INTERMEDIATE MACROECONOMICS-I (SEM3)

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Contents

Syllabus

Aggregate Demand and Aggregate Supply- the Complete Keynesian Model[L-14]

- Derivation of aggregate demand curve.
- Derivation of aggregate supply curves, both in the presence and absence of wage rigidity.
- Equilibrium, stability, and comparative statics-effects of monetary and fiscal policies. Effects of wage cut.
- Unemployment equilibrium and its causes- possible solutions, including real balance effect.

Keynes vs. Classics [L-10]

- Keynesian vs classical system.
- Hybrid models under Classical/Keynesian framework.
- Friedman's restatement of classical ideas

Disclaimer :

At the very beginning, I want to let the reader of this handout know that this is made for the convenience of my Economics(honors) students at Ramsaday College. It is compiled from various books and handout distributed by Prof Kaushik Gupta (University of Calcutta). I took help from the following books, mainly (i) Jaydeb Sarkhel, (ii) Gopal Tribedy, (iii) Venieris and Sebold. (iv) Ben Heijdra (v) William Branson. I have no copyright of this note. It is written heuristically and hence not free from mistake(s). If you find any mistake(s) please let me know. My email id is imdahal@gmail.com. Please distribute this as much as possible such that many students may get benefit of my endeavor. This handout can be directly downloaded from my Google site https://sites.google.com/view/imdadul/home. I have made this for two units which are assigned to me for teaching this year (2021).

1 Aggregate Supply

1.1 labor Market

In the general equilibrium of commodity and money markets, we assume that the equilibrium rate of interest and the equilibrium level of income are simultaneously determined by the intersection of IS and LM curves. But in the construction of the LM curve, we assume that the price level is given and constant. If the price level changes, the money supply remaining the same, we shall get a new LM curve, a new equilibrium rate of interest and a new equilibrium level of income. Unless the equilibrium price level is known, we cannot therefore find out the equilibrium rate of interest and the equilibrium level of income, Let us now see how the equilibrium price level is determined in the economy. In the labor market, we consider the labor demand function and the labor supply function.

1.1.1 labor demand

The labor demand function is derived from the aggregate production function. The aggregate production function states that aggregate output (Y) is a function of the volume of employment, given the capital stock (K_0). Keynes assumes that in the short run the supply of capital is constant and the level of Output will increase as more employment takes place. The aggregate production function can be written as:

$$Y = F(N, K_0) \tag{1}$$

Where N is the volume of employment in the Economy. It is assumed that $\frac{dY}{dN} > 0$ and, $\frac{d^2Y}{dN^2} < 0$ i.e ., the marginal Productivity of labor is positive but decreasing as more labor is employed in the production process. The total product curve will, therefore, be a concave curve from below. The total product curve is shown in figure 1.1.1. The slope of the aggregate production function at any point gives the marginal productivity of labor at that point. Since the curve is concave, the slopes diminish as we move along the curve from left to right. This reflects the assumption of diminishing Marginal productivity of labor.
It is assumed that of entrepreneurs desire to maximize profit. There is perfect competition in the market for commodities and in the market for labor. To maximize profit, an entrepreneur will demand labor up to the point where

the value of the marginal productivity of labor is equal to the money wage rate.[1]. Similarly in the economy also the aggregate demand for labor will be determined where the value of the marginal productivity of labor is equal to the money wage rate. If W is the money wage rate and P is the price level, the condition of profit maximization can be written as,

$$W = P\frac{dY}{dN} \tag{2}$$

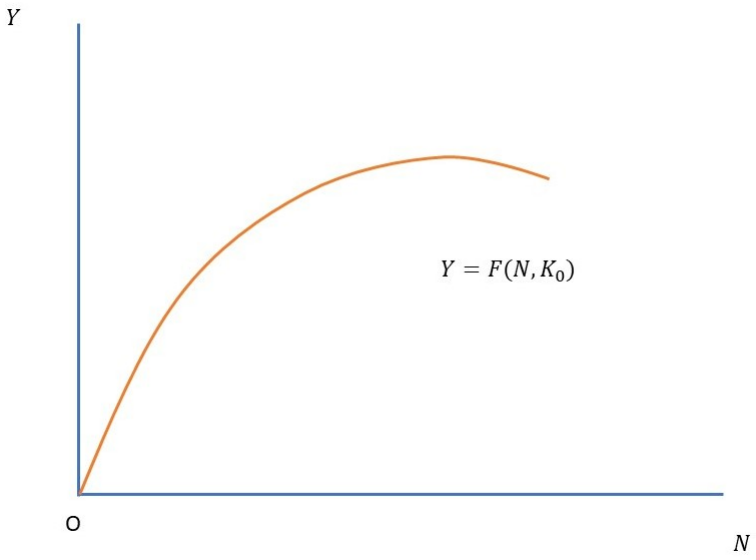

Figure 1.1.1 Aggregate Production Function

The marginal productivity curve is known from the Aggregate production function. Hence, the value of the marginal productivity curve is also known from the production function. Thus, the demand curve for labor is determined from the aggregate production function by the principle of profit maximization. Since the value of the marginal productivity (VMP) curve will be downward sloping, the labor demand curve will also be downward sloping. This means that if the price level is given, labor demand will increase as the money wage rate decreases. For each price level, we shall get one labor demand curve. For example, when the price level is P_0, the labor demand curve

[1]The profit function can be written as $\pi = PF(N, K_0) - WN$. Differentiating with respect to N we have $\frac{d\pi}{dN} = P\frac{dF}{dN} - W = 0$, which implies $W = P\frac{dF}{dN}$

is $P_0\frac{dY}{dN}$. But when the price level is P_1, the labor demand curve is $P_1\frac{dY}{dN}$. As the price level increases, the labor demand curve will shift to the money right. This means that more labor will be demanded at each money wage. Two labor demand curves corresponding to Two prices are shown in figure 1.1.1. In this figure $\frac{dY}{dN}$ represents MPP of labor. Assuming that $P_0 > 1$, $P_0\frac{dY}{dN}$ the curve will lie to the right of the $\frac{dY}{dN}$ curve. Again, since $P_1 > P_0$, the $P_1\frac{dY}{dN}$ curve lies to the right of the $P_0\frac{dY}{dN}$ curve. As the price level increases, the labor demand curve shifts to the right and vice versa.

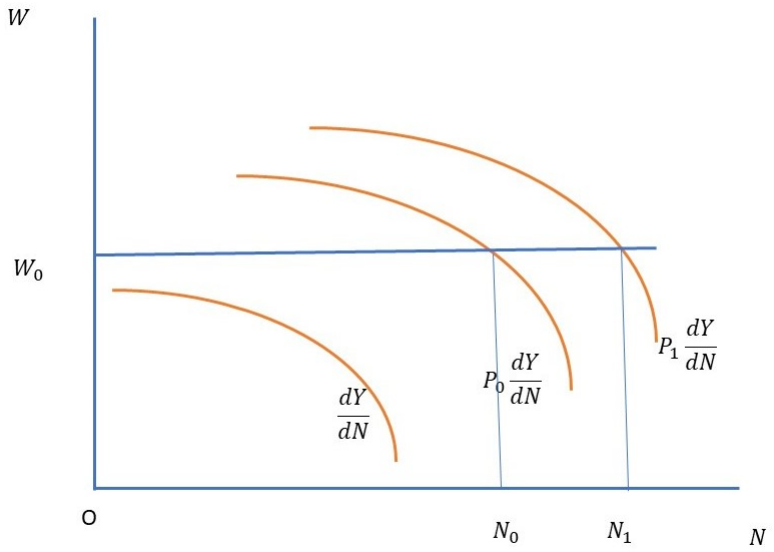

Figure 1.1.1 Labor Demand Curve at various price level

1.1.2 Labor Supply

Consider now the supply side of the labor market. The Keynesian labor supply function is a macroeconomic labor supply function. It gives us the number of laborers that are willing to work at different money wage rates. Keynes assumes that money illusion exists in the supply of labor function, i.e, the laborers are suffering from money illusion. When an individual is concerned not with the real value of money but only with the nominal value of money, the individual is said to be suffering from money illusion. Thus, if all prices and money income increase in the same proportion, an illusion-free individual will keep his quantities demanded and supplied unaffected.

In other words, this means that the supply of labor depends not on the real wage rate but on the money wage rate. Workers are not concerned with the real value of the wages that they receive but with the money value of wages. There are several reasons for assuming that laborers are subject to money illusion.

Firstly, Keynes thought that due to the growth of unions, the workers will not accept a low money wage rate whatever may be the real wage rate. In other words the money wage rate is rigid in the downward direction and cannot fall below a certain level, though the real wage rate has no such Limit.

Secondly, workers themselves have some obligations which are fixed in terms of money such as debts, taxes, etc. Even if money wages and prices fall these obligations will not be reduced. If money wages fall along with prices it would be difficult for the workers to meet these fixed obligations. For the existence of these obligations, the laborers will not accept a cut in money wage rates even though all current prices are cut proportionately.

The Keynesian labor supply function can be expressed with the help of the following equations :

$$W = \begin{cases} W_0 & \text{for } \mathrm{N} \leq N_f \\ W(N) & \text{for } N > N_f \end{cases}$$

In other words,

$$W = W_0 + W(N) \tag{3}$$

Where $W'(N) = 0$ for $N \leq N_f$ and $W'(N) > 0$ for $N > N_f$ Here W_0, is the minimum money wage rate below which it cannot fall further. At the money wage rate W_0, N_f, workers are willing to work. Let us call this level the full employment level. In simple language, this means that at the wage rate, W_0 all workers are willing to work up to full employment. When the level of employment is less than or equal to the full employment level, the money wage rate is constant. But if the volume of Employment exceeds the full employment level, the wage rate will go up as employment increases. The Keynesian labor supply function is drawn in figure 1.1.2.

In the horizontal axis we plot the volume of employment and in the vertical axis we plot the money wage rate. The money wage rate is constant at W_0

up to the full employment level N_f, after which it increases with increase in employment. By full employment level, we mean the number of laborers who are willing to work at the minimum wage rate W_0. The labor supply function is therefore horizontal up to the point of full employment, after which it is upward, rising. In the Keynesian model, labor supply is assumed to be a function of the money wage rate. If N represents the supply of labor and if W represents the money wage rate, then the labor supply function can be written as $N = N(W)$. But we have not written the labor supply function in this way. Instead, We have written the labor supply function in its inverse form where the money wage rate has been assumed to be a function of The supply of labor, i.e. $W = W(N)$. It is this inverse form of the labor supply function that we have taken in our analysis.

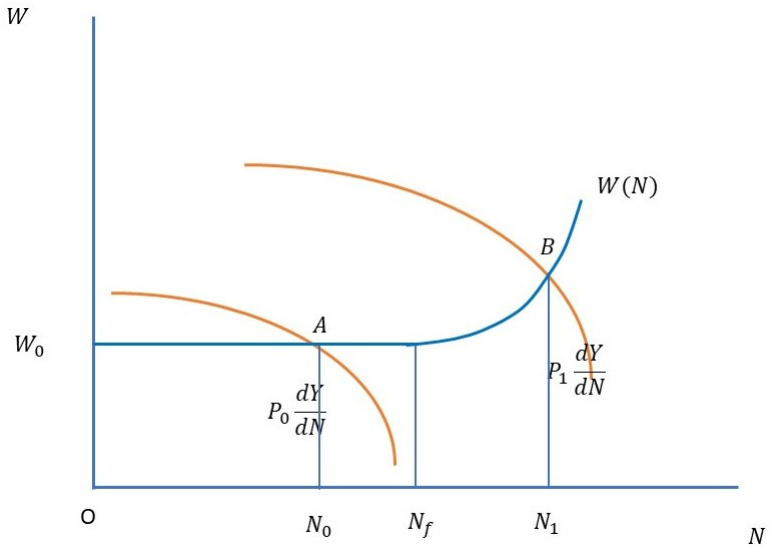

Figure 1.1.2 labor Supply Curve

1.1.3 Equilibrium in the labor Market

Consider now the equilibrium condition in the labor market. Equilibrium in the labor market will be achieved where labor demand equals labor supply.

Let us now plot the labor demand and labor supply curves in a single diagram (Fig. 1.1.2). Suppose that the price level is constant at P_1 and the

labor demand curve corresponding to the price level P_1 cuts the labor supply curve at its upward rising portion (at point B).

The equilibrium money wage rate is W, and the equilibrium level of employment is N_1. This is a situation of full employment, as all the persons who are willing to work at this wage rate (W) are getting employment.

But consider the case where the labor demand function intersects the labor supply function at the latter's horizontal portion. In our above figure, consider the labor demand curve corresponding to the price level Po. It cuts the labor supply curve at a point A. Here, the equilibrium wage rate is W_0 and the equilibrium level of employment is N_0. At this situation, there is unemployment to the extent of N_0N. At the wage rate W_0, ON_f, workers are willing to work but ON_0, workers are getting jobs. Hence, N_0N_f workers are willing to work but not getting jobs. They are **involuntarily unemployed**. The equilibrium point A, is therefore a situation of under employment equilibrium which exists because of the peculiar shape of the labor supply function. If some amount of involuntary unemployment exists at the equilibrium situation, then such an equilibrium is known as an under employment equilibrium. This level of unemployment N_0N_f, cannot be solved by reducing the money wage rate because the money wage rate cannot fall anymore.

Thus, we see that the equilibrium point in the labor market will depend on the position of the labor demand curve. The position of the labor demand curve will again depend on the price level. For one price level we can get one labor demand curve and one equilibrium level of employment. Unless we know the equilibrium price level, therefore, we cannot find out the equilibrium level of employment.

Again, there is no guarantee that full employment will be automatically achieved in the labor market. If the labor demand curve intersects the labor supply curve at the latter's horizontal portion, then full employment will not be achieved, and involuntary unemployment will prevail. Hence, we can say that there is no automatic mechanism in the labor market that will guarantee the achievement of full employment.

1.2 Derivation of Aggregate Supply : Graphical Exposition

In the labor market, we shall get one labor demand curve corresponding to one price level. As the price level increases, the labor demand curve shifts in the upward direction. Given the supply curve of labor, the equilibrium level of employment will increase as the price level increases. From the aggregate production function we know that as the level of employment increases, the level of output also increases. Hence, from the equilibrium condition in the labor market we can get different combinations of P and Y for which the demand for labor is equal to the supply of labor. Such a curve will be upward rising.

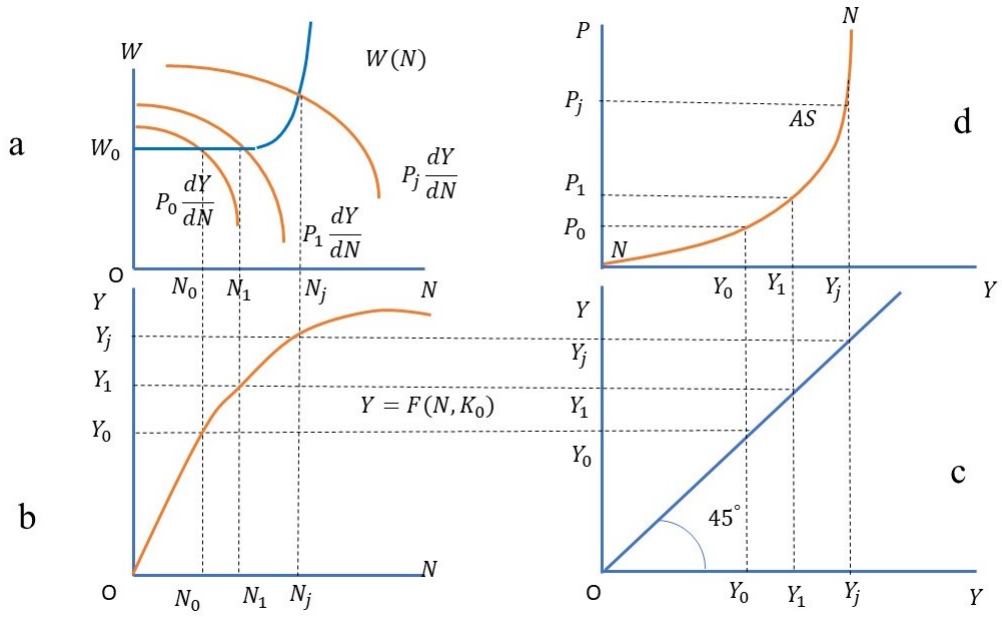

Figure 1.2 Derivation of Aggregate Supply Curve

Let us call this curve , NN curve which is the **aggregate supply curve (AS)** of the economy. The aggregate supply curve shows the amount of output supplied at different price levels. It is determined from the analysis of the labor market. This curve represents those combinations of P and Y for which the demand for labor is equal to the supply of labor. The labor

market will always be in equilibrium at any point on the aggregate supply curve. The **AS** curve can be derived as shown in figure 1.2 .

When the price level is P_0, the labor demand curve is given by $P_0\frac{dY}{dN}$. The equilibrium level of employment is N_0 and the corresponding level of output is Y_0. As the price level Increases to P_1, the labor demand curve becomes $P_1\frac{dY}{dN}$ and the equilibrium level of employment is N_1. The corresponding level of output is Y_1. Thus when the price level is P_0 and the level of output is Y_0, labor demand is equal to labor supply. Hence (P_0, Y_0) is a point on the NN curve. Similarly When the price level is P_1, and the output level is Y_1, labor demand is still equal to labor supply. Hence (P_1, Y_1) is also a point on the NN curve. By plotting other points similarly we can get the entire NN curve. This is shown in the above figure (figure 1.2). After a certain level of employment (N_j) labour supply curve becomes vertical which means a great amount of wage has to be increased to recruit additional labor in the labor market, even though price increases more than P_j employment will not increase more than N_j and hence output will not increase more than Y_j. So the **AS** curve becomes vertical at this level of output.

1.3 Derivation of Aggregate Supply : Mathematical Exposition

Mathematically the aggregate supply curve can be derived , follows. In the labor market we have 3 equations : $Y = F(N, K_0)$, $W = P.\frac{dY}{dN}$ and $W = W_0 + W(N)$. In these 3 equations, we have four unknowns. Y, N, W, and P. Hence, we cannot solve for these four unknowns. Instead, we eliminate N and W from these equations, and we can get a relation between Y and P. This relation represents the aggregate supply curve of the economy. Let us take an example. Suppose the labor market equations are given by :

Labor Demand :

$$W = P\left[\alpha_0 - \alpha_1 N\right]$$

The labor Supply equation is :

$$W = \begin{cases} W_0 & \text{forN} \leq N_f \\ \alpha_2 + \alpha_3 N & \text{for} N > N_f \end{cases}$$

and the production function is :

$$Y = \alpha_0 N - \frac{1}{2}\alpha_1 N^2$$

Note that $\frac{dY}{dN} = \alpha_0 - \alpha_1 N$, which is used in labor demand function. The system can be used to solve for Y in terms of P. First assume that the relevant labor supply schedule lies below N_f. in this case, the equation of the AS is :

$$Y = \alpha_0 \left[(\alpha_0 - W_0/P)/\alpha_1\right] - \frac{1}{2}\alpha_1 \left[(\alpha_0 - W_0/P)/\alpha_1\right]^2$$

which suggests that increases in P bring successively smaller increments in Y as P tales on higher and higher values. The student should work through the alternative case where $N > N_f$.

It is hard to solve explicitly when the labor demand function and production function are in general form. But we get to know some ideas related to it's slope.

Equating labor demand (equation 2) and labor supply (equation 3) we have $P\frac{dY}{dN} = W_0 + W(N)$

Differentiating both sides with respect to P we get

$$\begin{aligned}
&\frac{dY}{dN} + P\frac{d^2Y}{dN^2}\frac{dN}{dP} = W'(N)\frac{dN}{dP} \\
\implies &\frac{dN}{dP}\left[P\frac{d^2Y}{dN^2} - W'(N)\right] = -\frac{dY}{dN} \\
\implies &\frac{dN}{dP} = -\frac{\frac{dY}{dN}}{P\frac{d^2Y}{dN^2} - W'(N)}
\end{aligned}$$

Now differentiating production function (equation 1) with respect to P we get

$$\frac{dY}{dP} = \frac{dY}{dN}\frac{dN}{dP}$$

Plugging in the above value

$$= \frac{-\left(\frac{dY}{dN}\right)^2}{P\frac{d^2Y}{dN^2} - W'(N)}$$

Hence the slope of the AS is (inverting above equation) :

$$\frac{dP}{dY} = \frac{P\frac{d^2Y}{dN^2} - W'(N)}{-\left(\frac{dY}{dN}\right)^2}$$

By the assumptions of the model $\frac{dY}{dN} > 0$, $\frac{d^2Y}{dN^2} < 0$ and $W'(N) > 0$, we have $\frac{dP}{dY} > 0$. When $W = W_0$, since $W'(N) = 0$, $\frac{dP}{dY} > 0$. Thus the aggregate supply curve is upward rising even if the labor supply curve is horizontal. The positive slope of the aggregate supply curve follows from the assumption of diminishing marginal productivity. At $N = N_j$, $W'(N) \to \infty$ implies $\frac{dP}{dY} \to \infty$ that is the **AS** curve is vertical.

2 Aggregate Demand

2.1 Commodity Market

In the simple Keynesian model of income determination the equilibrium level of income is determined by the equality of intended saving and intended investment. But saving is a function of the level of income while investment is a function of the rate of interest. Thus in the market for commodities we get the following three equations :

$$S = S(Y) \quad : \text{saving function.} \tag{4}$$
$$I = I(r) \quad : \text{investment function.} \tag{5}$$
$$I = S \quad : \text{equilibrium condition.} \tag{6}$$

But this system of three equations cannot be solved as there are four variables : S, I, r and Y. Thus we can say that if investment is a function of the rate of interest then the equilibrium level of income cannot be determined from the equations of the commodity market. Unless we know the equilibrium rate of interest we cannot know the equilibrium level of income. From the

equilibrium condition in the commodity market we can get different combinations of r and Y for which saving will be equal to Investment. All these combinations of r and Y give us the IS curve of Hicks.

2.2 Money Market

To know how the rate of interest is determined In the money market, we turn to the liquidity preference theory of the rate of interest determination. In this theory we get three equations in the money market : one money demand function, one money supply function and one equilibrium condition :

$$L = kP_0Y + L_2(r) \quad : \text{money demand function} \tag{7}$$
$$M = M_0 \quad : \text{money supply function} \tag{8}$$
$$L = M \quad : \text{equilibrium condition} \tag{9}$$

By considering these three equations we see that there are again 3 equations and 4 unknowns : L, M, r and Y. Hence we cannot determine the value of r from the above three equations unless we know the value of Y. From the equilibrium condition of the money market we can get different combinations of r and Y for which the demand for money is equal to the supply of money. The locus of all such combinations is the LM curve of Hansen (or the LL curve of Hicks).

2.3 Derivation of aggregate demand curve : Graphical Exposition

Consider now the equilibrium conditions in commodity and money markets. Suppose that the supply of money is constant at M_0 and the price level is constant at P_0 We can then get one LM curve which represents those combinations of r and Y for which the demand for money is equal to the supply of money. We can also get an IS curve which represents those combinations of r and Y for For investment equals saving. The equilibrium level of income and the equilibrium rate of interest are simultaneously determined by the intersection of IS and LM curves. Now suppose that the supply of money remains constant at M_0 but the price level changes. As a result the LM curve

will change its position and we shall get a new equilibrium position and a new equilibrium level of income. For one price level we shall get one LM curve and one equilibrium level of income determined by the intersection of IS and LM curves. This is illustrated in figure 2.3

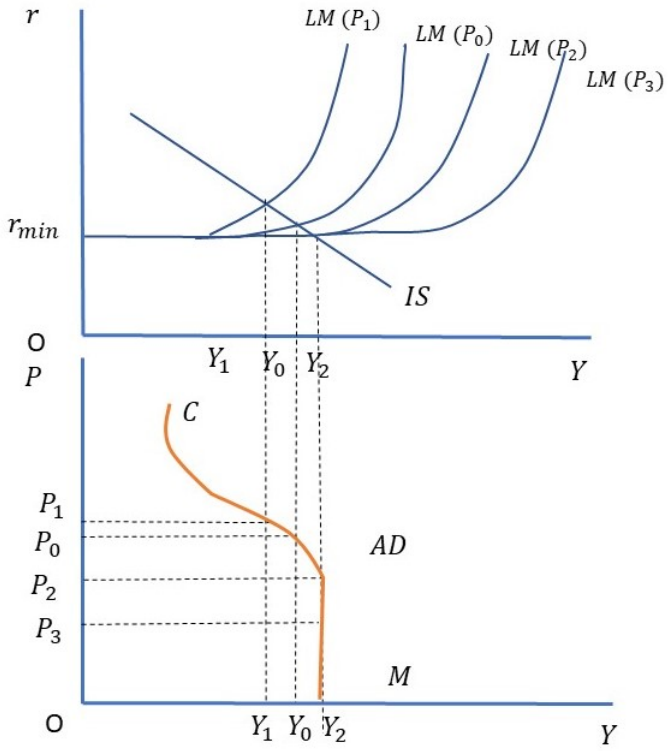

Figure 2.3 Derivation of Aggregate Demand Curve

Suppose that the LM curve is LM (M_0, P_0) when the money . supply is M_0 and the price level is P_0. The equilibrium level of income is then Y_0 . Now suppose that the price level increases to P_1. As a result the LM curve becomes LM (M_0, P) and the equilibrium level of income decreases to Y_1. On the other hand if the price level decreases to P_2 the equilibrium level of income increases to Y_2. By plotting the points (P_0, Y_0), (P_1, Y_1), (P_2, Y_2) etc in a diagram we get a downward sloping curve which is called the CM curve or **the aggregate demand curve**. The aggregate demand curve shows the demand for total output or the aggregate demand at different price levels.

This curve is downward sloping which means that as the price level falls aggregate demand increases.

Let us see why the aggregate demand curve is downward sloping. From the money market equilibrium (equation 9) we have $M_0 = kP_0Y + L_2(r)$. As the price decreases for given money supply (M_0) and income (Y) the transaction demand for money(kP_0Y) decreases in the money market. Since the supply of money is fixed to restore money market equilibrium speculative demand for money ($L_2(r)$) must increase. Speculative demand for money falls if and only if r falls. Which means the LM curve shifts to the right. This decrease in r has positive impact on the commodity market. The investment will rise which increase the aggregate demand as a result the income will also increase to maintain equilibrium in the product and money market. Hence as price decreases income will increase to maintain both product and money markets in equilibrium. So the CM **(the aggregate demand)** curve is negatively sloped.

Under certain circumstances the shape of aggregate demand curve may change .

Case A : Pure Classical Case

When the Speculative demand for money is unresponsive to interest rate change i.e., when LM is vertical ($L_2(r) = 0$) money is demanded for transaction purpose only. Then we have $M_0 = kPY$ which implies $PY = Constant$ an equation of **rectangular hyperbola**. This implies that price elasticity of demand for money is one. That is any percent increase in price level leads to same percentage decrease in income.

Case B : Liquidity trap Case

Suppose the commodity market is in equilibrium at a feasible minimum interest rate of the economy and hence interest may not decrease further. On this situation if price level decreases transaction demand for money decreases and to maintain money market equilibrium speculative demand for money should increase but due to downward rigidity of the interest rate, r can't fall further which means Y can't change further. Hence in this situation we have **vertical** sloped aggregate demand. Which is drawn in the figure at Y_2 level

of aggregate demand.

2.4 Derivation of aggregate demand curve : Mathematical Exposition

The aggregate demand curve is derived from the commodity and money markets. From the equilibrium conditions of commodity and money markets we get

$$S(Y) = I(r) \tag{10}$$

and

$$M_0 = kPY + L_2(r) \tag{11}$$

. In these two equations we have 3 unknowns r, Y and P. Hence we cannot solve for these 3 unknowns. But we can eliminate r from these two equations and we can get a relation between P and Y. This relation is the aggregate demand curve of the economy. The CM curve represents those combinations of P and Y for which the commodity market and the money market are in equilibrium.

To find the slope of the CM curve differentiate equation 11 with respect to P. We then get

$$\begin{aligned} 0 &= kY + kP\frac{dY}{dP} + L_2'(r)\frac{dr}{dP} \\ kP\frac{dY}{dP} + L_2'(r)\frac{dr}{dP} &= -kY \end{aligned} \tag{12}$$

Differentiating equation 10 with respect to P , we get

$$\begin{aligned} S'(Y)\frac{dY}{dP} &= I'(r)\cdot\frac{dr}{dP} \\ S'(Y)\frac{dY}{dP} - I'(r)\frac{dr}{dP} &= 0 \end{aligned} \tag{13}$$

Writing 12 and 13 in matrix form

$$\begin{bmatrix} kP & L_2'(r) \\ S'(Y) & I'(r) \end{bmatrix} \begin{bmatrix} \frac{dY}{dP} \\ \frac{dr}{dP} \end{bmatrix} = \begin{bmatrix} -kY \\ 0 \end{bmatrix}$$

Using Cramer's rule we can solve for $\frac{dY}{dP}$ as

$$\frac{dY}{dP} = \frac{\begin{vmatrix} -kY & L_2'(r) \\ 0 & -I'(r) \end{vmatrix}}{\begin{vmatrix} kP & L_2'(r) \\ S'(Y) & -I'(r) \end{vmatrix}} = \frac{kYI'(r)}{-kPI'(r)-S'(Y)L_2'(r)} \implies \frac{dP}{dY} = \frac{-kPI'(r)-S'(Y)L_2'(r)}{kYI'(r)}$$

$\frac{dP}{dY}$ is the slope of the CM curve. by assumption $I'(r) < 0$, $S'(Y) > 0$ and $L_2'(r) < 0$ in the normal case, $\frac{dP}{dY} < 0$. This shows that normally normally the CM curve is negatively sloped.

Note that when $L_2'(r) \to \infty$ the CM curve is vertical. This means when there is liquidity trap, a fall in the price level lead to an increase in aggregate demand.

Again when $I'(r) = 0$ then also CM curve is vertical. Thus when the investment function is completely interest inelastic then also a fall in the price level will not increase aggregate demand.

3 Equilibrium

3.1 Equilibrium : Graphical Analysis

Thus we see that from the labor market we can get different combinations of P and Y for which the labor market is always in equilibrium. Again from the commodity and money markets we can get different combinations of P and Y for which the commodity and money markets will be in equilibrium. The first relation is known as the NN curve (Aggregate Supply) which is upward rising and the second relation is known as the CM curve (Aggregate Demand) which is downward sloping.

Suppose we plot the CM curve and the NN curve in a single diagram. Suppose the two curves intersect at point A. At the intersection point all the three markets are in equilibrium. Hence the price level determined at the point of intersection of CM and NN curves is the equilibrium price level for which all the three markets will be In equilibrium. This price level is P. Similarly the output level Y satisfies the equilibrium conditions in all the three markets.

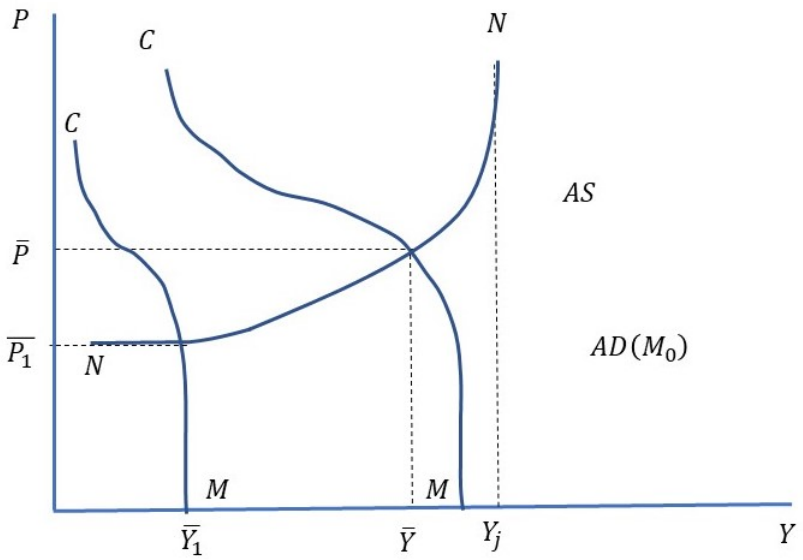

Figure 3.1 Derivation of Equilibrium Price and Income

The process by which the equilibrium price level is reached can be described as follows. Corresponding to any price level we get two levels of real income - one given by the labor market equilibrium condition and the other given by the commodity and money markets equilibrium conditions. If these two real incomes are the same then this price level is the equilibrium price level. But if these two real incomes are different then the price level is not in equilibrium and it changes. The real output level required for equilibrium in the labor market may be called the aggregate supply of output while the real output level required for equilibrium in commodity and money markets may be the called aggregate demand for output. If the aggregate demand for output is denoted by Y_d and the aggregate supply of output is denoted by Y_s then the adjustment mechanism can be written as follows :

$$\frac{dP}{dt} = f(Y_d - Y_s) \text{ such that } \frac{dP}{dt} \gtreqless 0$$

This means that if $Y_d > Y_s$ i.e. if there excess demand $\frac{dP}{dt} > 0$ and the price level rises. Similarly if $Y_d < Y_s$, i.e. if there is excess supply $\frac{dP}{dt} < 0$ and the price level falls. Lastly, if $Y_d = Y_s$ if aggregate demand equals Aggregate supply, i.e, $\frac{dP}{dt} = 0$ and the price level remains constant.

Now from the diagram (figure 3.1) we find that if the price level is higher than the equilibrium level, $\bar{P}$, then aggregate supply exceeds aggregate demand. Hence the price level falls. As the decreases price level falls, aggregate demand increases while aggregate supply decreases.This process continues until the price level reaches $\bar{P}$. Similarly if the price level is less than $\bar{P}$ aggregate demand exceeds aggregate supply. Hence the price level increases towards $\bar{P}$. As the price level increases aggregate demand decreases and aggregate supply increases. This process continues until the equilibrium price level $\bar{P}$ is reached where aggregate demand equals aggregate supply. When NN curve is horizontal and CM curve is vertical which means when P and r are fixed this is the **SKM case** as presented on the figure where $\bar{Y}_1$ and $\bar{P}_1$ are the equilibrium.

Once we know the price level P, we can get the labor demand curve corresponding to $\bar{P}$. Given the labor supply curve we can now get the equilibrium money wage rate ($\bar{W}$) and the equilibrium level of employment ($\bar{N}$). Similarly the LM curve corresponding to the price level ($\bar{P}$) can be known and the equilibrium rate of interest $\bar{r}$ can now be known from the point of intersection of IS and LM curves. In this way the equilibrium values of all the variables can be known from our analysis.

We should know two characteristics of this Keynesian model of income and employment. **Firstly,** the model is in-decomposable. This means that all the three markets must be in equilibrium simultaneously. We cannot isolate one or two markets to get equilibrium in those markets. In other words all the variables in the model are Interdependent. All of them have to be determined simultaneously. **Secondly,** there is no guarantee that the equilibrium that will be obtained is one of full employment. The equilibrium may be at a less than full employment level. More specifically, if the labor demand curve corresponding to the price level $\bar{P}$ as determined by the intersection of NN and CM curves, intersects the labor supply curve at the latter's upward rising portion, then full employment will be achieved. But there is no reason to believe that it must so happen. If the labor demand curve $\bar{P}\frac{dY}{dN}$ intersects the labor supply curve at the Latter's horizontal portion, then full employment will not be achieved. Hence we can say that there is no automatic mechanism that will guarantee the achievement of full employment in the Keynesian model of income determination.

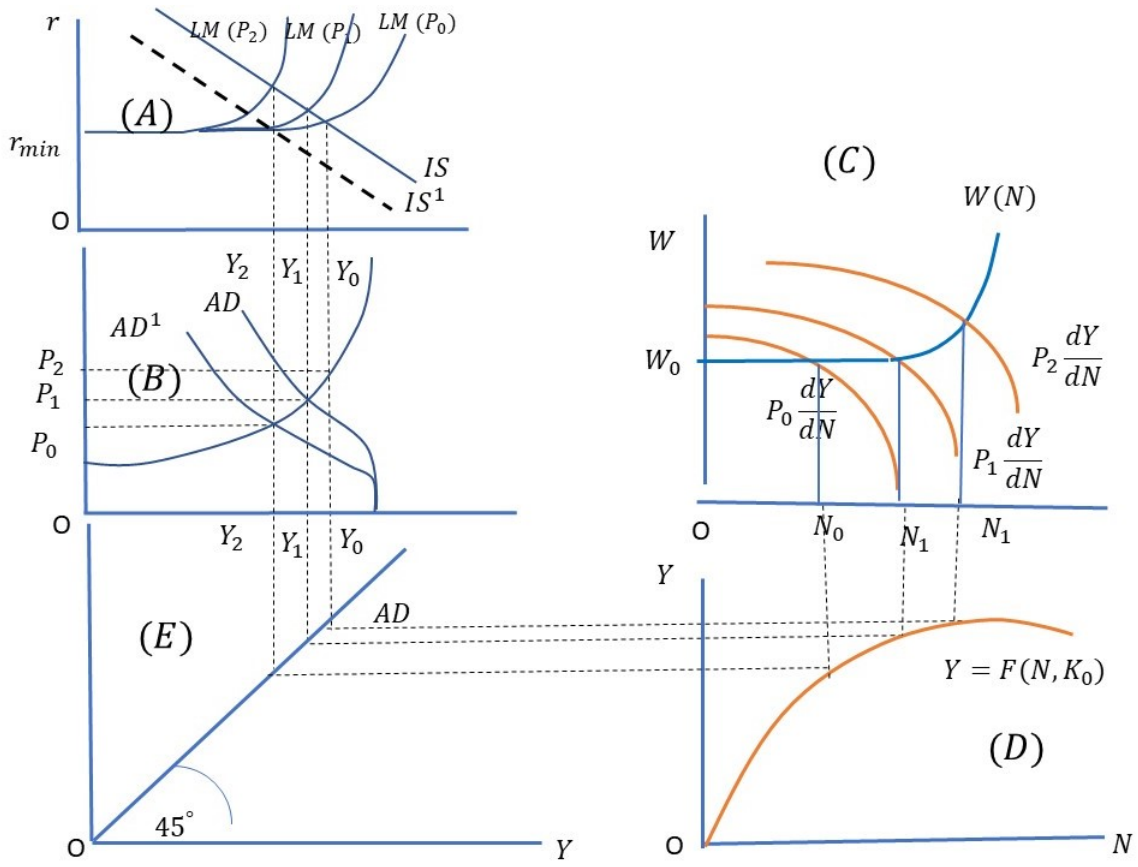

Figure 3.1 Derivation of Equilibrium Price and Income with involuntary unemployment

Let us explain the second point graphically. Much of the controversy between Keynes and the classics was over the automaticity of full employment. If P_1, Y_1 are the equilibrium values of price and output, the associated equilibrium level of employment will be N_1 and the corresponding money wage will be W_0. According to the labor market diagram shown in panel (C), the equilibrium will be associated with full employment. That is, N_1 is the level of employment which absorbs all those who want to work at the competitively determined wage. But, as should be apparent from the construction of figure 3.1 , full employment is only special case rather than an automatic result of the structure of the economy. If aggregate demand were lower, unemployment would result. To verify this suppose that (due perhaps to a decline in

autonomous investment) product market equilibrium is given by IS^1, rather than IS [see panel (A)]. If the IS schedule shifts to the left, the AD schedule in panel (B) will shift corresponding to AD^1. For example as we have shown the price level P_0 is now consistent with Y_2 in the product and money markets. The new general equilibrium point is represented by E' in panel (B) and this entails a lower price (P_0) and a lower level of output (Y_2). As we trace backward through the labor market diagrams to panel (C) we find that the equilibrium level of employment is now N_0. But although N_0 is an equilibrium value, it is *not* a full employment value. Instead, the new general equilibrium of the economy entails unemployment of labor.

3.2 Equilibrium : Mathematical Analysis

In the complete Keynesian Model the economy is divided into Four markets : the commodity market, the money market, the bond market and the labor market. It is a general equilibrium system where the equilibrium of the whole economy is considered. From the general equilibrium theory we know that if there are 4 markets in the economy and if equilibrium is reached In any 3 of them then the fourth market must also be in equilibrium. This is known as **Walras law**[2]. By virtue of **Walras law** Keynes dropped the bond market from the analysis and considered equilibrium conditions in commodity, money and labor markets. If these 3 markets are in equilibrium then the bond market must also be in equilibrium. In each market there are three equations.

The complete Keynesian model can now be described with the help of the following equations. In the labor market we have the following three equations :

$$\begin{aligned} Y &= F(N, K_0) \quad \text{: Aggregate production function} \quad \text{Eq (1)} \\ W &= P\frac{dY}{dN} \quad \text{: labor demand function} \quad \text{Eq (2)} \\ W &= W_0 + W(N) \quad \text{: labor Supply function} \quad \text{Eq (3)} \end{aligned}$$

[2]The proof is simple but powerful

In the commodity market we have the following three equations :

$$\begin{aligned} S &= S(Y) \quad \text{: savings function} \quad \text{Eq (4)} \\ I &= I(r) \quad \text{: Investment function} \quad \text{Eq (5)} \\ S &= I \quad \text{: Commodity Market Equilibrium} \quad \text{Eq (6)} \end{aligned}$$

In the Money market we have the following three equations :

$$\begin{aligned} L &= kP_0Y + L_2(r) \quad \text{: money demand function} \quad \text{Eq (7)} \\ M &= M_0 \quad \text{: money supply function} \quad \text{Eq (8)} \\ L &= M \quad \text{: equilibrium condition} \quad \text{Eq (9)} \end{aligned}$$

Thus we get altogether 9 equations and also 9 variables : S, I, r, Y, L, M, P, N, W. Since the number of equations is equal to the number of unknowns the system of equations can be solved. Thus the unique equilibrium values of all the variables can be determined. Alternatively, equations (4)-(6) can be transformed into a single equation :

$$S(Y) = I(r) \qquad \text{Eq } (1')$$

Equations (7)-(9) can be transformed into a single equation :

$$M_0 = kP_0Y + L_2(r) \qquad \text{Eq } (2')$$

Equations (2)-(3) can be condensed into a single equation :

$$P\frac{dY}{dN} = W_0 + W(N) \qquad \text{Eq } (3')$$

Lastly

$$Y = F(N, K_0) \qquad \text{Eq } (4')$$

Thus the system of 9 equations can be transformed into a system of 4 equations : (1′)-(4′). In these four equations we have also 4 variables : Y, r, P and N. Note that equations (1′) and (2′) contain 3 variables : Y, r and P. We can eliminate one variable r from these two equations and can get a relationship between P and Y. This is the CM curve or the **aggregate demand curve**. Similarly equations (3′) and (4′) contain three variables : Y, N and P. We can eliminate N from these two equations and can get

a relationship between P and Y. This is the NN curve or the **aggregate supply curve**. At the intersection point of the CM and NN curves all the four equations $(1')$-$(4')$ are satisfied. Here the price level P acts as the linking variable between equations $(1')$-$(2')$ and equations $(3')(4')$.

Alternatively we can write the system of equations with employment (N) as the linking variable. Consider the following equations where we put $F(N, K_0)$ in place of Y and $F'(N, K_0)$ in place of $\frac{dY}{dN}$. Equation $(1')$, $(2')$ and $(3')$ can then be written as :

$$S(F(N, K_0)) = I(r) \tag{14}$$
$$M_0 = kP_0F(N, K_0) + L_2(r) \tag{15}$$
$$PF'(N, K_0) = W_0 + W(N) \tag{16}$$

Thus we get 3 equations in three unknowns : N, r and P. We can consider equations (14) and (16). Here we have 3 variables r, N and P. We can solve for r and P in terms of N. By plotting these values of r and P in (15) we get only one equation in one unknown : N. Hence we can determine N from (15). Once N is known r is known from (14) and P is known from (16). In this way the system can be solved. We can therefore say that in whatever way we put the Keynesian system of equations the model is always determinate. But the achievement of full employment is not guaranteed in the model.

4 Comparative Statics

4.1 Comparative Statics: Monetary Policy (Increase in Money Supply)

Let us consider a case in which the economy is operating initially at an equilibrium (point E_0 in the figure 4.1) position where unemployment prevails. Let us consider that authorities choose to use a monetary policy to alleviate the unemployment problem. When the supply of money increases the money market got disturbed and to neutralize this disturbance at a given price level (P_0) the rate interest must fall. This leads to increase in private investment expenditure. As a result the income increases. In terms of figure 4.1, an increase money supply means the LM curve shifts from $LM(P_0, M_0)$

to $LM(P_0, M_1)$ where $M_1 > M_0$ and price level remains unchanged. This results a decrease in interest rate from r_0 to r_2 and increase in income from y_0 to y_2.

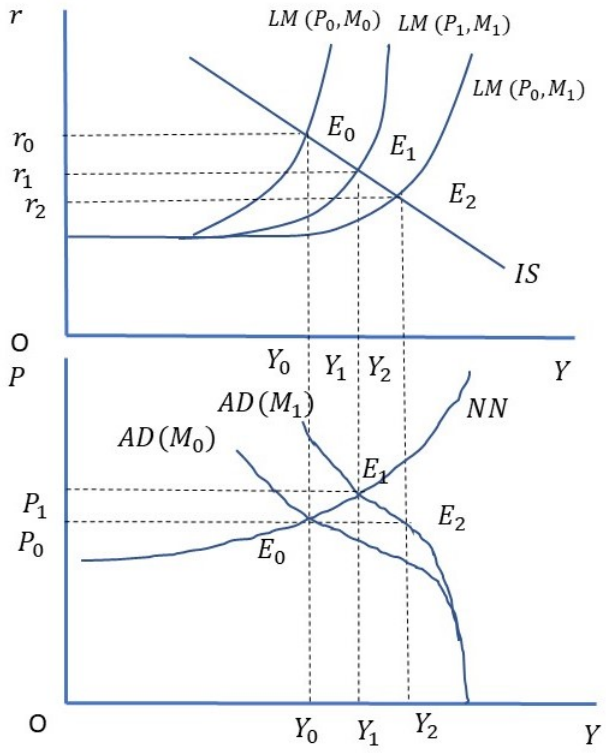

Figure 4.1 Derivation of Equilibrium Price, Income and rate of interest under Monetary Policy

As the income increases the aggregate demand increases which creates an excess demand in the commodity market by the amount $y_2 - y_0$ at given price level P_0 (denoted by the shift of aggregate demand curve from $AD(M_0)$ to $AD(M_1)$), this puts pressure on the price level at a given supply. And ultimately price increases. But since the increase of price level is associated with an increase in labor demand and hence employment. And ultimately supply of output also increases upto y_1. The crowding out of income $(y_2 - y_1)$ is due to the fact that price has increased. This increase in price leads to shift of the LM curve towards left to $LM(P_1, M_1)$. This is because when price level

increases transaction demand for money also increases to neutralize money market speculative demand for money must decrease, this will happen if rate of interest increases. This increase in r must be associated with decrease in private investment and hence fall in income.

$M_0 \uparrow \ \rightarrow r \ \downarrow$ (for given P) $\rightarrow I(r) \uparrow \ \rightarrow y \uparrow \ \rightarrow AD \uparrow$ (given P) $\rightarrow$
Excess Demand $> 0 \ \rightarrow P \uparrow \ \rightarrow$
$(i) \ kPy \uparrow \ \rightarrow L_2(r) \ \downarrow \ \rightarrow r \uparrow \ \rightarrow I(r) \downarrow \ \rightarrow y \ \downarrow$
& $(ii) \ P\frac{\partial y}{\partial N} \uparrow \ \rightarrow N \uparrow \ \rightarrow y \uparrow$

4.2 Comparative Statics : Fiscal Policy (Government Expenditure)

Let us consider the effect of change in government expenditure on the equilibrium values of all variables in the complete Keynesian model. The process is as follows : suppose an increase in government expenditure leads to an increase in income (at a given rate of interest equivalent to simple Keynesian multiplier effect) which leads to an increase in demand for money due to transaction purpose. Since the supply of money remains unchanged to release this increased amount of money the demand for money for speculative purpose will decrease due to increase in rate of interest. This increase in rate of interest reduces the investment expenditure which means that aggregate demand falls due to (partial) crowding effect. ultimately this increase government expenditure leads to increase in income but increase in rate of interest for given price level as we obtained in IS-LM model.

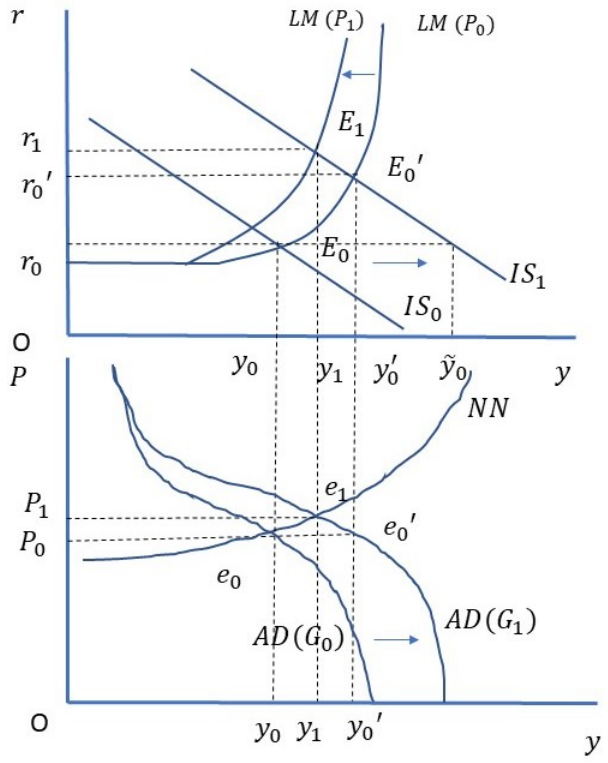

Figure 4.2 Derivation of Equilibrium Price, Income and rate of interest under Fiscal Policy, namely the increase in Government Expenditure.

Graphically speaking as the government expenditure increases the IS curve will shift rightward from IS_0 to IS_1 at the initial rate of interest r_0, y increases from y_0 to $\tilde{y_0}$ this is what is known as the simple Keynesian multiplier effect. The r also increases, due to increase in demand for money, from r_0 to $r_0^{'}$, due to decrease in investment expenditure because of this interest rate increase the income get reduced to $y_0^{'}$. This is first partial crowding out due to increase in interest rate, Ultimately, the economy, for a given price level, reached to the equilibrium at E_1.

Now the question is, does the price level change ? The answer is yes. As the income increases the aggregate demand will increase at a given price level. which creates an excess demand in the economy as a result the price level increases. Graphically speaking, at a given price level P_0 , when y increases from y_0 to $y_0^{'}$, the aggregate demand curve CM shifts rightward to

CM', except for the classical zone where speculative demand for money is absent and fiscal policy is not successful (that is vertical LM and rectangular hyperbola CM), generating excess demand by the amount e_0e_0'. Due to this excess demand price level increases from P_0 to P_1. As the price level increases transaction demand for money increases to maintain money market equilibrium the rate of interest must increase, which means that the LM curve will shift leftward from $LM(P_0)$ to $LM(P_1)$. Due to this increase in rate interest the private investment get reduced once again (second crowding out effect) and hence the equilibrium income get reduced to y_1. The new equilibrium is established at E_1 point on the IS-LM curve and e_1 point on AD-AS curve.

Note that increase in P has two effects :

i) **Demand side effect:** As P increases transaction demand for money (kPy) also increases. Since the supply of money unchanged so speculative demand for money $L_2(r)$ decreases. Which means r must increase and hence $I(r)$ decreases. This leads to decrease in income from y_0' to $y1$ which is explained through leftward shift of LM curve.

ii) **Supply side effect:** When P increases derived labor demand also increases through increase in value of the Marginal product of labor $P.MPN$ so the employment increases and hence Y increases. ultimately, we find that when P increases from P_0 to P_1 output increases from y_0 to y_1 . things can be summarized as follows.

$G\uparrow \ \rightarrow$
$i) \ \ r \uparrow$ (for given P) $\rightarrow I(r)\downarrow \ \rightarrow y\downarrow$ (first crowding out)
& $ii) \ \ y\uparrow \rightarrow AD\uparrow$ (given P) $\rightarrow$ Excess Demand $> 0 \ \rightarrow P\uparrow \ \ \rightarrow$
$(a) \ \ kPy \uparrow \ \ \rightarrow \ L_2(r) \ \downarrow \ \ \rightarrow \ r \uparrow \ \ \rightarrow \ I(r) \downarrow \ \ \rightarrow \ y \ \downarrow$
(second crowding out)
& $(b) \ P\frac{\partial y}{\partial N}\uparrow \ \rightarrow N\uparrow \ \rightarrow y\uparrow$

4.3 Comparative Statics : Wage Cut

In the Keynesian system the labor supply function is $W = W_0 + W(N)$ where W_0 represents the fixed money wage rate at which the labor supply function is horizontal. At this money wage rate N_f persons are willing to work. When the money wage rate changes this means that W_0 changes. Let us assume that the initial equilibrium price level is P_0. As the money wage rate falls, the real wage rate will immediately fall because the price level P_0 does not change immediately. The Employment N increases and hence the output increases. Graphically speaking, as explained in figure 4.3, because of the lower wage labor supply curve moves downward and hence employment increases which means that the aggregate supply curve moves rightward keeping aggregate demand unchanged. At a given price level P_0 there will be excess supply $(e_0 e_0^{'})$ in the output market which puts downward pressure on the equilibrium price level. And hence the price level decreases to P_1. This fall in P has two effects

i) **Demand side effect :** As price decreases, transaction demand for money decreases, to maintain equilibrium in the money market the speculative demand for money should increase. This means that the rate of interest should decrease, lower interest rate tends to stimulate Investment, via the multiplier higher investment will raise the real income (y).

ii) **supply side effect :** The fall in the price level reduces the demand for labor, which leads to a decrease in real income.

In general the demand side effect is stronger than the supply side effect.Ultimately at the new equilibrium P falls from P_0 to P_1 and real income increases from y_0 to y_1. And hence generally, a wage cut leads to a fall in the real wage rate, that is the fall in wage is proportionately less than the fall in price which leads to ultimately decrease in r , decrease in P and increase in y. as explained in figure 4.3. If we keep doing so does it imply a full employment equilibrium like neoclassical model?

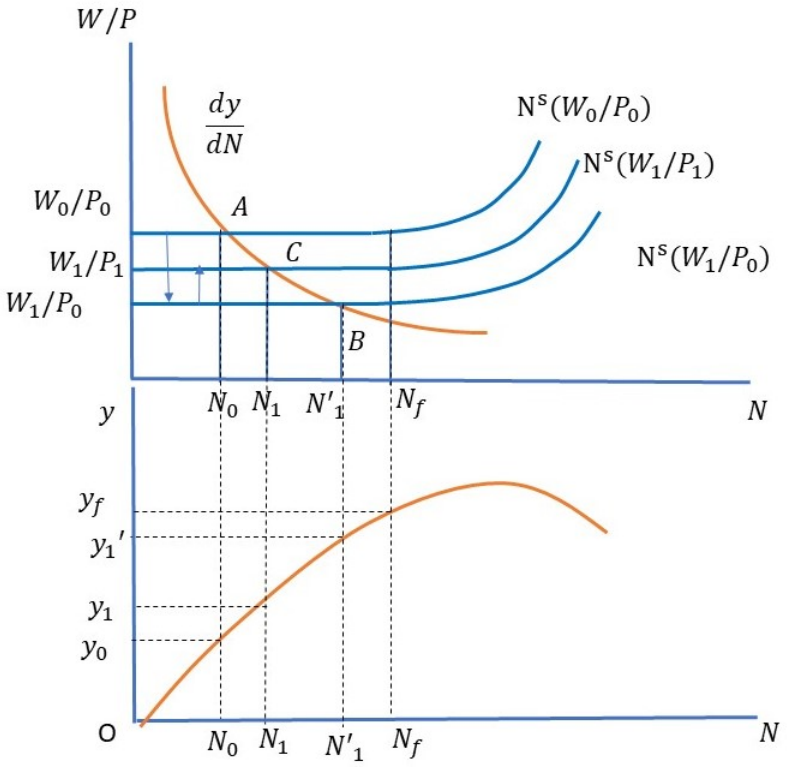

Figure 4.3 Increase in aggregate supply due to wage cut.

Keynes argued that even if prices and money wages did move downwards, the economy would not return to full-employment equilibrium as in neoclassical analysis. In the neoclassical approach (as in the Keynesian model outlined here) unemployment occurs when the real wage rate exceeds its market-clearing level. The neoclassical adjustment mechanism is that unemployed workers bid down the money wage rate in order to secure employment. Provided that prices fail less rapidly than the money wage rate, the real wage rate falls, causing an increase in the demand for labor and consequently in the supply of real output. Keynes pointed out that this adjustment process does not occur in such a simple fashion if prices fall as rapidly as money wages, leaving real wages unchanged.

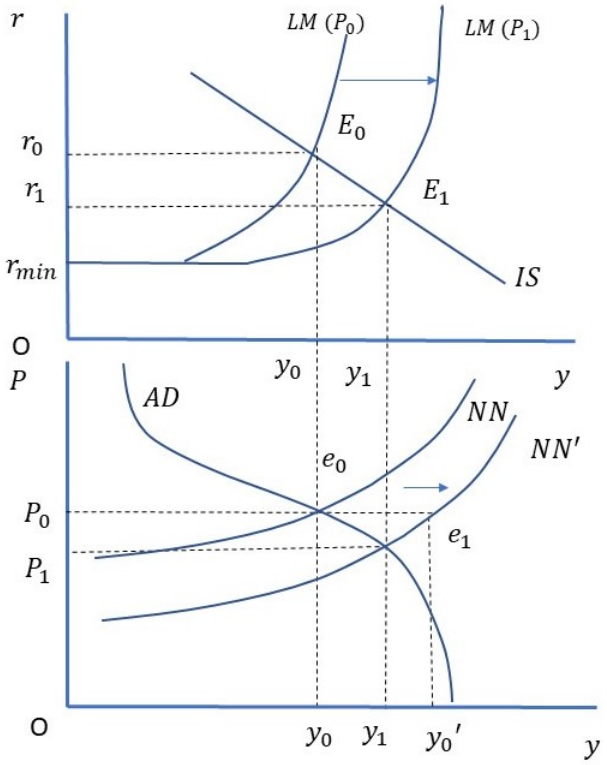

Figure 4.3 Adjustment in terms of Aggregate Demand and Aggregate Supply when wage cut occurs.

He reasoned that this would occur because of a lack of sufficient aggregate demand (for example when the aggregate demand curve is vertical that is when there is no room for reduction of real rate of interest i.e in a liquidity trap, to establish the equilibrium in the money market and) to take up the additional output produced. When money wages and hence real wages fall, inducing firms to produce more output, the income equivalent to the increased production is paid out to factors of production. If the marginal propensity to spend out of this additional income is less than 1.0, the resulting increase in aggregate demand will be less than the increase in output. The excess supply of output will cause prices to fall further, and real wages will again rise unless money wages continue to fall. Furthermore, Keynes conjectured that there might be no floor to the downward spiral of prices and money wages. He suggested that the actual downward rigidity of the money wage rate was a stabilizing factor preventing such a destabilizing fall

in prices and money wages and should not be blamed for the failure of the market adjustment mechanism to work.

Keynes thought that the only way falling money wages could bring about an increase in real output was through their effect on the real quantity of money. As prices fell, so the real value of a fixed nominal money supply would rise, causing the interest rate to fall. Investment would therefore increase and, via the multiplier effect, cause a further rise in real output. This process of adjustment, summarized below, is known as the ***Keynes effect***.

$$W\downarrow \ \rightarrow P \ \downarrow\rightarrow \tfrac{M_0}{P}\uparrow\rightarrow \ r\downarrow \ \rightarrow I(r)\uparrow\rightarrow \ y\uparrow \quad \textit{Keynes Effect}$$

Keynes suggested that the Keynes effect was likely to break down in two possible places. **First,** the interest rate might not fall as the real money supply increased. This would occur if the demand for money were perfectly interest elastic, i.e. if there were a liquidity trap. Because people are prepared to hold unlimited real money balances at the existing rate of interest, the interest rate does not fall when real balances expand. Given a Keynesian transmission mechanism, the absence of any decline in the interest rate means that monetary expansion has no effect on aggregate demand and hence on output.

The **second** possible break in the Keynes effect link between a fall in the price level and a rise in real output is the failure of investment to respond to a fall in the interest rate. One strand in this argument was Keynes's belief that the expected return from investment had become so low in the 1930s' depression that a very low interest rate would be needed to establish the full-employment level of investment. As already mentioned, Keynes doubted if the interest rate could be pushed this low. In addition, Keynes thought that even if the interest rate did fall, investment would be slow to react and the total response would be small : 'moderate changes in the prospective yield of capital or in the rate of interest will not be associated with very great changes in the rate of investment' (*The General Theory,* p. 250). Keynesian economists interpreted this argument for static analysis in terms of totally interest-inelastic investment.

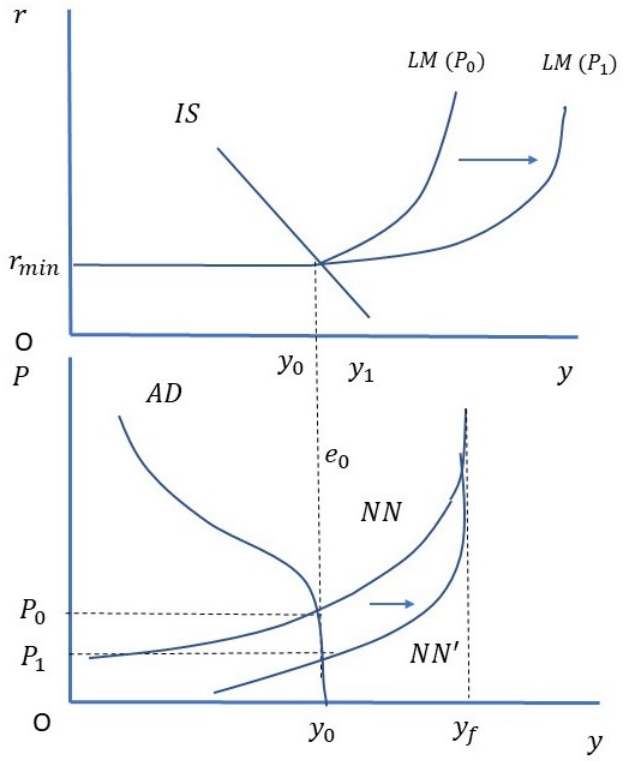

Figure 4.3 Failure to achieve full employment equilibrium when money market is in liquidity trap , that is the Intersection between AD and AS occurs on the vertical region of the AD curve.

Either of the two breakdowns in the Keynes effect, the failure of the interest rate to fall when the real money supply increases or a very interest-inelastic investment function, would be sufficient on its own to prevent an adjustment towards neoclassical equilibrium via the Keynes effect, even if money wages were flexible downwards. Keynesian argued that either of these conditions would prevent aggregate demand increasing as the price level fell and would thus give rise to a vertical aggregate demand schedule, as shown in figure 4.3 This means that even with a neoclassical aggregate supply function, the labor market will fail to clear unless the aggregate demand and supply schedules just happen to coincide. The model contains no adjustment mechanism to ensure such a coincidence. Real output is constrained to equal the smaller of either aggregate demand or aggregate supply. If the two schedules were as depicted in Figure 6.7, real output would be below its

full-employment level. If the aggregate demand schedule has these extreme Keynesian characteristics, then the price level is indeterminate and is set exogenously by institutional factors.

5 Derivation of Aggregate Supply Under Neoclassical System:

6 Keynes vs the Classics

In the earlier chapters we have considered the Keynesian model and the classical model separately. Let us now compare these two models. The comparison between the Keynesian model and the classical model can be made if we write the equations of the two models side by side. We have taken the equations of the simple classical model and the equations of the complete Keynesian model.

Classical Model

$$\begin{aligned} Y &= F(N, K_0) \quad (1) \\ W &= P\frac{dY}{dN} \quad (2) \\ N &= N(W/P) \quad (3) \\ L &= kPY \quad (4) \\ S &= S(r) \quad (5) \\ I &= I(r) \quad (6) \\ S &= I \quad (7) \end{aligned}$$

Keynesian Model

$$
\begin{aligned}
Y &= F(N, K_0) \quad (1)\\
W &= P\frac{dY}{dN} \quad (2)\\
W &= W_0 + W(N) \quad \text{Such that} \quad (3)\\
W &= \begin{cases} W_0 & \text{for } \mathrm{N} \leq N_f \\ W(N) & \text{for } N > N_f \end{cases}\\
L &= kPY + L_2(r) \quad (4')\\
S &= S(Y) \quad (5')\\
I &= I(r) \quad (6')\\
S &= I \quad (7')
\end{aligned}
$$

In both the models we have 7 equations and 7 unknowns. The system of equations is determinate in both the models. Looking at them, it is clear that the Keynesian model differs from the classical model in three respects. The first is the difference in the labor supply function i.e. in equations (3) and (3'). The second is the difference in the money demand function i.e. in equations (4) and (4'). Lastly, there is a difference in the saving function i.e. in equations (5) and (5').

In the classical model the supply of labor is assumed to be a function of the real wage rate. Further the money wage rate is assumed to be flexible in both upward and downward directions. But in the Keynesian model the supply of labor is assumed to be a function of the money wage rate and the money wage rate is rigid in the downward direction. It cannot fall below the level W_0 Again, in the classical model it is assumed that money demand is a function of the level of income, The classical economists considered only the transactions precautionary demand for money. But in the Keynesian model the demand for money is assumed to be a function of both the rate of interest and the level of income. Keynes added the speculative demand for money function with the classical money demand function. Lastly, Keynes modified the classical saving function on the ground that income, rather than the rate

of interest, is the main determinant of aggregate volume of In the classical model saving is assumed to be a function of the rate of interest. But in the Keynesian model saving is assumed to be a function of the level of income.

The difference in the conclusions of the two models can now be noted. The conclusions of the Keynesian model are opposite to those of the classical model. In the classical model, full employment is automatically achieved. Full employment is the only possible equilibrium situation. But in the Keynesian model there is no such automatic mechanism. The equilibrium may be one of full employment or one of less than full employment. The possibility of an under employment equilibrium is said to be the novelty of the Keynesian model. While classical economists denied the possibility of such under employment equilibrium, the Keynesian model argues that there is no difficulty in getting an underemployment equilibrium.

Further, in the classical model money is neutral. It is a veil. An increase in the supply of money in the classical model affects only the price level and the money wage rate, keeping the real variables like the rate of interest and the level of income and employment unaffected. But in the Keynesian model money is non-neutral. A change in the quantity of money in the Keynesian model affects not only the real variables like the volume of income, employment' and rate of interest, but also the monetary variables like the money wage rate and the price level.

Let us now consider which of the differences in assumptions lead to these differences in conclusions. In other words, let us find out which is the crucial difference between the classical model and the Keynesian model. Some economists have said that it is the difference in the money demand function, others that it is the difference in saving function, others the difference in labor supply function, while still others say that it is none of these but something else which is not shown in the formal structure, By crucial difference we mean a difference by which alone we can explain the differences in conclusions of the two models.

The main difference in conclusion is the possibility of under employment equilibrium. Let us now sec whether under employment equilibrium is caused due to the first difference or due to the second difference or due to the third.

6.1 Classical Model with Keynesian Speculative Demand for Money (CU 2021 Q-4)

We can see that the difference in the money demand function alone is not capable of giving under employment equilibrium. Suppose we retain the equations of the classical model except equation (4) which is now replaced by equation (4'). We then have the following system of equations:

$$\begin{aligned} y &= F(N, K_0) \quad (1) \\ W &= P\frac{dy}{dN} \quad (2) \\ N &= N(W/P) \quad (3) \\ L &= kPy + L_2(r) \quad (4') \\ S &= S(r) \quad (5) \\ I &= I(r) \quad (6) \\ S &= I \quad (7) \end{aligned}$$

In this case we shall get automatic full-employment by equations (1)-(3). Equations (5)-(7) will determine the rate of interest and the equation (4') will determine the price level. The resulting model will have classical character and full employment will be automatically achieved due to the assumption of wage-price flexibility. Thus, the mere addition of the speculative demand for money with the classical model cannot give us an under employment equilibrium situation. The addition of the speculative demand fer money is not, therefore, the crucial difference between the classical model and the Keynesian model.

Similarly we can see that the difference in saving function is also not crucial difference. For we can replace the classical saving function (5) by the Keynesian saving function (5') and consider the resulting model. We then have the following system of equations :

$$
\begin{aligned}
y &= F(N, K_0) \quad (1)\\
W &= P\frac{dy}{dN} \quad (2)\\
N &= N(W/P) \quad (3)\\
L &= kPy \quad (4)\\
S &= S(y) \quad (5')\\
I &= I(r) \quad (6)\\
S &= I \quad (7)
\end{aligned}
$$

equations (l)-(3). The resulting model will have classical properties. The only difference is that a shift of the production function or a shift of the labor supply function will affect the rate of interest because by altering y they will change saving relative to investment, But this is a minor difference. Hence, the difference in the saving function is also not the crucial difference between the classical model and the Keynesian model.

Instead of changing the money demand function and the saving function separately we can change both of them at the same time. Suppose in the classical model we replace equation (4) by (4') and equation (5) by (5' We then have the following system of equations :

$$
\begin{aligned}
y &= F(N, K_0) \quad (1)\\
W &= P\frac{dy}{dN} \quad (2)\\
N &= N(W/P) \quad (3)\\
L &= kPy + L_2(r) \quad (4')\\
S &= S(y) \quad (5)\\
I &= I(r) \quad (6)\\
S &= I \quad (7)
\end{aligned}
$$

In this system equations (1)-(3) determine y, N, Full employment is automatically achieved by virtue of wage-price flexibility. Once y is known S is

known from (5'). From (6) (7) we can get r. Again when y and r are known, we can get P from equation (4'). The resulting model is classical in character because like the simple classical model, full employment is automatically achieved in the labor market, the rate of interest is determined from saving and investment and the price level is determined from the money market. Thus, it is seen that the difference in the money demand function and the difference in the saving function taken together cannot explain the difference in conclusions.

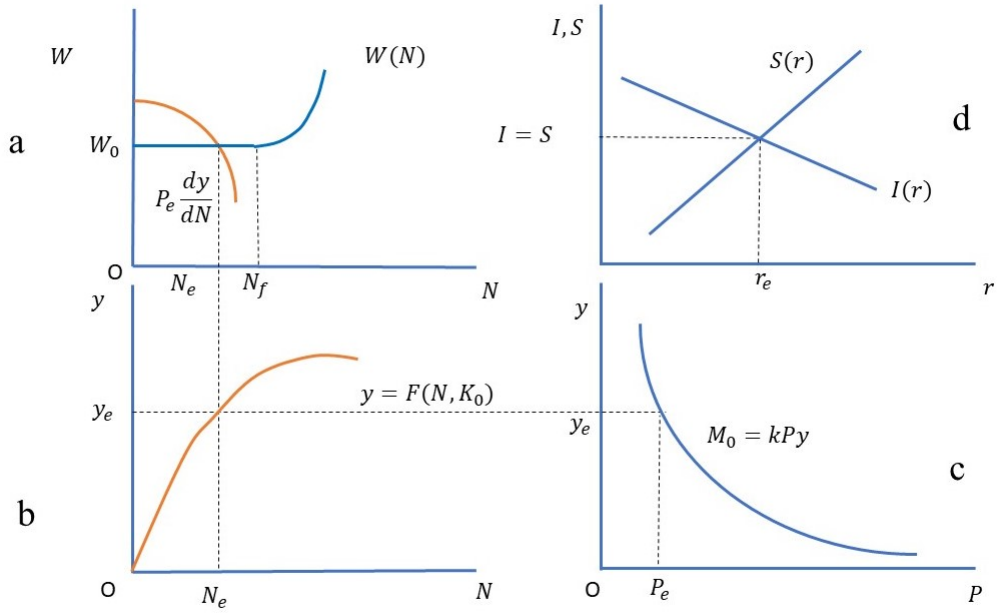

Figure 6.1 Underemployment equilibrium when wage is downward rigid in the labor market.

From the above analysis it is clear that so long equation of the classical model remain unaffected, full employment will be automatically achieved. Hence, the difference in equations (3) and (3') is the crucial difference between the classical model and the Keynesian model. Classical model by equation (3') of the Keynesian model keeping other equations unchanged then full employment will not be automatically achieved even in the classical

model. Again if we replace equation (3') of the Keynesian model by equation (3) of the classical model we get automatic full employment even with the Keynesian equations, Thus full employment is automatically achieved in the absence of wage rigidity and full employment is not automatically achieved in the presence of wage rigidity. Hence, we can say that the assumption of wage rigidity is the crucial difference between the classical model and the Keynesian model. Under employment equilibrium in the Keynesian model is thus caused by the assumption of wage rigidity. Only if rigid wages are assumed can there be any equilibrium at less than full employment. Since Keynes' principal claim was to have demonstrated this possibility it is clear that wage rigidity is his crucial assumption. This is presented in figure 6.1