PHILLIPS CURVE:
A SURVEY OF
THEORETICAL ANALYSIS

Dissertation Submitted to the
UNIVERSITY OF POONA
in part fulfilment of the
Degree of Master of Philosophy

by
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Gokhale Institute of Politics and Economics
POONA - 411 004

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T. Dayakara Rao

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Section I
INTRODUCTION

"Unemployment and inflation still preoccupy and perplex economists, statesmen, journalists, housewives and everyone else. The connection between them is principal domestic burden of presidents and prime ministers, and major area of controversy and ignorance in macroeconomics". (J. Tobin).

In this paper an attempt has been made to present the 'Phillips Curve approach' to explanation of inflation, which epitomized the universally found evils of unemployment and inflation in a state of trade-off. A.W. Phillips finds in his empirical work that there exists a stable, inverse relation between unemployment and inflation. This and the subsequent developments on similar lines throw light upon policy issues such as selecting an optimum combination of unemployment and inflation, if it is possible to choose any such combination. The emergence of Phillips curve hypothesis shattered the belief that the authorities, can control both unemployment and inflation, i.e. acceptable level of unemployment with zero rate of inflation or minimum level of unemployment with desired rate of inflation. This results in what economists describe as the 'cruel dilemma' faced by governments in choosing a combination of unemployment and inflation. In some of the later studies on the subject, attention has been focussed to see whether the trade-off is permanent or only a
Before going into the details of these studies, a brief analysis of the earlier theories of inflation, viz. (a) the quantity theory and (b) the Keynesian approach to inflation is presented.
Section II
THEORIES OF INFLATION

Inflation has been defined by several economists on different occasions in different ways. The most accepted definition of inflation is that it is a sustained rise in prices. Thus, the possibility of identifying inflation with each and every increase in prices is excluded. But this definition of inflation also involves issues such as the following:

(a) which price, i.e. retail or wholesale price, has to be taken into account;
(b) whether price should be measured inclusive of taxes or without taxes; and-
(c) in the presence of controls which price, i.e. the black market price or the control price, has to be taken into consideration.

All these factors have their impact in presenting the intensity of inflation.¹

Now, we shall present the two main approaches to explanation of inflations, viz., (i) the Quantity theory approach, and (ii) the Keynesian approach.

Modern Quantity Theory Approach

"The phrase 'Quantity theory of money' ... in its more recent and narrow sense ..., a theory of demand for money, ... survives as useful component of inflation theory."² In presenting the Quantity theory approach to inflation, we
accept the above interpretation of Laidler; hence, we are not talking here of the Quantity theory, which establishes a direct and proportional relation between money stock (M) and the price level (P).

The adherents of the Modern Quantity theory approach believe that there is a stable demand function for money in real terms. This demand for real balances is influenced by changes in rate of inflation, since the cost of holding money is determined by changes in expected price levels. Hence, given the demand function for money, the rate of increase in the nominal stock of money determines the rate of inflation. The public, in order to maintain its real balances unchanged in the face of inflation, must accumulate money balances at a rate equal to the rate of inflation, sacrificing the consumption of current real income. The Modern Quantity theory approach to inflation can be depicted with the help of the figure shown on page 5.

In the figure, rate of inflation is measured on the vertical axis and the ratio of money stock to money income (or of real balances to real income) is taken on the horizontal axis. The demand for real balances as a function of the rate of inflation is represented by the curve DD'. At zero rate of inflation, i.e., with price stability, the ratio of real balances to real income is OD'. But after inflation starts and is expected to continue at a level OP, the demand for real
Figure 1: Modern Quantity Theory Explanation of Inflation
balances relative to income falls to $OM$, and hence the cost of holding real balances reduces the quantity demanded of money by $MD'$. The area $OPPM$ represents the amount of money (as proportion of real income) which has to be accumulated, in the form of money balances by the holders of real balances, in order to keep their real balances unchanged in the face of inflation.

**Keynesian Approach**

This approach, also known as the income-expenditure approach to inflation, follows the Keynesian tradition to ascertaining the determinants of the speed and stability of the inflationary process. It was argued in 1930's and in the early 40's that the Keynesian theory was an ad hoc theory and that its scope was confined to the explanation of depression. But after successful application of Keynesian analytical methods during the war, it has been recognised that Keynesian theory is adaptable to the problem of inflation. The notion of deficient aggregate demand has been advanced to explain the unemployment problem in 1920's and 1930's whereas the notion of excessive aggregate demand has been advanced to explain the phenomenon of inflation in 1940's.

This approach has laid emphasis on the flow of aggregate expenditure as the main determinant of inflationary process in an economy. It has to be remembered that after reaching full employment, if the aggregate expenditure rises above
the full employment capacity output, it will result in the creation of an inflationary or expansionary gap. This can be shown with the help of the figure shown in page 8.

In figure 2, real income and real expenditure are measured on horizontal and vertical axes, respectively. OC represents the economy's aggregate output capacity while the line labelled C + I + G represents aggregate expenditure. Now, if the desired level of expenditure at full employment (YfR) exceeds the capacity output (OC), the difference RS is called an inflationary or expansionary gap. Further, the gap shown in the figure as R S can be proved equal to RS times the simple multiplier \( \frac{1}{1-MPC} \), where MPC is the marginal propensity to consume. The degree of inflation is assumed to vary with the extent of the inflationary gap and, hence, in order to bring down inflation, the inflationary gap has to be bridged either by reducing 'G' in C+I+G, or by increasing taxation.

With the help of figure 3 (page 9) it is possible to see whether such an inflationary gap comes to an end with a new and high price level or it will continue indefinitely as hyper inflation.

As is shown, inflationary process comes to a halt if the expenditure curve follows a path like aE', eliminating the inflationary gap ab. On the other hand, if the expenditure curve takes the path of aE", aggregate expenditure
Figure 2: Keynesian Explanation of Inflation
Figure 1: Alternative Paths of Inflation
being higher than aggregate income, inflationary gap will never be eliminated and the economy will experience periods of hyper inflation. That is, even though the price level is increasing i.e., from $P_1$ to $P_2$, the real demand is not declining; thus, this approach emphasizes the crucial role of excess demand for goods in the market.

Bent Hansen,\(^3\) as an improvement of the above-mentioned analysis, considers the market for productive factors separately from the market for goods. In Hansen's view, excess demand for goods or what he calls as "goods gap" should be measured separately from the "factor gap" that relates primarily to labour. In his model, for a full inflation to exist, there must be both a goods and a factor gap, each involving positive excess demand. Hansen's two gap model, as it has come to be known, can be illustrated as in figure 4 shown on page 11.

In figure 4, both gaps are measured horizontally. The goods gap is given by $(D-X)$, and factor gap by $(S-X)$. They are both positive between $W_1$ and $W_2$.

Now, consider a position slightly above $W_1$. Here, the factor gap is small and so money wages rise slowly; the goods gap is large, so prices rise rapidly. The net result will be a decline of real wage to $W$. Meanwhile, both absolute prices and money wages continue to rise because both the gaps are positive; however, real wages may fluctuate
Figure 4: Hansen's Two-Gap Model
between $\frac{1}{W_1}$ and $\frac{1}{W_2}$. The inflationary process continues until either curve DD shifts to the left up to point 'K', or curve 'XX' shifts to the right and reaches point 'P'.

Hansen's separation of goods and factor markets and the role assigned to the excess demand for factor of production in pushing up money wages independently of prices provided a useful starting point for subsequent empirical studies of the determinants of the rate of change of money wage rates.

The central feature of these models based, among others, on Keynes's pamphlet 'How to Pay for the War' is that manipulation of aggregate demand to control inflation will result in a redistribution of real income among different groups of the society. Thus, in these models the focus has been laid on income-expenditure flows. On the other hand, the Quantity theory approach to inflation as expressed by Milton Friedman, maintains that "inflation is always and everywhere a monetary phenomenon .... and can be produced only by a more rapid increase in the quantity of money than in output".

Thus, the stock of money is the central variable in the Quantity theory approach to inflation and it views inflation as imposing a tax on holdings of real balances, — the transfer is from holders of real cash balances to the controllers of money supply. Another major difference between the two approaches is that according to Modern Quantity theory approach
the rate of inflation is determined by the rate of increase in money stock, whereas in the Keynesian analysis, rate of inflation is governed by the inflationary gap.

As we have seen monetarists as well as Keynesians believe that excess demand is the key factor in the inflationary process which has to be controlled in fighting inflation. But this is not acceptable to a group of writers labelled as 'cost-push' theorists who argue that inflation is a non-economic phenomenon.

**Demand Pull Vs. Cost Push Inflation**

The debate between the two schools of thought centres around the recommendations for containing inflation. The proponents of the 'demand pull' theory hold that the existence of excess demand for final goods and services would cause their prices to rise. Profits improve as a consequence and firms may be able and induce to expand demand for the factors of production which they use. As a result, the prices of factors, such as labour, will themselves increase. Thus the theory argues that inflation will be sparked off by an excess demand for goods and services, which will, in turn, lead to a rise in wages.

The demand-pull theory can be applied directly to the Phillips curve approach, as we shall see in the next section, by taking the level of unemployment as a proxy for the state of excess demand. Rising excess demand represented by falling
unemployment will lead to a rise in the rate of price and hence of wage inflation, and the variations in the rate of inflation over time may be explained by variations in the level of excess demand.

On the other hand, adherents of the cost-push theory argue that inflation is a non-economic phenomenon and hence deny the efficacy of the demand management policy for controlling inflation. They maintain that inflation is essentially socio-political in origin and independent of excess demand conditions and can only be contained by a policy of prices and incomes. They argue that inflation would be set off by exogenous increase in factor prices and especially in the price of labour. Any increase in wages would, they argue, cause firms to raise the prices of final goods and services in an attempt to maintain their profit levels. This can occur irrespective of whether or not excess demand for such goods and services is in existence at that time, although the extent to which firms may be able to pass on wage increase to consumer will be partly determined by market conditions. Thus, this group of writers opines that inflation would begin with rising wages, which would hence precede the rise in prices of final goods and services.

But, here the important question is why should wages rise in the absence of excess demand for labour services? It may be because of the ability of trade unions in pushing
the wages up by their bargaining power. This may also happen in cases where the prices are being pushed up by the administrative acts of the oligopolistic firms with market power. The variations in the rate of wage inflation depend upon the pressure on employers to grant wage rises which is linked to factors like trade union membership figures, industrial profit rate etc. which we will examine in Section III. These other factors, such as profit, productivity, etc. tend to be associated with the state of economy. The more prosperous the economy the more obvious the opportunity for trade unions to try to get higher wages from employers. The state of an economy may be proxied by the percentage of work force in employment. Hence, the higher the level of employment (or lower the level of unemployment) the higher the bargaining power of the unions for wage increases; this will lead to wage-price spiral.

Thus, the two hypotheses, viz., demand-pull and cost-push have linked together causally the rate of inflation and the level of unemployment and this can provide an adequate explanation for the existence of 'Phillips curve'.

Gottfried Haberler, however, argues that in reality both types of inflation mentioned above are monetary in nature since they require monetary expansion; either the stock of money or its velocity of circulation must go up. Though, theoretically it is possible that money stock may remain constant and a rise in prices be entirely met by an increase
in velocity of circulation, in reality it does not happen like that. But, at the same time, it has to be remembered that velocity of circulation of money rose to abnormal heights during hyper inflation in Germany and it fell to an unusually low level during 'The Great Depression'. Thus, generally ignoring exceptions like hyper inflation of Germany and 'The Great Depression', inflation which is a monetary phenomenon may be prevented by monetary restrictions. The difference lies in that while stopping demand-pull inflation by monetary measures will have only a slight and temporary adverse effect on output and employment, containing cost-push inflation by monetary means will create some lasting unemployment and corresponding loss in output.

Thus, existence of powerful trade unions, which force up money wages by strikes or threat of strikes, confronts the monetary authorities with a disagreeable dilemma; either they can create enough money to permit the rise in prices that is compatible with rise in wages or they can prevent inflation by restricting the rate of monetary expansion. But if they want to contain inflation, they can do so only at the cost of creating significant amount of unemployment. If unemployment is to be kept low, one has to accept certain amount of inflation. This trade-off between unemployment and inflation has been formalised in the Phillips curve hypothesis, which we shall see in the next section.
Section III

PHILLIPS CURVE ANALYSIS

A.W. Phillips in his article, "The Relation Between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957" examines whether the statistical evidence supports the hypothesis that the rate of change of money wage rates can be explained by the level and rate of change of unemployment and the rate of change of retail prices operating through cost of living adjustments in wage rates.

Phillips treats wages as prices paid to labour services and applied to labour market the traditional supply and demand analysis used to explain the level of prices in the market for goods and services. Consequently, Phillips argues, that when demand for labour is high and there are very few unemployed, employers will bid up money wage rates above the prevailing rates in order to get the required labour services. On the other hand, it appears that the workers are not willing to offer their services at less than the prevailing wage rates when the demand for labour is low and unemployment is high so that wage rates fall if at all, only slowly. Consequently, the relationship between unemployment and the rate of change of wage rates, is likely to be non-linear.

In this hypothesis, which tries to establish a relation between the rate of change of money wage rates and the level
of unemployment, excess demand for labour is proxied by the level of unemployment since excess demand for labour can not be observed directly. Changes in the level of unemployment can be taken as an approximate indicator of the situation in the labour market which we shall see in greater detail while presenting Lipsey's analysis. The problem is thus simplified because the figures of unemployment and money wages are directly observable variables.

Phillips, in his analysis, has computed the rate of change of wage rates from the index of hourly wage rates constructed by E.H. Phelps and Sheila Hopkins. The unemployment figures are taken from the Board of Trade and Ministry of Labour Statistics and from trade union returns.

Then, Phillips has plotted the annual figures for unemployment and for the rate of change of money wages over the period 1861-1913. The unemployment figure is the average number of unemployed workers during the year; wage rate change is also measured as an average during the year under consideration. Thus, for each variable, it gives 52 observations. A scatter diagram presenting the relation of the rate of change of money wage rates and the percentage unemployment for the whole period has been drawn. (Figure 5 on page 19) Phillips notices, however, that there were 6 fairly regular trade cycles with an average period of about eight years. Each cycle is represented in the form of a loop, shown on page 20.
Turn 5: Phillips's Scatter Diagram-Curve Fitted for the period 1861-1913
Figure: Phillips's Explanation of Loops 1869-79.
The loops are explained in Phillips's own words as:

"In a year of rising business activity with the demand for labour increasing and the percentage of unemployment decreasing, employers will be bidding more vigorously for the services of labour than they would be in a year during which the average percentage unemployment was the same, but the demand for labour was not increasing. Conversely in a year of falling business activity with the demand for labour decreasing and the percentage unemployment increasing, employers will be less inclined to grant wage increases and workers will be in a weaker position to press for them than they would be in a year during which the average percentage unemployment was the same, but the demand for labour was not decreasing."

The above statement of Phillips implies that at any given level of unemployment the rate of change of money wages would be high during the upswing of the cycle than during the downswing of the cycle. Thus, given the level of unemployment, the rate of change of money wage rates will also depend on the rate of change of unemployment. Therefore, the rate of change of money wage rates will be high when the level of unemployment is low, and vice-versa.

Then, Phillips presents a relationship between the rate of change of money wage rates ($W$) and the level of unemployment ($U$), by the following equation.
\[ \dot{W} = a + bU^c \]  
\[ \text{(or)} \]
\[ \log (W - a) = \log b + c \log U \]

Phillips grouped the 52 observations into six groups to surmount the difficulty of dealing with certain observations which require negative logarithms. Finally, he fits the curve to six points which represent the average value of \( \dot{W} \), associated with the indicated level of unemployment. Phillips's justification for this procedure is as follows:

"Since each interval includes years in which unemployment was increasing and years in which it was decreasing, the effect of changing unemployment on the rate of change of wage rates tends to be cancelled out by this averaging, so that each cross gives an approximation to the rates of change of wages which would be associated with the indicated level of unemployment, if unemployment were held constant at that level."

In other words, whereas Phillips's loops establish a relation between \( \dot{W} \) and the level of unemployment (\( U \)) and its rate of change (\( \dot{U} \)), the grouping of observations has the effect of making \( \dot{U} \) equal to zero at each point along the Phillips curve.

The equation of the fitted curve is:

\[ \dot{W} + 0.900 = 9.638 U^{-1.394} \]  
\[ \text{.... (2)} \]
or
\[ \log (W + 0.900) = 0.984 - 1.394 \log U. \]

This explains that a one per cent rise in the rate of unemployment is roughly associated with 1.394 per cent fall in the rate of change of wage rates.

Although Phillips concentrated upon the relation between rate of change of wages and the level of unemployment and its rate of change, he also noted that, "A third factor which may affect the rate of change of money wage rates is the rate of change of retail prices operating through cost of living adjustments in wage rates." But he felt that the effect of cost of living adjustments on the rate of change of money wage rates would be small and need not be taken into account. This is because employers will be merely giving under the name of cost of living adjustment, which in any case they would have to pay in the process of competitive bidding for more labour services.

Phillips's model, therefore, postulates three basic relations between the rate of change of money wage and its determinants. The rate of change of money wages is predominantly determined by the level of unemployment, but also by the rate of change of unemployment level and by the rate of change of retail prices.
Phillips draws the conclusion, from the figure in which the width of the loops goes on diminishing, that there is a reduction in the dependence of the rate of change of money wage rates on the rate of change of unemployment. This he accounts for two reasons.

1. In certain industries like coal and steel, wage rates were linked to prices of the products. In the earlier years these industries were given fairly large weights in the wage index and in the following period with enhanced coverage of more and more industries the weights of these industries in the index was reduced.

2. The second reason is the time lag existing between wage changes to changes in the level of unemployment due to the extension of collective bargaining and the growth of arbitration and conciliation procedures. Therefore, if one stipulates the existence of such a time lag in the response of $W$ to changes in $U$, then wage change in any year has to be related not to average unemployment during that year, but to the average unemployment lagged by some months, which Phillips has taken as seven months.

After presenting this relationship, Phillips compares the curve which was fitted to 1861-1913 data with the scatter diagram depicting the relation of the rate of wage change and level of unemployment for the years 1913-48 and 1948-57.
Phillips contends that the fit proved satisfactory for the period 1913-48 and remarkably good for the period 1948-57 provided that unemployment is lagged by seven months. (Figure 7 on page 26). Phillips's hypothesis that the rate of change of money wage rates can be explained by the level of unemployment, the rate of change of unemployment, and by the rate of change of retail prices (when the import prices rose rapidly affecting the cost of living index and giving rise to wage-price spiral), may be substantiated with the help of the table given below:

**Phillips's Explanation of the Rate of Change of Money Wage Rates**

<table>
<thead>
<tr>
<th>Year</th>
<th>Change in wage rates (1)</th>
<th>Demand pull (2)</th>
<th>Cost push (3)</th>
<th>Change in import prices (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1947</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>20.1</td>
</tr>
<tr>
<td>1948</td>
<td>3.9</td>
<td>3.5</td>
<td>7.5</td>
<td>10.6</td>
</tr>
<tr>
<td>1949</td>
<td>1.9</td>
<td>4.1</td>
<td>2.9</td>
<td>4.1</td>
</tr>
<tr>
<td>1950</td>
<td>4.6</td>
<td>4.4</td>
<td>3.0</td>
<td>26.5</td>
</tr>
<tr>
<td>1951</td>
<td>10.5</td>
<td>5.2</td>
<td>9.0</td>
<td>23.3</td>
</tr>
<tr>
<td>1952</td>
<td>6.4</td>
<td>4.5</td>
<td>9.3</td>
<td>-11.7</td>
</tr>
<tr>
<td>1953</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
<td>-4.8</td>
</tr>
<tr>
<td>1954</td>
<td>4.4</td>
<td>4.5</td>
<td>1.9</td>
<td>5.0</td>
</tr>
<tr>
<td>1955</td>
<td>6.9</td>
<td>6.8</td>
<td>4.6</td>
<td>1.9</td>
</tr>
<tr>
<td>1956</td>
<td>7.9</td>
<td>8.0</td>
<td>4.9</td>
<td>3.8</td>
</tr>
<tr>
<td>1957</td>
<td>5.4</td>
<td>5.2</td>
<td>3.8</td>
<td>-7.3</td>
</tr>
</tbody>
</table>

Figure 7: Phillips Curve for 1948-57 With Unemployment Lagged Seven Months
In the above table column (1) represents the percentage changes in money wage rates during years 1948-57. The figures in column (2) are the percentages by which wage rates are expected to rise for the corresponding years, given the level of unemployment. As the level of unemployment is the proxy for the excess demand for labour, the figures in column (2) represent the demand pull element in the rate of change of wages and these figures are calculated from the curve fitted to the 1861-1913 data, corresponding to the average percentage of unemployment lagged seven months. Column (3) shows the cost-push element in wage adjustments and likewise column (4) the percentage change in the index of import prices for the years 1947-57.

In brief, column (1) shows the actual percentage changes in wage rates during the period 1948-57, whereas column (2) gives the rate of change of money wage rates predicted by the Phillips curve fitted to the data of 1861-1913, at different levels of unemployment as shown in Figure 7.

From the above table it can be seen that import prices reached a high level in 1950 and even in 1951, and as a result of this rise, retail price index increased by 9.0 per cent and 9.3 per cent in the years 1951 and 1952, respectively. This is because the rise in import prices are assumed to reflect in the cost of living index with a time lag. The figures in columns (1) and (2) are quite close, except for the year 1949 in which wages policy was assumed to be effective and the
years 1951 and 1952 in which the effect of a rapid rise in import prices reflected in the increased cost of living index and thus caused a spurt in the rate of change of wage rates, thus proving Phillips's hypothesis that there is an inverse relation between rate of change of wage rates and the level of unemployment.

On the basis of the fitted curve (Figure 7), it is possible to predict the rate of change of wage rates at different levels of unemployment. From the same figure, it is seen that at a level of 5.5 per cent level of unemployment, wages would remain stable. And at a level of unemployment of 2½ per cent, prices would be stable though money wages are rising at approximately 2 per cent per annum, since productivity is estimated to increase at 2 per cent per annum.

**Lipsey's Analysis**

Richard Lipsey made a pioneering attempt in 1960 to give a theoretical explanation to the empirical (concept) findings of Phillips. First, he postulates the following relation between rate of change of wage rates (\(\dot{W}\)) and the level of unemployment (U):

\[
\dot{W} = a + bU^{-1} + cU^{-2} \quad \ldots \quad (3)
\]

Lipsey prefers this equation which can be fitted by the method of least squares to all the original 52 observations, to overcome the statistical problem encountered by Phillips, as we have seen earlier, which made Phillips group the 52 observations into six groups and fitting the curve to the
average values of $\dot{W}$ and $U$.

Lipsey demonstrates the superiority of his equation over Phillip's by first fitting a curve to the six average points or crosses as in Phillips, and then a curve to all the original 52 observations of Phillips by using least squares. The two equations are:

$$\dot{W} = -0.44 + 0.023U^{-1} + 12.52U^{-2} \quad \quad \quad \text{(4)}$$

$$\dot{W} = -1.14 + 5.53U^{-1} + 3.68U^{-2} \quad \quad \quad \text{(5)}$$

Lipsey points out that equation (4) shows the distorting effect caused by fitting the curve to six average points rather than to the actual observations as is done in equation (5).

Then Lipsey examines Phillip's contention that the rate of change of unemployment ($\dot{U}$) is a variable whose importance is diminishing over time and also analyses the role played by the rate of change of cost of living index ($\dot{P}$), by making $\dot{U}$ and $\dot{P}$ as additional explanatory variables. Lipsey's finding is that over the period 1862-1913, Phillips curve was best approximated by the equation

$$\dot{W} = -1.21 + 6.45U^{-1} + 2.26U^{-2} - 0.019\dot{U} + 0.21\dot{P} \quad \quad \text{(6)}$$

The $R^2$ for this relation was $0.85$; that is, 85 per cent of the variance in $\dot{W}$ is explained by variations in $U$, $\dot{U}$ and $\dot{P}$. Further, the squared partial correlation coefficients were $0.78$, $0.50$ and $0.17$ for $U$, $\dot{U}$ and $\dot{P}$, respectively. That is, 78 per cent of the variance in $\dot{W}$ is explained by variation in
U; variation in \( U \) explains 50 per cent of the variance in \( W \) not accounted for by variations in \( U \); and finally that variations in \( P \) explains a further 17 per cent of variance in \( W \) not accounted for by variations in \( U \) and \( \dot{U} \).

Lipsey's conclusions are that:

(i) "there is a significant relation between the rate of change of money wage rates on the one hand and the level of unemployment and its rate of change on the other and that over 80 per cent of the variance in money wage rates over the period 1862 - 1913 can be associated with these variables, \( U \) and \( \dot{U} \);

(ii) Phillips's hypothesis that the influence of the rate of change of unemployment has diminished over the period is rejected; and

(iii) Phillips's hypothesis that the cost of living enters with a threshold effect\(^{14}\) is rejected. There seems to be some evidence in favour of a simple relation between changes in the cost of living and changes in money wage rates.\(^{15}\)

L. A. Dicks-Mireaux and J. C. R. Dow\(^{16}\) and R. J. Ball and L. R. Klein\(^{17}\) support Lipsey's conclusion that \( \dot{P} \) has always some influence in the determination of \( W \), assuming that changes in the cost of living have a proportionate effect on wage rates in every year.
After contending that there is a significant relationship between rate of change of wage rates and the level and rate of change of unemployment, Lipsey proceeds to give a theoretical explanation to Phillips's analysis. Lipsey begins to do this by examining the behaviour of wages in micro-labour markets. The main characteristic of the micro labour market is that labour is more mobile within than between the labour markets. The way in which Lipsey explains a relationship between the rate of change of wages and the level of unemployment may be explained by the figures shown on pages 31A & 31B.

(Fig. 8)

In the figure, \((D-S)/S\) represents excess demand for labour as a proportion of labour force, \(U\) represents percentage of labour force unemployed and \(\dot{W}\) the rate of change of wage rates.

Lipsey follows the traditional demand and supply analysis to explain changes in wages. Suppose, there is an excess demand for labour 'JK' as shown in Fig. 8(a), then wages rise towards the equilibrium wage rate \(w_e\) and, likewise, wages will move downwards, if there exists an excess supply. But, this itself does not explain the rate at which wages change in response to changes in excess demand for labour. The rate of change of wage rates is sought to be explained with the help of figure 8(b). Let us assume that there is an excess demand 'Oa' in figure 8(b), which is assumed equal to 'JK' in figure 8(a); then, the corresponding rate of change of
Figure 8(a): Explanation of the Relation Between Wages and Demand & Supply.
Figure 8(a): Explanation of the Relation Between Unemployment and Excess Demand

Figure 6(c): Explanation of the Relation Between Unemployment and Rate of Change of Wage
wages will be 'ab'; similarly 'cd' for 'Oc'. Here, it is assumed that there will be "an unchanging adjustment mechanism in the market, i.e. a given excess demand should cause a given rate of change of prices whatever the reason for excess demand". 18

Lipsey states that excess demand for labour is not directly observable. While he considers the difference between unfilled vacancies and unemployed workers might be taken as a reasonable measure of excess demand, such data are not available for the period of his study. Hence, excess demand for labour is related to the percentage of unemployed as shown in figure 8(c), which depicts an inverse non-linear relation between them. This is because of the assumption that zero excess demand must be accompanied by some positive amount of unemployment - frictional unemployment. 19 Therefore, steadily rising excess demand will be accompanied by increasingly smaller reduction in unemployment. The relationship between rate of change of wages and level unemployment follows from the relationship between rate of change of excess demand for labour and level of unemployment. When combined with the relation between rate of change of excess demand for labour and rate of change of wages.

Thus, Lipsey arrives at two directly observable variables viz., rate of change of wages and level of unemployment and shows how they are inversely related. This may be seen in figure 8(d). In this way Lipsey provides a satisfac-
tory theoretical explanation for Phillips's hypothesis, through relations explained above in the micro-labour markets.

Lipsey then aggregates the various micro markets into a single macro market. This aggregation process is affected not only by the rate of unemployment but also by its distribution amongst various micro-markets. More specifically, Lipsey argues that if the various micro Phillips curves were to be identical then the macro Phillips curve would be displaced above and to the right of the micro curves, when unemployment rates are unequal as between various markets.

Lipsey gives an interpretation for the "loops" that is different from the one offered by Phillips. He observes that in order to obtain a loop it is necessary that something affect \( \dot{W} \) without simultaneously affecting \( \dot{U} \). Phillips explains that the loop occurs because of greater competitive bidding for labour when \( \dot{U} \) is negative than when it is positive. Lipsey, however, explains the loops as upward displacements from the stable single market relations between rate of change of wage and the level of unemployment, the loops being produced by systematic variations in the degree of upward displacement.

Lipsey explains this by taking an example, in which there exists two markets with different levels of unemployment. In a period of rising demand, the market with lower level of unemployment experiences the pressure of demand for labour and hence a rapid rise in wage rates compared with the market with higher unemployment where wage rates may still be
at the older level or are rising slowly. Therefore, the net impact of both this rapid rise of wage rates in one market and stable or slowly rising wage rates in the other will be an upward displacement in the aggregate rate of change of wage rates.

This, together with the non-linear relation between \( \dot{\bar{w}} \) and \( \bar{u} \) as presented in figure 8(d), causes the upward displacement of the aggregate or macro observation from the individual micro market observations, during the upswing. Lipsey assumes that during the downswing equal levels of excess demand result in an uniform rate of change in unemployment. The macro relation for the downswing, therefore, approximates to the micro-function. Thus, Lipsey's interpretation of the loops implies that the greater the inequality in the distribution of unemployment among micro-markets, the greater will be the rate of change of wage rates for a given level of average unemployment.

Many writers have emphasized the importance of dispersion of unemployment as an important variable in the determination of the rate of change of wage rates. But it has to be noted that some of them e.g., G.C. Archibald, R.L. Thomas and F.J.M. Stoney,\(^{21}\) and F.R. Brechling\(^{22}\) have defined micro- or a sub-market in regional terms whereas J.D. Sargan has concentrated on industrial labour market.\(^{23}\) Here, mention may be made of the way in which Thomas and Stoney have shown the effect of dispersion of unemployment between micro or
individual markets on the aggregate rate of change of wage rates. This is illustrated in the figure 9 given on page 36.

From the figure it is evident that when unemployment is unevenly distributed between a and b, the aggregate rate of change of wage rates differs. With aggregate unemployment, U, the corresponding \( \dot{W} \) is \( \dot{W} \), but when it is distributed between markets a and b as shown in the figure, the aggregate rate of change of wage rate will be higher, since

\[
\dot{W}_b \frac{U_b}{U} + \dot{W}_a \frac{U_a}{U} > 2 \dot{W}L \dot{U}.
\]

That is,

\[
\frac{\dot{W}_b - \dot{W}}{\dot{W}} > \frac{\dot{W} - \dot{W}_a}{\dot{W}}
\]

Thomas and Stoney give two reasons for the way in which dispersion of unemployment influences aggregate inflation.

(1) Non-linearity in the relationship between the rate of change of wage rates and the level of unemployment implies that as the level of unemployment goes on declining, every successive percentage fall in the level of unemployment leads to higher and higher rate of change of wage rates. Moreover, the greater the dispersion in market unemployment rates the more marked is the upward movement in the aggregate wage function.

(2) Secondly, there may be a transfer mechanism which may result in spill-overs into markets with higher level of unemployment. Generally in markets with lower level of
Fig. 9: Explanation of the Dispersion Effect of Unemployment on Rate of Change of Wages
unemployment, the rate of change of wage rates will be higher, and this may induce the other market with relatively higher level of unemployment and lower rate of change of wage rates to demand higher wage changes. Hence, the greater the dispersion in unemployment rates, the greater is the resulting upward pressure on the aggregate rate of change of wage rate.

Coming back to the explanation of the loops, A.G. Hines has given a different interpretation. Hines agrees with Lipsey that zero excess demand is accompanied by some amount of positive unemployment, i.e. frictional unemployment. However, this does mean that when excess demand for labour \( E \) is zero, vacancies \( V \) will be equal to unemployment \( U \).

Symbolically,

\[ \text{when } E = 0, \quad V = U \]

Hines argues that the relationship between \( V \) and \( U \) is non-linear. This is because, \( V \) and \( W \) are positively linearly related, and \( W \) and \( U \) are related in a negative non-linear way. Thus, when \( E \) is rising, \( V \) rises more rapidly than \( U \) conversely, when \( E \) is falling \( U \) rises more rapidly.

Therefore, when unemployment rate is used as a proxy for the level of excess demand it misstates the level of excess demand. The nature of this misstatement will be such that for any given level of unemployment, employers will be bidding more vigorously for labour on the basis of the level of excess demand when unemployment is falling than when it is
rising. This will reduce unemployment by less than it reduces vacancies when excess demand is rising. This process will produce loops of the Phillips type. Thus, in situations where excess demand is changing, the rate of change of unemployment is a valid proxy along with the level of unemployment, for the level of excess demand for labour.

Looking back into Lipsey's study, we may see that the curve fitted to the data for the years 1923-29 and 1948-57 is of the form:

\[ \dot{w} = 0.74 + 0.43u^{-1} + 11.18u^{-2} + 0.038\dot{u} + 0.69\ddot{p} \]  \quad (7)

A comparison of this with the equation fitted for the period 1862-1913 (see equation 6) shows that the regression coefficient for \( \dot{u} \) has changed the sign - from negative to positive. This suggests that the loops have changed direction. But, further analysis shows that when the data are broken up into three time periods, the coefficients for \( \dot{u} \) are:

1923 - 29 = 1.91; 1929 - 39 = -6.25; 1948-57 = 3.28

This shows that the change in the direction of loops is applicable to 1920's and 1950's but not to 1930's.

Lipsey's main conclusion are:

1. The basic relation explaining the variance in the rate of change of wage rates (\( \dot{w} \)) in terms of level and rate of change of unemployment (\( u, \dot{u} \)) and the rate of change of prices (\( \ddot{p} \)) continues to hold.
2. The importance of $P$ as an explanatory variable has increased in the later periods, i.e. 1923-39 and 1948-57, when compared with the period of 1862-1913. The coefficient of $P$ has risen from 0.21 in equation (6) to 0.69 in equation (7) which, in Lipsey's view, indicates a substantial movement in the direction of a one-to-one relation between changes in prices and changes in wages.

3. A comparison of equations (6) and (7) reveals that the squared partial correlation coefficients for $U$ and $\dot{U}$ have fallen from 0.78 to 0.38 and 0.50 to 0.30, respectively and for $P$ it has risen from 0.17 to 0.76. This shows that the importance of variables $U$ and $\dot{U}$ has declined in explaining the variance in $W$ during the periods 1923-39 and 1948-57 as compared to the period 1862-1913, whereas $P$ has gained in importance.

F.A. Samuelson and R.M. Solow\textsuperscript{25} have plotted annual percentage changes in average hourly earnings\textsuperscript{26} in United States manufacturing against unemployment for the period 1900-1968. Although the relationship between rate of change of wage rates and level of unemployment is not very stable over the whole time period, there seems to be a clear tendency for wage rates to increase when unemployment is low, i.e. when labour market is tight. The data also suggest that the post-war Phillips curve was more unfavourable than
that of the earlier periods; that is, the unemployment rate associated with wage stability is 8 per cent for the post-war period. They also made some conjectures about the post-war trade-off between inflation and unemployment in the U.S.A. They suggest that

(a) a wage change of 2½ per cent a year, approximately equal to average productivity growth, implies an unemployment rate of about 5.5 per cent, and

(b) a 3 per cent unemployment rate is most likely to be accompanied by an annual inflation rate of 4 to 5 per cent.

The comparison done by Samuelson and Solow of their finding with that of Phillips's reveals certain important points. The trade-off is much more favourable in United Kingdom than in United States of America. This may be, in their opinion, due to (a) “responsible” trade union leadership in U.K., (b) the geographical compactness of the English economy which is conducive for labour mobility and makes the labour market more perfect than that of United States and (c) the industrial policy followed by England to reduce structural unemployment.

R.J. Bhatia, in his study for U.S. for the period 1900-58, tries to find out the relation between the rate of change of money earnings (E) on one hand, the level of unemployment and its rate of change (U, U) and the rate of change of
prices (P) on the other. He divides the period into 3 sub-periods: 1900-32 (excluding 1915-20),28 1933-48 (excluding 1933-34 and 1942-48) and 1948-58.

He finds the relation between E and U in U.S. to be linear,29 where as Phillips and Lipsey state that for U.K. the relation between W and U was non-linear. This is due to the downward flexibility of earnings in U.S. during that period.

The equation fitted for the period 1930-32 is

\[ \dot{E} = 4.62 - 0.70 U \]  \hspace{1cm} (8)

\( R^2 \) for this relation is 0.80, i.e. 80 per cent of variance in money wage earnings was explained by level of unemployment. Bhatia finds that, in case of the U.S., the rate of change of unemployment is an insignificant variable. This is because the inclusion of \( \dot{U} \) in the above equation raises \( R^2 \) to 0.81, with a squared partial correlation coefficient of \( \dot{U} \) being 0.03. On the other hand, \( \dot{P} \) appears to be significant in explaining \( \dot{E} \) for the same period, as shown by the following equation:

\[ \dot{E} = 2.51 - 0.31 U + 0.64 \dot{P} \]  \hspace{1cm} (9)

\( R^2 \) for this relation is 0.96. The squared partial correlation coefficient for \( U \) is 0.5 and for \( \dot{P} \) 0.79.

The period 1933-48 also gives more or less similar
results. And the fitted equation for period 1948-58 is:

\[
\dot{E} = 5.46 - 0.37U - 0.02\dot{U} + 0.64\dot{P} \quad \text{..... (10)}
\]

\(R^2\) for this relation is 0.51 and the squared partial correlation coefficients are 0.05 for \(U\) and 0.03 for \(\dot{U}\) and 0.32 for \(\dot{P}\). Though the association between \(\dot{P}\) and \(\dot{E}\) is less when compared with equation (9), still it is a significant variable in explaining \(\dot{E}\), since the other two variables \(U\) and \(\dot{U}\) are not significant.

As \(\dot{U}\) is insignificant in all the three sub-periods studied, and while there exists a relationship between \(U\) and \(\dot{E}\) for the first two periods, but not for the years 1948-58, Bhatia's study hints that the trade-off relation between inflation and unemployment as envisaged by Phillips and Lipsey may not hold for the U.S. for post-1942 data. However, the association between \(\dot{E}\) and \(\dot{P}\) for the entire period is significant.

The major finding of a study by W.G. Bowen and R.A. Berry is that the relation between rate of change of wage rates (\(\dot{W}\)) and rate of change of unemployment in the U.S.A. was significant and quite stable whereas the more familiar relationship between \(\dot{W}\) and the level of unemployment (U) was quite unstable. This is in direct conflict with Bhatia's finding which we have seen earlier.

Bowen and Berry argue that the instability of the
Phillips Curve was not surprising in view of the large institutional changes that have taken place in the United States over the period 1900-58, such as the development of trade unions in big industries and varying degrees of structural unemployment. Like Phillips, they regard the change in the rate of unemployment as a useful index of future conditions of labour market, e.g., unions demand higher wages when unemployment is declining and employers are likely to offer higher wages when unemployment is decreasing than when it is increasing. They also maintain, as Samuelson and Solow, that Phillips curve in U.S. shifted upward in the post-war period, i.e., the trade-off became more unfavourable.

In a later study of prices and productivity in the United States, R.G. Bodkin estimates some wage equations of Phillips’s variety and obtained quite good results. All the explanatory variables, i.e., level of unemployment, rate of change of unemployment and the rate of change of prices are highly significant and carry the expected signs. Bodkin derives some steady state trade-off estimates between inflation and unemployment by assuming that price changes equal wage changes minus productivity changes.

S.F. Kaliski in his work done for Canada for the periods 1921-39 and 1945-58 finds that the relation between level of unemployment and the rate of change of wage rates was unstable. All the three variables, $U$, $\dot{U}$ and $\dot{P}$, are found
to be significant for the post-war period whereas only $\dot{P}$ is significant for the inter-war period.

All these studies, however, do support Phillips-Lipsey version about the trade-off between rate of change of wage rates and the level of unemployment.
Section IV

ALTERNATIVE MEASURES OF EXCESS DEMAND 
AND USE OF ADDITIONAL VARIABLES

In the previous Section we have seen how the Phillips curve hypothesis explains the relation between the rate of change of wage rates and the level of unemployment. In Phillips's original article and also in Lipsey's analysis, unemployment variable is the proxy for excess demand in the labour market. Phillips, by drawing an analogy between product and labour markets, states that the rate of change of wages will be higher, the higher the excess demand, proxied by level of unemployment. However, this measure is not acceptable to some writers like C.C. Holt, Jim Taylor etc., who have introduced alternative measures of excess demand.

They argue that even at zero level of excess demand there will be some positive level of unemployment because of frictions and imperfections in the market. This unemployment which is frictional, of course, may be matched by equal number of vacancies. They also maintain that when excess demand is rising vacancies will exceed unemployment and vice versa. Therefore, level of unemployment or vacancies alone will not be an adequate measure of excess demand.

Charles C. Holt\(^3\) has shown that Phillips's relation may be derived from a set of behavioural relationships in the labour market where he explains the rate of a change of wage rates with the help of the ratio of vacancy rate to
unemployment rate. The ratio of vacancy rate to unemployment rate represents the average duration of unemployment and average period for which vacancies remain unfilled.

Holt's analysis has been presented in terms of stocks and flows of the labour market. The stock of unemployment and the stock of vacancies are the two important stocks, and quits, lay-offs, recalls, hires etc. are the flows in his analysis of the determination of rate of change of wages. These stocks and flows are interrelated or interdependent, since flows into and out of the stocks determine the size of the stocks which in turn influence the flows. The interaction between the two stocks plays a vital role in determining the rate of change of wage rates. For example, when the stock of vacancies is large and the stock of unemployed workers is small, workers find an opportunity to get better jobs i.e. better paid jobs, and hence start searching for them either by quitting the old jobs or searching for new jobs while continuing in present m jobs.

But the process of search involves costs due to lack of information about the existing wage-payments and vacancies. If the searcher is already employed, he has to balance the costs of search such as information of vacancies and wage rates elsewhere and also set up costs and moving costs with his desired wage. The employee's desired wage is a function of several variables like the wage he is getting at present, the duration of unemployment if he has to quit the present job
when searching for a new job. On the other hand, if he is unemployed, he has to take into consideration the duration of unemployment i.e. waiting for a better paid job instead of accepting the present available one. The desired or acceptance wage is thus a decreasing function of the duration of unemployment period, whereas the employer's wage offer is an increasing function of the duration of job vacancy.

E.S. Phelps states that, "in a world where lives are short and information costs are high, the firm may have to pay a permanently higher wage differential, the greater the employment force it wishes to sustain." Thus, the individual firm has to see the wages paid elsewhere and to increase the wages in order to maintain the desired wage differential to attract the people from the pool of unemployment, from other firms and also to reduce quitting because hiring and training involves costs. Therefore, for an agreement to be reached both the parties have to be satisfied. Holt gives the probability of arriving at such an agreement as $P_{oa}$ which depends on initial acceptance and offer levels, their rates of adjustment, the durations of unemployment, vacancies etc.

The total potential contacts may be denoted by $(u \times v)$, since $u$ is the number of unemployed and $v$ the vacancies. If $T_s$ is the "mean search time", that is the average time required for making a contact, then the number of contacts per period of time will be represented by $\frac{(u \cdot v)}{T_s}$.
We have already mentioned that $P_{oa}$ is offer acceptance probability, and hence

$$\frac{(u,v) P_{oa}}{T_s}$$
gives the expected flow of hires and recalls per period of time; that is

$$f = \frac{(u,v) P_{oa}}{T_s} \quad \cdots \quad (11)$$

The relation between flows and stocks in the above equation may be presented to suit the purpose, i.e. the determination of the rate of change of wage rates with the help of the ratio of vacancy rate to unemployment rate. This may be done by re-writing equation (11) as

$$u,v = \frac{f.T_s}{P_{oa}} \quad \cdots \quad (12)$$

Till now we are referring to a single firm, and by aggregation for the whole economy equation (12) may be written as

$$U.V = \frac{F.T_s}{P_{oa}} \quad \cdots \quad (13)$$

where $F$ is turnover rate given as $\frac{f}{E}$, $E$ being number of employed workers. From equation (13), the ratio of vacancy rate to unemployment rate, which is thought to be a better proxy for excess demand rather than unemployment rate, can be derived by dividing both sides of the equation by $U^2$

Thus, $\frac{V}{U} = \frac{F.T_s}{P_{oa}} \cdot U^{-2}$
Other criticisms of the unemployment rate as a proxy for excess demand are that it fails to take into account
(a) hidden unemployment
(b) hoarded labour and
(c) Change in age/sex composition of unemployment which alter the degree of wage pressure associated with any given level of unemployment rate.

Hidden unemployment arises during periods of less than full employment. During periods of recession, generally women and retired people are the first to lose their jobs who generally do not register as unemployed. And this is not the case with men in the prime age group i.e. within the age group of 25-55, since they do not drop out of the labour force when they become unemployed. Thus, it is clear that during periods of less than full employment, the recorded unemployment rate will overstate the degree of tightness in the labour market because recorded labour force will understate the size of real labour force, which is due to the failure of women and retired people to register as unemployed.

Labour hoarding represents under-utilisation of the employed labour. This under-utilisation of labour arises during recession when employers will be willing to reduce the average output per worker rather than throw out trained and experienced workers. This may be accounted for by two reasons:

(1) Recruiting and training of new-workers involves certain costs, and
(2) The contracts made between workers or their unions
and the management.

Hence, unemployment will be an imperfect indicator
of excess demand-supply conditions of the labour market.
This is because during recession, when there is a decline
in excess demand, employers will prefer to reduce the average
output per worker rather than dismissing some of them, and
in the upswing of the cycle the employers will first try to
keep up with the rising excess demand for labour to a certain
extent by offering higher payments for overtime work; hence
unemployment rate does not move perfectly with changes in
excess demand.

As regards the age/sex composition of unemployment,
it is argued that at any given level of unemployment, the
aggregate unemployment rate becomes an imperfect proxy for the
excess demand in the labour market as some types of labour
exert a stronger influence on the aggregate wage changes than
do others. For example, prime age men will be naturally
able to do work more hours and obtain higher average wages
than women and younger and older people of both sexes. The
implication of age/sex composition argument is that the
higher the proportion of women and younger people in the
pool of unemployed, the lesser the downward pressure on
wages for any given level of unemployment.

In recent years much work has been done purporting
to test Phillips's hypothesis. One of the main features of this work is the use of different variables as either alternative or supplementary explanatory variables to determine the rate of change of money wage rates. Some critics like Nicholas Kaldor and A.G. Hines point out that Phillips's hypothesis seems to ignore some important factors in the wage bargaining process, especially with respect to organised labour markets where the traditional demand-supply analysis may operate very imperfectly.

Here we shall consider the influence of certain variables such as profits, productivity and trade union aggressiveness.

**Profits**

Profits are one of the important factors that influence the rate of change of wage rates. The general argument is that unions try to press hard for higher wages in times of high business profits, when employers will also be willing to concede such wage increases. Besides, if the periods of high profits are also periods of high demand, the management may generally accept the demands of the unions for wage increases, since otherwise it has to bear considerable amounts as loss if the unions resort to strike. Further, during periods of high and increasing demand, demands of unions for wage hikes are accepted with little hesitation, because the increased costs due to increased wages can be passed on easily to the consumer in the form of increased prices. Similarly, when
profits are high, unions will demand larger wage increases to maintain labour's share in the firm's or industry's income. Thus, it is the contention of some writers that there exists a positive relationship between rate of change of profits and rate of change of money wage rates.

Nicholas Kaldor\(^3\) is one of the writers who has emphasized the role of profits in influencing the money wage rates. Kaldor rejects Phillips's contention that the level of unemployment is the crucial variable in the determination of wage rate changes. He believes that profit rate may be taken as the explanatory variable in determining the rate of change of wages. He argues that wage rate is a function of profit rate which is linked with the prosperity of the industry, which, in turn, is assumed to be closely related to the trade union bargaining strength, thus relegating unemployment variable to the background.

Kaldor's hypothesis is tested empirically by R.G. Lipsey and N.D. Steur\(^3\) for the U.K. data for the period 1870-1958. As their results show a weak association between rate of change of wage rates on one hand and the level and rate of change of profits on the other, they reject Kaldor's hypothesis that the rate of change of profits explain wage changes better than level of unemployment.

Using the U.S. data for the period 1948-59, R.J. Bhatia\(^3\) finds that profit rate and rate of change in profit
rate are significant variables in explaining rate of change of wage rates. Further, he argues that for this period profit rate and its rate of change explain the rate of change of wage rates better than unemployment level and the rate of change in it. The former variables explain about 80 per cent of variance in rate of change of wage rates whereas the later variables explain only 22 per cent of rate of change of wage rates.

G.L. Perry who attempts to explain the rate of change of wage rates taking into account both excess demand and bargaining factors, uses unemployment as well as profit as explanatory variables. His model explains more than 85 per cent of the variation in the rate of change of wage rates, and all coefficients are statistically significant with appropriate signs. His study reveals that the trade-off relation between inflation and unemployment is more unfavourable the higher the rate of profit and the lower the rate of productivity increase. This is because wage changes are positively related to the rate of profit and price changes are assumed to be equal to wage changes minus changes in productivity. We shall consider this later while explaining price inflation and excess demand.

Change in Productivity

The inclusion of profit variable in the wage rate equation has been criticised by Edwin Kuh who advances
the hypothesis that changes in wage rates may be explained by rate of change of productivity. Kuh argues that businessmen may not be simply willing to grant higher wages when profits are high, for higher profits may be transitory in some cases while wages are sticky downward. Besides, he maintains that profits may be a proxy for the marginal value product of labour. Kuh's case for including marginal value productivity in determining the rate of change of wage rates may draw support from the classical employment theory, which argues that, in equilibrium, workers will be hired up to the point at which money wage rate equals the marginal value product of labour. This may be shown as:

\[
\frac{W}{P} = \frac{dX}{dN}
\]

where, \(X\) = total physical product

\(N\) = input of man hours.

We know that in the Cobb-Douglas production function, the average product \((X/N)\) is related to the marginal product of labour by a multiplicative constant 'a'; that is

\[
\frac{dX}{dN} = a \left(\frac{X}{N}\right).
\]

By substitution we get

\[
\frac{W}{P} = a \left(\frac{X}{N}\right)
\]

\[
W = aP \left(\frac{X}{N}\right)
\]

This equation explains that, in equilibrium, wages are equal to marginal value product of labour. Kuh claims
that even when level of unemployment is high, there can be a rise in rate of change of wages if the value productivity of labour is increasing. This may happen where either $P$ or $X$ rises at a faster rate than $M$.

**Trade Union Aggressiveness**

Trade union aggressiveness is also used as one of the explanatory variables in the wage rate equation by some writers on the subject. A.G. Hines argues that trade unions do affect the percentage change in money wage rates independently of the demand for labour. In his analysis, the rate of change of unionised labour force and, to a minor extent, the level of unionisation itself appear to be significant influences, with rate of change of prices as a further important element. Hines regards trade union "pushfulness" as a decisive influence that cannot be measured directly. He considers that a more militant attitude of the unions will normally be reflected in their drive for increasing the union membership. Thus, changes in the rate of labour force unionised may be a suitable proxy for the trade union aggressiveness. Hines' empirical work, using U.K. data for the period 1893-1961, shows that the rate of change of labour force unionised explains the rate of change of wage rates better than the level of unemployment and its rate of change in general and, in particular, for the inter-war period.

Thus, a number of studies emphasised the importance of the independent explanatory power of the variables like
profit, productivity and union aggressiveness apart from rate of change of prices. The central feature of these hypotheses is that excess demand can be better proxied by variables such as profit, productivity and trade union aggressiveness rather than by unemployment. But, in most of these studies, unemployment still remains as a variable in the explanation of wage inflation. All these models which we have mentioned above have been worked more or less within the same framework, except for inclusion of additional explanatory variables or substitution of some variables by others in the wage rate equation. As Leijonhufvud observes, the "hypotheses" tested seem all too often to be of the type: "it seems to suppose that by using variable 'x' as an additional or substitute independent variable a better regression result should be obtained." At a given level of unemployment, the higher the rate of profit or the productivity or the aggressiveness of the unions, the higher will be the rate of change of wages.

Thus, all these hypotheses accept that there is a trade-off between rate of change of wages and the level of unemployment. From this a relation between rate of inflation and level of unemployment can be deduced, since wages are the major component of costs and hence of prices. A generally followed method of price fixation is by adding a constant mark-up to cover over-head costs and a certain profit margin to the sum of prime unit costs. In certain models, this mark-up is related to actual costs (in some cases to normal costs).
Section V
ACCELERATION HYPOTHESIS

In Sections II and III we have seen Phillips curve approach to the explanation of inflation and the subsequent developments that have taken place, which include redefining the variables in wage rate equation or including some additional explanatory variables to the wage rate equation. It has been assumed in all the studies presented above that there exists a trade-off between the level of unemployment in an economy, and the rate of change of wage rates. However, to quote D.W. Laidler, "... nothing of basic importance was added by this literature to the fundamental contributions of Phillips and Lipsey." Thus, though some of the studies outlined in the previous section are able to explain the rate of change of wage rates with explanatory variables which seemed to have more influence than unemployment, e.g., trade union aggressiveness, profits, productivity, etc., they could not drop the unemployment variable from the wage rate equation. However, all these hypotheses are one in regard to the inverse relation between unemployment and rate of change of wages which the original Phillips version maintained.

A stable and inverse relation of the Phillips type implies that the authorities are free to choose from among the combinations of unemployment and inflation (rate of change of wage rates which may be substituted by rate of
change of prices) lying along the fitted Phillips curve. That is, the authorities can decide, whether the extent situation is acceptable, if not, what price has to be paid in terms of a rise in the inflation rate in the desired gain in the anticipated reduction in the level of unemployment.

This line of argument is in line with one strand of Keynesian argument which maintains that aggregate demand may be managed by governmental fiscal policies. Thus Phillips curve approach to controlling wage inflation through variations in the level of unemployment, which is the proxy for excess demand in the labour market, falls in line with Keynesian approach to controlling inflation by demand management policies.

The other line of Keynesian thinking, interpreting inflation, treats it as almost spontaneous, virtually independent of the level of unemployment and hence not induced by aggregate demand or contained by demand management policies. According to them inflation arises mainly because of changes in the wage rates and hence, they argue in favour of incomes policy, which according to them will control the source of inflation, i.e., rate of change of wages. This we shall see in the next section in a greater detail.

But this type of reasoning is not acceptable to Milton Friedman, who opines that Phillips curve is a transitory phenomenon, thus denying a trade-off between unemployment and inflation in the long-run. According to
Friedman the basic error in Phillips's analysis is the confusion between real and money wages. He argues that Phillips should have taken rate of change of real wage rates, i.e., the rate of change of money wage rates minus the anticipated rate of change of prices, on the vertical axis, since his (Phillips's) analysis is based on the classical demand and supply analysis according to which demand for and supply of labour varies with real wage rate. Hence, employment variations can be accomplished through variations in real wage rate. This relation between real wage rate changes and level of unemployment may be substantiated by Lipsey's contention that the speed of wage rate changes depends upon the extent of excess demand.

Friedman analyses the trade-off problem by introducing the concept of 'natural rate of unemployment' and expected rate of inflation. Friedman defines natural rate of unemployment as follows:

"At any moment of time, there is some level of unemployment which has the property that it is consistent with equilibrium in the structure of real wage rates.... The natural rate of unemployment, in other words, is the level that would be ground out by the Walrasian system of general equilibrium equations, provided there is embedded in them the actual structural characteristics of the labour and commodity markets, including market imperfections, stochastic variability
in demands and supplies, the cost of gathering information about job vacancies and labour availabilities, the costs of mobility and so on.  

The natural rate of unemployment is that proportion of the labour force which will remain unemployed even though the overall supply of labour has been brought into line with the demand for labour through variations in real wage rates. Thus, it may be taken as that unemployment rate which is consistent with the supply and demand equilibrium, in the labour market. Hence, it may be taken as equivalent to the level of unemployment '0a' which may exist due to frictions and imperfections in the labour market, as we have shown in Lipsey's analysis. (Fig. 8(d)). At point 'a' where the Phillips curve passes through the horizontal axis, rate of change of prices is assumed to be stable. Some positive rate of change of wage rates equal to the rate of labour productivity growth is compatible with the stable rate of inflation which is equal to zero. Hence, '0a' is natural rate of unemployment which may be regarded as the full employment level of unemployment.

The central feature of Friedman's argument is that, if the authorities want to maintain a level of unemployment either less than or greater than the natural rate of unemployment, they can achieve it only by an accelerated inflation or a continuous deflation. The above analysis which may be labelled as 'acceleration hypothesis' may be presented with the help of the figure given on page 61.
Figure 10: Short run - Long run Phillips Curves
In the figure, at point $U^*$, which denotes the natural rate of unemployment, there exists wage and price stability (rate of productivity increase is assumed to be zero or absent) at which actual and expected rates of inflation are equal. If the rate of change of prices is to remain stable, the authorities will have to maintain a rate of unemployment equal to $U^*$. On the other hand if the authorities think that at $U^*$, the cost of price stability in terms of unemployment is too high, they may prefer a level of unemployment which is less than $U^*$. Upto this point, the rate of inflation is stable i.e., actual and expected rates of inflation are the same, and is also expected to remain stable in the future.

But now, because the authorities desire to have a level of unemployment less than $U^*$, say 4 per cent, at a rate of inflation of 4 per cent per annum, there is positive inflation. Initially, according to Friedman, the authorities may be able to achieve this combination of unemployment and inflation. But the crucial point is if the authorities want to maintain 4 per cent level of unemployment indefinitely, the price they have to pay in terms of rate of inflation will mount cumulatively, since there will be a continual tendency for inflation to accelerate overtime, as long as there is divergence between expected and actual inflation rates.

This process may be explained as follows. A rise in the price inflation, and the rate of wages makes more workers who are frictionally unemployed, to accept employ-
ment in the false belief that their real incomes are also increasing at the same rate as the rise in money wage rates. This is because, they are still assuming that the rate of price change remains unchanged and a rise in money wage is synonymous to a rise in real wage. But there is no improvement in real wages, since inflation is also rising at the same rate as wages. This the employees will notice as the time passes and their living standards decline and, hence, bargain for higher money wages. Again, they assume the rate of inflation to be stable, i.e., they assume that inflation will get stabilised at a rate of 4 per cent per annum and accordingly settle wage agreements, with a 4 per cent increase in money wage rates. In these circumstances, the rate of inflation will rise to 8 per cent per annum, for the relevant trade-off will be one which corresponds to an expected rate of inflation of 4 per cent per annum. Once again, inflation will have been underestimated by employees by 4 per cent and once again there will be a tendency to revise expectations in an upward direction. Hence, if the authorities want to maintain an unemployment level of 4 per cent, they have to allow the rate of inflation to accelerate continuously. Thus, as long as there is a divergence between expected and actual rates of inflation, inflation rate will accelerate and the trade-off will shift in the north-east direction.

This process may be stopped, according to Friedman,
if the authorities abstain from meddling with the economy by varying aggregate demand in order to maintain a level of unemployment less than $U^*$, since the expected rate of inflation will tend toward actual rate of inflation and they will become equal at a level of unemployment characterised by $U^*$. Thus, if the economy is left free without government interference, the forces in the market will adjust themselves and settle down at $U^*$ with a constant rate of inflation, depending upon the initial expectations. In this way Friedman repudiates the existence of a long-run trade-off postulated by Phillips's hypothesis, which supports the Keynesian demand management policies to contain inflation. The long-run Phillips curve which is the locus of points at different constant rates of inflation, depending upon expectations at a level of unemployment $U^*$, will be a vertical straight line. Thus, in the long run there is no trade-off or natural unemployment rate is independent of the rate of inflation.

E.S. Phelps also expresses the same opinion i.e., in the long run, Phillips curve is a vertical straight line. He states, "... the persistent underestimation of price or wage increases which would result from an unemployment level consistently below the equilibrium rate would cause expectations continually to be revised upward so that the rate of inflation would gradually increase without limit; correspondingly an increase of the constant rate of inflation,
while buying a very low unemployment rate at first, would require a gradual rise of the unemployment rate toward the equilibrium rate as expectations of that inflation developed. Therefore, society cannot trade between steady unemployment and steady inflation, on this theory; it must eventually drive (or allow) the unemployment rate toward the equilibrium level or force it to fluctuate around that equilibrium level. 45

Monetarists believe that monetary policy is the most effective instrument to reduce inflation by controlling aggregate demand through variations in the stock of money. One group of Keynesians as also monetarists believe that the source of inflation is excessive aggregate demand in the economy, but differ in their policy prescriptions to fight inflation. Monetarists argue that as the natural rate of unemployment reflects the structural conditions of the labour market; it can not simply be reduced by policies of demand control. But, at the same time, the natural rate of unemployment is not an irreducible minimum; it may be brought down by improving the labour market conditions, e.g. better information about job vacancies and wages, on-the-job training etc. In a way, Friedman's attack on Phillips curve approach and his rejection of a long-run trade-off may be interpreted as his denial of the effectiveness of Keynesian demand management policies to control inflation.
Section VI
INCOMES POLICY AND INFLATION

Monetary and fiscal policies, it was maintained, attempts to control inflation by controlling aggregate demand. Here, mention may be made of another line of thinking which argues that inflation may be effectively brought under control by using prices and incomes policy, which according to its proponents aims at controlling wages and other incomes as well as prices.

Incomes policy is a broader concept which comprises not only a wage policy aimed at controlling the rate of increase of money wages, but also a policy for controlling rents, profits and dividends. Generally, incomes policy includes prices policy also, but here we are stating it separately to avoid ambiguity. Prices policy restrains, the rate of increase of prices.

A wages policy may not be acceptable to the employees, unless it is followed by a policy of controlling other incomes also. This is because it will lead to a redistribution of income in favour of rentiers and owners of means of production, and, if at the same time prices are not controlled, it will decrease the real wages of employees. Hence, incomes policy in the broader sense coupled with a price policy is favoured to cure inflation, like wage-price guide posts in U.S.A.
The main objective of incomes policy is to see that the rate of increase of wages does not exceed the rate of productivity rise in the economy which ensures price level stability. On the other hand, if the rate of change of wage rates exceeds the rate at which productivity is increasing, inflation will emerge.

The adherents of incomes policy believe that inflation should not be brought down by demand management policies, especially in situations with rising levels of unemployment and rising rates of inflation, which is characterised as 'new inflation' since it will further worsen the unemployment position. Incomes policy is favoured for combating inflation when real aggregate demand is below the supply potential of the economy as, in such a situation, the use of demand management policies will adversely affect output and employment.

Now, we shall examine the two ways in which incomes policy is considered an effective anti-inflationary measure.

Firstly, Sidney Weintraub in his wage-cost-mark-up equation explains that there exists a direct proportional relationship between the price level and wage changes.

The wage-cost-mark-up equation is as follows:

\[ P = \frac{KW}{A} \]

where \( P \) is the average price level, \( K \) is the average mark-up of price over unit labour costs, \( W \) is the average wage per
employee and $A$ is the average real output per employee. We know that

$$A = \frac{Q}{N}$$

where, $Q$ is total output and $N$ is total number of employees. Therefore,

$$P = \frac{KWN}{O}$$

or

$$PQ = KWN$$

or

$$K = \frac{PQ}{WN}$$

$K$ is assumed to be constant, and indeed referred to as 'magic' $K$, because of its relative constancy over long periods of time, in a number of different countries. Weintraub states "compared to the other 'great ratios' of economics, $K$ (or its reciprocal) has been most nearly constant; its sidewise trend is pronounced when measured against ratios of capital-output, capital-labour, the average propensity to consume or money velocity."47

When we examine the equation

$$P = \frac{KW}{A}$$

it is clear that money wage is the chief determinant of the price level, since $K$ is a constant, and $A$, which represents average productivity of labour, is nearly constant or changes rather very slowly. Therefore, every change in $W$ is reflected in a
proportionate change in \( P \). Thus, Weintraub argues that if rate of increase of wages exceeds the marginal productivity of workers inflation will arise; incomes policy accompanied by a price policy is the appropriate tool to fight inflation rather than monetary and fiscal policies. His argument is supported by his empirical studies. B.S.R. Rao states that, "Weintraub's theoretical formulation stands the empirical scrutiny well in a number of economies at different stages of economic development including India. It can also be mentioned that he applied his theory to the Indian data and found it to be satisfactory in explaining the price movements in the country."\(^4\)

The second approach to incomes policy as a measure against inflation, as mentioned earlier, follows from the Phillips curve hypothesis which posits, as described above, an inverse relation between level of unemployment and rate of change of wage. But to some of the economists the implied trade-off between them is only a short run phenomenon. In the long-run, they argue, employees anticipate the rate of inflation correctly and adjust accordingly their wage demands. Here comes the role of incomes policy in influencing the expectations of the public regarding the future rate of inflation and the authorities' determination to control it. In this way by restraining wages, incomes policy enables the authorities to choose relatively lower levels of unemployment, than those possible without such policy in operation. It is argued that
Phillips curve will be shifted downwards, in the periods when incomes policy is in operation, making the trade-off more favourable.

R.G. Lipsey and J.M. Parkin made an attempt to study the effectiveness of post-war incomes policy in the United Kingdom. They made a comparison of the wage and price equations in policy-on and policy-off periods. Policy-on periods are those in which some active form of incomes policy is in operation. Policy-off period is that in which there is no restraint on incomes or wages.

They argue that aggregate demand policies attempt to control inflation by controlling aggregate demand without changing the links by which aggregate demand affects prices. Here the link is like this: changes in aggregate demand cause changes in the level of unemployment; changes in level of unemployment cause changes in the rate of change of wage rates and this, in turn, will affect the rate of change of prices.

On the other hand, they contend that when the incomes policy is in operation (i.e. in policy-on periods) the above said link and consequently the trade-off between unemployment and inflation will be broken.

Lipsey and Parkin in their empirical testing of the model (with U.K. data) find that in the policy-on periods, the Phillips curve pivoted and intersected with the policy-off curve at a level of 1.8 per cent unemployment. They conclude that incomes policy generally reduces wage
inflation at low levels of unemployment and increase wage inflation at high levels of unemployment. On the effectiveness of incomes policy, empirically there is no conclusive proof. But the efficiency of incomes policy is questioned on two grounds.

(1) If, the public have confidence in the capacity of the authorities in bringing down inflation and accept the expediency of it, then they may accept any other policy measure to contain inflation, and extend their cooperation.

(2) If incomes policy is in operation and puts a restraint on rate of wage increases by influencing expectations regarding future rate of inflation, then in policy-off periods, i.e., in periods when the incomes policy is dispensed with, the employees would revise their expectations upward and bargain for higher wage changes. In this view incomes policy is only temporarily effective in reducing inflation.

Jim Taylor states that "when an alternative method of measuring the effectiveness of income policy on restraining wage inflation was used, incomes policy appears to have had only temporary success. Hard won gains have been quickly lost when the brakes have been released." This does mean that, if inflation can be kept under control only as long as incomes policy is in operation then, in effect, one is advocating a permanent price-incomes policy.
Section VII
CONCLUDING COMMENTS

Unemployment and inflation, the two major problems of any economy, have been assuming significant dimensions. A.W. Phillips presents them as conflicting goals, i.e., the authorities are placed between the devil and the deep sea, being unable to reduce one of them without having much of the other. However, Phillips states that his conclusions are 'tentative' and invites for more detailed research to explore the relations between unemployment, wage rates and productivity rates. Many writers responded to this, some of them supporting and some rejecting the 'trade-off' hypothesis, as presented in this survey.

The protagonists of the 'trade-off' differ in their opinions on matters regarding the policy prescription to control inflation. One group argues in favour of fiscal measures, and another incomes policy. However, writers like Steinitz are not happy with this explanation. He feels that Keynes's primary concern was solving the problem of unemployment and therefore curing inflation with 'a rise' in unemployment is not at all a Keynesian solution to inflation. He favours prices and incomes policy as a counter-inflationary measure, based on grounds discussed earlier.

On the other hand, writers like Friedman and Phelps argue that in the long-run there is no 'trade-off' at all, and the Phillips curve will be a vertical straight line.
Their argument is based on the belief that in the long-run price expectations will be fully realised, i.e., employees will be able to anticipate future rate of inflation perfectly and incorporate it into their wage agreements.

To summarise, one branch of Keynesians provides an explanation of controlling inflation by moving along the Phillips curve; this completely ignores expectations about the future rate of inflation. Another group of Keynesians favours prices and incomes policy which, according to them, shifts the curve in anti-clockwise direction flattening it in the process. Monetarists and writers like Phelps by introducing expectations, make the curve a vertical straight line.

However, in a world of reality expected and actual rates of inflation may not be equal; if we were to accept that people tend to underestimate the rate of inflation in the initial stages, it may not be wrong to say that some fraction of them may go on doing the same. If this were to happen, then there always exists some trade-off between unemployment and inflation.

Incomes policies have been in operation for short periods and the empirical evidence on its impact shows that on some occasions they produced a 'substantial effect' while at other times they could achieve a 'partial success'. Hence, we conclude that the evidence on the effectiveness of income policy is a mixed one.
Therefore, further research work needs to be done to explore how expectations are formed, their impact on wage rate changes and effectiveness of incomes policy in influencing expectations. This will throw light upon whether there exists a 'trade-off' between inflation and unemployment as hypothesised by A.W. Phillips, and whether such a trade-off is permanent or only transitory.
NOTES AND REFERENCES

1. The Ikeda government in Japan, for example relied on wholesale price indexes to show that the rapid growth of 1960-62 was not inflationary, while the opposition relied on consumer price indexes and national income deflators to show the reverse.


7. Even during the German hyperinflation in which velocity of money reached the peak level, money stock was not constant.

8. Phillips, A. W., "The Relation Between Unemployment and

9. Rate of Change of wages is calculated by taking the first central difference, i.e., \[ \dot{W} = \frac{W_t + 1 - W_{t-1}}{2W_t} \] x 100.

To calculate the rate of change of wages in year 1900 is equal to \[ \frac{\text{Wages in 1901} - \text{Wages in 1899}}{2(\text{Wages in 1900})} \] x 100.


14. Rate of change of prices influence the wage bargain only when the real wage would otherwise fall.


19. This may be defined as the amount of unemployment that exists at all times because of imperfections in the working of the labour market, e.g., dearth of information and costs of moving from one occupation or industry to another occupation or industry.


26. Taylor J. argues in favour of average hourly earnings index correlated for overtime, whereas Bhatia, R.J. shows that a comparison of the two series of the data of earnings, one excluding overtime payments and the other including overtime payments, shows that they move very closely together with a very small difference between them.


28. During 1916-19 the average annual rate in consumer prices was about 14 per cent and hence the period 1915-20 was omitted since the rate of change in one year expressed as the first central difference is related to the difference between indices of the subsequent and preceding years.

29. One explanation for the linear shape of the Phillips curve in the U.S. is that there are hardly any observations in the 0-3 percentage range of unemployment. Another explanation is money earnings are flexible downwards whereas money wages are rigid downwards.


34. For further discussion, see Phelps, E.S., "Money Wage Dynamics and Labour Market Equilibrium, in Phelps, E.S., (ed.), *Op.cit.* pp. 124-166


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