

Chapter 5

The AS - AD Model

Learning Objectives :

After learning this chapter you will understand :

- **Aggregate Supply**
 - ✓ Derivation of Aggregate Supply Relation,
 - ✓ Properties of AS Relation,
 - ✓ Properties of AS curve.
- **Aggregate Demand**
 - ✓ Derivation of Aggregate Demand,
 - ✓ Shifts in Aggregate Demand.
- **Equilibrium in the Short Run.**
- **Equilibrium in the Medium Run.**
- **Effects of Monetary Expansion.**
- **Neutrality of Money.**
- **Effects of Decrease in Budget Deficit.**
- **Increase in the Price of Oil.**

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Basic Concepts

1. **Aggregate Supply** : The aggregate supply relation captures the effects of output on the price level. It is derived from the behavior of wages and prices. As we know that wage determination is represented by the following equation :

$$W = P^e F(u, z)$$

(-, +)

The aggregate nominal wage, W , depends on three factors :

- The expected price level, P^e
- The unemployment rate, u
- A catchall variable, z , that stands for all other variables that may affect the outcome of wage setting.

The Price Setting Relation : As we know that, in non-competitive markets, Firms set their price according to :

$$P = (1 + \mu)W$$

2. **Deriving the Aggregate Supply Relation** : The following steps are taken for deriving aggregate supply relation.

Step 1: Eliminate the nominal wage from :

$W = P^e F(u, z)$ and $P = (1 + \mu)W$, then the aggregate supply relation becomes :

$$P = P^e (1 + \mu)F(u, z)$$

In words, the price level depends on the expected price level and the unemployment rate. We assume that μ and z are constant.

Step 2: Express the unemployment rate in terms of output :

$$u = \frac{U}{L} = \frac{L - N}{L} = 1 - \frac{N}{L} = 1 - \frac{Y}{L}$$

Therefore, for a given labor force, the higher is output, the lower is the unemployment rate.

Step 3: Replace the unemployment rate in the equation obtained in step one :

$$P = P^e (1 + \mu)F\left(1 - \frac{Y}{L}, z\right)$$

In words, the price level depends on the expected price level, P^e , and the level of output, Y (and also μ , z , and L , but we take those as constant here). This relation is called the aggregate supply relation.

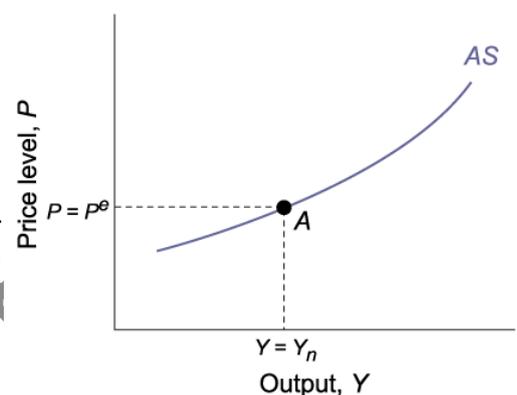
3. **Properties of the AS Relation** : The AS relation $P = P^e (1 + \mu)F\left(1 - \frac{Y}{L}, Z\right)$ has

two important properties :

- (a) An increase in output leads to an increase in the price level. This is the result of four steps :
 - (i) An increase in output leads to an increase in employment.

- (ii) The increase in employment leads to decrease in unemployment and therefore to a decrease in the unemployment rate.
- (iii) The lower unemployment rate leads to an increase in the nominal wage.
- (iv) The increase in nominal wage leads to an increase in the prices set by the firms, and, therefore, to an increase in the price level.
- (b) An increase in the expected price level leads, one for one, to an increase in the actual price level. This effect works through wages :
 - (i) If wage setters expect the price level to be higher, then they will set a higher nominal wage.
 - (ii) The higher nominal wage increases the costs of the firms so they increase the prices.

4. **Aggregate Supply Curve** : The relation between the price level P and output Y , for a given value of the expected price level P^e , is represented by the aggregate supply relation. Given the expected price level, an increase in output leads to an increase in the price level. If output is equal to the natural level of output, the price level is equal to the expected price level.



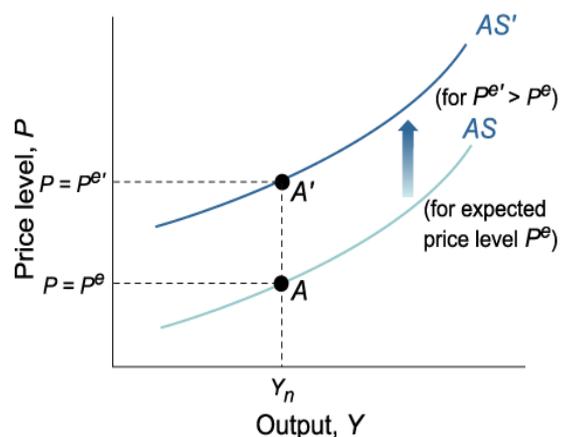
5. **Properties of the AS curve** : The aggregate supply curve has the following properties :

- (i) The AS curve is upward sloping. As explained earlier, an increase in output leads to an increase in the price level.
- (ii) The AS curve goes through point A, where $Y = Y_n$ and $P = P^e$. It means that when output (Y) is equal to natural level of output (Y_n), the price level P turns out to be equal to the expected price level P^e . This property has two implications :

When $Y > Y_n$, $P > P^e$.

When $Y < Y_n$, $P < P^e$.

- (iii) An increase in P^e shifts the AS curve up, and a decrease in P^e shifts the AS curve down. At a given level of output and correspondingly at a given unemployment rate, the increase in expected price level leads to an increase in wages, which leads, in turn to an increase in prices. So, at any level of output, the price level is higher. The aggregate supply curve shifts up.



6. **Aggregate Demand** : The aggregate demand relation captures the effect of the price level on output. It is derived from the equilibrium conditions in the goods and financial markets.

The equilibrium in goods market is :

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

and the equilibrium in financial market is :

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

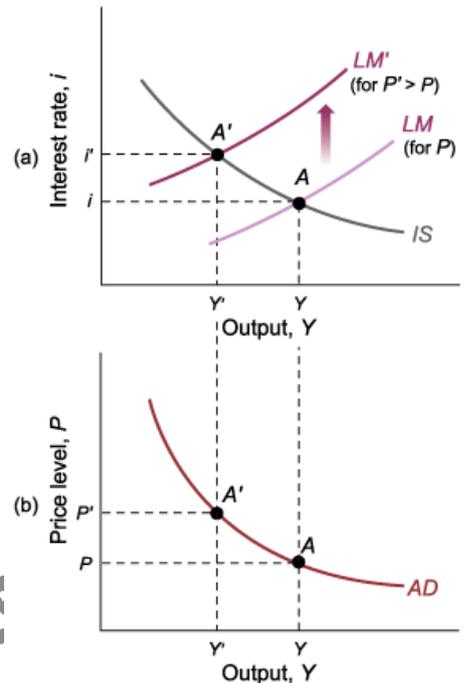
7. **Derivation of Aggregate Demand** : The aggregate demand curve is derived from the simultaneous equilibrium of Goods and financial markets. This process can be explained symbolically, as :

$$\uparrow P \rightarrow \downarrow \frac{M}{P} \rightarrow i \uparrow \rightarrow \downarrow \text{demand} \rightarrow \downarrow Y$$

It means due to increase in price from P to P' , the real balances $\left(\frac{M}{P}\right)$ will fall. The decrease in the real balances will shift the LM curve upwards to the left from LM to LM' . So the equilibrium point shifts from A to A' and equilibrium rate of interest increases from i to i' .

Due to increase in the rate of interest the investment falls and hence equilibrium output also reduces from Y to Y' . Now, plotting the equilibrium out corresponding to each price level in the lower panel we obtain the aggregate demand curve.

The down ward sloping aggregate demand curve shows that the increase in price leads to a decrease in output.

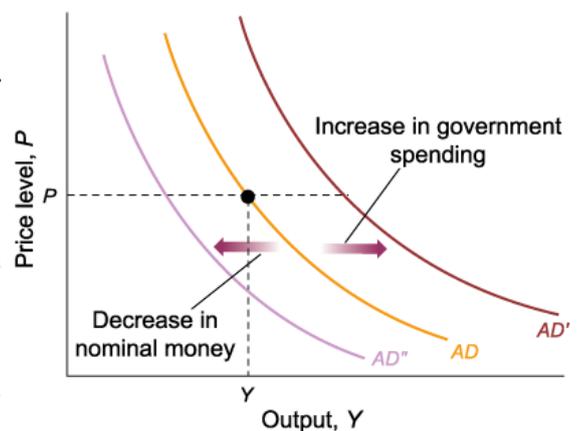


8. **Shifts in Aggregate Demand Curve** :

Changes in monetary or fiscal policy—or more generally in any variable, other than the price level, that shift the IS or the LM curves—shift the aggregate demand curve.

Effect of Changes in Fiscal Policy : An increase in government spending increases output at a given price level, shifting the aggregate demand curve to the right from AD to AD' .

Effect of Changes in Monetary Policy : A decrease in nominal money decreases output at a given price level, shifting the aggregate demand curve to the left from AD to AD'' .



Thus the aggregate demand relation shows that output is an increasing function of real money stock $\left(\frac{M}{P}\right)$, an increasing function of government spending G and a decreasing function of taxes T . Mathematically, the aggregate demand relation can be shown as :

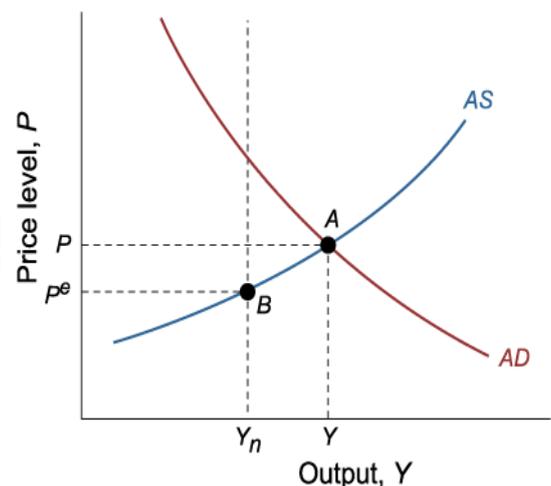
$$Y = Y\left(\frac{M}{P}, G, T\right)$$

(+, +, -)

9. **Equilibrium in the Short Run and in the Medium Run :** For a given value of P^e which enters the aggregate supply relation $P = P^e(1 + \mu)F\left(1 - \frac{Y}{L}, z\right)$ and for given values of monetary and fiscal policy variables M , G and T , which enter the aggregate demand relation $Y = Y\left(\frac{M}{P}, G, T\right)$, the equilibrium values of output Y and price level P are determined by the aggregate supply and aggregate demand relations.

Equilibrium depends on the value of P^e . The value of P^e determines the position of the aggregate supply curve, and the position of the AS curve affects the equilibrium.

10. **Equilibrium in the Short Run :** The aggregate supply curve AS is drawn for a given value of P^e . It is upward sloping and the position of the curve depends on P^e . when output is equal to natural level of output, the price is equal to expected price level, this means that the AS curve passes through point B. The aggregate demand curve is drawn for given values of M , G and T . It is downward sloping, which means at higher price level the output is lower.



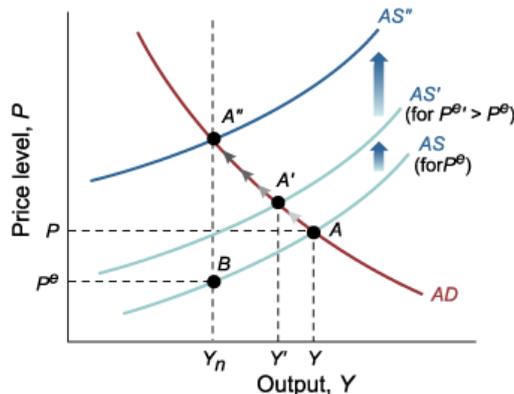
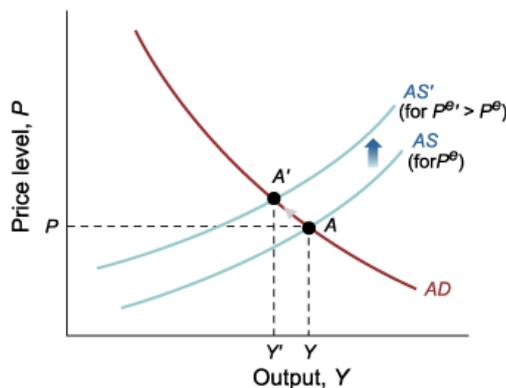
The equilibrium is given by the intersection of the aggregate supply curve and the aggregate demand curve. At point A, the labor market, the goods market, and financial markets are all in equilibrium. The labor market is in equilibrium because A lies on the AS curve and Goods and Financial markets are in equilibrium because A lies on AD curve. At point A the output Y is not equal to natural level of output Y_n and there is no reason that it should be equal to natural level of output. In short run the actual out may be more than or less than the natural level of output.

11. **Equilibrium in the Medium Run :** In the medium run the equilibrium lies on the natural level, *i.e.*, $Y = Y_n$. As we know that in short run the actual out may be more than or less than the natural level of output. But in the medium run the equilibrium will always lie at natural level. This can be explained as under :

At point A, $Y > Y_n \Rightarrow P > P^e$

So, Wage setters will revise upward their expectations of the future price level. This will cause the AS curve to shift upward. Expectation of a higher price level also leads to a higher nominal wage, which in turn leads to a higher price level. The adjustment ends once $Y = Y_n$ and $P = P^e$. Wage setters no longer have a reason to change their expectations. In the medium run, output returns to the natural level of output.

Thus, in the medium run if output is above the natural level of output, the AS curve shifts up over time, until output has decreased back to the natural level of output.

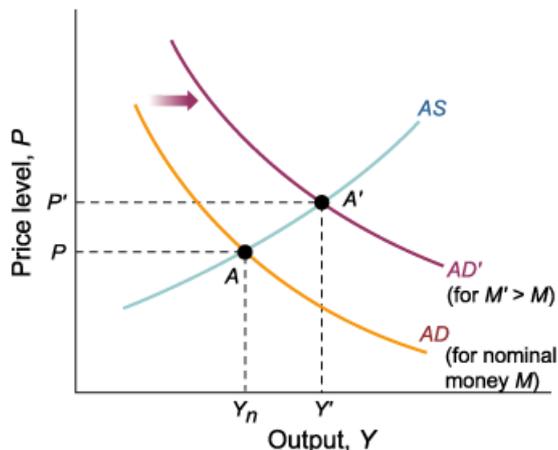


Note In Short-Run, output can be above or below the natural level of output. Changes in any of the variables that enter either aggregate supply relation or aggregate demand relation lead to the changes in output and to the changes in the price level.

Note In Medium-Run, output will eventually return to the natural level of output. When output is above the natural level the price level increases and higher price level decreases demand and output.

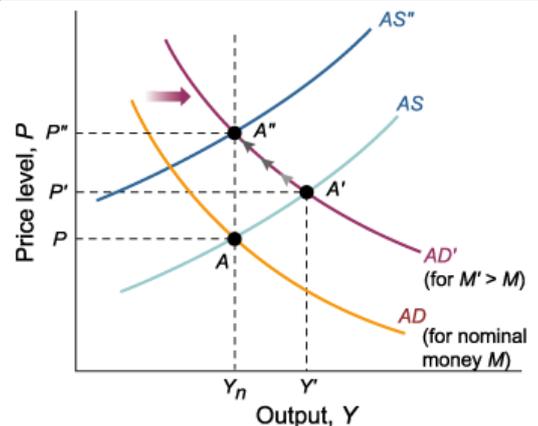
12. **The Effects of a Monetary Expansion :** A monetary expansion leads to an increase in output in the short run, but has no effect on output in the medium run.

This can be explained as under : In the aggregate demand equation, we can see that an increase in nominal money, M , leads to an increase in the real money stock, M/P , leading to an increase in output. The aggregate demand curve shifts to the right.



The increase in the nominal money stock causes the aggregate demand curve to shift to the right. In the short run, output and the price level increase. The difference between Y and Y_n sets in motion the adjustment of price expectations.

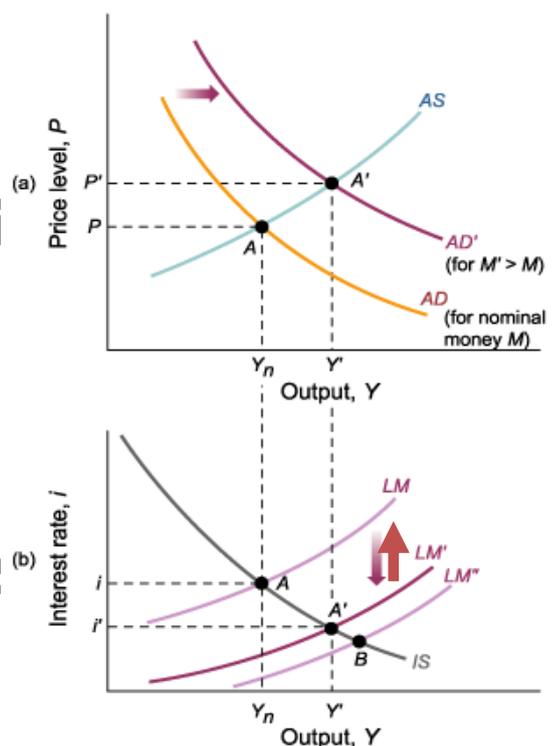
In the medium run, the AS curve shifts to AS'' and the economy returns to equilibrium at Y_n . The increase in prices is proportional to the increase in the nominal money stock.



13. **The Effect of Monetary Expansion Explained Using IS – LM Model :**

The impact of a monetary expansion on the interest rate can be illustrated by the IS-LM model. The increase in nominal money initially shifts the LM curve down, decreasing the interest rate and increasing output. Over time, the price level increases, shifting the LM curve back up until output is back at the natural level of output. This can be explained by the following steps :

- ❖ Before the change in the nominal money the equilibrium is given by the intersection of IS and LM curves at point A, where, output is equal to natural level of output Y_n and interest rate is i .
- ❖ The short-run effect of the monetary expansion is to shift the LM curve down to LM' . The interest rate is lower, output is higher.
- ❖ If the price level did not increase, the shift in the LM curve would be larger—to LM'' . But even in short run the price increases a bit and LM curve moves back to LM' .
- ❖ Over time, the price level increases, the real money stock decreases and the LM curve returns to where it was before the increase in nominal money.
- ❖ In the medium run, the real money stock and the interest rate remain unchanged.



14. **The Neutrality of Money :** In *short run*, a monetary expansion leads to an increase in output, a decrease in the interest rate and an increase in the price level. Whereas, in the *medium run*, the increase in the nominal money is reflected

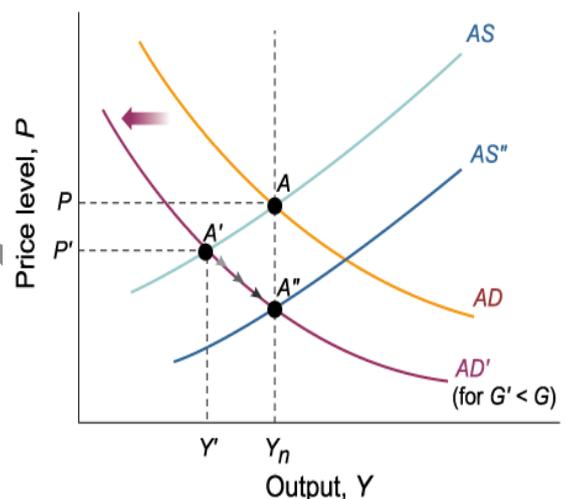
entirely in a proportional increase in the price level. The increase in nominal money has no effect on output or on the interest rate.

Over time, the price level increases, and the effects of a monetary expansion on output and on the interest rate disappear. The neutrality of money refers to the fact that an increase in the nominal money stock has no effect on output or the interest rate in the medium run. The increase in the nominal money stock is completely absorbed by an increase in the price level.

15. **A Decrease in the Budget Deficit :** The budget deficit is a situation where government expenditures exceed government revenues. A policy aimed at reducing the budget deficit through a decrease in government spending is called fiscal contraction or fiscal consolidation.

The Dynamic Effects of a Decrease in the Budget Deficit :

A decrease in the budget deficit leads initially to a decrease in output. Over time, output returns to the natural level of output. Assume that output is initially at the natural level of output, so the economy is at point A, as shown in the adjoining figure. The decrease in government spending (from G to G') shifts the aggregate demand curve to the left, from AD to AD' . For a given price level output is lower. In the short run, the equilibrium moves from A to A' , output decreases from Y_n to Y' and the price level decreases from P to P' .



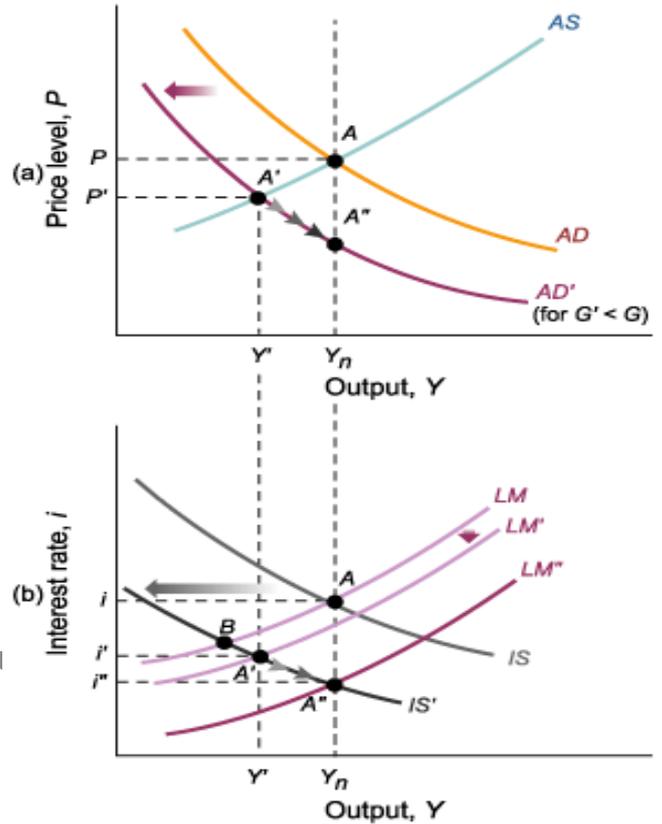
Over time, as long as the output is below the natural level of output, aggregate supply curve keeps shifting down. The economy moves down along the aggregate demand curve AD' until the aggregate supply curve is given by AS'' and the economy reaches point A'' . Where output is back at the natural level of output Y_n .

16. **The Effect of Decrease in Budget Deficit Explained Using IS – LM Model :** Deficit reduction leads in the short run to a decrease in output and to a decrease in the interest rate. In the medium run, output returns to its natural level, while the interest rate declines further. This can be explained by the following steps :

- ❖ Before the change in the fiscal policy the equilibrium is given by the intersection of IS and LM curves at point A, where, output is equal to natural level of output Y_n and interest rate is i .
- ❖ As government reduces the budget deficit, the IS curve shifts to the left to IS' .
- ❖ If the price level did not change, the economy would move from point A to point B. But, Since the price level declines in response to the decrease in

output, the real money stock increases. This causes a shift of the LM curve to LM'.

- ❖ Both output and the interest rate are lower than before the fiscal contraction.
- ❖ The LM curve continues to shift down to LM'' until output is back to the natural level of output. The economy moves down from point A' along IS curve and eventually reaches A''.
- ❖ At A'' the output is back at the natural level of output Y_n but the interest rate is lower than it was before deficit reduction.



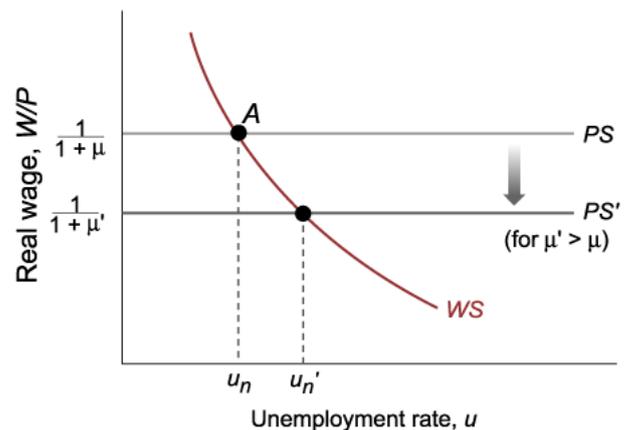
Note The composition of output is different after reduction in budget deficit than it was before deficit reduction. Rewriting the IS relation we have :

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

Income and taxes remain unchanged, thus, consumption is the same as before. Government spending is lower than before; therefore, investment must be higher than before deficit reduction—higher by an amount exactly equal to the decrease in G.

Note In the medium run, budget deficit reduction leads to a decrease in the interest rate and an increase in investment.

17. The Effects of an Increase in the Price of Oil on the Natural Rate of Unemployment : The higher price of oil causes an increase in the markup and a downward shift of the price-setting line thus increasing the unemployment rate. This can be explained by the following steps :



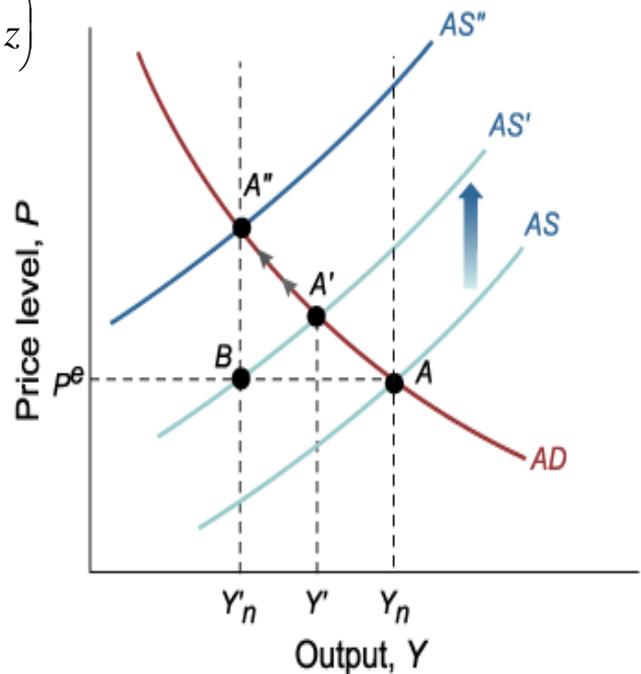
- ❖ The initial equilibrium is at point A and the initial natural unemployment rate is u_n .
- ❖ An increase in the markup leads to a downward shift of the price setting line from PS to PS'.
- ❖ The equilibrium moves from A to A' where the real wage is lower and natural unemployment rate is higher.

18. **The Dynamics of Adjustment of Increase in the Price of Oil :**

As we know that the aggregate supply relation is given by :

$$P = P^e (1 + \mu) F\left(1 - \frac{Y}{L}, z\right)$$

- ❖ An increase in the markup, μ , caused by an increase in the price of oil, results in an increase in the price level, at any level of output, Y . The aggregate supply curve shifts up from AS to AS'.
- ❖ After the increase in the price of oil, the new AS curve goes through point B, where output equals the new lower natural level of output, Y'_n , and the price level equals P^e .
- ❖ The economy moves along the AD curve, from A to A'. Output decreases from Y_n to Y' .
- ❖ Although output has fallen, the natural level of output has fallen even more. At point A', output Y' is still above the natural level of output Y'_n , so the aggregate supply curve continues to shift up to AS''.
- ❖ Over time, the economy moves along the AD curve, from A' to A''.
- ❖ At point A'', the economy has reached the new lower natural level of output, Y'_n , and the price level is higher than before the oil shock.



19. **Stagflation :** Stagflation is a combination of stagnation and inflation. It means economy is facing negative growth and high inflation.

Exercise 1

Theory Questions

- Q1. Derive an upward sloping aggregate supply curve.
 Q2. Derive the aggregate supply equation from the wage setting and price setting relations. Draw an aggregate supply curve and explain the following two properties of the curve :
 [Eco. (H) III Sem. 2014(ER)]

- (i) Aggregate supply curve passes through a point where $Y = Y_n$ and $P = P^e$. The symbols have their usual meaning.
- (ii) An increase in the expected price level shifts the aggregate supply curve up and a decrease in the expected price level shifts the aggregate supply curve down.
- Q3. Using the AD-AS diagram, show what happens to output, price level and unemployment rate in the short run and in the medium run when there is an increase in the price of oil. Assume that the economy starts at the natural rate of output.
- Q4. Consider an economy that is in the medium run equilibrium. Examine the short run and medium run impact of an increase in petroleum price on the level of output and the rate of unemployment in this economy. [Eco. (H) III Sem. 2014(ER)]
- Q5. Derive the equation of the aggregate supply curve from the wage setting and the price setting relations. Explain clearly how this curve is affected by a decline in each of the following : [Eco. (H) III Sem. 2012]
- (i) oil price;
- (ii) unemployment benefits and
- (iii) expected price level.
- Q6. Consider an economy in its medium run equilibrium. Now suppose that the government passes a stricter law against the exercise of market power leading to decline in markup over wages. Explain using IS-LM and AD-AS curves how it will affect price level, interest rate and output in the short run and in the medium run. [Eco. (H) III Sem. 2012]
- Q7. Using AD and AS framework show the short run, medium run and long run effects of a monetary expansion. Is money neutral in the long run? [Eco. (H) 2007, 2009]
- Q8. Explain using AS-AD model how the output eventually returns to the natural level in the medium-run, in response to a contractionary monetary policy. [Eco. (H) III Sem. 2013]
- Q9. Out of the following expansionary fiscal policies, viz, an income tax cut, increase in government spending, and an increase in investment subsidy, which do you think is the best for increasing output and why ? [Eco. (H) III Sem. 2013]
- Q10. Discuss the adjustment of output, interest rate and price level in response to a fiscal expansion in an AD-AS and IS-LM framework. Does the composition of the aggregate output change as a result of this adjustment? Explain. [Eco. (H) III Sem. 2014(ER)]
- Q11. What do you understand by stagflation? Show how a sudden and a significant increase in the mark-up over cost can lead to stagflation in an economy. [Eco. (H) III Sem. 2013]
- Q12. Explain how an increase in the price of oil leads to stagflation in the economy. [Eco. (H) III Sem. 2015]
- Q13. Explain how economy moves from an under full employment equilibrium to the full employment equilibrium to the full employment equilibrium without any government intervention. Use the AD-AS approach to answer your question.

Q14. Analyze the effects and dynamics of oil price rise during 1990s and 2000s on the natural rate of unemployment and output in an economy with the help of AD & AS. [BBE III Sem. 2012]

Q15. Using the AS-AD model, show the effects of each of the following shocks on the position of the IS, LM, AD, and AS curves in the short run and the medium run. Then, show the effect on output, the interest rate, and the price level in the short run and the medium run. Assume that before the changes, the economy was at the natural level of output.

(i) **A increase in consumer confidence (spending shock)**

Ans. In the short-run the IS and the AD curves shift up because the increase in consumer confidence increases the amount of autonomous consumption for a given level of output. Therefore, aggregate demand raises and so does the level of output. The rise in output causes an increase in the amount of transactions and thus in the demand for money. Therefore, the new equilibrium is reached at higher level of output and higher interest rates.

In the medium-run the economy should go back to the natural output level. How does this adjustment take place? If we assume that before the changes the economy was at the natural level of output, the higher level of output resulting from the increase in consumer confidence is above the natural output level, Y_n . Thus, the unemployment rate at that point should be below the natural unemployment rate u_n , in other words the economy is in an inflationary gap. As a result, there will be pressure on wages to raise, with the consequent increase in marginal costs, and a shift in the AS curve to the left. In the medium run, prices will increase, and output will return to its natural level. As for the LM curve, as prices increase, real money balances drop, leading to a shift in the LM upwards. This will cause the interest rate to increase in the medium run.

(ii) **An increase in government spending (spending shock)**

Ans. The answer is the same as in (i) with the only difference that the shift in the IS and AD curves is caused by the increase in government spending.

(iii) **A decrease in unemployment benefits (supply shock)**

Ans. To figure out the effect of a decrease in unemployment benefits on the IS-LM and AD-AS relations, you need to look first at the labor market. In other words, how does a decrease in unemployment benefits affect the price-setting and wage setting relations. Now, if unemployment benefits fall, the nominal wage that will prevail in the market will decrease, since there will be less incentive for workers to be unemployed and they will have less bargaining power. Thus, the wage-setting relation shifts down, and the natural unemployment rate drops to a new lower level.

Thus, in the short run, the economy will move towards a point with a lower natural unemployment rate and a higher natural output level. Thus, the AS shifts right, more output is produced; there is pressure on wages and prices to drop. The

latter causes an increase in real money balances, which leads to a rightward shift in the LM curve.

In the medium run, if the economy has not yet adjusted to the natural level of output, the AS and LM will continue shifting until $Y = \text{new } Y_n$.

(iv) A decrease in the price of oil (supply shock)

Ans. Again in this case it is easier if you figure out first the effect of the decrease in the price of oil in the labor market. How does a decrease in oil prices affect the price setting and wage setting relations?

If the price of oil falls, non-labor costs fall, allowing firms to charge a lower markup. Therefore, the price-setting relation shifts up, real wages increase, and the natural unemployment rate drops. This lower natural unemployment rate is consistent with a higher natural output level.

Thus, in the short run, the economy will move towards a point with a lower natural unemployment rate and a higher natural output level. Hence, the AS shifts right, more output is produced, there is pressure on wages and prices to drop. The latter causes an increase in real money balances, which leads to a rightward shift in the LM curve.

In the medium run, if the economy has not yet adjusted to the natural level of output, the AS and LM will continue shifting until $Y = \text{new } Y_n$.

Q16. Assume that initially the economy is operating at the natural output level. Suppose that after a long discussion, parliament approves a cut in government spending aimed to reduce the budget deficit.

(i) Analyze the short-run effect of this fiscal policy on the interest rate, consumption, output and investment. Justify your answer with a graphical representation of the ISLM and AD-AS curves and with words.

Ans. In the short run, the cut in government spending will shift the IS and AD curves to the left, leading to a lower equilibrium level of output and interest rates. How do we reach this new short-run equilibrium? As the government cuts government spending, the demand for goods falls, leading to a drop in the income level. At the new lower income level, the number of transactions decreases, thus leading to a reduction in the demand for money. Initially, the real money demand will be lower than the real money supply, that is people will want to switch from money to bonds, driving the price of bonds up and the interest rate down.

(ii) What is the medium-run effect of the decrease in government spending on output, prices, and the interest rate? Justify your answer with a graphical representation of the IS-LM and AD-AS curves and with words.

Ans. Given the cut in government spending and the consequent drop in output, the actual level of output will be below the natural level of output. In other words, there will be a smaller number of people employed, and the observed unemployment rate will be above the natural unemployment rate. As a result, in the medium run, there will be pressure on wages to drop, leading to a decrease in marginal costs. Workers will expect prices to fall in the future, which will shift the AS rightward. As the AS curve shifts to the point where $Y = Y_n$, prices will drop. As a result, real money balances will increase, which will cause the LM curve to

shift to the right. In the medium run, the economy will return to the initial natural level of output, interest rates will decrease, and prices will drop.

- (iii) Now, assume that the Central Bank is committed to maintain output at the natural level. What type of monetary policy would the Central Bank pursue to attain this goal? Justify your answer with a graphical representation of the IS-LM and AD-AS curves and with words.

Ans. In this case we assume that instead of waiting for prices and wages to adjust, that is for the economy to adjust in the medium run, the central bank conducts monetary policy to maintain output at its natural level. Thus, when the government cuts spending, the central bank has to implement an expansionary monetary policy. The central bank does this by buying bonds, which drives the price of bonds up and pushes interest rates down. As interest rates drop, the cost of financing becomes smaller, and investment increases. This leads to an increase in the demand for goods, and the consequent increase in the output level from point (i) to the original natural output level.

Graphically this would be represented by a rightward shift of the LM curve up to the point where the economy is in equilibrium at $Y = Y_n$. And a simultaneous rightward shift in the AD demand curve.

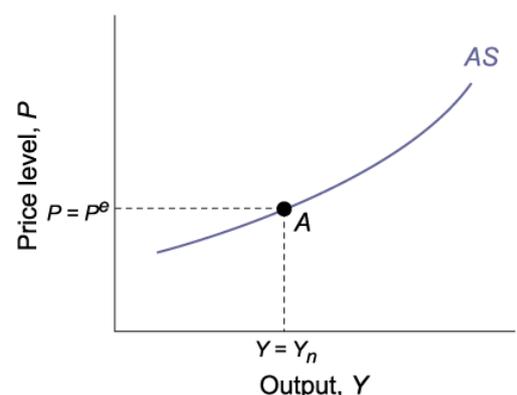
- Q17. Using the information in this chapter label each of the following statements true, false or uncertain. Explain :

- The aggregate supply relation implies that an increase in output leads to an increase in the price level.
- The natural level of output can be determined by looking at the aggregate supply relation alone.
- The aggregate demand relation slopes down because at a higher price level, consumers wish to purchase fewer goods.
- In the absence of changes in fiscal or monetary policy, the economy will always remain at the natural level of output.
- Expansionary monetary policy has no effect on the level of output in the medium run.
- Fiscal policy cannot affect investment in the medium run because output always returns to its natural level.
- In the medium run, prices and output always return to the same value.
- The aggregate supply curve is upward sloping because firms produce more goods at higher prices.

Ans.(a) TRUE. The aggregate supply relation describes how changes in output affect the price level. We can see from the adjoining figure that an increase in the level of output leads to an increase in the price level.

This process is a four step process :

- An increase in output leads to an increase in the level of employment.
- The unemployment rate falls as a result.



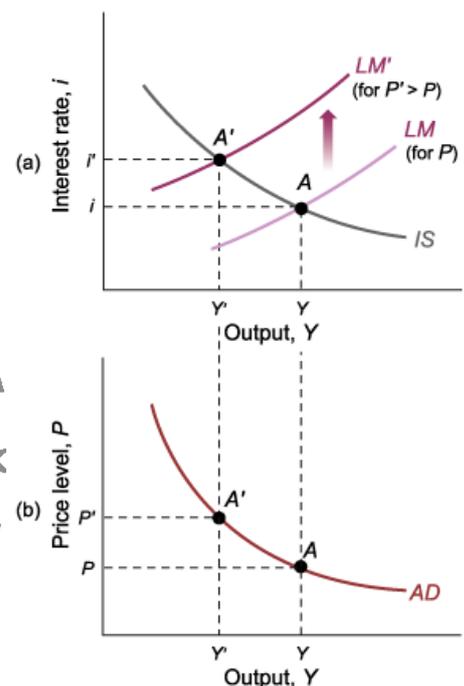
- (iii) The lower unemployment rate leads to a rise in nominal wages.
- (iv) This increase in the nominal wage causes firms to increase their prices, so raising the overall price level in the economy.

(b) **TRUE.** The natural rate of unemployment, and hence the natural level of output, is determined by labour market conditions. The natural level of output Y_n is such that, at the associated rate of unemployment u_n , the real wage (W/P^e) chosen in wage setting (workers' side) is equal to the real wage (W/P) chosen in price setting (firms' side). Therefore, the aggregate supply relation determines the natural level of output, for given labour market conditions, when the actual price level P is equal to the expected price level P^e .

(c) **FALSE.** The aggregate demand relation is derived from the IS-LM Model. The AD curve represents the locus of equilibria in the IS-LM model.

The LM Curve represents the set of equilibria in the Money Market for a given price level, P . If the price level rises to P' (inflation), then the real money supply (M/P) falls. This causes the LM curve to shift upwards. The equilibrium, A , moves along the IS Curve to the new equilibrium at A' . The interest rate increases and output therefore decreases from Y to Y' . Mapping these equilibria in (P, Y) space gives us the aggregate demand (AD) curve. This is downward-sloping and shows the negative relationship between the price level and the level of output. As the price level increases from P to P' , the level of output falls from Y to Y' .

Summary: The AD curve slopes down, because a rise in the price level causes a fall in the real money supply. This shifts the LM Curve upwards and so causes a rise in interest rate and a fall in the level of output.



(d) **FALSE.** This is untrue, because there are other causes of changes in supply and demand that cause the economy to deviate from the natural level of output. These include shocks such as changes in oil prices and fluctuations in consumer or business confidence in the economy.

(e) **TRUE.** The short run effect of an increase in the money supply is that output increases, while the interest rate falls and the price level rises. In the medium run, the output level and the interest rate are unchanged, but the price level is higher.

Looking at the IS-LM diagram first; a monetary expansion causes the money supply to rise from M_0 to M_1 , and so the LM Curve shifts from LM to LM_1 . The new equilibrium is at A_1 , with a consequent rise in the output level and a fall in the interest rate. This causes the AD curve to shift to the right, with the price level

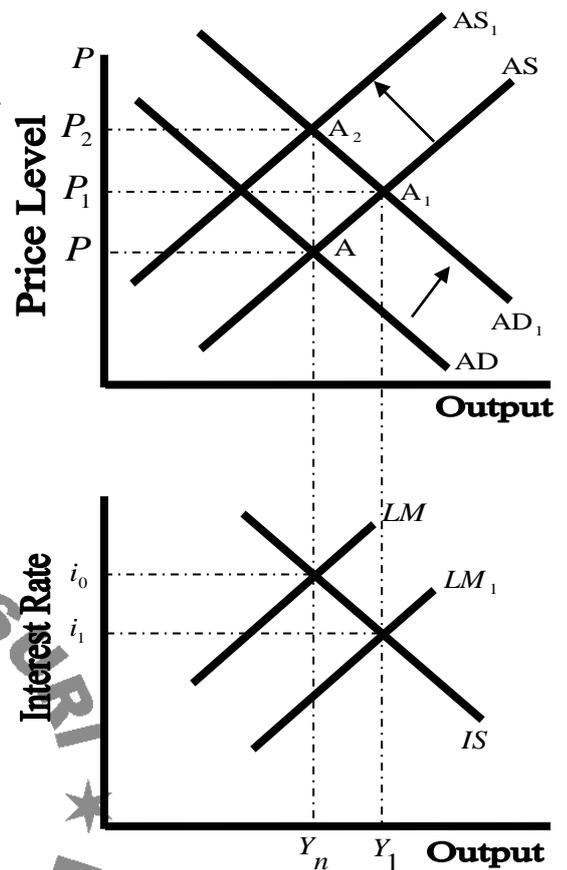
rising from P to P_1 . The new (short run) equilibrium is at A_1 , with higher output level Y_1 , higher price level P_1 and an lower interest rate of i_1 .

In the medium run the price level is higher than expected and so the expected price level increases too.

Workers demand higher nominal wages to compensate them for the higher cost of living. Firms in turn raise their prices to cover the increase in their wage costs. This causes the AS Curve to shift upwards to AS_1 . The new equilibrium is now at A_2 , with higher price level P_2 .

Looking again at the IS-LM Model, we see that the rise in the price level causes the real money supply to contract again and so the LM curve shifts back upwards. The interest rate rises back to its initial level (i_0) and the level of output falls back to its initial level (Y_n).

Overall, in the short run, the monetary expansion causes the interest rate to fall, output to increase and the price level to rise. In the medium run, the interest rate rises back to its initial level, the level of output falls back to its initial level and the price level is higher than at the outset.

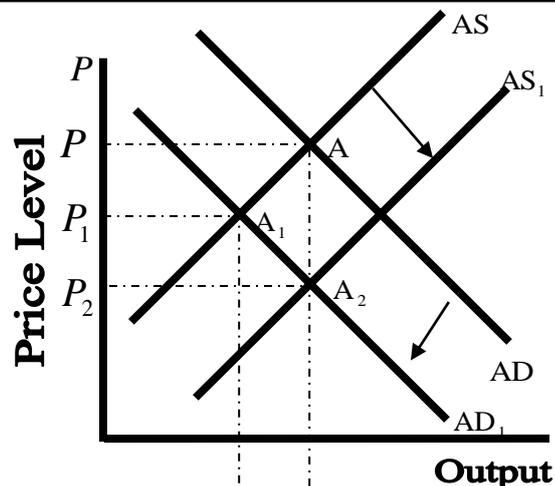


- (f) **FALSE.** Fiscal policy can affect investment in the medium run, because it can affect the interest rate in the medium run. We use the example of a deficit reduction (in the form of a decrease in government spending, G) to illustrate the effect that fiscal policy can have on investment in the medium run.

Looking at the IS-LM diagram first, we see that the fall in government spending causes the IS Curve to shift to the left, from IS to IS_1 . On the AS-AD diagram, the fiscal contraction causes the AD Curve to shift to the left, from AD to AD_1 . The new equilibrium has a lower output level, Y_1 , and also a lower price level, P_1 .

This lower price level feeds back into the IS-LM model, as it raises the real money supply (M/P) and so shifts the LM Curve downwards, from LM to LM_1 . The new (short run) equilibrium is at A_1 , with lower output level Y_1 , lower price level P_1 and an lower interest rate of i_1 .

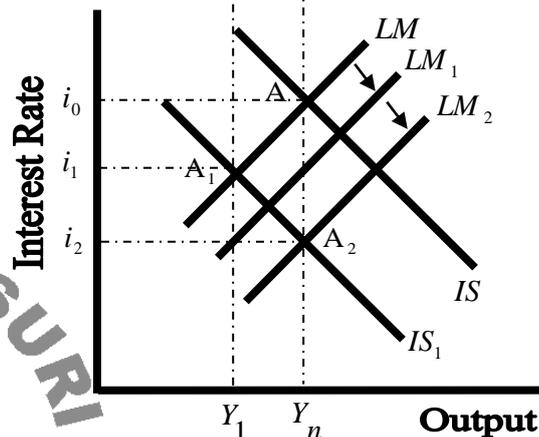
In the medium run, the price level has fallen below the expected price level, P_e , and so the expected price level falls too. This pushes the price level down further, which in turn pushes up the real money supply (M/P) and so shifts the LM Curve further down, to LM_2 . The level of output increases back to the natural level of output, Y_n , and the interest rate falls further to i_2 . The fall in the price level shifts the AS Curve downwards, giving the medium run equilibrium at A_2 , with output at the natural level (Y_n) and the price level falling to P_2 .



Overall, output is back to its natural level and the price level is lower. But the interest rate is also lower in the medium run and this is how fiscal policy can affect the level of investment in the economy. Investment is higher than before the fiscal contraction due to the fall in the interest rate. This is clear from looking at the IS relation :

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

The level output is the same as before (Y_n), as is consumption (C) and tax (T). The fall in government spending (G) is therefore offset by the increase in investment (I).



- (g) **FALSE.** In the medium run, the level of output usually returns to the natural level. An exception to this is when the economy experiences supply-side shocks. A good example of this is the oil shock.

In the medium run, the price level doesn't necessarily return to its initial level either. We have already seen a number of examples where the medium run price level is not the same as the initial one :

In part (e) above we have seen that a monetary expansion can cause the price to rise in the medium run.

In part (f) above, we saw that a fiscal contraction can cause the price level to fall in the medium run.

- (h) **False.** The AS curve is upward sloping because higher output means a lower unemployment rate, which enhances workers' bargaining power and results in a higher real wage for a given expected price level, and prices go up in response to an increase in wage.

Q18. In what sense is money neutral? Why is monetary policy useful if money is neutral?

Ans. *Neutrality of Money* : Money is neutral because nominal money supply has no effect on output and the interest rate in the medium run. The increase in the nominal money supply is entirely reflected in the proportional increase in the price level. The interest rate is determined by the position of the IS curve and the natural level of output (which is determined by the position of the AS curve). Because the IS curve doesn't move, there is no effect on the interest rate (and level of investment) so that the level of output also does not change. Therefore in the medium run the monetary policy is not effective.

Effectiveness of Monetary Policy : Despite the neutrality of money in the medium run, monetary policy can be effective in the short run. With a monetary expansion, the LM curve shifts down and the AD curve shifts to the right. The interest rate decreases and therefore output increases due to increased investment. In summation, monetary policy can be useful in the short run as it decreases the interest rate and increases output.

In application, monetary policy can speed up the economy's return to the natural level of output when output has fallen below this level.

As an example of monetary policy being able to pull the economy out of recession and towards the natural level of output, we can consider a situation where we can use an expansionary monetary policy to prevent a decrease in output (and the resultant increase in unemployment), caused by a decline in business confidence (negative exogenous demand shock). We can observe that without monetary policy, output will return to its natural level in the medium run. When applying monetary policy, output will return to its natural level in the short run and in fact the initial output level and price level will not change at all. The monetary policy is useful against the negative demand shock. (The monetary policy also prevents the increase in the rate of unemployment which remained at its natural level.)

We should remember that monetary policy is not useful when the LM curve is flat. In this case The expansionary monetary policy is ineffective because the economy falls into a "Liquidity Trap".

Q19. In the AS-AD Model Suppose that the interest rate has no effect on investment.

(i) **Can you think of a situation where this may happen?**

Ans. If for example, financial markets function poorly, and firms cannot borrow and have to finance investment through profits (retained earnings), then the interest rate will have no effect on investment. This is admittedly an extreme case.

(ii) **What does this imply for the slope of the IS curve?**

Ans. The IS curve becomes vertical, i.e., $\frac{dY}{di} = 0$.

(iii) **What does this imply for the slope of the LM curve?**

Ans. The slope of the LM curve remains the same.

(iv) **What does this imply for the slope of the AD curve?**

Ans. The AD curve also becomes vertical, *i.e.*, $\frac{dY}{dP} = 0$. An increase in 'P' shifts the LM curve up. However, given a vertical IS curve, the shift of the LM curve has no effect on output. In other words, the increase in the price level increases the interest rate. But the increase in the interest rate does not affect investment and so does not affect demand. Continue to assume that the interest rate has no effect on investment. Assume that the economy starts at the natural level of output. Suppose there is an increase in *z*, so that the AS curve shifts up.

(v) **What is the short-run effect on the price level and output? Explain in words.**

Ans. The price level goes up and output stays unchanged in the short run. The increase in price reduces the real money supply and thus shifts up the LM curve, which leads to a higher interest rate. However, since the interest rate has no effect on investment, investment and output remain unchanged.

(vi) **What happens to output and the price level over time? Explain in words.**

Ans. As price goes up, the expected price level goes up also. However, as long as the interest rate has no effect on investment, output will stay unchanged at its original natural level. Since output cannot adjust to its new lower natural level after the shock to *z*, price continues rising and so does the expected price level. As a result, the real money supply keeps shrinking, and the interest rate keeps rising. Clearly, such dynamics cannot be sustainable, and we need to reconsider our assumptions.

Q20. Elaborate on the dynamic effects of monetary expansion on the level of output and the interest rate both in the short run and in the medium run. **[BBE III Sem. 2011]**

Q21. Does reduction of budget deficit increase investment? Discuss.

[BBE III Sem. 2012]

Q22. How does a decrease in the government deficit affect the price level, output and interest rate in an economy both in the short run and the medium run?

[BBE III Sem. 2011]

Q23. What are the short run and medium run effects of an expansionary monetary policy on the levels of output and price.

[BBE III Sem. 2011]

Q24. Using the model of aggregate supply (AS) and aggregate demand (AD), show the movements in the level of output both in the short run and medium run.

[BBE III Sem. 2011]

Multiple Choice Questions (MCQ's)

Q1. When the nominal wage rate is rigid, the aggregate supply schedule (in the output-price space) is :

[DSE MA Ent. Eco. 2009]

- | | |
|----------------------|--------------------|
| (a) horizontal | (b) vertical |
| (c) downward sloping | (d) upward sloping |

[Ans. : (d)]

Q2. Under nominal wage rigidity, the short run aggregate supply schedule will be

- | | |
|--------------------|----------------------|
| (a) vertical | (b) horizontal |
| (c) upward sloping | (d) downward sloping |

[Ans. : (c)]

[DSE MA Ent. Eco. 2011]

- Q3. The short-run aggregate supply curve is upward sloping because
- (a) A lower price level creates a wealth effect
 - (b) Lower taxes motivate people to work more
 - (c) Money wages do not immediately change when the price level changes
 - (d) Most business firms operate with long-term contracts for output but not labour

[Ans. : (c)]

[DSE MA Ent. Eco. 2012]

- Q4. The short-run aggregate supply curve is upward sloping because
- (a) lower price level creates a wealth effect
 - (b) lower taxes motivate people to work more
 - (c) money wages do not immediately change when the price level changes
 - (d) most business firms operate with long-term contracts for output but not labour

[Ans. : (c)]

[DSE MA Ent. Eco. 2013]

- Q5. The aggregate demand curve is
- (a) the total quantity of an economy's intermediate goods demanded at all price levels.
 - (b) the total quantity of an economy's intermediate goods demanded at a particular price level.
 - (c) the total quantity of an economy's final goods and services demanded at a particular price level.
 - (d) the total quantity of an economy's final goods and services demanded at different price levels.
 - (e) none of the above.

[Ans. : (d)]

- Q6. The total quantity of an economy's final goods and services demanded at different price levels is
- (a) the aggregate supply curve.
 - (b) the aggregate demand curve.
 - (c) the Phillips curve.
 - (d) the aggregate expenditure function.
 - (e) both (b) and (d) of the above.

[Ans. : (b)]

- Q7. The aggregate demand curve is downward sloping because
- (a) a lower price level, holding the nominal quantity of money constant, leads to a larger quantity of money in real terms, causes the interest rate to fall, and stimulates planned investment spending.
 - (b) a lower price level, holding the nominal quantity of money constant, leads to a larger quantity of money in nominal terms, causes the interest rate to rise, and stimulates planned investment spending.
 - (c) a higher price level, holding the nominal quantity of money constant, leads to a larger quantity of money in real terms, causes the interest rate to fall, and stimulates planned investment spending.

- (d) a higher price level, holding the nominal quantity of money constant, leads to a smaller quantity of money in real terms, causes the interest rate to fall, and stimulates planned investment spending.

[Ans. : (a)]

- Q8. The aggregate demand curve slopes downward because a decrease in the price level means a(n) _____ in the real money supply and therefore a _____ level of real spending.

- (a) increase; higher (b) increase; lower
(c) decrease; lower (d) decrease; higher

[Ans. : (a)]

- Q9. The Keynesian analysis of aggregate demand indicates that a decline in the price level causes

- (a) a decline in the real money supply, an increase in interest rates, a decline in investment spending, and a decline in aggregate output demanded.
(b) a decline in the real money supply, a decline in interest rates, an increase in investment spending, and an increase in aggregate output demanded.
(c) an increase in the real money supply, a decline in interest rates, an increase in investment spending, and an increase in aggregate output demanded.
(d) an increase in the real money supply, an increase in interest rates, a decline in investment spending, and a decline in aggregate output demanded.

[Ans. : (c)]

- Q10. According to the monetarists an increase in the money supply, other things equal, shifts the aggregate _____ curve to the _____.

- (a) demand; right (b) demand; left
(c) supply; left (d) supply; right

[Ans. : (a)]

- Q11. According to monetarists, a decline in the money supply, holding other factors constant, shifts the aggregate _____ curve to the _____.

- (a) demand; right (b) demand; left
(c) supply; right (d) supply; left

[Ans. : (b)]

- Q12. According to the Keynesians, a decrease in government spending, other things equal, shifts the aggregate _____ curve to the _____.

- (a) demand; right (b) demand; left
(c) supply; left (d) supply; right

[Ans. : (b)]

- Q13. According to the Keynesians, an increase in taxes, other things equal, shifts the aggregate _____ curve to the _____.

- (a) demand; right (b) demand; left
(c) supply; left (d) supply; right

[Ans. : (b)]

- Q14. The Keynesian analysis of aggregate demand indicates that a change in taxes

- (a) shifts the aggregate demand curve in the same direction as the change in government spending.

- (b) shifts the aggregate demand curve in the direction opposite to that of the change in government spending.
- (c) moves the economy along the aggregate demand curve rather than shifting it.
- (d) has no effect on aggregate demand.

[Ans. : (b)]

Q15. The aggregate supply curve is upward sloping because in the _____ run, costs of many factors that go into producing goods and services are _____, meaning that the price for a unit of output will _____ relative to input prices and the profit per unit will rise.

- (a) short; fixed; rise
- (b) short; fixed; fall
- (c) long; flexible; rise
- (d) short; flexible; fall
- (e) long; fixed; fall

[Ans. : (a)]



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