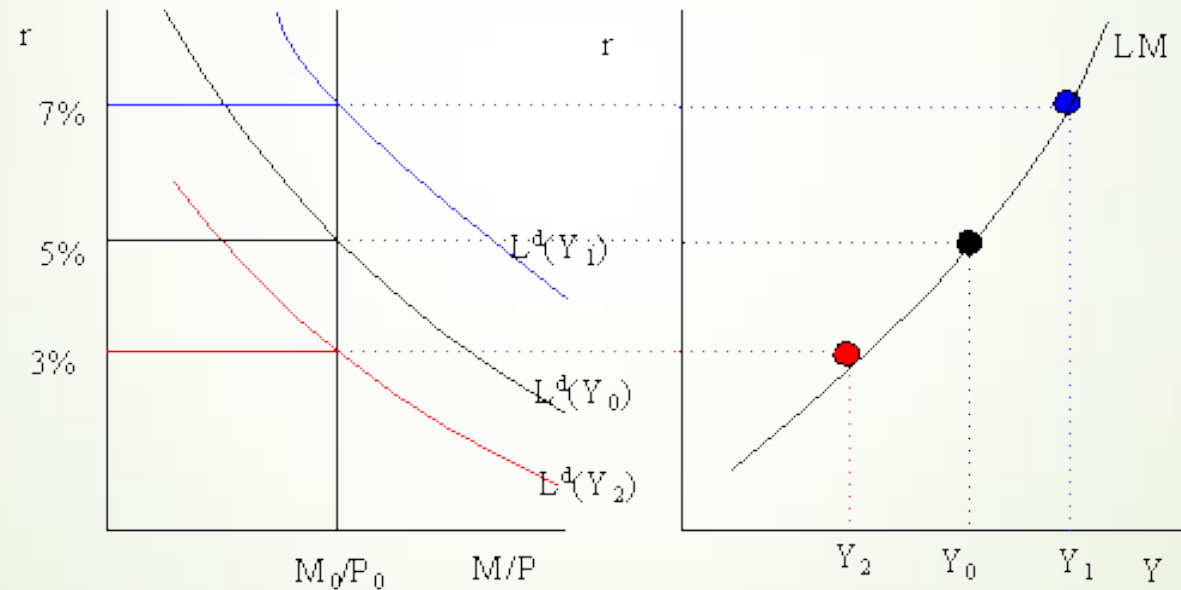






# Derivation of LM curve

- Keynes theory of money or liquidity preference provide a family of liquidity preference schedules at different levels of income.
- It together with the supply of money curve gives the LM curve.
- Liquidity preference
  - Demand for holding money in cash
  - An increasing function of income
  - Implies that as income increases, liquidity preference also increases and vice-versa.
- Supply of money is
  - fixed
  - provided by monetary authority
  - is interested inelastic
  - represented by vertical line.

The LM curve, "L" denotes Liquidity and "M" denotes money, is a graph of combinations of real income,  $Y$ , and the real interest rate,  $r$ , such that the money market is in equilibrium (i.e. real money supply = real money demand). The graphical derivation of the LM curve is illustrated below.



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- ▶ The left-hand side of the graph illustrates money market equilibrium for a given level of  $Y$ .
    - ▶ For example, when  $Y = Y_0$  the equilibrium real interest rate is 5%. The right-hand-side of the graph gives the LM curve. The LM curve is plotted with the real interest rate on the vertical axis and real income (GDP) on the horizontal axis. Each point on the LM curve represents a money market equilibrium for a particular real interest rate and income pair ( $r, Y$ ). For example, the money market equilibrium at ( $r=5\%$ ,  $Y=Y_0$ ) is given by the black (middle) dot on the LM curve.
  - ▶ At a higher level of income,  $Y_1 > Y_0$ , the money demand curve shifts up and right and a new equilibrium occurs at  $r = 7\%$ . This equilibrium is represented by the blue (upper) dot on the LM curve. Similarly, at a lower level of income  $Y_2 < Y_0$  the money demand curve shifts down and left and a new equilibrium occurs at  $r = 3\%$ . This equilibrium is given the by the red (lower) dot on the LM curve.




The above analysis shows that the LM curve

- ▶ is an upward sloping curve in the graph with  $r$  on the vertical axis and  $Y$  on the horizontal axis.
  - ▶ Every point on the LM curve represents an intersection between the real money supply ( $M/P$ ) and real money demand ( $L^d$ ).
  - ▶ The LM curve will shift whenever the variables we hold fixed, other than  $Y$ , in the money-supply/money-demand diagram change.
  - ▶ These variables are  $M/P$  and  $e$ .
  - ▶ In particular, if  $M/P$  increases holding expected inflation fixed then  $r$  falls in the money market and so the LM curve shifts down and right.
  - ▶ Similarly, if expected inflation increases real money demand falls, lowering the interest rate, and the LM curve shifts down and to the right.
  - ▶ Functionally, we represent the LM curve as
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- ▶ The (+) sign indicates that an increase in the variables shifts the LM curve down and to the right.



# Determination of level of income

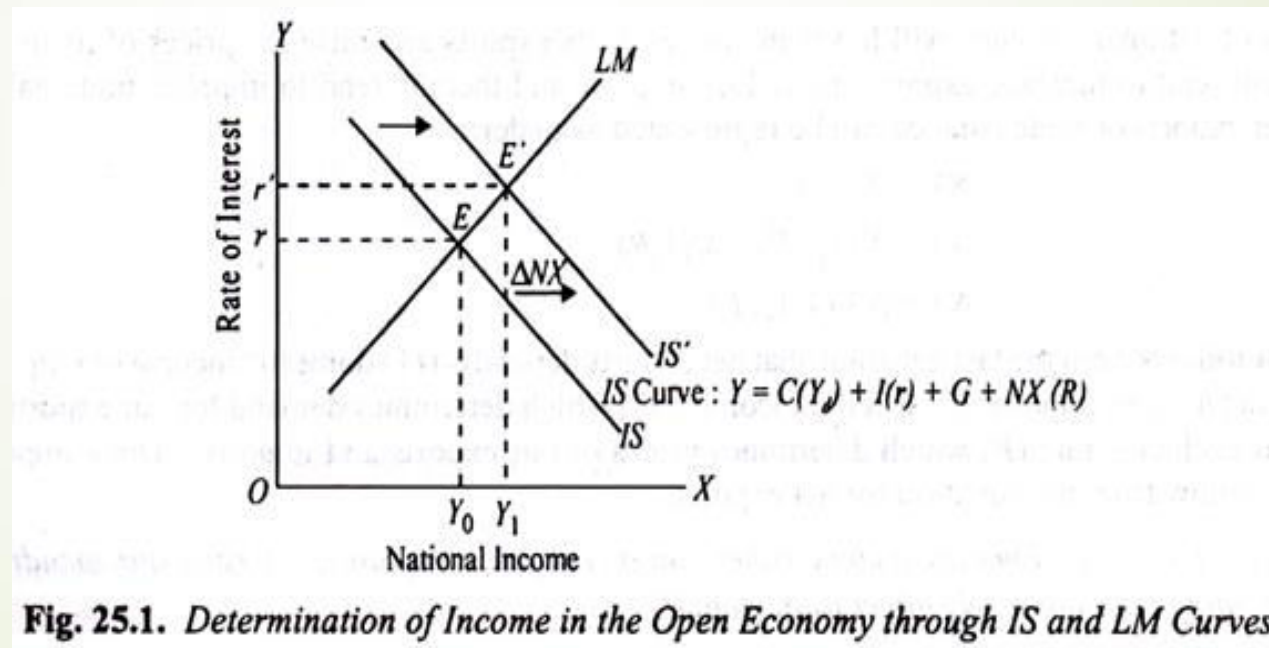
- IS – LM curve model involves the determination of national income and rate of interest through joint equilibrium of goods market and money market.
- IS curve of an open economy is steeper than that of a closed economy. This means that for a given reduction in interest rate, a smaller increase in output and income is required to restore equilibrium in the goods market.
- Besides, IS curve of the open economy also includes net exports (NX) as a component of aggregate demand for goods. The real exchange rate of the national currency, which determines the prices of exports and imports and thereby determine net exports also affects the open economy IS curve.

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- ▶ For example, depreciation of real exchange rate of the national currency which raise exports and lowers imports results in increase in net exports and will therefore cause an outward shift in the IS curve to the right.
  - ▶ Similarly, increase in foreign income which will raise foreign spending on our goods will lead to the increase in net exports, which is a component of aggregate demand, will also cause a shift in the IS curve to the right.
  - ▶ LM curve which represents money market equilibrium at various rates of interest and level of income is represented by the following equation:

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

where  $M/P$  stands for supply of real money balances, and  $L(r, Y)$  for demand for money which is determined by rate of interest ( $r$ ) and level of income ( $Y$ ).

- The intersection of open-economy IS and LM curves determine jointly the income and rate of interest in the open economy. This is shown in Figure. It will be seen that open economy IS and LM curves intersect at joint E and determine  $Y_0$  equilibrium level of income and  $r$  equilibrium rate of interest.



**Fig. 25.1.** *Determination of Income in the Open Economy through IS and LM Curves*

# IS-LM Model with three Sector Economy

## 1. Monetary Variables:

- Refers to distinct changes made by central bank (NRB in Nepal) due to economic recession.
- Affect money market by changing demand for money and supply of money.
- Ex: when central bank adopts **expansionary monetary policy** then investment, output, employment and income increase with decrease in rate of interest. On the other hand, when central bank adopts **contractionary monetary policy** then investment, output, employment and income decrease with increase in rate of interest.





## 2. Fiscal Variables:

- Refers to distinct changes made by government in its expenditure, taxation and debt.
- Government adjust tax rates and government spending for the purpose of promoting economic growth and stability.
- Government might decide to increase its own spending (ex: building more highways); the idea is that additional government spending creates jobs and lowers the unemployment rate.



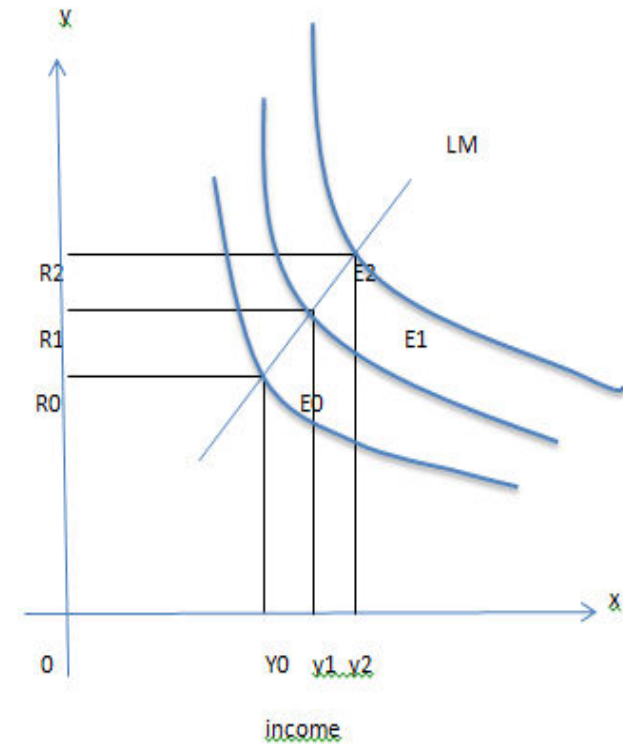
# Shifts in the IS and LM functions changes in general equilibrium

Shifts in the IS Curve (or Function):

The IS function shifts to the right with a reduction in saving and autonomous increase in investment. The increase in investment may result from expectations of higher profits in the future.

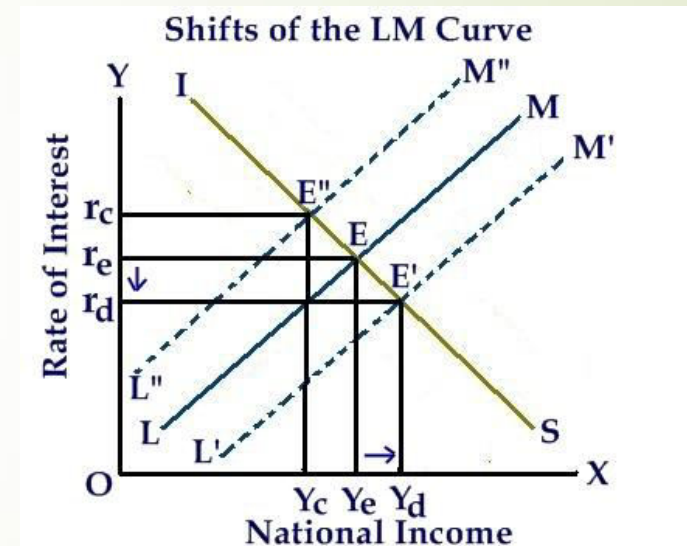
Let  $E_1$  be the initial equilibrium and  $r_1$  and  $y_1$  be the initial rate of interest and level of income respectively. When autonomous investment increases, the IS curve shifts from  $IS_1$  to  $IS_2$  and the new equilibrium is established at  $E_2$  which indicates the higher level of income  $y_2$  at higher interest rate  $r_2$ . It is due to forward multiplier effect.

Conversely when investment falls, the IS function will shift to the left and the new equilibrium will be established at a lower level of income and interest rate i.e.  $y_0$  and  $r_0$  respectively. It will occur due to the backward multiplier effect.



# Shift in the LM Curve (or Function) a

- ▶ The LM function shifts to the right with the increase in the money supply given the demand for money, or due to the increase in the demand for money. If the central bank like NRB follows an expansionary monetary policy.
- ▶ When central bank adopts contractionary policy, the LM curve shifts rightwards. A decrease in the demand for money means a reduction in quantity of balances demanded at each level of income and interest rate.





# Macroeconomic equilibrium



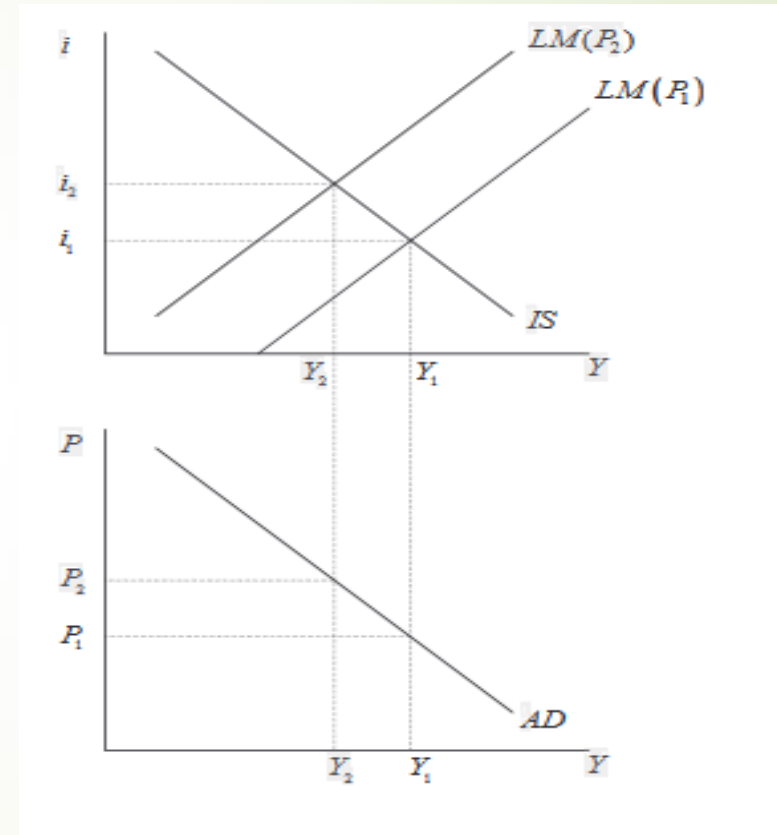
# Introduction



- ▶ The macroeconomic equilibrium means such a state in the economy that does not cause a change of economic operators' behavior.
- ▶ Macroeconomic equilibrium represents equality of aggregate demand to aggregate supply.
- ▶ **Macroeconomic equilibrium** occurs when the quantity of real GDP demanded equals the quantity of real GDP supplied at the point of intersection of the *AD* curve and the *AS* curve.

# Aggregate demand curve

- ▶ The aggregate demand curve shows the inverse relation between the aggregate price level and the level of national income.
- ▶ The aggregate demand (AD) curve shows the combinations of the price level and level of output at which the goods and money markets are simultaneously in equilibrium.



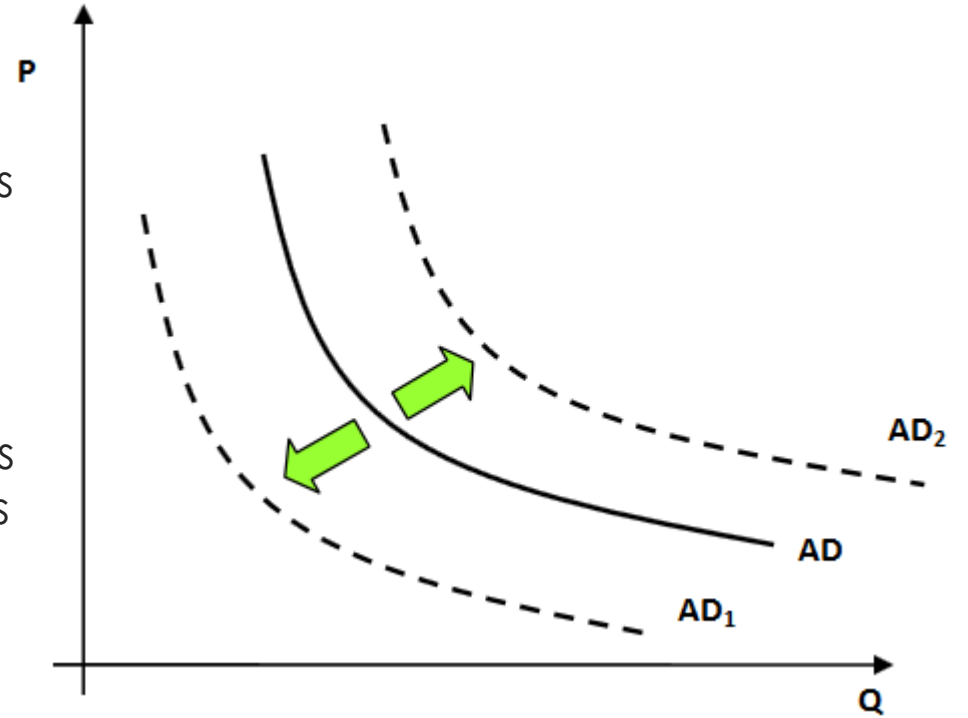


# Cause of negative sloping of AD curve

- 1. **Wealth effect:** this effect is similar to **income effect** (explained above) at micro level. As price level rises, the purchasing power of consumers' falls.
- 2. **The interest rate effect:** with increase in overall price level, consumers' savings also fall. They have to spend greater proportion of their income on consumption because of rising prices. They have to spend more to purchase same amount of goods. This has a negative effect on savings. As a result, investment falls which leads to fall in aggregate demand.
- 3. **Exchange rate effect:** increase in Overall price level increases interest rates because the investment falls due to lack in supply of loanable funds. This causes foreign investors to demand their domestic assets more, increasing the demand of their currency. Thus, foreign currency value falls. It has the effect of increasing imports and declining exports. As a result, net exports fall and aggregate demand also falls.

# Shifts in AD Curve

A shift to the *right* of the aggregate demand curve, from  $AD$  to  $AD_2$ , means that at the same price levels the quantity demanded of real GDP has *increased*. A shift to the *left* of the aggregate demand curve, from  $AD$  to  $AD_1$ , means that at the same price levels the quantity demanded of real GDP has *decreased*.



**Aggregate demand curve and its shifts**

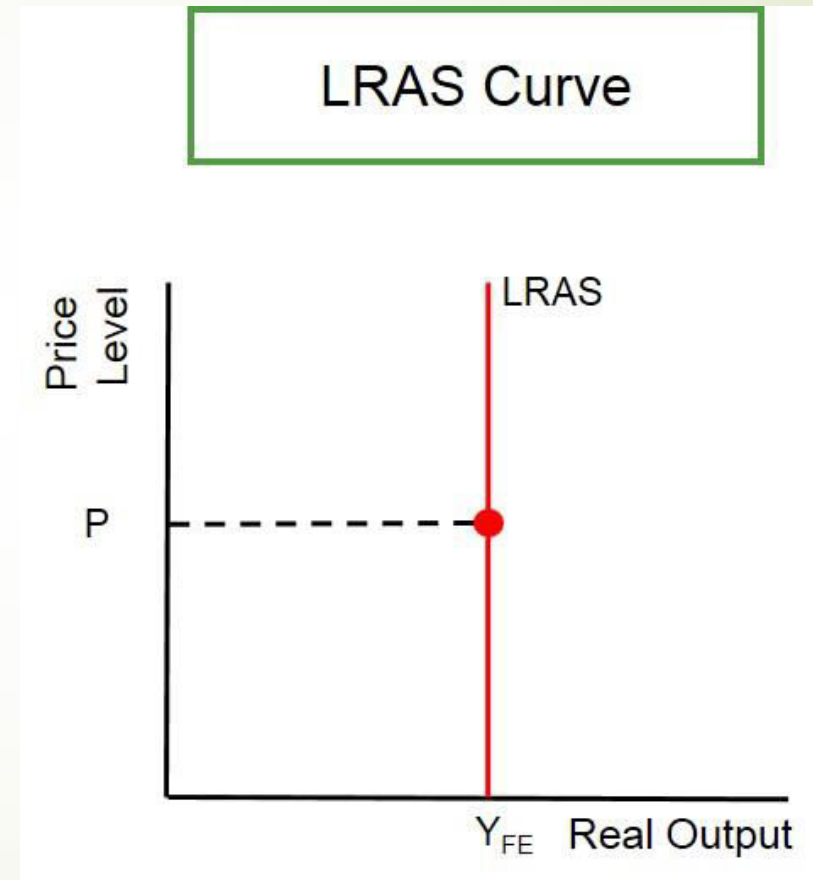


➤ Cause of shift in AD Curve

Decrease in AD (Leftward Shift)	Increase in AD (Rightward Shift)
1. Consumption declines <ul style="list-style-type: none"> <li>a. Reduced disposable income or wealth</li> <li>b. Smaller/older households</li> <li>c. More durables owned</li> <li>d. More indebtedness</li> <li>e. Less money available/slower spending</li> <li>f. Pessimism about income</li> <li>g. Expectation of price deflation</li> </ul>	1. Consumption declines <ul style="list-style-type: none"> <li>a. Increased disposable income or wealth</li> <li>b. Larger/younger households</li> <li>c. Pent-up demand for durables</li> <li>d. Less indebtedness</li> <li>e. Bigger money supply/faster spending</li> <li>f. Security jobs and income</li> <li>g. Expectations of price inflation</li> </ul>
2. Investment declines <ul style="list-style-type: none"> <li>a. Higher interest rates</li> <li>b. Investor pessimism</li> </ul>	2. Investment increases <ul style="list-style-type: none"> <li>a. Lower interest rates</li> <li>b. Investor optimism</li> </ul>
3. Government <ul style="list-style-type: none"> <li>a. Spending declines</li> <li>b. Tax increases</li> <li>c. Money supply decreases</li> </ul>	3. Government <ul style="list-style-type: none"> <li>a. Spending increases</li> <li>b. Tax decreases</li> <li>c. Money supply grows</li> </ul>
4. Net foreign sector declines <ul style="list-style-type: none"> <li>a. Exports decline</li> <li>b. Imports grow</li> </ul>	4. Net foreign sector grows <ul style="list-style-type: none"> <li>a. Exports increase</li> <li>b. Imports decline</li> </ul>

# Aggregate supply curve

- ▶ The **aggregate supply curve** depicts the quantity of real GDP that is supplied by the economy at different price levels.
- ▶ The aggregate supply curve on a chart shows this relationship. Normally, it's positive – as prices go up, production goes up.



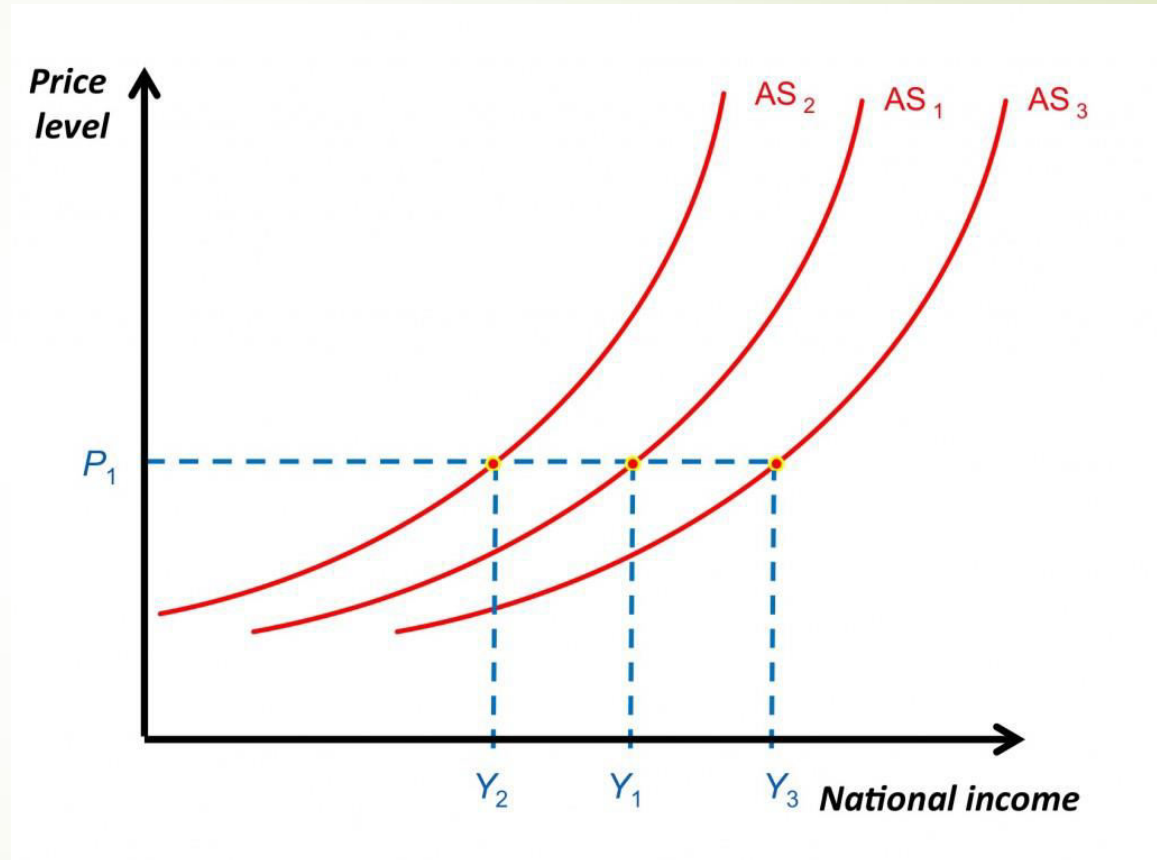


# Segments of AS Curve

- ▶ **Horizontal view:** When the aggregate supply curve is horizontal and an economy is below full employment, the only effects of an increase in aggregate demand are increases in real GDP and employment, while the price level does not change. Stated simply, the Keynesian view is that “demand creates its own supply.”
- ▶ **Vertical view:** When the aggregate supply curve is vertical at the full-employment GDP, the only effect over time of a change in aggregate demand is a change in the price level. Stated simply, the classical view is that “supply creates its own demand.”
- ▶ **Intermediate view:** The rising segment of the aggregate supply curve, which represents an economy as it approaches full-employment output.

# Shifts in AS Curve

- ▶ An aggregate supply curve may shift, resulting in an increase or decrease in the total quantity of goods and services produced in an economy. A rightward shift will result in an increase in quantity at a particular price level, while a leftward shift will result in a decrease in quantity.



# Cause of shift in AS Curve

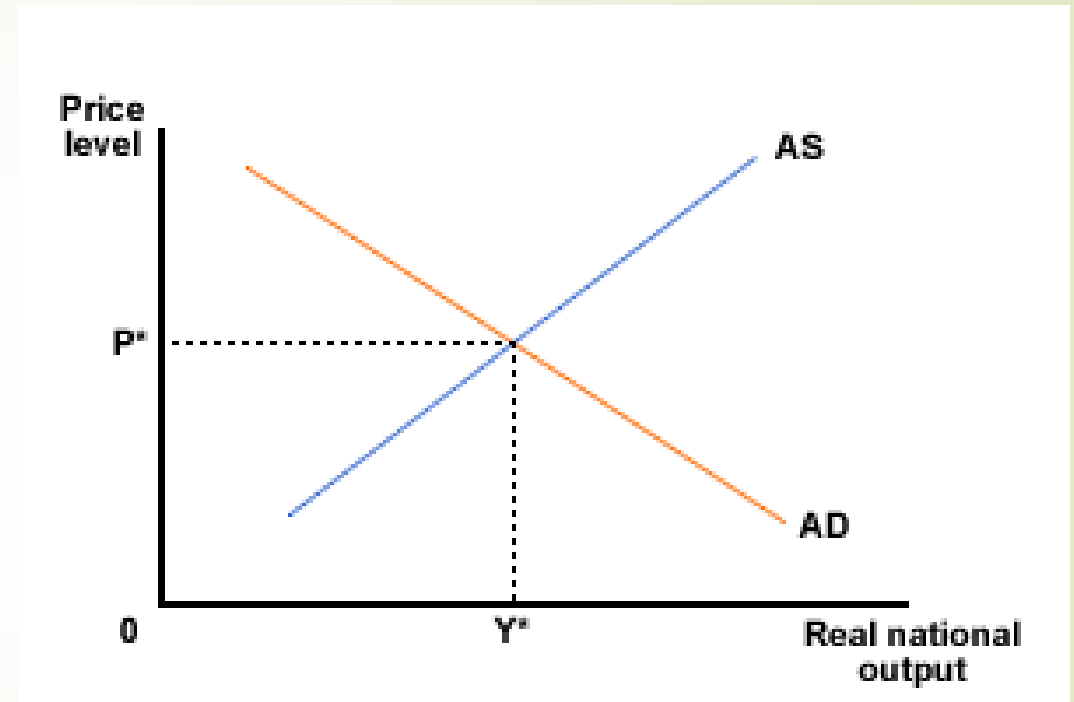
The main causes for shift in AS Curve

Decrease in AS (Leftward Shift)	Increase in AS (Rightward Shift)
<ol style="list-style-type: none"> <li>1. Resources cost rise               <ol style="list-style-type: none"> <li>a. Workers prefer more leisure</li> <li>b. Less education and training</li> <li>c. Shrinking work force</li> <li>d. Inflationary expectations shrink labour supplies</li> <li>e. Unions becomes more powerful</li> <li>f. Decreased saving and investment</li> <li>g. Investor pessimism</li> <li>h. Shrinking supplies of raw materials</li> <li>i. Competition reduced</li> </ol> </li> <li>2. Technology declines</li> <li>3. Government policies worsen               <ol style="list-style-type: none"> <li>a. Inefficient new regulations</li> <li>b. Higher taxes on productive effort</li> <li>c. Welfare programmes discouraging productivity</li> </ol> </li> <li>4. The foreign sector               <ol style="list-style-type: none"> <li>a. Increase in exports</li> <li>b. New barriers to imports</li> </ol> </li> </ol>	<ol style="list-style-type: none"> <li>1. Resources cost fall               <ol style="list-style-type: none"> <li>a. Workers desire more leisure</li> <li>b. More education and training</li> <li>c. Increased labour supplies</li> <li>d. Decreasing inflationary expectations</li> <li>e. Unions power declines</li> <li>f. Higher saving and investment</li> <li>g. Investor optimism</li> <li>h. Discoveries of new raw materials</li> <li>i. Competition increases</li> </ol> </li> <li>2. Technology advances</li> <li>3. Government policies improve               <ol style="list-style-type: none"> <li>a. More efficient regulatory environment</li> <li>b. Reduces taxes on productivity</li> <li>c. Efficient welfare reform</li> </ol> </li> <li>4. The foreign sector               <ol style="list-style-type: none"> <li>a. Increase in imports</li> <li>b. Lower trade barriers</li> </ol> </li> </ol>

# Determination of equilibrium output and price level

- ▶ According to the Keynesian Theory, equilibrium condition is generally stated in terms of aggregate demand (AD) and aggregate supply (AS). An economy is in equilibrium when aggregate demand for goods and services is equal to aggregate supply during a period of time.
- ▶ **So, equilibrium is achieved when:**

$$AD = AS$$





**Thank You!**