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AN INVESTIGATION INTO THE STABILITY
OF THE PHILLIPS CURVE FOR THE UNITED
KINGDOM IN THE PERIOD 1950-70.

N.H. Lighting

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ABSTRACT

An Investigation into the Stability of The Phillips Curve For The United Kingdom In the Period 1950-70

by N H Lighting

The study begins with a survey of some of the theoretical work on the wage-change equation, followed by a complementary summary of some of the empirical evidence on the determinants of wage inflation in the United Kingdom for the post war sample period. Estimates are then presented of the wage-change equation for the United Kingdom for the chosen (1950-70) sample period, using annual data, in order to explore the sensitivity of the results to the use of alternative wage-rate and unemployment series, and to the use of alternative definitions of the time rate of change variables.

The main enquiry of the study centres on the use of the unemployment rate as an efficient proxy for the degree of excess demand for labour in the theory of the Phillips curve. It is possible that the observed instability of the curve may reflect the fact that the reported unemployment rate has become increasingly inefficient as such a proxy. An important source of error in the reported unemployment statistics is due to the non-registration by 'secondary' workers in the labour force. Estimates are presented of some 'adjusted' unemployment series which take into account the cyclical nature of this non-registration and which are worked up from an analysis of participation rates in the United Kingdom. These estimates are carried over into an analysis of the 'mapping' from excess demand to unemployment where the objective is to identify and measure changes in the level of 'maladjustment' unemployment (the level associated with zero aggregate excess demand for labour).

Estimates are obtained of maladjustment unemployment, and these are

used to further correct the unemployment statistics for changes in 'maladjustment' unemployment. Finally this corrected unemployment series is incorporated in the aggregate wage-change equation to re-examine the statistical significance of the Phillips relation.

I N T R O D U C T I O N

In 1958 Phillips (54) published an article in which he hypothesised "that the rate of change of money wage-rates in the United Kingdom can be explained by the level of unemployment, and the rate of change of unemployment, except in or immediately after those years in which there was a very rapid rise in import prices" (P.284). He examined the relevant data for the United Kingdom for the period 1861-1957, and concluded that the evidence seemed in general to support the hypothesis. In particular, he estimated the relationship between the percentage rate of wage inflation and the level of unemployment for the period 1861-1913, and concluded that it appeared to have been stable over the entire sample period of 96 years. Subsequently this relationship has been popularised as 'the Phillips curve', and has attracted a good deal of attention, partly because of the implications it has for macro economic policy.

The Phillips curve appears to demonstrate that the policy goals of 'full' employment and price stability are incompatible, given the assumption of a 'simple' monotonic relationship between the rate of increase of prices and the rate of increase of money wage-rates. It shows the possibility of 'trading' lower levels of unemployment against higher rates of price inflation, and the non-linearity of the relationship emphasises that the terms of such a trade-off worsen as the level of unemployment falls. In particular, at low levels of unemployment, further decreases can only be 'bought' at the expense of accelerating rates of inflation, and it is within this range of unemployment values

that any government which attaches great weight to the 'full' employment goal will be operating. The apparent stability of the relationship over the long sample period 1861-1957 seemed also to suggest that the Phillips curve could be viewed as a stable 'policy frontier'.

Since the publication of the original study, theoretical and empirical work on the relationship has proceeded apace, and it is not too unfair to say that the validity of the original hypothesis and the conclusions on the stability of the measured relationship and the derived policy implications have all been disputed, and at the very least, amended. In Chapter I we present a survey of some of the theoretical work on the wage-change equation (which is defined as the equation which has the aggregate rate of change of money wage-rates as the dependent variable). The fully specified conventional excess demand model of the Phillips curve is presented, in which the level of unemployment appears as only one, and not necessarily the most important, of the determinants of the rate of wage-inflation. Some alternative derivations of the aggregate wage-change/unemployment relationship are discussed, and the Chapter concludes with a review of the union militancy explanation of wage inflation. Chapter II complements Chapter I in that it presents a summary of some of the empirical evidence on the determinants of wage inflation in the United Kingdom. For the post-war sample period this evidence fairly clearly suggests that the unemployment rate has not been a principal determinant of the rate of wage inflation; on some views the unemployment rate makes no statistically significant contribution to the

explanation of wage inflation. It appears that changes in expectations of price inflation, and changes in the measured dispersion of unemployment have come to dominate the underlying Phillips curve relationship, or that the relationship itself has ceased to hold. This latter view sees changes in trade union militancy as the major determinant of wage-inflation.

However, consistent comparisons of the empirical evidence from different studies is upset to some degree by the use of different data series from different sample periods in those studies. Chapter III presents estimates of the wage-change equation using annual data for the sample period 1950-70. It investigates the sensitivity of the results to the use of alternative wage-rate and unemployment series, and to the use of alternative definitions of the time rate of change variables, in the wage-change equation. We find that the use of hourly wage-rates, rather than weekly wage-rates, always adds to the explanatory power of the wage-change equation. A similar result follows if the dependent variable is defined by first central differences rather than (simple) percentage differences. In the fully specified wage-change equation we find that the unemployment rate, when entered non-linearly, has a weak explanatory role, and that the dominant explanatory variable appears to be the Hines proxy variable for trade union militancy.

Chapters IV and V are devoted to the main area of enquiry in this study. This centres on the use of the unemployment rate as an index of the degree of excess demand for labour in the Phillips curve. It is well-known that the reported

unemployment rate is not an accurate measure of the numbers unemployed in the economy, and as such that it may not be an efficient proxy for the degree of excess demand for labour. It is possible that the observed instability of the Phillips curve may reflect not the insignificance of the relationship itself but the fact that, especially in the post war sample period, the reported unemployment rate has increasingly misrepresented the 'true' unemployment rate. Thus, if it is possible to 'correct' the reported unemployment rate for this mis-statement of the 'true' rate, then it may be that the wage-change/unemployment rate will re-emerge.

An important source of error in the reported unemployment statistics is due to non-registration by 'secondary' workers in the labour force. In Chapter IV we present estimates of some 'adjusted' unemployment series which take into account the cyclical nature of this non-registration, and which are worked up from an analysis of aggregate participation rates in the United Kingdom and Great Britain. These estimates are carried over into Chapter V which concentrates on an analysis of the 'mapping' from excess demand to unemployment in the theory of the Phillips curve. The main objective in this chapter is to identify and measure any changes over the sample period 1950-70 in the level of unemployment associated with zero aggregate excess demand for labour, (the level of 'maladjustment' unemployment). Estimates are obtained of 'maladjustment' unemployment, and these are used to further correct the unemployment statistics for changes in 'maladjustment' unemployment. This yields an unemployment

series which, in the context of the theory of the Phillips curve, corresponds to a stable mapping relation over the sample period 1950-70.

However, when these are incorporated in the aggregate wage-change equation we can find no statistically significant role for the unemployment variable. Estimates of the excess demand/unemployment and wage-change/excess demand relationships strongly suggest that the observed instability of the Phillips curve does not arise from instability in the mapping relation. Whereas the latter relation seems statistically well-determined over the period 1950-70, we do not find that the measured excess demand for labour makes any statistically significant contribution to the explanation of money wage-rate inflation.

I THE DEVELOPMENT OF THE THEORY
OF THE PHILLIPS CURVE

INTRODUCTION

This chapter presents a survey of some of the theoretical work on the wage-change equation. It is organised so that the relationships between the rate of change of money wage-rates and various explanatory variables are separately discussed. The following notation is introduced at this point:

(\dot{W}/W) is some measure of the percentage rate of change of aggregate money wage-rates.

(U) is the aggregate number of unemployed workers. It is usually expressed as a proportion of the labour force (L) .

(\dot{U}/U) is the percentage rate of change of the aggregate unemployment rate.

(\dot{P}/P) is some measure of the percentage rate of change of the aggregate price-level. Where it appears superscripted by an asterisk it refers to the anticipated or expected value of this variable.

(T) is the percentage of the labour force that is unionised.

(\dot{T}/T) is the rate of change of the percentage of the labour force that is unionised. It is usually measured as an absolute change.

It is as well to point out that this survey is not comprehensive. In particular we have excluded from our brief, discussions on the role and effectiveness of incomes policies, and on the study of the phenomenon of 'wage drift'.

Our objective has been to present a survey covering the main areas of theoretical analysis of the determination of the rate of change of money wage-rates.

I The Relationship Between \dot{W}/W and (U/L)

The basis of Phillips' hypothesis is that the rate of change of the price of any commodity is determined by the degree of excess demand that exists for that commodity, and that the rate of change will be greater, the greater is the degree of excess demand. In the labour market the commodity concerned is labour services, and the price is the money wage-rate, so that we should expect to see a relationship between the rate of change of money wage-rates, and the degree of excess demand for labour. Phillips thought that this relationship would be highly non-linear. For positive values of the excess demand for labour he expected that the rate of increase in money wage-rates would be higher, the higher the level of excess demand for labour, viz. "When the demand for labour is high and there are very few unemployed we should expect employers to bid wage-rates up quite rapidly, each firm and each industry being continually tempted to offer a little above the prevailing rates to attract the most suitable labour from other firms and industries" (P.283). But when there was excess supply of labour he anticipated some downward inflexibility in money wage-rates, "..... it appears that workers are reluctant to offer their services at less than the prevailing rates when the demand for labour is low and unemployment is high, so that wage-rates fall only very slowly" (P.283). Since high levels of excess demand for labour are associated with low unemployment, and low levels of excess demand for labour with high unemployment, then the relationship between \dot{W}/W and (U/L) would also be highly non-linear.

Any discussion of the theory that was first put forward to account for the $(\dot{W}/W)/(U/L)$ relationship has to simultaneously embrace the work of Lipsey (41). Indeed, the version of that theory which has become in the nature of 'accepted doctrine' is largely the work of Lipsey. This is because Phillips' seminal article was mainly empirical, and did not precisely specify a theoretical framework within which the forms of the relationships he discussed were set out. As a result the theoretical content of Phillips' article is capable of differing interpretations, and of interpretation at different levels. The main hypothesis, that which accounts for the Phillips curve, has been seen as apparently 'self-evident' since "when an economy is booming, 'obviously' wages rise faster than they rise during a slump".¹ But, at a different level, it is apparent that two relationships form the heart of the Phillips hypothesis. These are the relationship between the rate of change of money wage-rates and the level of excess demand for labour, and that between the level of excess demand for labour and the level of unemployment. The former is the fundamental behavioural hypothesis, which concerns the determinants of the time rate of change of money wage-rates in disequilibrium situations. The latter is in the nature of a transform between two magnitudes, one of which, the level of excess demand for labour, was not directly observable throughout the long sample period chosen by Phillips. As we shall subsequently explain, the level of excess demand for labour is in principle observable given the existence of the appropriate unemployment and vacancy statistics. It was

1 A. Marin "The Phillips Curve (Born 1958-Died?)" (P.28)
THREE BANKS REVIEW Dec. 1972.

the unavailability of the appropriate vacancy statistics which led Phillips to the choice of the unemployment rate as a proxy for the level of excess demand for labour. Differences in the interpretation of Phillips' statement of his main hypothesis are possible because that statement does not contain the precise form of these two relationships. He argued that the $(\dot{W}/W)/(U/L)$ relationship would be highly non-linear and we have suggested above that this non-linearity derives at least from the non-linearity of the relationship between (\dot{W}/W) and the level of excess demand for labour. As we shall now see Lipsey's more formal model explains the non-linearity of the Phillips curve in terms of a non-linear relationship between the level of excess demand for labour and unemployment. Our interpretation does not deny this. We have taken Phillips' own statement that when the demand for labour is low wage rates will fall only very slowly, to be a statement about downward inflexibility in money wage-rates with respect to the level of excess demand for labour.

The model that Lipsey put forward to account for the relationships we have mentioned begins with an individual perfectly competitive labour market where the equilibrium level of the money wage-rate (not the real wage-rate) is determined at the point of intersection of 'normally' sloped labour demand and supply curves. The greater the divergence of the actual money wage-rate from its equilibrium level, then the greater is the (positive or negative) level of excess demand for labour associated with that money wage-rate. A method of adjustment is usually specified whereby, for positive levels of excess demand for labour, the quantity of labour services actually employed is given along the supply curve, while for

negative levels of excess demand for labour, this quantity is determined along the demand curve. Lipsey now introduced an hypothesis about the dynamic behaviour of money wage-rates which is the point at which the Phillips' analysis begins. This hypothesis says that "the speed at which wages change depends on the excess demand as a proportion of the labour force" (P.13). A simple linear proportional form of this relationship is assumed since this is ".... capable of explaining the observed phenomenon and, in the absence of empirical evidence about the second derivative of \dot{W} , the simpler relationship is assumed". (P.13 Footnote 3).¹ We can now specify the relationship between the rate of change of the money wage-rate in the individual or micro labour market and the level of (proportional) excess demand for labour in that labour market (this is subsequently referred to as the reaction function).

$$(\dot{W}/W)_i = \lambda X_i$$

where

$\lambda > 0$ and is constant

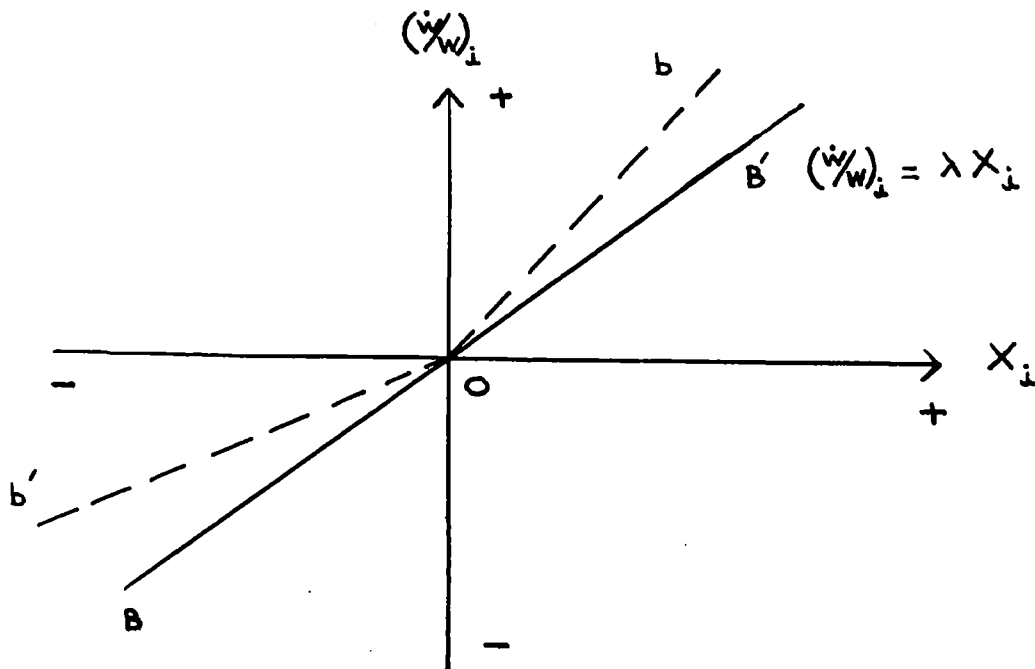
$(\dot{W}/W)_i$ is some measure of the proportional rate of change of money wage-rates in the i'th micro labour market

X_i is the level of (proportional) excess demand in the i'th micro labour market.

1 Whereas we have suggested above that Phillips own statement of his hypothesis can be interpreted as suggesting a non-linear form of this relationship due to downward inflexibility of money wage-rates. (\dot{W} is the Lipsey notation of the rate of change of the money wage rate in the individual labour market).

The level of excess demand for labour associated with any given money wage-rate is the quantity of labour services demanded minus the quantity supplied at that wage-rate. In the context of a single micro labour market this absolute measure of excess demand for labour is adequate. For the purposes of this hypothesis the level of excess demand for labour is expressed in proportional terms (as a proportion of the quantity of labour services supplied at the given money wage-rate), which allows us to make inter micro-market comparisons which take into account the different sizes of such markets. The reaction function is illustrated in Figure I.1 as BOB'.

Figure I.1 - The Reaction Function



The theory of the perfectly competitive labour market, which is the starting point of the Lipsey model, draws attention to those (demand and supply) factors which determine the equilibrium wage-rate in the market. As it is generally

presented it is a 'comparative static' theory which therefore contains no information on the dynamic behaviour of the endogenous variable in disequilibrium situations. An additional assumption is required if a theory about what determines the equilibrium wage-rate in a market, and why it changes, is also to explain what determines the time rate of change of the wage-rate. The Phillips hypothesis provides this additional information, and specifies the level of excess demand for labour as the relevant determinant of $(\dot{W}/W)_t$. Given the adjustment process specified above, all movements of the wage-rate in the labour market must be equilibrating. This means that any disturbance to an equilibrium position leads to a rate of change in the wage rate which becomes progressively lower following the disturbance (and assuming no further 'demand' or 'supply' disturbances) and one which 'dies' to zero as the new market clearing equilibrium wage-rate is approached.¹ Additional disturbances would interrupt adjustment towards this equilibrium, and set off adjustments towards different equilibria as defined by the changing demand and supply conditions in the market. From this it follows that an accelerating rate of change of the wage-rate in such a market is evidence that shifting demand and/or supply curves are increasing disequilibrium levels of positive excess demand. It also follows that the wage-rate only falls if there is negative excess demand (excess supply) in the market. Our remarks here apply to the rate of change of the real wage-rate, or the money wage-rate if, as Lipsey seems to have implicitly

1 We assume here that the adjustment process in the market is stable in the sense that it converges towards equilibrium values of the variables.

assumed, the price-level is constant. However, it is not necessary to put the Phillips hypothesis in the context of this perfectly competitive labour market. As Phillips stated it, the hypothesis can be seen independently of this theoretical framework merely as a dynamic theory about the determination of the rate of change of money wage-rates.

The reaction function is the first of the two relationships which essentially define the theory of the Phillips curve. The second relationship, which we shall call the 'mapping relation' from excess demand to unemployment, really only arises because the level of excess demand for labour is not directly observable over the long sample-period of Phillips study. It is in principle an observable quantity. Dow and Dicks-Mireaux (16) have shown that the statistics of unemployment and unfilled vacancies can be used to derive an index of demand for labour which they claim is a reliable ordinal indicator of the pressure of demand for labour but for various reasons is less reliable as a cardinal indicator. A direct measure of the level of excess demand for labour in a labour market is

$$X_i = (V_i - U_i)/L_i$$

where the i subscript means all variables are measured over a single micro labour market,

U is the number of unemployed workers

V is the number of job vacancies

L is the size of the labour force.

This follows from the definition of the (proportional) level of excess demand for labour as

$$X_i = (N_{D_i} - N_{S_i}) / N_{S_i}$$

$$\text{and } N_D = E + V$$

$$N_S = E + U$$

where N_D is the demand for labour

N_S is the supply for labour

E is the number of employed workers.

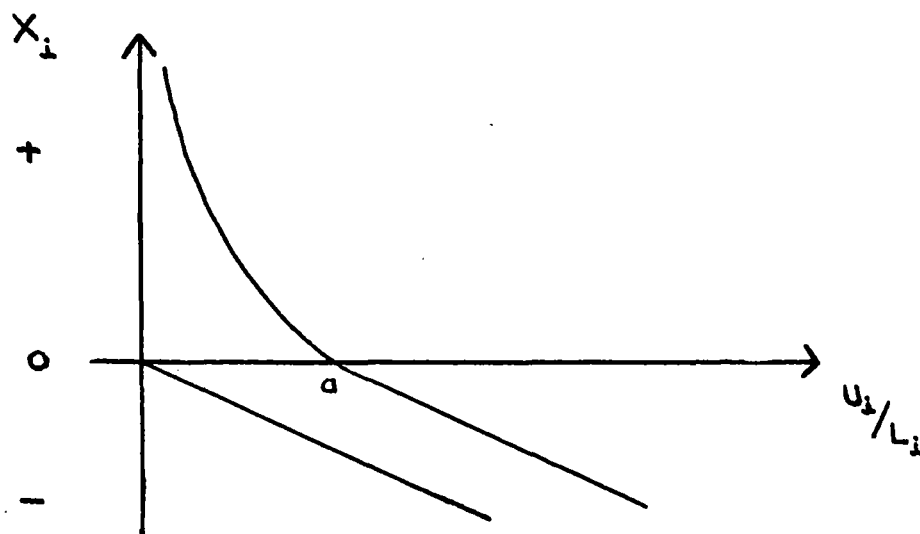
However, since statistics of job vacancies are not available for most of the sample period under consideration by Phillips and Lipsey, then it was not possible for them to construct an index of demand for labour along the lines suggested by Dow and Dicks-Mireaux, or to measure excess demand for labour directly as specified above. It was necessary therefore to relate excess demand to something that was directly observable over the whole sample period, and whose variations accurately reflected the variations in the level of excess demand for labour. Phillips indicated that the level of unemployment might be a suitable proxy to use, although he did not specify the form of the relationship between the level of excess demand for labour and the level of unemployment.

Lipsey suggested that this mapping relation is negative and non-linear, as we illustrate in Figure I.2 below.

Symbolically, we can represent this relationship as

$$X_i = \phi(U_i/L_i)$$

$$\left| \begin{array}{ll} \text{As } X_i \rightarrow \infty, & U_i \rightarrow 0 \\ \text{As } X_i \rightarrow 0, & U_i \rightarrow a \quad (a > 0) \end{array} \right.$$

Figure I.2 - The Mapping Relation

Lipsey explained the form of this relationship in the following manner. When the level of excess demand is zero the demand for, and supply of, labour are by definition equal but this does not mean that unemployment will be zero. Zero excess demand is accompanied by the positive level of frictional unemployment $0a$, and an equal level of frictional vacancies; where frictional unemployment arises because some workers will be changing jobs and job changing cannot be an instantaneous transaction. The effect of labour market frictions is thus to keep open job vacancies and prolong the waiting period of the 'between jobs' unemployed worker. The next assumption is that as X_i takes on larger positive values the time taken to move between jobs falls so that ceteris paribus (a constant proportion of those employed are assumed to leave employment per time period) an increase in excess demand will cause a reduction in the level of unemployment. Since the level of unemployment is bounded at zero, then as $X_i \rightarrow \infty$, $U_i \rightarrow 0$ asymptotically. This means that, as the level of excess demand for labour increases (for $X_i > 0$), the

level of unemployment becomes decreasingly sensitive to such increases below the point oa . For negative values of X_1 Lipsey assumes that ".... Any increase in excess supply brings an equal increase in the number of persons unemployed. Therefore to the right of point oa , there will be a linear relationship between X_1 and U_1 " (P.15). This implies a unit proportional relationship between X_1 and U_1 , and between X_1 and (U_1/L_1) when L_1 is constant. For values of $U_1 > oa$ the mapping relation therefore becomes a line at 45° to the horizontal below the unemployment axis in Figure I.2 when equal scales are plotted along the axes. However, in a footnote, Lipsey suggests two reasons why the mapping relation might in fact show a slight curvature over this range of values of X_1 and (U_1/L_1) . In the first place, the unemployment rate has a limiting value of - 100%, when the entire labour force is unemployed. If we may presume in this unlikely situation that frictional unemployment and vacancies have declined to zero, then it must also be the case that excess demand for labour as defined above (P.8) has a limiting value of - 100%. Therefore the mapping relation might appear slightly concave when viewed from below for values of $X_1 < 0$ (ie. $d^2 X_1 / d(U_1/L_1)^2 < 0$)

On the other hand it may well be that, for various reasons, some people who become unemployed drop out of the recorded labour force when $X_1 < 0$. If this is so then the reported unemployment rate will not "increase as fast as real excess supply" as Lipsey puts it. Once more the mapping relation would appear slightly concave when viewed from below over this range of values of X_1 . However, this argument implies that we are unable to record the 'true' level of unemployment on one axis and are simultaneously able to record the 'true' level

of excess demand on the other axis. Since our measurements of excess demand are based upon our measurements of unemployment (and vacancies)¹ then the error in the measurement of unemployment must be carried over into the measurement of excess demand. This point is taken up in a subsequent chapter (Chapter IV) where we argue that non-registration by some unemployed workers leads us to observe a mapping relation which is convex from below for values of X_i

We are now in a position to derive the Phillips curve relationship at the micro level. This is obtained by combining the reaction function and mapping relation to yield a relationship in terms of observable variables for the sample period 1861-1957 ie:

$$(\dot{W}/W)_i = \lambda \left[\theta (U_i/L_i) \right]$$

This micro Phillips curve will be identical to the mapping relation in Figure I.2 when $(\dot{W}/W)_i$ is plotted on the vertical axis instead of X_i . The theory thus predicts that, if we can identify individual labour markets from the available data, then we should observe corresponding micro Phillips curves in the relevant data. Data on wage-rates and unemployment rates offer disaggregation into industry or regional groupings, so that to the extent that such groups correspond to individual micro labour markets then we might expect to observe Phillips curves for each of these markets. In order to generate observations on (\dot{W}/W) and (U/L) it is now necessary to aggregate over individual labour markets.

1 Measures of excess demand could be derived from estimates of labour demand and supply schedules, in which case the mapping relation becomes redundant.

Lipsey assumes that all micro labour markets have identical micro Phillips curves, and that the main effects of the aggregation procedure can be illustrated by considering a 'simple' economy consisting of only two micro labour markets α and β . If the labour force is divided equally between each market then we shall have,

$$(U/L) = (U/L)_{\alpha} + (U/L)_{\beta} / 2 \text{ and } (\dot{W}/W) = (\dot{W}/W)_{\alpha} + (\dot{W}/W)_{\beta} / 2$$

Assuming that this distribution of the labour force between micro labour markets remains unchanged, and that the unemployment rates in each market are always identical, then it follows that $(U/L) = (U/L)_{\alpha} = (U/L)_{\beta}$. Given that the micro Phillips curves are assumed identical it further follows that $(\dot{W}/W) = (\dot{W}/W)_{\alpha} = (\dot{W}/W)_{\beta}$. Varying the aggregate level of unemployment under these conditions means that the relation between (\dot{W}/W) and (U/L) , the aggregate Phillips curve, would coincide with the identical micro Phillips curves in each micro labour market. This result does depend on a rather restrictive set of assumptions, and, as we shall see, later contributors have examined the necessary conditions to produce the result in the next stage of Lipsey's aggregation argument which has become known as the dispersion hypothesis. Lipsey now assumes that aggregate unemployment is held constant at the level $o\alpha$ (where aggregate excess demand is zero), while the distribution of this unemployment between the two markets is altered: say $(U/L)_{\alpha}$ is reduced, and $(U/L)_{\beta}$ is increased. Because of the non-linearity in the identical micro Phillips curves, wage-rates will rise faster in market α than they fall in market β , so that (\dot{W}/W) increases. Hence the aggregate rate of change of money wage-rates will increase at $(U/L) = o\alpha$, as the distribution of unemployment associated with $(U/L) = o\alpha$ is increased. This follows because at least one micro labour

market has positive excess demand for labour so that adjustment is occurring along the non-linear section of the micro Phillips curve. It will be recalled that Lipsey assumed that the mapping relation from X_i to $(U/L)_i$ is a unit proportional linear relation for values of $X_i < 0$.¹ Thus, if all micro labour markets are in excess supply (U/L) , $(U/L)_\alpha$, $(U/L)_\beta < 0$, and remain in excess supply as the distribution of unemployment (which we shall notate as σ_u^2) is widened, then the change in wage-rate changes in market α will be just offset by the change in wage-rate changes in market β . As a result (\dot{W}/W) remains the same, and there is no displacement above the linear section of the micro Phillips curve.

The aggregate Phillips curve is therefore a 'statistical curve' in the sense that the observations that are generated to produce it depend on the variation of (U/L) and σ_u^2 as of the structural micro relations between $(\dot{W}/W)_i$ and $(U/L)_i$. The aggregate curve is restricted in its location with respect to the (identical) micro curves. It can never lie below the micro curve, and will coincide with it only if there is an identical percentage of the labour force unemployed in each market at all levels of unemployment. This means that the dispersion of unemployment is zero and constant. Variations in this dispersion, combined with excess demand in at least one micro market will cause the aggregate curve to be displaced above the identical micro curves, the degree of upward

1 Although, as we mentioned above, he did suggest reasons why there might be some slight curvature over this range of values of X_i . He justifies the assumed linear form on the grounds that there was no empirical evidence favouring any one of the rival hypotheses as to the shape of the curve. He also argued that empirically the degree of curvature is too slight to be picked up by the usual curve fitting techniques given the 'crudity' of the data.

displacement varying directly with the extent of the dispersion of aggregate unemployment over the micro labour markets (this is the dispersion hypothesis). The Lipsey theory of the Phillips curve therefore predicts the following aggregate relationship

$$\dot{w}/w = F \left[(U/L), \sigma_u^2 \right] \quad \left| \begin{array}{l} F'_{(U/L)} < 0, F''_{(U/L)} > 0 \\ F'_{\sigma_u^2} > 0 \end{array} \right.$$

This aggregate wage-change relationship includes as an explanatory variable some measure of the dispersion of unemployment over 'true' micro labour markets. This is not a variable whose influence Phillips had specifically considered¹ and this is mainly because Phillips did not specifically consider the process of aggregation over individual labour markets. The inclusion of the σ_u^2 variable does though mean that the average degree of dispersion of unemployment over micro labour markets over time, is a factor which can influence the structural stability of an empirically estimated aggregate Phillips curve.

In spite of the fact that the Lipsey theory of the Phillips curve is clearly specified from the micro level, the reaction function and mapping relation, and their combination to yield the Phillips curve relationship, have been freely interpreted as macro relationships. On this view we should therefore expect to observe the 'aggregate' relationships

1 Although in his study of the sample sub-period 1913-48 Phillips mentions "The extremely uneven geographical distribution of unemployment may also have been a factor tending to increase the rapidity of wage-changes during the upswing of business activity between 1934 and 1937" (ibid P.295), he does not specify why this factor should operate in the way he suggests.

between (\dot{W}/W) and X , and X and (U/L) , yielding us the negative and non-linear aggregate Phillips curve as a structural relation with no place for the dispersion variable σ_u^2 . One possibility is that, as Perry (50) notes "the problem may be intrinsically a macro economic one in the sense that the appropriate variables to explain changes in the general wage-level may be aggregate ones, with any hypotheses about behavioural underpinnings at a micro economic level affording no additional information" (P.23-24). If we accept this point then, to the extent that we are only interested in explaining aggregate wage changes, disaggregation is interesting but not helpful. However, it does not seem to be the case that the factors mentioned by Phillips are by their nature aggregates, and are therefore not to be seen at the micro level; and we have seen that the micro economic foundation of Lipsey's model throws up the dispersion variable σ_u^2 as an additional determinant of (\dot{W}/W) . This means that, in the context of the Lipsey model, the aggregate Phillips curve is a statistical and not a structural relation. The structural relation we expect to be negative and non-linear, while the statistical relation will show "the average relationship between $((\dot{W}/W)$ and $(U/L))$ given the average degree of inequality in the distribution of unemployment between markets, and therefore it cannot be interpreted in the same way as the Phillips curve".¹ Moreover, as Hines (27) has further pointed out, even if all micro Phillips curves are non-linear then it does not necessarily follow that the aggregate Phillips curve will be non-linear in the Lipsey model.

1 A.G.Hines (27) P.62

We have now described the theory of the Phillips curve as it was originally stated by Phillips and Lipsey. We have seen that in essence it consists simply of the reaction function and mapping relation combined together to yield the Phillips curve relationship between (\dot{W}/W) and (U/L) . Subsequent developments have usually focused on one or other of these relationships (in the main the mapping relation) and will be discussed on this basis.

As regards the reaction function between (\dot{W}/W) and X , Phillips emphasised the chain of causation as running from excess demand for labour to wage-changes, and clearly interpreted this as evidence of 'demand pull' inflation.¹ However excess demand in the labour market can arise as a result of shifts in either the demand or supply curves, or as a result of simultaneous shifts in both curves. Phillips' interpretation of his hypothesis as a 'demand pull' explanation of wage inflation is only correct if the supply curve in the labour market is known to have been stable. Equally consistent with the Phillips hypothesis is a situation where wage-rates are rising in response to an excess demand for labour situation which is the result of trade union-induced shifts in the supply curve; a situation which might properly be labelled as a 'cost-push' explanation of wage inflation. The reaction function formulation does not enable us to identify the source or impulse factor of the inflationary process. Hines (28) has suggested a re-specification of the model in terms of the

1 Phillips used his estimated wage-change equation to predict changes in wages for the years 1948-57 and interpreted these predictions as representing the 'demand pull' element in wage adjustments. (See Phillips *ibid* P.298)

parameters of shift of the labour demand and supply curves, as opposed to the usual excess demand presentation. The perfectly competitive labour market is specified as below

$$N_D = f \left(\frac{W}{P} Y \right)$$

$$N_S = g \left(\frac{W}{P} Z \right)$$

$$N_D = N_S$$

$$f' < 0 \quad g' > 0$$

(W/P) is the real wage-rate
 Y, Z are sectors of exogenous variables, the elements of which are parameters of shift of the demand and supply curves.

This corrected the mis-specification of the Lipsey model in which the money wage-rate appeared as the dependent variable, which is inconsistent with the usual version of the relevant economic theory unless some specific assumption about the price-level is included. The reaction function can now be written as

$$\frac{\dot{(W/P)}}{(W/P)} = \lambda X \text{ where } X = \frac{(N_D - N_S)}{N_S} \text{ and}$$

where $\frac{\dot{(W/P)}}{(W/P)}$ is the proportional rate of change of the real wage-rate. Alternatively though we can have

$$\frac{\dot{(W/P)}}{(W/P)} = \lambda h \left(\frac{W}{P} / Y, Z \right) \text{ given that } X = h \left(\frac{W}{P} / Y, Z \right)$$

which specifies "... all the variables which are parameters of shift of the demand and supply equations or are proxies for such parameters of shift" (P.5). The advantage of this formulation is that it specifies and identifies the impulse factors in the inflationary process because it is in terms of the determinants of the level of excess demand for labour. This formulation also suggests an alternative approach

to the study of aggregate wage-rate changes which is used in the study by McCallum (44). He specifies labour demand and supply schedules in terms of observable variables, and so derives an expression for excess demand, which incorporates only observable variables, and which is then substituted into the reaction function. This yields an equation which relates (\dot{W}/W) to 'observable' determinants of the level of excess demand for labour. An additional advantage of this formulation is that, as Hines points out, "... the level of unemployment or for that matter any other proxy for excess demand would become redundant". (P.5) This avoids the problems which are posed if the available proxies are known to be inefficient indicators of the level of excess demand for labour.

One of the major conclusions of the original Phillips' study is that the aggregate Phillips curve has remained stable over the long sample-period 1861-1957. This conclusion, which was subsequently considerably modified by Lipsey, carried important implications for the influence of trade unions on wage-rates over that period. Major changes had occurred in the course of the period 1861-1957 with respect to the institutional framework governing procedures for setting wage-rates. The bargain between an individual employer and an individual employee had been largely superseded by the bargain between an employers federation and the employees trade union. The apparent stability of the Phillips curve over the long sample period suggested that "... whatever the influence of the union on the market, this influence has remained relatively stable over that time-period".¹

1 Lipsey *ibid* P.17

The implication was that the growth of trade unionism seemed not to have changed in any significant way the determination of the rate of change of wage-rates by the 'market' forces of the level of excess demand for labour, as postulated by the reaction function. But the reaction function relationship can accommodate the influence of trade unions. As we mentioned above, the level of excess demand for labour depends on 'demand' and 'supply' influences in the labour market and this includes the effects of union induced shifts in the labour supply schedule. Another possibility, which is mentioned by Lipsey, is that union influence in the labour market might operate through affecting the slope of the reaction function. Unions might cause a faster increase of wages in response to positive excess demand for labour, and a slower fall in response to negative excess demand for labour than is postulated in the simple linear proportional form of the reaction function. Such an effect is shown by the 'kinked' curve $b'ob$ in Figure I.1, and leads us to expect a higher (\dot{W}/W) at each level of unemployment, other than oa , in the Phillips curve based on this reaction function, than in the curve obtained from the simpler form of the reaction function which is identical to the mapping relation in Figure I.2.

We suggested above that since Phillips specifically mentioned that under conditions of excess supply there would be some downward inflexibility in wage-rates then this implied a non-linear form to the reaction function. A form that is consistent with this proposition is $b'oB'$ in Figure I.1, where the linear section $b'o$ can be seen as an approximation to a relation that shows slight curvature for values of $X_i < 0$.

If this is combined with the normal form of the mapping relation which is linear for $X_1 > 0$, then we should derive a Phillips curve which shows a slight convex curvature when viewed from below for values of $(U/L)_1 > 0$ indicating that unit increases in unemployment above 0 are associated with diminishing changes in $(\dot{W}/W)_1$. This form of Phillips curve is typical of the non-linear 'fitted' Phillips curves found in many studies.

Another proposition about the way in which trade unions might influence wage-rate adjustments is that we can include in the reaction function formulation what Hansen (23) calls 'spontaneous' wage changes. The idea is that the wage-setting institutions (specifically the trade unions) are inflationary because they keep wage-rates rising in times of excess labour supplies. This idea is incorporated by including in the equation of the reaction function a positive constant to represent the 'spontaneous' rate of wage increase,

$$\text{ie: } (\dot{W}/W)_1 = \lambda(X_1) + \omega$$

where ω is the spontaneous rate of wage-rate increase (> 0). Diagrammatically, this means shifting vertically the reaction function BOB' in Figure I.1 to yield a positive intercept $O\omega$ on the $(\dot{W}/W)_1$ axis. One of the implications that Perry (50) draws from his estimates of wage-change equations based on United States data is that the corollary to this proposition might also be true. He suggests that it is possible that the institutional environment associated with American wage-bargaining operates to modify extreme wage increases when labour markets are tight. If this is the case, then incorporati

this proposition in the reaction function would mean a non-linear relation between $(W/W)_i$ and X_i for $X_i > 0$ such that the rate of increase of wage-rates decelerates as X_i increases, (ie $(d^2(\dot{W}/W)_i/dX_i^2) < 0$). Each of these alternative forms of reaction function will of course yield Phillips curves that differ in slope and location from the 'standard' version of Figure I.2 (with $(\dot{W}/W)_i$ plotted on the vertical axis instead of X_i). Indeed it is clear from the discussion so far that the form and stability of the Phillips curve depends crucially on the form and stability of the constituent relationships, the reaction function and the mapping relation.

We now turn our attention to the mapping relation between X_i and (U_i/L_i) . The form of this relationship is based upon the existence of frictional unemployment in the micro labour market, and upon specific assumptions about the rate at which employed workers become unemployed, and the rate at which unemployed workers become employed, per time period. A strict interpretation of the orthodox perfectly competitive model of the labour market involves a set of assumptions which imply that the micro labour market is 'frictionless'. In such a market homogenous factors are employed to produce an homogenous commodity in a given location, information costs are zero, transactions costs are zero and market clearing equilibrium prices and quantities are rapidly attained.¹ Assuming a non-instantaneous process of market clearing, a frictionless labour market would yield a mapping relation

1 To the extent that this market clearing mechanism is instantaneous (more or less) then disequilibrium situations, and consequently the Phillips curve, would never be observed!

showing $X_i = (U_i/L_i)$ for $X_i \leq 0$, and that the mapping relation is consequently not defined for $X_i > 0$. In Figure I.2 this is shown by the line b_0 while for $X_i > 0$ the relation lies along the vertical axis. Lipsey's introduction of frictional unemployment does represent a step away from a 'pure' model of perfect competition and makes possible the co-existence of vacancies and unemployment at zero excess demand for labour in a micro labour market. The rationale usually given for frictional unemployment is that it takes time for workers to move between jobs because of the various search costs involved.

Another explanation is that a job may exist in one place and the corresponding unemployed worker in another. It is important to note that this latter sort of unemployment arises as a phenomenon of aggregation over individual micro labour markets. The argument is that a job vacancy/unemployed worker 'match' exists, but that the vacancy is in one place, and the unemployed worker is in another: in which case they must be in different markets. The main source of this type of unemployment is the (low) degree of geographical mobility of labour over the short period between different labour markets. The locational space over which a micro labour market is defined obviously depends upon the degree of geographical mobility of labour. Our argument suggests that this space is such as to permit a high degree of geographical mobility within it in the short run. This reasoning cannot therefore be used to explain frictional unemployment within a true micro labour market since if the appropriate job/worker 'match' exists within such a market, it will be made, other things being equal. It does however seem more than likely that the actual sectoral labour markets for which statistics on

unemployment and vacancies are available (namely by regional and industrial groupings) may not correspond to true micro labour markets. To the extent that they do not, then the measured unemployment and vacancy rates in these 'empirical' micro labour markets will include some co-existing job vacancies and unemployed workers arising from the fact that the 'empirical' micro labour markets are aggregates of 'true' micro labour markets. The levels of unemployment and vacancies which we observe when excess demand for labour is zero in the industrial and regional labour markets which are the disaggregates available in the United Kingdom data, do not therefore consist solely of the type of frictional unemployment and vacancies described in the Lipsey model.

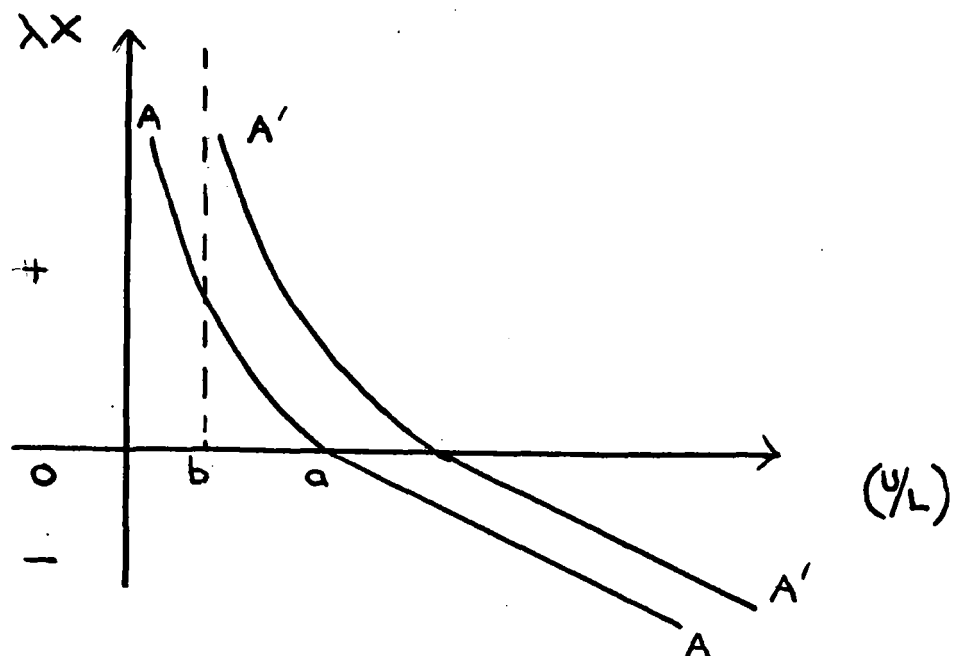
Aggregation over true micro labour markets also introduces an additional reason for the co-existence of job vacancies and unemployed workers at zero aggregate excess demand for labour. This arises because while labour services are assumed to be homogenous^e within separate micro labour markets, the real world heterogeneity of labour services arises between separate micro labour markets. It is quite possible for the types of labour on offer to differ from the types of labour being demanded. The source of this type of unemployment lies in the lack of synchronisation at any one time between the patterns of labour demand and supply as defined by such characteristics as age, experience, skill, occupation etc. In practice it is usually recognised that the patterns of labour demand and supply in these dimensions adjust only rather slowly over time.

We therefore reach the position that in the 'true' micro labour market of the Lipsey model, all unemployment and vacancies associated with zero excess demand for labour in that market are of a 'purely' frictional nature, arising from the fact that job changing is not an instantaneous process. The process of aggregation over individual micro labour markets will, given that the patterns of labour demand and supply as defined by such characteristics as geographical location, age, experience, occupation, skill etc. are not perfectly synchronised, introduce an additional positive element, which we shall label as a 'structural' element, into the unemployment and vacancy levels associated with zero aggregate excess demand for labour. If, at any moment in time, the patterns of labour demand and supply as defined by these characteristics are perfectly synchronised, then this structural element becomes zero. In this situation, zero aggregate excess demand for labour corresponds to zero excess demand for labour in all micro labour markets, and the corresponding aggregate unemployment rate is purely of the 'frictional' variety, being obtained as an appropriately weighted sum of the frictional unemployment consistent with zero excess demand for labour in each micro labour market. The existence of positive 'structural' elements at zero aggregate excess demand for labour thus implies a non-zero distribution of excess demand for labour over micro labour markets.

In Figure I.3 the curve AA is the aggregate Phillips curve obtained by aggregation over identical micro Phillips curves when σ_u^2 is zero. Suppose that σ_u^2 is non-zero as a

result of 'structural' unemployment factors and that, under these circumstances aggregation yields a structural unemployment component of ob when aggregate excess demand is zero. It is often suggested that, by its nature (viz the short term geographical and occupational immobility of labour), this type of unemployment is not amenable to variations in the level of excess demand for labour, so that ob is now the minimum attainable unemployment level as $X \rightarrow \infty$. Hence the level of unemployment associated with zero aggregate excess demand for labour is now equal to $(ob + oa)$ so that the aggregate Phillips curve shifts to the right by the amount of the additional structural component ob to a position such as $A'A'$ in Figure I.3. This horizontal shift of the aggregate Phillips curve consequent upon a non-zero distribution of excess demand for labour over micro labour markets, can be seen as the counterpart to the vertical shift which occurs because of the non-linearity in micro Phillips curves as outlined in the Lipsey dispersion hypothesis above.

Figure I.3



This analysis points to an important source of temporal instability in the observed aggregate Phillips curve. Changes in the 'structural' component of aggregate unemployment will shift the aggregate Phillips curve via shifts in the mapping relation which impair the efficiency of the aggregate unemployment rate as a proxy for the level of aggregate excess demand for labour. The question then arises as to whether such changes have occurred over some specified sample period, and if so, whether it is possible to construct some measure of these changes which could be used to adjust the reported unemployment figures. For example, in Figure I.3 above we can in principle deduct ob from all unemployment rates along the curve $A'A'$ and thus expect to observe an unchanged Phillips curve AA (given a stable reaction function, and that the structural component ob is invariant with respect to cyclical changes in X). Dow and Dicks-Mireaux (16) have investigated the reliability of the statistics of unemployment and vacancies as indicators of trends in (X) . They have analysed the relationships between X and (U/L) , X and (V/L) , and (V/L) and (U/L) and, using these relationships, they suggest a method of measuring changes in the level of unemployment associated with zero aggregate excess demand for labour. Their analysis, and the method of adjusting the unemployment series to dispose of temporal instability in the aggregate Phillips curve forms a major part of the empirical work in this study, and is dealt with in Chapter V.

Before we leave this point it is worth noting that any systematic changes in the structural component of aggregate unemployment will lead to systematic shifts in the aggregate

Phillips curve. As we mentioned above it is usually thought that any changes in 'structural' unemployment are of an essentially long-term nature representing as they do the (slow) adjustment of say the occupational pattern of labour supply to labour demand. However, Rees (56) is quite emphatic that systematic short run variations in structural unemployment can be expected viz "... In my opinion a decrease in structural rather than in frictional unemployment accounts for most of the reduction in unemployment that initially accompanies a rise in the demand for labour" (P.231). This occurs because the structurally unemployed workers may be the only workers available at or slightly below prevailing real wage-levels at times when employers are seeking to expand output and employment in micro labour markets. Workers who are frictionally unemployed in the sense that they are searching for new jobs will not in the first instance accept new job offers at wage-rates below the higher wage-rates they are seeking. Hence the employers are forced to hire the long-term unemployed, or members of disadvantaged minorities, in order to fill vacancies. Indeed, Rees is sceptical of the extent of frictional unemployment and of the response of frictional unemployment to changes in the level of excess demand for labour, as these appear in micro economic labour market models.¹

Another source of instability in the aggregate Phillips

1 To be correct we must point out that Rees was specifically considering the model of Alchian (1). This model does predict, like the Lipsey model, that increases in the excess demand for labour shorten the duration of frictional unemployment. In the Alchian model this effect is due to lags in the adjustment of the individual worker's expectations about wage-rates.

curve arises out of changes in the participation rate (the proportion of the working-age population who are in the reported labour force). As we mentioned above, Lipsey thought that in situations of increasing excess supply the reported unemployment rate might not increase as rapidly as 'true' excess supply because of people dropping out of the recorded labour force by not registering as unemployed persons. The participation rate might therefore fall with the level of excess demand for labour. Evidence for the United States (see for example Tella (64) and Simler and Tella (59)) and for the United Kingdom (Corry and Roberts (10)) does suggest that the participation rate varies directly with the level of excess demand for labour. The implication of this is that the reported unemployment rate is in general an inaccurate measure of the 'true' unemployment rate, since it excludes those workers who do not register as unemployed when they leave employment, and as such is not an efficient proxy for the 'true' level of excess demand for labour. In Chapter IV we present estimates of the unemployment rate in the United Kingdom for the sample period 1951-70, which have been adjusted to include the 'unregistered' unemployed. These estimates are presented as more accurate indicators of the 'true' level of excess demand for labour than the reported unemployment statistics.

For the moment we return to our discussion of the mapping relation in the Lipsey model of the theory of the Phillips curve. As we have seen Lipsey postulates frictional unemployment of o_a in the micro labour market for $X_1 = 0$. He then argues that frictional unemployment falls when X_1 is

positive and increasing because the average time spent job searching falls. In a recent paper (42) Lipsey re-states the formal version of this model of frictional unemployment and shows that the inverse relationship between (U_i/L_i) and X_i derives from the assumptions that the rate at which those in employment leave jobs per time period (either voluntarily or because they are sacked) is equal to a constant proportion of the numbers employed while the number of unemployed who find jobs per time period is taken to be an increasing function both of the number of persons searching for jobs and the number of jobs available. In addition, these assumptions yield a mapping relation which is convex from below for $X_i < 0$.¹ In the Lipsey model then the hiring rate varies directly with X_i and rises faster than the quit rate when X_i increases. Corry and Laidler (9) have pointed out that a priori it is equally possible to assume that the quit rate might increase with the hiring rate in such a way as to just offset the tendency for U_i to fall (when the mapping relation and Phillips curve becomes vertical for $X_i > 0$), or even so as to cause U_i to increase (when the mapping relation and Phillips curve will get a positive slope for $X_i > 0$). The point is that a priori the micro Phillips curve can take a positive vertical or negative slope in the positive quadrant depending upon how the quit rate and hiring rate are assumed to vary with X_i . Since, in the aggregate, this represents policy trade-off space, it is therefore important to reduce the theoretical possibilities.

1 The mapping relation as derived from the Lipsey model is (in absolute terms)

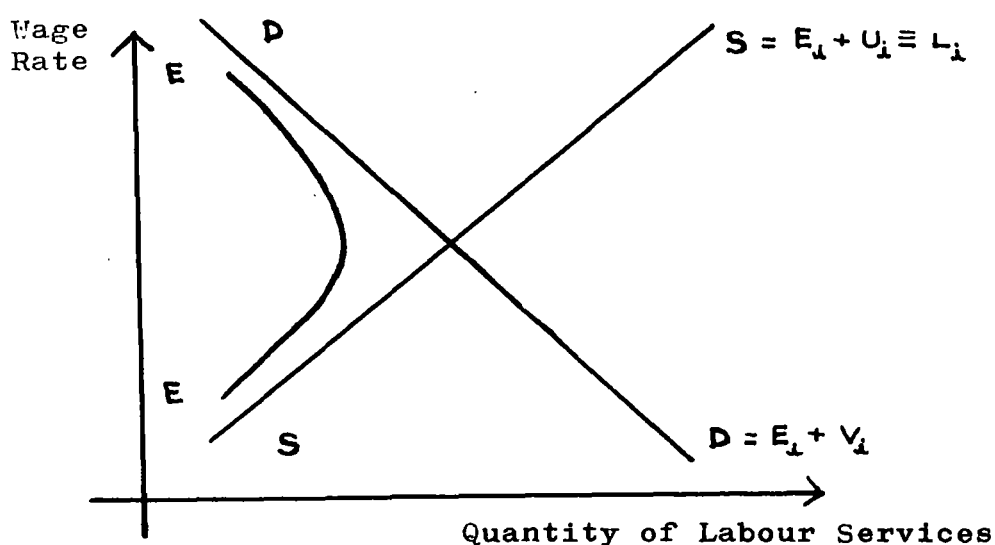
$$X_i = \frac{\alpha}{\beta} L_i U_i^{-1} - U_i - \frac{\alpha}{\beta} \quad \text{where } \alpha, \beta \text{ are positive constants}$$

From this it follows that $(dX_i/dU_i) < 0$ and $(d^2 X_i/dU_i^2) > 0$.

by obtaining relevant empirical evidence on the behaviour of the quit-rate and the hiring rate.

Alternative derivations of a negative and non-linear mapping relation are available. Hansen (23) introduces frictional unemployment into an orthodox labour market model on the grounds that it takes time for a worker to move from job to job and for an employer to fill a vacancy. His idea is not that we may expect frictions within the micro labour markets of economic theory, but that we can expect frictions within empirically identifiable micro labour markets. "The implication is that an observable submarket will, for all practical purposes, have both unemployed men and vacant jobs, and that a change in the tightness of a particular submarket may show itself in changes in both unemployment and vacancies" (P.6). In Figure I.4 we show the situation of an 'orthodox'

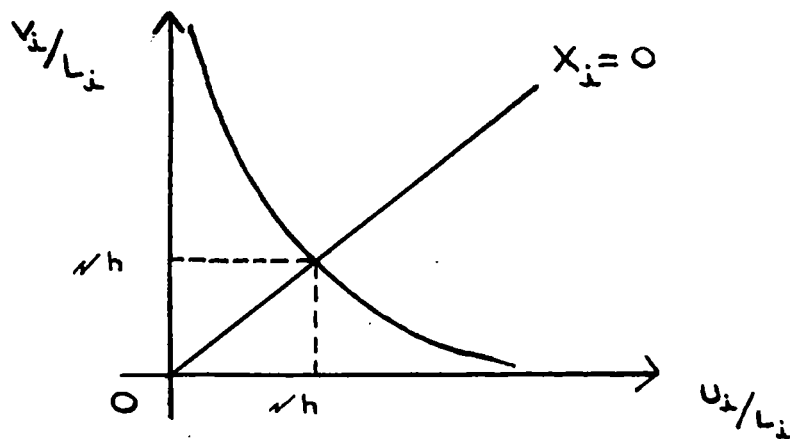
Figure I.4.



labour market model with well defined normally sloped demand and supply curves. In the 'frictionless' case adjustment to the equilibrium wage is along the demand curve for $X_i < 0$ and along the supply curve for $X_i > 0$. Hansen's argument is that

the existence of frictional vacancies and unemployment means that actual employment in the market place is not determined along the demand and supply curves, but along the curve EE. For when $X_i < 0$, there will always be some 'frictional' vacancies due to the fact that some employers in any given short period will be unsuccessful in recruiting all the labour they require and the number of unfilled job vacancies is shown by the horizontal distance between the demand curve DD and the curve EE. When $X_i > 0$ though, the existence of frictional unemployment means that actual employment is not given along the supply curve and the number of unemployed workers is given by the horizontal distance between the supply curve SS and the curve EE. Assuming that all the curves remain stable as X_i varies in this labour submarket then the relationship between U_i and V_i will be of the hyperbolic form shown in Figure I.5. Following Dow and Dicks-Mireaux (16),¹ Hansen suggests that such a relationship can be approximated by a 'simple' rectangular hyperbola of the form,

Figure I.5.



1 Dow and Dicks-Mireaux in fact propose that such a relationship exists between aggregate vacancies and unemployment, whereas the Hansen model is one of an empirically identifiable labour submarket.

$$\frac{1}{L_i} V_i - U_i = h$$

Given that

$$X_i = (V_i - U_i)/L_i$$

then

$$X_i = h (U_i/L_i)^{-1} - (U_i/L_i)$$

which is the negative and non-linear mapping relation. h in the diagram is the level of 'frictional' vacancies or unemployment associated with zero excess demand for labour in the submarket. In Chapter V we discuss and utilise the Dow and Dicks-Mireaux analysis of the aggregate relationships between excess demand for labour, unemployment, and unfilled vacancies. For the moment though we turn from the discussion of the mapping relation, to the Phillips curve relationship itself.

So far we have looked at the 'conventional' theory of the Phillips curve which offers us the prediction of micro Phillips curves existing in 'true' micro labour markets. We cannot proceed from this point without at least mentioning what Phelps (52) calls the 'new' microeconomics in employment and inflation theory.¹ This new body of theory is concerned with the 'dilemmas' posed by the conventional neoclassical theory of the supply decisions of the household and the firm. That theory does not specify formal links between a fall in aggregate demand and a fall in the quantities

1 See E.S. Phelps "Introduction: The New Microeconomics in Employment and Inflation Theory" in "Microeconomic Foundations of Employment and Inflation Theory" by E.S. Phelps et al NORTON 1969.

of aggregate output and employment.¹ Nor can it explain the 'trade-off' between lower levels of unemployment and higher rates of inflation that seems to be a common phenomenon of the real world as demonstrated along the Phillips curve (when a stable relationship linking the rate of increase of wage rates with the rate of increase of 'the' price-level is presumed).² The division of the short-run effects of a change in aggregate demand (at or near full employment levels) between output and employment, and price changes, is not a phenomenon which the essentially price adjusting conventional neoclassical model admits. To analyse this problem requires a microeconomic approach; a look at the supply decision making process of the relevant decision making units, namely the firm and the household, in order to try and explain the observed 'imperfect flexibility' of money prices and wages. The 'new' microeconomics thus emerges as a body of theory of these supply decisions, with the crucial common theoretical departure from conventional neoclassical theory that the postulate of perfect information is removed. What results is a number of complex models of decision making in disequilibrium situations, as exemplified by the collection in the Phelps (51) volume. Their detailed nature prohibits any further meaningful generalisations on our part, and cannot

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- 1 A fall in output and employment requires, *ceteris paribus*, a rise in the product wage rate. As Phelps points out "... The theory is mute as to why a fall of demand should be expected to raise product wage rates". (P.2). In any case "... It is widely agreed that product wage rates do not rise markedly and unerringly whenever unemployment rises" (P.2)
- 2 In the conventional neoclassical model increases in the rate of inflation cannot buy any increases in employment and output since resources are fully employed. "But if one recognises the normal residue of frictional unemployment there is still the question of how inflation and its concomitants operate to decrease that residue". (P.2).

be encompassed in the scope of our discussion. For our purposes the point is that some of these models suggest 'momentary' Phillips curve type relationships in micro labour markets.

In the labour market, the absence of perfect information on the part of firms and workers with respect to wage-rates elsewhere in the economy implies that there will usually be a certain amount of frictional or search unemployment. Many of the 'new' microeconomic models of the labour market predict, as does the Lipsey model, that this level of search unemployment is inversely related to the level of (excess) demand for labour. The paper by Alchian (1) sees the existence of non instantaneous market adjustment processes as a consequence of the fact that, for the two parties to an exchange, "the collating of information about potential exchange opportunities is costly and can be performed in various ways" (P.28). For a worker in the labour market job search and the evaluation of alternatives is a costly procedure which may be more efficiently performed in the unemployed rather than the employed state. In the fact² of declining demand for labour, workers may well prefer to become unemployed rather than to accept wage reductions because search costs are greater in the employed or partially-employed state, and because workers believe an efficient 'search' will reveal some job opportunity commensurate with that just experienced. In the new situation though, the structure of job opportunities has altered, and it will take time for workers to learn that their 'best' job options are now at a lower level and to revise downwards and reformulate a new lower acceptable expected wage-rate. In the interim period

therefore people will be looking longer to find their best option and thus the amount of unemployment will increase. Further decreases in aggregate demand for labour will increase the extent and average duration of unemployment, since such decreases will also have to be 'learnt' and incorporated in reformulated 'expected' wage-rates on the part of workers. Conversely, increases in aggregate demand for labour will be manifest in more job vacancies and an improved structure of job opportunities. Any worker can now more easily find a job which offers a higher wage rate than is currently anticipated, where that expectation is based on the previous 'lower' structure of job opportunities. Workers will be tempted into accepting these new job offers too soon, thus reducing unemployment, because they have not yet 'learnt' and incorporated into their expectations the changed market situation. Thus 'temporary' trade-offs in the $(\dot{W}/W)_i / (U_i/L_i)$ space can exist; temporary in the sense that any new stable level of demand would come to be 'learnt' and adjusted to fully in time.

In the Holt 'job search' model (33), the assumed decision process of the worker is that under conditions of imperfect information and knowledge of the future, the unemployed worker will accept a job offer which carries a wage-rate in excess of his wage-aspiration level. This wage aspiration level is set depending on the worker's previous experience of the market (vis a vis his most recent wage, his knowledge of what other workers earn and his perception of job opportunities currently available in the market) and is assumed to decline with the duration of unemployment. In

addition to wage-rate changes that unemployed workers receive between jobs, the change in the aggregate wage-level will include 'on the job' wage increases, and wage increases that occur when workers change jobs without unemployment. It is presumed that employed workers will tend to switch jobs or to quit to seek 'better' jobs in response to an increase in the number of high-paying job vacancies, while employers are assumed to make 'on the job' wage increases in response to losses of existing employees through quitting and difficulties in recruiting new employees. An increase in aggregate (excess) demand for labour increases job vacancies and reduces the current stock of unemployed workers and the average duration of unemployment. Wage aspirations therefore rise. The increase in job vacancies will tend to increase 'on the job' quitting for 'better' job opportunities, and will trigger off defensive on the job wage increases as firms attempt to maintain work forces at desired levels. In this way a Phillips-type relationship between changes in aggregate wage levels and unemployment emerges.

These brief remarks can hardly do justice to the scope, complexity, and ramifications of these dynamic models of labour market adjustment processes. They are intended only to provide the flavour, and to indicate the direction of this important new body of theory. Still further rationalisations of an aggregate $(\dot{W}/W)/(U/L)$ relationship are available, and some of these derive from the fact, suggested by casual empiricism at least, that labour markets exhibit the whole spectrum of market power from the perfectly competitive model through to wage bargains made under conditions of virtual bilateral monopoly. Although, as we have seen,

the excess demand model is consistent with trade-union influence on (\dot{W}/W) , it is the bargaining strength of labour unions that is often stressed. For example in 1959 Kaldor (34) proposed that "... the rise in money wages depends on the bargaining strength of labour, and bargaining strength, in turn, is closely related to the prosperity of industry, which determines both the eagerness of labour unions to demand wages, and the willingness and ability of employers to grant them," (P.293). Profits are taken to be the indicator of the prosperity of industry, and times of high and rising profits are also times of low and falling unemployment. Hence the observed Phillips relation merely reflects the fact that (U/L) is a proxy for the level of profits, whereas the chain of causation begins with the bargaining strength of labour and runs through the prosperity of industry to profits. This hypothesis thus predicts that a measure of the level of profits and (U/L) are inversely related, and that there is a significant relationship between the level of profits and (\dot{W}/W) . (It is not an hypothesis for which Lipsey and Steur (43), in their study of United Kingdom data, were able to find supporting evidence).

Eagly (17) also sees the process of wage-determination as a bargaining process, in which the outcome of the wage bargain is dependent upon labour's bargaining power relative to that of the employers. He argues that the level of unemployment in the wage-change equation is an indicator of the general economic conditions under which the wage-bargain takes place, but does not represent a direct behavioural relationship between itself and (\dot{W}/W) . In Eagly's view it is

the 'market power' of labour which determines (\dot{W}/W) , and which is the 'intervening mechanism' in the $(\dot{W}/W)/(U/L)$ relationship. A suitable index of market power is the quit-rate, the percentage of workers who voluntarily leave their jobs, for, when unemployment is low the bargaining position of the worker is improved (since employers fear the loss of employees because of the cost and inconvenience of recruiting replacements when the labour market is tight), and the range of alternative employment opportunities widens. To the extent that workers, aware of their individual market power, are prompted to quit and move to alternative employers "we would expect the quit-rate to reveal quantitatively the strength of labour's market power" (P.49) This hypothesis therefore predicts that (\dot{W}/W) and the quit-rate will be directly related, and that (U/L) and the quit-rate will be inversely related. As in the Kalder hypothesis the precise form of the basic behavioural relationships is not specified.

So far Eagly's hypothesis is in terms of the market power of the individual employee. Since "... wage bargaining that can be achieved through union action will preclude any necessity on the part of the individual worker to bargain directly on his own" (P.55) it seemed possible that the 'collective' market power of the union would effectively replace individual market power in industries with a high degree of unionisation. Eagly therefore constructed an index of union market power for individual industries (the index being measured as the percentage of workers in each industry covered by collective bargaining agreements) and, for post war United States data, found that

across industries there was a negative correlation between the index of individual market power (the quit rate), and that of union market power. Industries with low quit-rates tended to be those which were highly unionised. He also found that, in time series United States data, the quit-rate, used as an indicator of market power, was able to explain more variance in $\dot{(W/W)}$ than was (U/L) . This evidence seemed to support his view that the 'relative bargaining power' of labour determines $\dot{(W/W)}$ rather than aggregate excess demand for labour. The expected inverse relationship between the quit rate, the 'direct' index of labour's relative bargaining strength, and the unemployment rate, means that the $\dot{(W/W)}/(U/L)$ relationship is consistent with these 'bargaining power' theories of wage-determination, as well as with the conventional excess demand model of Phillips/Lipsey. The general presumption is that 'general economic conditions' impinge on the wage-bargain: when employment is high, and labour markets tight, then unions are in a stronger position to press wage demands and employers are more likely to concede such demands. This is because employers will strive harder to avoid costly strikes when business is buoyant than when it is slack and declining, especially since their ability to find non-union labour in the event of a strike is much reduced when labour is 'scarce'. Moreover, in tight labour markets, employers will be competing for labour in order to maintain their work force in the face of voluntary quits and to recruit additional workers to fill new vacancies. The role of the profits variable in the wage-change equation is similarly open to different interpretations. In the Kaldor hypothesis described above the profits variable enters as an

indicator of labour's bargaining strength. However, large profits may also be evidence of previous increases in aggregate demand for final goods, and the associated increases in (\dot{W}/W) are therefore the outcome of 'derived' excess demand for labour.

Enough has been said by now to suggest that an inverse relationship between (\dot{W}/W) and (U/L) is consistent with different interpretations of what are the underlying behavioural relationships. The conventional excess demand model and bargaining power theories are obvious competitors. On the basis of some specific assumptions about how union influence might be expected to influence the slope and location of the reaction function, it is possible to demonstrate some micro economic predictions that might be capable of discriminating between these explanations. Burton (8) discusses some micro Phillips curves that might be generated in unionised and non-unionised sectors of the economy. However, the theory of the Phillips curve, as presented by Phillips and Lipsey, was never simply the theory of the $(\dot{W}/W)/(U/L)$ relationship (though Phillips may be said to have seen this as the dominant relationship). We now turn to a consideration of the relationship between (\dot{W}/W) and the rate of change of unemployment (\dot{U}/U) .

II The Relationship Between \dot{W}/W and \dot{U}/U

There is a strong argument that, in the 'excess demand' formulation of the wage-change equation, we should not expect to find any other variables than the level of unemployment, the proxy for excess demand. As Perry (50) puts it, "If the rate of wage-change is proportional to the amount of excess demand, which in turn is measured by unemployment, there is no room for other variables" (P.22). Archibald (2) has used the same argument to conclude that "we should not expect to find any variable, such as prices or productivity, which affects either the demand curve or the supply curve, or both, apparently exercising an independent effect on \dot{W}/W " (P.125). This argument implies that additional explanatory variables other than (U/L) and σ_U^2 in the aggregate wage-change equation can only be rationalised if it can be shown that in their absence (U/L) is an insufficient proxy for the level of excess demand for labour. The argument only applies to the 'excess demand' formulation: the Hines reformulation of the wage-change equation in terms of the determinants of the level of excess demand for labour which we discussed above will clearly allow the inclusion of additional explanatory variables.

The original Phillips hypothesis had included the notion that the rate of change of money wage-rates might (also) be influenced by the rate of change of the level of excess demand for labour as reflected by the rate of change of unemployment. Thus,

".... in a year of rising business activity, with the demand for labour increasing and the percentage 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". (P.283) We therefore expect to find that the rate of change of money wage-rates will be greater for years when unemployment is falling and the level of excess demand for labour is increasing (and $\dot{U}/U < 0$), than for years when (U/L) is at the same average level but is stable at that level. Conversely for those years characterised by falling excess demand for labour ($\dot{U}/U > 0$) we expect that (\dot{W}/W) will be lower than it would be for years when (U/L) is at the same average level, but is stable at that level. Implied in this argument is that the Phillips curve itself is the relationship between the rate of change of money wage-rates and stable levels of excess demand for labour and unemployment. One explanation of positive and negative deviations from such a curve is that they are due to the effects of changing excess demand for labour as reflected in the rate of change of unemployment.

Phillips estimated the relationship between (\dot{W}/W) and (U/L) for the period 1861-1913 on the basis of six 'points of average' which were generated from annual data in the following way. Each annual $(\dot{W}/W)/(U/L)$ observation was allotted

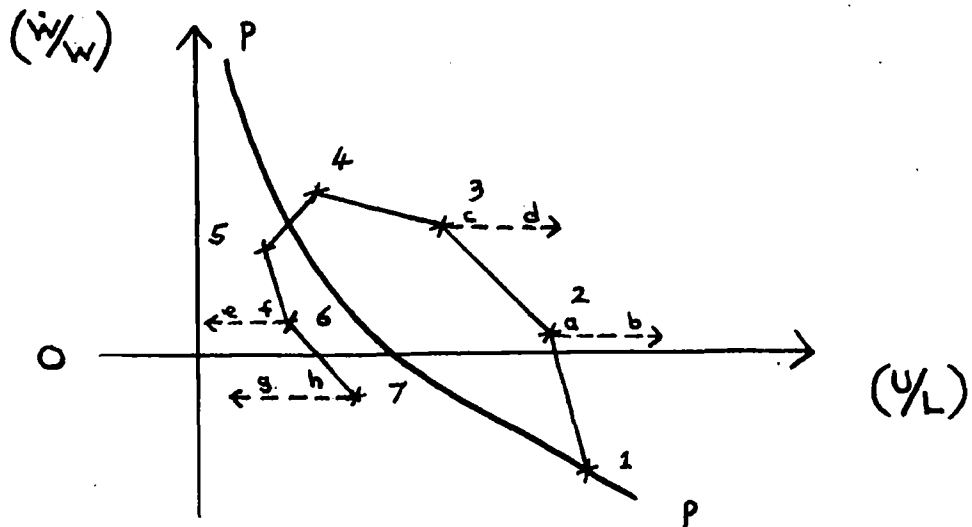
by value into one of six intervals of (U/L) between zero and 11%,¹ and the average (\dot{W}/W) and (U/L) was calculated from each interval. Each interval of (U/L) included years during which unemployment was increasing or decreasing, so that "... the effect of changing unemployment on the rate of change of money wage-rates tends to be cancelled out by this averaging" (P.290). Strictly speaking, the averages from each interval will only give the (\dot{W}/W) associated with average stable unemployment levels if, within each interval, the effect on (\dot{W}/W) of changing excess demand for labour as measured by years of falling unemployment is similar to the effect measured by years of rising unemployment. Hence Phillips' 'average' $(\dot{W}/W)/(U/L)$ curve is probably not totally free from the influence of changing unemployment on (\dot{W}/W) .² When Phillips considered observations of wage-changes in individual years in relation to the fitted curve, he observed that the time-path of these observations over the course of a typical nineteenth century trade-cycle, traced out an anti-clockwise 'loop' around the curve. These loops (which have since become popularised as 'Phillips loops') were taken to be the manifestation of the influence of changing unemployment on (\dot{W}/W) as reflected by changes in (\dot{U}/U) . A subsidiary hypothesis was then introduced by Phillips to account

1 Lipsey (41) gives these intervals defined by percentage unemployment, with the number of observations within each interval in parentheses. These are: 0-2 (6), 2-3 (10), 3-4 (12), 4-5 (5), 5-7 (11), 7-11 (9) - the upper limit is included in each interval.

2 Self-cancelling errors between 'average' observations from each interval that are biased in different directions may reduce this 'unwanted' element of changing unemployment to a random disturbance.

for an apparent narrowing of the anti-clockwise loops associated with successive trade-cycles over the period 1861-1913. This is that there had developed over that period a time-lag in the adjustment of wage-rates to the level of excess demand for labour, which could have been one result of a certain minimum time-period involved in the negotiation of new wage bargains between employers federations and organised labour - consequent upon the extension of collective bargaining and the growth of arbitration and conciliation procedures over the course of the period.

Figure I.6



In Figure I.6 PP represents the curve that Phillips fitted to the 'average' observations from the period 1861-1913. Each numbered cross represents a contemporaneous $(\dot{W}/W)/(U/L)$ observation and the time-path of points 1 to 7 represents an anti-clockwise 'loop' around the Phillips curve. Now assume that a lag exists in the adjustment of wage-changes. This means that, at point 2, for example, the rate of change of money wage-rates should be related to a previous higher unemployment level (unemployment is falling).

That is the 'true' observation lies to the east of point 2 along the dotted horizontal line ab through point 2. Similarly the 'true' observation at point 3 lies east along the dotted line cd. When unemployment is rising as at point 6, the associated rate of change of money wage-rates should be related to a previous lower level of unemployment and so the 'true' observations will lie west of points 6 and 7 somewhere along the dotted lines ef and gh. Hence, although we observe an anti-clockwise loop in the contemporaneous data, the existence of a time-lag in the adjustment of wages means that the 'true' loop is much wider than the 'observed' loop.

However, when he looked at the period 1948-57 Phillips found that the observations showed a clockwise time-path around the Phillips curve fitted to the data from 1861-1913. Negative deviations from the curve occurred when the hypothesis about the effect of changing unemployment predicted positive deviations. It seemed that either the relationship between (\dot{W}/W) and (\dot{U}/U) had ceased to hold, or had been swamped by the influence of another variable. To account for this Phillips again fell back on a time-lag hypothesis such that the current (\dot{W}/W) should be related to a previous unemployment level. We can utilise Figure I.6 once more by supposing that the time-ordering of the points in the diagram is reversed so that we go round the 'loop' in a clockwise direction. The time-lag effect now means that at points 7, 6 and 5 the associated (\dot{W}/W) should be related to a previous higher level of unemployment (since unemployment is falling) and that the 'true' observations lie east of these points in the horizontal plane. Conversely, at points such as 1, 2 and 3

the associated (\dot{W}/W) should be related to a previous lower level of unemployment (since unemployment is rising) and the 'true' observations thus lie to the west of these points in the horizontal plane. The extent of these displacements will depend on the length of the postulated time-lage and on the speed with which unemployment changes. It is easily seen from Figure I.6 that, starting with a clockwise loop in contemporaneous data, the plotting of the appropriate 'lagged' relation will move all the points in the direction of the curve PP so that the clockwise loops disappear. It is not so clear that the combination of the effects of the time-lag and the speed with which unemployment changes, will be such that when the appropriate lagged relation is plotted, the points in Figure I.6 will 'cross-over' to form an anti-clockwise loop. This is what is implied if the underlying relation between (\dot{W}/W) and (\dot{U}/U) is unchanged. Thus we see that the influence of (\dot{U}/U) on (\dot{W}/W) is manifest in anti-clockwise loops around the fitted Phillips curve, except that time-lags in the adjustment of wage-rates can shroud this picture, or even lead to the observation of clockwise loops in contemporaneous data. Estimated wage-change equations using an unlagged specification may not therefore find the expected negative coefficient on the (\dot{U}/U) variable or indeed that the (\dot{U}/U) variable shows up as significant as defined by conventional statistical criteria.

The rationalisation of the $(\dot{W}/W)/(\dot{U}/U)$ relationship is not unambiguous as it is stated by Phillips. One interpretation is that the intensity with which employers bid for labour services, and their resistance to wage demands, is based not only on their current needs but on what they expect to need

in the future. For example when employers expect a higher future level of demand for final goods, for which a larger work force is required, then they anticipate a tightening labour market and will increase their current demands for labour in the expectation of needing more in the future. The current strength of their bidding for labour will increase since they will be seeking to employ more labour than the current level of aggregate demand for final goods would indicate was required. (\dot{U}/U) enters as the indicator to employers of the trend of future aggregate demand, upon which future expectations of labour requirements by employers are based. As Lipsey (41) pointed out, this explanation is consistent with a relationship between (\dot{W}/W) and (\dot{U}/U) but cannot account for the loops. Any explanation of 'loops' has to show that something affects (\dot{W}/W) without simultaneously affecting (U/L) , whereas this argument implies that although employers offer higher wages they will also employ a greater quantity of labour. To explain loops requires an explanation that predicts more competitive bidding by employers, and thus a higher (\dot{W}/W) , when unemployment is falling than when unemployment is rising, at any given unemployment level. This is the phenomenon described in the Phillips hypothesis. One rationalisation of this type of behaviour suggested in an earlier paper by Hines (27) is that firms may over bid for labour on the upswing of activity and under bid on the downswing because they consistently over-estimate shifts in the industry demand curve for labour on the upswing and the downswing. Interestingly this argument relies on imperfect information in the labour market, while a second rationalisation offered by Hines rests on another market imperfection, the heterogeneity of the labour supply. He suggested that firms

may offer higher wage-rates during the upswing in an attempt to secure the better quality labour from the unemployed pool. Given that such labour is a fixed proportion of the available supply, then "the effect of such bidding is simply to raise the rate of change of money wage-rates above what it would be for the given level of unemployment" (P.61). On the other hand on the downswing of activity "each firm believes that it is easier to obtain the better quality labour and is tempted to offer less than is justified by the prevailing level of demand" (P.61). Both of these explanations provide a sufficient theoretical justification of a $(\dot{W}/W)/(\dot{U}/U)$ relationship and the Phillips loops. However, a more satisfactory explanation of the $(\dot{W}/W)/(\dot{U}/U)$ relationship has subsequently been provided by Hines (29). He argues that (\dot{U}/U) is a valid joint proxy with (U/L) for the level of excess demand for labour when that excess demand is changing. The argument shows that whenever $\dot{X} > 0^1$, $\dot{X}/X > \dot{U}/U$, which implies that on the upswing of economic activity (U/L) underestimates X while on the downswing of activity (U/L) overestimates X . Given that "employers bid for labour on the basis of the level of excess demand, they will bid more for labour when (U/L) is falling than when it is rising for any given level of (U/L) " (P.10), which means that " (\dot{W}/W) will be greater when (U/L) is falling than when it is rising for any given level of (U/L) " (P.10). In addition, the argument also implies that the mis-statement of X by (U/L) when X is changing cyclically, is such as to generate anti-clockwise loops around the Phillips curve.

1 A dot over a variable indicates the time derivative - $\dot{X} = (dX/dt)$

Lipsey originally proposed that the loops did not represent the manifestation of a direct relationship between (\dot{W}/W) and (\dot{U}/U) . We have seen that, in the Lipsey model, aggregation over micro-Phillips curves introduces σ_u^* into the aggregate wage-change equation. The Lipsey dispersion hypothesis is that there is a direct relationship between (\dot{W}/W) and σ_u^* ; the degree of upward displacement of the aggregate Phillips curve above the (identical) micro-Phillips curves varies directly with the extent of the dispersion of unemployment over the micro labour markets at any given aggregate unemployment rate. Lipsey interpretes the loops as the result of upward displacements from the stable micro-Phillips curves: they are the manifestation of systematic variations in this degree of upward displacement caused by systematic variations in the degree of dispersion of unemployment over the micro labour markets. As the level of excess demand for labour rises in the recovery phase of the trade-cycle, the distribution of that demand becomes more unequal, since different markets will recover at different rates eg. the consumer goods industries might recover first, while the capital goods sector might not recover until significant excess demand had developed in the consumer goods industries. In the later stages of the recovery therefore, as excess demand for labour is transmitted to all labour markets, the distribution of that demand over the micro labour markets would become more equal. This argument leads us to expect that in the initial stages of the recovery a measure of the dispersion of unemployment would increase, leading to an upward displacement of the (\dot{W}/W) observation above the structural micro-relations, while in the later stages of the recovery such a measure of dispersion, and the degree of upward

displacement of the (\dot{W}/W) observation above the micro-relations, would fall. On the downswing of economic activity, the fall in demand is assumed to occur more uniformly in all markets, so that no great inequality in the distribution of that demand arises, and the (\dot{W}/W) observations would lie near the micro curves. A curve fitted to the resulting loop of points would roughly bisect it, and yield the phenomenon which Phillips observed.

The Lipsey explanation of the loops requires that in the early stages of a recovery there is a longer time lag before an increase in demand in one market is transmitted to other markets. In that case there will be a greater dispersion of unemployment in the early upswing than in the early downswing. We should therefore expect to find a relationship between some measure of the dispersion of unemployment and (\dot{U}/U) . This relationship will not be a simple one since, according to the hypothesis, σ_U^2 first increases and then decreases during the upswing of activity when $(\dot{U}/U) < 0$, while on the downswing, when $(\dot{U}/U) > 0$, σ_U^2 shows no significant variation.¹ If σ_U^2 does behave in this way over the course of the trade-cycle, then the implication is that in years of cyclical upswing the relationship between (\dot{W}/W) and σ_U^2 would show up much more firmly in the data than it would during years of cyclical downswing. To include (\dot{U}/U) as a proxy for σ_U^2

1 This type of variation in σ_U^2 can be seen as an example of a cyclical variation in 'structural' unemployment, based on the geographical/occupational immobility of labour, in the sense that without any inter micro labour market frictions, changes in demand for labour would be transmitted much more quickly to all markets. Time lags in the speed of recovery of different markets (both factor and product markets) do occur, and would lead us to expect cyclical variation in σ_U^2 and therefore in the shifts in the mapping relation and Phillips curve as argued above. P.28.

which is how Lipsey rationalises a $(\dot{W}/W)/(\dot{U}/U)$ relationship, should not on this explanation yield a wage-change equation with greater explanatory power than one in which σ_u^2 replaces (\dot{U}/U) , ceteris paribus. The Lipsey explanation of the Phillips loops also implies that if we were to observe clockwise instead of anti-clockwise loops then, other things being equal, σ_u^2 falls during the early upswing of economic activity and rises during later stages of the recovery. In that case we should expect to find a positive relationship between σ_u^2 and (\dot{U}/U) , and between (\dot{W}/W) and (\dot{U}/U) which is in contrast to the negative relationships that must hold to generate anti-clockwise loops.

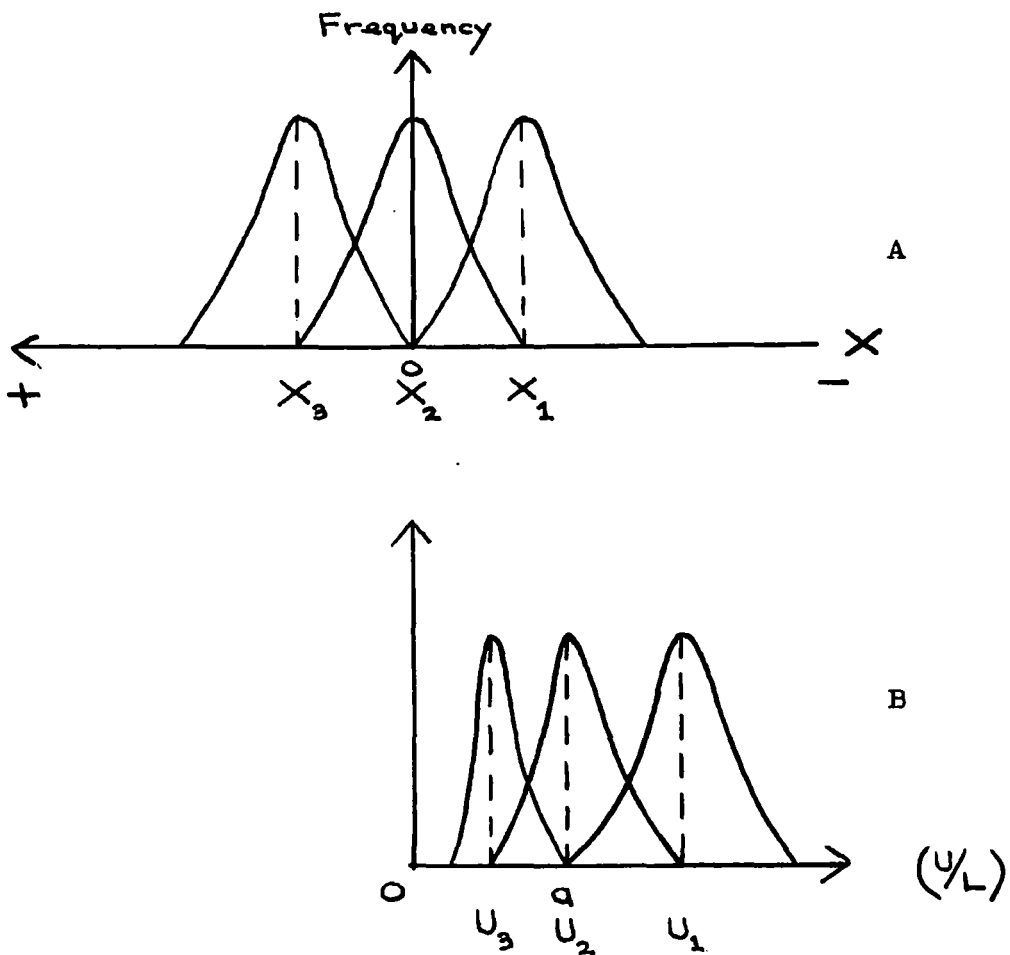
The dispersion hypothesis, and the role of (\dot{U}/U) in the wage-change equation have received a good deal of attention in the literature. The hypothesis does require a positive 'dispersion effect': that $d(\dot{W}/W)/d\sigma_u^2 > 0$. Archibald (2) shows that the stringent assumptions of identical non-linear micro Phillips curves are not necessary for this result. He shows that a necessary condition is that, in the case of two sectors, the Phillips curve in the sector with lower unemployment should have a steeper slope than the curve in the sector with the greater unemployment. When this condition is not satisfied Hines (29) shows that in the case of two sectors, an unambiguous dispersion effect requires identical, non-linear Phillips curves with a constant second derivative. He also shows that when the case of three sectors is considered (and, by implication, all higher cases) the sign of the dispersion effect is unambiguous, a result which must cast some doubt on the Lipsey theory of the loops which requires that the

sign of the dispersion effect is unambiguously positive.

The non-linearity in the mapping relation from X to (U/L) throws some doubt on the efficiency of σ_U^2 as a proxy for σ_X^2 , the degree of dispersion of excess demand for labour between micro labour markets. Figure I.7 uses a form of diagram adapted from that in Vanderkamp (72). In part A of the diagram X_1 , X_2 , and X_3 are aggregate levels of excess demand for labour. The distribution of the rates of excess demand for labour in micro labour markets around each aggregate rate, are shown as symmetric and approximately 'normal'. For pedagogic purposes we assume that σ_X^2 remains constant as X changes so that in the diagram the distributions around each mean aggregate level of X can be taken as having an identical shape. Consider the level of aggregate excess demand for labour X_1 . As of this distribution, no micro labour market has positive excess demand for labour and, given that the mapping relation between X and (U/L) is assumed to be linear and proportional for $X_1 \leq 0$, then the frequency distribution around the corresponding mean aggregate unemployment rate mirrors that around X_1 . This is shown in part B of Figure I.7. Now consider $X = X_2 = 0$ in part A of the diagram. For those markets still in excess supply the 'transformed' unemployment distribution is unaltered, so that $(X_2 - X_1)$ in A is equal to $(U_2 - U_1)$ in B. For those micro markets showing positive excess demand for labour, in the left half of the frequency distribution associated with X_2 , the transformed unemployment distribution shows a smaller dispersion because of the non-linearity in the mapping relation for $(U/L)_i < 0$. Hence $(X_3 - X_2)$ in A exceeds $(U_3 - U_2)$ in B which shows that as X rises from X_1 to X_2 , σ_X^2 constant, U falls from U_1 to U_2 , and σ_U^2

also falls. Finally, when $X = X_3$, $U = U_3$, and all micro labour markets get positive excess demands. As a result of the non-linearity in the mapping relation for $(U/L)_1 < \infty$ the fall in (U/L) is less than the rise in X . The distribution of unemployment associated with U_3 is therefore skewed $((U_3 - U_2) < (X_3 - X_2))$, and has a smaller dispersion than has the distribution of unemployment associated with U_2 . Thus as X rises from X_2 to X_3 , σ_x^2 unchanged, (U/L) falls from U_2 to U_3 , σ_u^2 falls, and a measure of the skewness of the distribution of unemployment gets a positive sign.

Figure I.7



We therefore see that, even if the dispersion of excess demand for labour remains constant as X rises through zero, the dispersion of unemployment will fall, and the skewness of the observed unemployment distribution will increase. Only if $(U/L)_i \geq 0$ in all micro labour markets will σ_x^2 and σ_u^2 move closely together. If our empirical measures of σ_u^2 are at all accurate correlates of true σ_u^2 , then it would seem that σ_u^2 is 'inevitably' linked inversely to X ; which movement in σ_u^2 may effectively dominate the overall variation shown by σ_u^2 . To the extent that this is true then we cannot rely on σ_u^2 as a sufficient indicator of what is happening to σ_x^2 , unless we have additional information to show that this 'non-linearity' effect has not dominated the variation in σ_u^2 . All this seems to throw up more doubts for the Lipsey 'dispersion hypothesis' explanation of Phillips loops which proposes that (\dot{U}/U) can be used as a valid proxy for σ_u^2 .¹ The major doubt surrounding that hypothesis must remain the ambiguity which Hines has shown attaches to the sign of the dispersion effect. This is an important matter since the policy implication of the $(\dot{W}/W)/\sigma_u^2$ relationship is that a reduction in σ_u^2 (consequent say upon appropriate regional policies) will shift the aggregate Phillips curve down, and therefore improve the terms of trade-off between (\dot{W}/W) and (U/L) .

1. Although the predicted 'inevitable' decline in σ_u^2 is consistent with the variation postulated by Lipsey: namely that in the later stages of the recovery the dispersion of unemployment will narrow, having worsened in the earlier stages when presumably many micro labour markets show excess supplies of labour and σ_u^2 is more 'free' to vary.

An alternative rationalisation of the $(\dot{W}/W)/\sigma_u^2$ relationship is however available, namely the demand shift/wage-spread hypotheses of inflation popularised by Schultze (58). The demand shift proposition is that due to various labour market imperfections money wage-rates are more flexible upwards than downwards. Hence increases in the dispersion of excess demand for labour which lead to positive excess demands in some micro labour markets will cause money wage-rates to rise in those markets, with no corresponding fall in wage-rates in those markets newly in excess supply. Thus (\dot{W}/W) is directly related to σ_x^2 , and a direct test of this hypothesis would require accurate measures of this dispersion. The underlying behavioural hypothesis would seem to be that there exist reaction functions in micro labour markets which are positively sloped for $X_i > 0$ and flat for $X_i \leq 0$.¹ The associated proposition is that there exists a 'wage-spread' or 'transfer' mechanism which transmits wage-rate increases obtained in some markets to other markets, again causing (\dot{W}/W) to increase. When associated with the demand shift proposition, the idea is that wage-rate increases in micro labour markets where $X_i > 0$ 'spill over' into markets where $X_i \leq 0$, thus augmenting the effects of changes in σ_x^2 on (\dot{W}/W) . However the latter proposition

1 Rees (56) argues that in this case wage stability need not accompany zero aggregate excess demand for labour (when aggregate vacancies and unemployment are equal), because "an excess of vacancies over unemployed workers in any one sub-market will be sufficient to cause wages in that market to rise and hence to cause the average of all wages to rise" (P.229). Indeed, even within a sub-market wages may rise when $(U/L)_i > (V/L)_i$ as long as "employers regard some of the unemployed as unsuited to fill their vacancies, so that they prefer to offer higher wages than to hire these unemployed at going wages" (P.229).

is essentially 'neutral' in that it leads to wage-rate increases which occur in some markets, for whatever reason, to be spilled over into other markets. Significant 'wage-spread' effects have important implications for the micro economic basis of the theory of the Phillips curve as it is presented for example in the excess demand model. That model assumes the existence of reasonably isolated labour market sectors, with wages in each sector responding to the unemployment rate in each sector. A significant wage-spread mechanism implies that wages in 'following' sectors follow wages in 'lead' sectors. In this situation the unemployment rates in following sectors may therefore offer poor predictions on the rates of change of wage-rates in those sectors. This state of affairs is inconsistent with the Lipsey dispersion argument which rests on aggregation over identical non-linear micro Phillips curves.

An important question is what determines $(W/W)_1$ in lead sectors?¹ If wage-rates rise in lead sectors in response to an increase in excess demand for labour in those sectors then, as mentioned above, we could get a positive dispersion effect. Whether or not the combination of 'demand shift' and 'wage-spread' yields anti-clockwise Phillips loops would then depend on whether or not 'lead' sectors are the first to recover during the upswing of the trade cycle. Clockwise loops would imply that they are not, and that $(\dot{W}/W)_1$'s in following sectors are unresponsive to increases in the $(X)_1$'s. Another important question concerns the nature of the 'wage-spread' mechanism. This is often seen as due to successful

1 For some possible hypotheses see Hines (28)

attempts by trade unions to preserve inter-sectoral wage differentials, and implies that in 'following' sectors trade union activity has an important influence on $(\dot{W}/W)_f$. If this is so then one might reasonably presume that union activity in 'lead' sectors is important (see below),¹ and that the influence of the level of excess demand in these sectors is correspondingly diminished. A valid test of the 'lead' and 'following' sector hypothesis requires that such sectors can be identified. If we accept the trade-union wage-spread mechanism then we shall need to identify sectors which correspond to the boundaries within which trade unions are organised. An observed wage-spread mechanism across say the 'industry' groups in United Kingdom data, may reflect nothing more than the fact that trade unions are organised across industries. Another problem is that the definition of sectors by trade union organisation and influence, may not correspond to the labour market sectors which are taken to be the empirical counterparts of the micro labour markets of economic theory. Indeed the existence of reasonably isolated labour market sectors is a proposition that has been criticised on the grounds that it ignores the effects of labour mobility. The scope and nature of possible interdependencies between 'sub sectors' thus raises many dilemmas.

1 Although it could be that employers are more likely to accede to wage-demands based on 'preservation of differential' arguments in following sectors, than they are to wage demands in lead sectors which do not use this argument.

III The Relationship Between (\dot{W}/W) and (\dot{P}/P) , $(\dot{P}/P)^*$

Phillips saw only a minor role for the influence of (\dot{P}/P) in the wage-change equation. His argument is that cost-of-living adjustments in wage-rates will have little or no effect on the rate of change of money wage-rates except in years when rapid rises in import prices cause the 'cost-of-living' index to rise faster than the rate of increase in money wage-rates which is occurring as a result of employers' competitive bidding for labour. At such times he suggests that employees will successfully obtain cost of living adjustments in money wage-rates, which means that (\dot{W}/W) will exceed the rates predicted by contemporary levels of (U/L) and (\dot{U}/U) . This argument implies that, at such times as real wages are rising ($(\dot{W}/W) > (\dot{P}/P)$), trade unions (in fact organised or unorganised labour) would not be able to prevent any diminution in the rate of increase of real wages, since the level and rate of change of excess demand for labour set the limit to the rate of increase in money wage-rates. (\dot{P}/P) only exerts an independent influence on (\dot{W}/W) at such times that the cost of living is increasing rapidly enough to cause a fall in real wages. This hypothesis predicts that we should expect a greater rate of change of money wage-rates than is predicted by the level and rate of change of unemployment only during periods when real wages are falling. This prediction is the basis of the test of this view of the modus operandi of (\dot{P}/P) in the wage-change equation conducted by Lipsey (41). He does not find that it is supported by the evidence. Another testable implication of this hypothesis is that if we exclude from any sample-period years

during which and immediately after very rapid increases in import prices occurred (so that the effect of minor wage-price spirals is worked out), then we should not expect (\dot{P}/P) to show any explanatory significance in the wage-change equation.¹

Lipsey (41) proposes a simpler hypothesis which is that "the outcome of the wage bargain is affected simply by the change in the cost of living, that an increase in the cost of living makes trade-unions more aggressive in demanding increases, while a decrease in the cost of living acts in the reverse direction" (P.9). We therefore expect to see a positive relationship between (\dot{W}/W) and (\dot{P}/P) . A more satisfactory and rigorous rationale for this relationship is available when it is remembered that the Lipsey specification of the labour market as determining the money wage-rate is only advisable if the price-level is assumed to be constant. More correctly, as Hines (29) points out, the reaction function is specified in real wage terms as

$$(\dot{W}/P)/(W/P) = \lambda X \quad (\text{see above P.20})$$

and since

$$(\dot{W}/P)/(W/P) = (\dot{W}/W) - (\dot{P}/P)$$

then

$$(\dot{W}/W) = \lambda X + \beta (\dot{P}/P) \quad \text{where } \beta = 1$$

Thus (\dot{P}/P) , if it is anticipated, "affects the rate of change of money wage-rates quite independently of the level of excess demand as measured by the level of unemployment, or any other such variable" (P.2).² Changes in the price-level,

1 Such a procedure might lead to the exclusion of most of the period since 1968, a period for which the Phillips curve has proved most elusive.

2 And (\dot{P}/P) is thus a legitimate explanatory variable, in addition to (U/L) and (\dot{U}/U) , in the excess demand formulation of the wage-change equation.

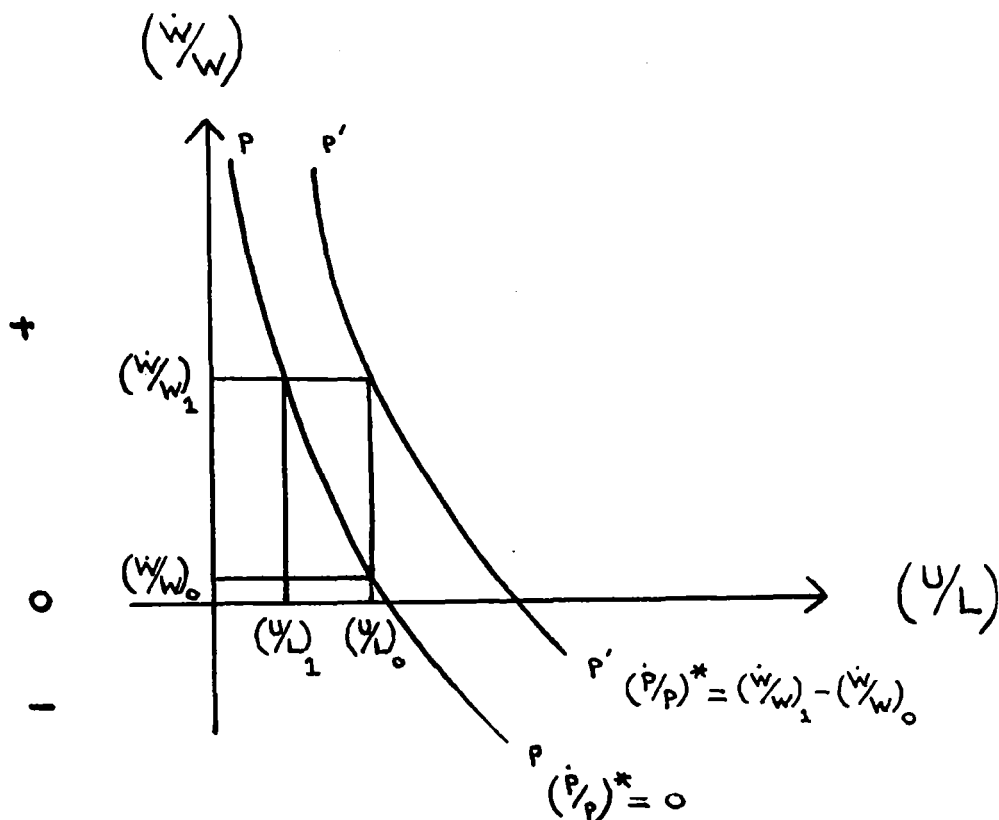
if fully anticipated, are therefore fully reflected in changes in money wage-rates, which implies that the real wage-rate never alters. In the aggregate neo-classical labour market real wage-rates are assumed to adjust to yield Friedman's (20) equilibrium 'natural' rate of unemployment, which is 'full employment' in the sense of there being no demand deficient unemployment. Unemployment levels above or below this minimum level indicate the presence of negative and positive aggregate excess demands for labour respectively, which will produce downward and upward pressure on real wage-rates respectively. Within this context, the full adjustment of money wage rates to price changes implies a steady state solution of a vertical Phillips curve at the natural rate of unemployment. In full equilibrium there is no $(\dot{W}/W)/(U/L)$ trade-off along a Phillips curve: in the final equation above we get $(\dot{W}/W) - B(\dot{P}/P) = \lambda X = 0$.

How then does the Phillips curve arise? Friedman, Phelps (53) and others have argued that workers are real income conscious and bargain for real and not money wages. However the real wage that workers bargain for is based not on actual but on 'expected' or 'anticipated' price changes, $(\dot{P}/P)^*$. Workers are assumed to aim for money wage adjustments to compensate for anticipated price changes over the period for which the bargain is being made. Hence the relevant price-level variable to include in the wage-change equation is $(\dot{P}/P)^*$ and not (\dot{P}/P) , where $(\dot{P}/P)^*$ enters with a coefficient of unity. Friedman argues then that the Phillips curve is drawn for a world in which everyone anticipates that nominal prices will be stable, and in which that expectation remains unshakeable and immutable whatever happens to actual

prices and wages. In fact, as the argument implies, there exists a different Phillips curve for every expected rate of inflation.

It is not, however, simply the case that $(\dot{P}/P)^*$ becomes a parameter of shift of the Phillips curve, because it is usually the case that people form their expectations about inflation on the basis of current and previous price-change experience, so that any ongoing stable rate of price-change would come to be fully anticipated by workers in time. As we can now see this argument implies that the unemployment/wage-inflation trade-off offered along any Phillips curve is essentially a temporary phenomenon. Figure I.8 is taken from Laidler (38).

Figure I.8



Assume the economy is initially in the position $(U/L)_0 / (\dot{W}/W)_0$ on the Phillips curve PP with stable prices and expected price stability (the rate of wage-inflation $(\dot{W}/W)_0$ is thus compensated for by rising labour productivity). Assume further that the authorities try to peg the economy at the lower unemployment rate $(U/L)_1$ via the appropriate expansionary policies (an increase in the rate of monetary growth in the Friedman world). Initially this enables them to 'buy' the lower unemployment rate $(U/L)_1$ at the cost of an inflation rate of $(\dot{W}/W)_1 - (\dot{W}/W)_0$. This increase in output and employment is due to a simultaneous fall ex post in real wages to employers, and increase ex ante in real wages to employees. Since, as Friedman argues, the final prices of output respond to an unanticipated increase in aggregate demand faster than factor prices, then real wages paid by employers and received by employees fall, but these lower real wages to employees are seen as higher real wages in the short run, as they represent higher money wages evaluated as of expected price stability ie the expected real wage increases temporarily. Thus it is unanticipated inflation on the part of employees which allows the temporary increase in output and employment along the unchanged Phillips curve PP.

However, as the rate of inflation $(\dot{W}/W)_1 - (\dot{W}/W)_0$ continues employees expectations adapt to this new price change experience and would ultimately become fully adjusted. Employees will demand higher money wages to compensate them for the greater expected rate of inflation. Full adjustment of employees expectations and money wage-rates to the ongoing inflation rate means that the 'short run' Phillips curve shifts to $P' P'$ in Figure I.8, the decline in ex post real wages

is reversed, and the unemployment rate returns to $(U/L)_0$. Thus, in the long run, the Phillips curve becomes a vertical line at $(U/L)_0$ given that the actual (\dot{P}/P) becomes perfectly anticipated. To the extent that expectations on the part of employees do not fully adjust, or that there is not full adjustment of money wage-rates to expectations, then the 'long run' Phillips curve becomes steeper than the short-run curve but not vertical; the terms of the unemployment/wage inflation trade-off worsen in the long run. In the former case the short run Phillips curve in Figure I.8 does not fully shift up to $\dot{P}^!P^!$. This analysis also implies that unemployment levels below $(U/L)_0$ can only be held in the long run by additional expansionary policies which create an accelerating rate of inflation to which expectations never fully adjust.

The adaptive expectations mechanism is one scheme in which current expectations are formed on the basis of previous experience of inflation. It shows an 'error learning' process in which current expectations are adjusted by some proportion of the error which turned out on previous expectation ie

$$(\dot{P}/P)_t^* = (\dot{P}/P)_{t-1}^* + \alpha \left[(\dot{P}/P)_{t-1} - (\dot{P}/P)_{t-1}^* \right]$$

where the t 's are time subscripts. The case where $\alpha = 0$ is the case of completely inelastic expectations, and corresponds to the 'usual' statement of the Phillips curve as in the Phillips/Lipsey model. The case where $\alpha = 1$ is the case of completely elastic expectations and yields the steady state solution of the vertical Phillips curve. In this case $(\dot{P}/P)_t^* = (\dot{P}/P)_{t-1}$, so that we should expect $(\dot{P}/P)_{t-1}$ to enter

the wage-change equation with a co-efficient of unity. More usually $0 < \alpha < 1$, which implies the gradual adjustment of expectations to the actual rate of inflation and that 'short' and 'long run' Phillips curves exist,¹ the latter having a steeper slope. For the purposes of testing the expectations hypothesis in this case, the adaptive expectations mechanism implies that a $(\dot{P}/P)^*$ series can be generated as some weighted function of all past values of (\dot{P}/P) . In general then (\dot{P}/P) may be used as a proxy for $(\dot{P}/P)^*$ in the wage-change equation, where its efficiency as such will depend on the speed with which $(\dot{P}/P)^*$ adjusts to (P/P) (in the above expectations generating scheme, it will depend on how near α is to unity). The formal statement of the expectations hypothesis is therefore:

$$(\dot{W}/W) = \lambda \left[\Theta((U/L), (U/U)) \right] + B (\dot{P}/P)^*$$

where $B = 1$. The policy implications of the hypothesis are rather drastic in that there is no 'long run' unemployment/wage-inflation trade-off, and that to hold unemployment above or below its 'natural' rate requires steadily increasing deflation or inflation.

As Parkin (47) notes in his survey of the recent literature this conclusion holds only for a closed economy (or for an economy with a floating exchange rate). In an open economy with a fixed exchange rate an increase in imports and a diversion of goods from exports becomes a possible substitute for the domestic inflation that would otherwise accompany positive aggregate excess demand for labour. Hence,

1 But only in the disequilibrium state, which is prolonged by this partial adjustment.

increases in aggregate demand aimed at lowering unemployment below its natural rate may not cause the domestic inflation rate to vary very much. The openness of the economy will also mean that the domestic inflation rate will tend toward the world rate. Thus the effects of the attempts to lower unemployment via expansive monetary policies will be on the balance of payments initially, but will inevitably lead to an exchange-rate devaluation and domestic price inflation as the effects of the higher domestic prices of imports (and possibly exports if these are diverted to more profitable overseas markets) work through the economy. Price expectations will be adjusted, and then money wage-rates, so that the zero long run trade-off conclusion remains after full adjustment. For an open economy with a fixed exchange rate, the domestic inflation rate is very much tied to the world inflation rate as well as to the level of domestic aggregate demand.¹

Rees (56) has criticised the expectations argument in its Friedman version as outlined above for its emphasis on the behaviour of employees in adjusting money wage-rates when "... It should be remembered that in the great majority of labour markets, employers take the initiative". (P.233) He also argues that the 'temporary' trade-off along the short-run Phillips curve in the expectations hypothesis, may in practice turn out to be a lot less temporary because of the 'stickiness' of wage-rates. The consequence of this stickiness (which he puts down to the costs of making wage changes) is

1 This model of the determinants of inflation in an open economy is applied to the U.K. experience of the late 1960's by Laidler (38) and Parkin (47) P.7-8.

that the labour market can remain for long periods in a state of dynamic disequilibrium, with money wage increases exceeding productivity increases so there is inflation and a situation of lower unemployment than would exist if prices were stable. Thus, even with correct expectations, slow market adjustment processes prolong the duration of the policy trade-off along the Phillips curve. Rees also suggests that the initial fall of unemployment below the natural rate due to unanticipated inflation, may not be completely reversed when wages and prices are fully adjusted. This is because the 'employment experience' of the newly hired employees, whom Rees argues are taken in the main from 'structurally' unemployed groups, increases the average quality of the labour force and so "the fraction of the labour force worth employing at the old real wage will have increased as a result" (P.232).

The Phelps (53) version of the expectations hypothesis concentrates on expectations on the demand side of the labour market. The argument is that the expected rate of wage increases elsewhere, explicitly enters the competitive firm's own rate of wage increase. If the firm wishes just to preserve its existing labour force, then it must preserve its existing relative wages, and if wages elsewhere are rising, or are expected to rise, then this has to be taken into account in its own rate of wage-increase. Firms wishing to recruit more labour will want to raise their relative wages, and so will raise their wages at a faster rate than they expect wages elsewhere to rise ie there is an adjustment for

excess demand on top of the expected rate of wage increase. Firms with an excess supply of labour will make a downward adjustment from the expected rate of wage increase. Under these conditions Phelps is able to derive a temporary Phillips curve and a natural unemployment rate associated with zero excess demand for labour.

As Parkin (47) points out the 'real wage' which employers pay out, and employees negotiate, means different things to the two groups. For the employer, it is the gross money wage (inclusive of payroll taxes) in relation to the (wholesale) price of output, while for the employee it is the net of tax wage in relation to the price of consumer goods (retail prices). Ignoring other influences on aggregate demand for and supply of labour, such as changes in productivity and changes in demographic variables, incorrect expectations on all these factors can lead to wage-changes which are independent of the state of excess demand for labour. Thus Parkin (P.21) specifies a wage-change equation which includes as explanatory variables 'expected values' of employers payroll taxes, the ratio of take home pay to gross pay, the rate of change of retail, export and domestic wholesale prices. These are the expectations variables suggested from the demand and supply sides of the labour market by the expectations hypothesis. It is evident from this analysis that the role of inflationary expectations in the wage-change equation is only partially captured by the inclusion of $(\dot{P}/P)^*$ (which is usually taken as the expected rate of change in retail prices) on its own. The expectations augmented version of the Phillips curve should include the more comprehensive list of 'expectations' variables just described.

IV The Relationship Between \dot{W}/W and Trade Union Pushfulness

The extent to which trade unions can push up \dot{W}/W independently of the level of excess demand for labour was first systematically explored by Hines (26, 28). We have seen that trade union influence on \dot{W}/W is not inconsistent with the conventional excess demand model of the Phillips curve. That influence may manifest itself either through altering the speed of adjustment of money wage-rates (changing the slope of the reaction function) and/or by shifting vertically the reaction function due to 'spontaneous' wage-changes. Moreover, as Hines has argued, 'union pushfulness' can legitimately be included as an explanatory variable in the 'excess demand' model of wage-changes when that model is specified in terms of the determinants of excess demand for labour. The difficulty with testing the hypothesis that 'union pushfulness' determines \dot{W}/W , is that it is not a directly observable quantity. Hines proposes that the level of unionisation (T) (where T measures the percentage of the labour force that is unionised) and/or its rate of change (\dot{T}/T), may be used as an index of union pushfulness. We should therefore expect to find a significant relationship between \dot{W}/W and (T) and/or (\dot{T}/T).

The rate of change of unionisation is taken to be an index of union pushfulness on the assumption that "... When unions are being aggressive they simultaneously increase their membership and bid up wage rates" (P.225). This occurs for several reasons. In the first place, increasing membership makes officials of the union adopt a more intransigent

strategy at the wage bargain because they feel stronger. Secondly, increasing membership increases the militancy of workers and thus their willingness to support strike action. Under these circumstances, employers resistance to wage-increases is reduced, and the prospects of a 'successful' wage-demand on the part of the union are enhanced. If these arguments are correct then a union, in the pursuit of the goal of maximising its members incomes, will, immediately before and during the negotiation of a wage demand, pursue a policy of extending its membership so as to increase its bargaining power. Thus, increasing union pushfulness is associated with an acceleration in the rate of change of unionisation, and (\dot{T}/T) can be used as an index of union pushfulness.

In addition to (\dot{T}/T) which is a measure of the activity of trade unions, Hines also proposes that T , a measure of the strength of trade unions is also a valid proxy for union pushfulness. This is because the rate of change of unionisation is likely to be a decreasing function of the level of unionisation on the (reasonable) view that, as total union membership increases, it requires an increasing intensity of recruiting effort to produce a given increase in membership. This implies that a given (\dot{T}/T) is indicative of more 'pushfulness' the higher is the level of (T) . In addition, any large 'jumps' in the level of unionisation, as might occur when a previously unorganised group of workers become 'unionised', is likely to lead to a 'once and for all' increase in the equilibrium level of money wage-rates. Thus, on the assumption that (T) remains constant thereafter, such an increase would result in a sequence of wage-increases which

dwindle over time to zero. Other arguments can be used to support the inclusion of (T) as a proxy for union pushfulness, in the sense that such pushfulness is more effective when it is based on union strength. Thus, the higher is the level of unionisation, then the lower is the level of potentially substitutable non-union labour in any firm or industry, and perhaps the greater is the reluctance of non-unionists to blackleg.

An important dimension of the Hines hypothesis is the contention that union pushfulness is independent of the level of excess demand for labour. Hines shows, using United Kingdom data for the period 1893-1961 that, with perhaps the exception of the sub-period 1893-1912, there is no statistically significant relationship between the conventional indicators of the level of excess demand for labour and the rate of change of unionisation. He presents some formidable evidence to show that, over the period 1921-61, this index of union pushfulness is closely associated with the rate of change of money wage-rates, and that it is the causal variable in this relationship. Moreover, in the presence of this unionisation variable, the level of excess demand for labour as measured by the unemployment rate did not show as a significant explanatory variable in the wage-change equation. The firmness of the $(\dot{W}/W)(\dot{T}/T)$ relationship, and its predominance in the wage-change equation thus received strong statistical support.¹

1 The role of (T) was not neglected by Hines, and in the period 1921-61 (T) does show as a significant explanatory variable. Hines stresses however the role of (\dot{T}/T) as the index of union militancy based upon 'background' strength as described by (T) . The arguments for the inclusion of (T) stress its importance at times of large shifts in the level of unionisation. In the post-war period in the U.K. (T) has not varied greatly, and thus over this sample period, has not shown as a significant explanatory variable.

An observed relationship between aggregate (W/W) and aggregate (\dot{T}/T) may not however imply that such a causal relationship exists at the micro level. Hines suggests one route by which this aggregate relationship can be reached, which illustrates this point. If wage-rates rise in one sector of the economy then this disturbs the existing pattern of wage differentials. Assume that a prime objective of unions is to maintain that pattern of differentials, then we shall find that unions in other sectors become more militant and to the extent that they are successful in negotiating wage-increases we shall observe a rise in aggregate (\dot{W}/W) and (\dot{T}/T) . But the initial increase in wage-rates which triggered this 'spill over' mechanism may have been the outcome of increased demand for labour in that sector. Here we see the 'demand shift' idea mentioned above in a slightly different guise, with the implication that, at least in one sector, wage-changes are responsive to excess demand for labour. Alternatively, the initial wage-increase may have been the result of increased union militancy manifest in increased pushfulness on wage-rates. These arguments led Hines (28) to see if the pushfulness hypothesis operated at the micro level (it is after all an hypothesis about individual union behaviour) and to see whether the aggregate $(\dot{W}/W)/(\dot{T}/T)$ relationship was merely a phenomenon of aggregation. On the basis of industry level data for the period 1948-62 he concludes that unemployment, used as an indicator of excess demand for labour, is not a significant determinant of $(\dot{T}/T)_1$ in the majority of cases. He also finds a significant association between $(\dot{W}/W)_1$ and $(\dot{T}/T)_1$ in the majority of industries studied, including identified 'lead' and 'following' sectors. This is

in contrast to the much weaker, though in some instances significant, role of $(U/L)_i$ which was measured. The weight of this evidence seemed to support the findings and interpretation of the results of the aggregate study.

Purdy and Zis (55) have criticised the Hines hypothesis on the grounds that (\dot{T}/T) is an imperfect measure of union militancy. In the first place they argue that (\dot{T}/T) may change as a result of changes in employment in the closed shop sector of industry, where such changes do not reflect changes in union militancy in closed shop sectors. Dogas and Hines (31) accept this argument but argue that changes in (\dot{T}/T) from this source will be 'empirically unimportant' given that the closed shop sector covers only $\frac{1}{5}$ of manual workers, and $\frac{1}{6}$ of all workers. Purdy and Zis also point out what they call a 'dynamic' influence of the closed shop, which probably does reflect increased militancy, and involves the extension of the area of the closed shop across industry. Dogas and Hines (31) cite some evidence that the introduction of a closed shop in any sector usually follows a high level of unionisation so that even this 'closed shop' effect might not have a quantitatively important effect on (\dot{T}/T) . However, the main Purdy and Zis argument is that since $(T)_i$ varies between different sectors/industries then shifts in the sectoral distribution of the labour force will cause aggregate unionisation to vary even if there is no change in individual $(T)_i$'s because of the change in the labour force weights attached to the sectoral $(T)_i$'s. Similarly, aggregate (\dot{T}/T) will change for the same reasons. Using this argument, Purdy and Zis construct separate (\dot{T}/T) measures (and (T)) to show respectively that part of the change in aggregate (\dot{T}/T) which

is 'passive' and due to sectoral shifts of the labour force, and that part which is due to increased militancy as shown in changes in $(T/T)_1$ as of unchanged labour force weights. The latter is then regarded as the 'pure militancy' index appropriate to the Hines hypothesis. They find that when this 'pure militancy' index replaces the aggregate (\dot{T}/T) in the wage-change equation, its explanatory power is substantially weakened. In post-war data they find that this pure militancy index is statistically insignificant.

Dogas and Hines (31) do not accept this argument. To begin with, it implies that when workers move between industries they are always unionised exactly in the proportion unionised in the industry to which they move. Under these conditions $(T/L)_1$ in each industry remains unchanged, but the labour force weights attaching to each industry do change and so (T/L) changes given that the $(T/L)_1$'s are different in different sectors. But Dogas and Hines suggest that this is an unreasonable behavioural assumption, and one that is much more realistically seen as the outcome of militancy on the part of unions and their members in the industries to which workers are moving. They suggest that the outcome of such shifts, in the absence of union militancy in the industries gaining new entrants, is that due to 'inertia and habit persistence' the new workers will most likely unionise in the proportions prevailing in the industries from which they have moved. On this latter assumption they then show that a change in the sectoral distribution of the labour force results in a zero change in aggregate (\dot{T}/T) . Hence the aggregate Hines militancy variable (\dot{T}/T) remains as the appropriate index of union militancy.

The impressive empirical results which the Hines unionisation hypothesis has yielded, have raised a dilemma. In the context of the excess demand model of the Phillips curve union militancy is seen as a parameter of shift of the labour supply curve and enters a wage-change model specified in terms of the determinants of excess-demand for labour. Hines has pointed out that such a model should not explain a greater proportion of the variation in (\dot{W}/W) than the conventionally specified excess demand model. However, the latter model is a consistently inferior performer than the former. One implication of this, is that conventional measures and proxies of the level of excess demand for labour may not be accurate indicators of the 'true' level of excess demand for labour. Hines (30) has proposed an alternative framework for the $(\dot{W}/W)/(U/L)$ relationship. This is the Keynesian model, in which trade unions are assumed to exert autonomous upward pressure on the level of money wage-rates in efforts to preserve and increase the level of real incomes. Successful upward adjustments of money wage-rates increase aggregate expenditures and the derived aggregate excess demand for labour and reduce unemployment. Rising unit labour costs are assumed to result in rising prices, given the prevalence of oligopolistic market structures and associated administered price policies. The increase in prices frustrates the real income gains expected by workers who continue the upward push on money wage-rates. Assuming that the government does not respond with fiscal and monetary policies that contract aggregate demand, then money wage-rates and prices continue to increase at an increasing rate while

unemployment falls. Hence we observe the Phillips-type relation between (\dot{W}/W) and (U/L) . However, the government could respond with a contractionary fiscal and monetary policy which succeeds in raising unemployment. In this case we should observe a positive $(\dot{W}/W)/(U/L)$ relationship. If government policy has the effect of stabilising unemployment then the $(\dot{W}/W)/(U/L)$ relationship is not defined. In this scenario then the government can, by varying aggregate demand force trade unions (and oligopolists) to choose between higher rates of increase in money incomes and lower levels of unemployment. But (\dot{W}/W) is not obviously amenable to government policy of this nature, being determined largely by the pushfulness or militancy of trade unions.

A relevant question is what determines union pushfulness as this is measured by (T/T) ? In his aggregate study (26), Hines relates (\dot{T}/T) to the level of unionisation, on the grounds that the rate of change of unionisation is a decreasing function of the level of unionisation; to the rate of change of prices, entered with an institutional lag, on the grounds that changes in the cost of living between wage-settlements influence the militancy of trade unions; and to the level of profits using the Kaldor argument mentioned above that profits are an index of the prosperity of industry to which the bargaining strength of labour is related. Statistically, these variables could be associated with a high proportion of the variation in (\dot{T}/T) over the same period 1921-61.¹ The study of the disaggregate (industry) data (28),

1 In the context of the arguments above, the relevant 'price-change' variable to introduce as a determinant of (\dot{T}/T) is $(\dot{P}/P)^*$.

measures less well-determined relationships, and finds some slight role for the level of unemployment. Hines suggests "that it might very well be the case that a part of the variations in union militancy as measured by our index is to be explained in terms of political and sociological factors which are usually regarded as exogenous in economic models" (P.74). In this connection, he mentions the timing of elections of union officials, the power of shop stewards and unofficial leaders in unions, and the political climate.

Other studies (21, 63) have used alternative indications of union militancy, the most common type being some measure of strike activity. Some possible alternatives are the number of strikes, and its rate of change, the number of workers involved in strikes and the number of working days lost through strikes.¹ Whatever measure of militancy is used in wage-change models, the empirical success of the Hines model has sometimes been interpreted as evidence that trade unions cause inflation. This interpretation has always been disputed by Hines,

"It should be emphasised that our result in no way lays the blame for inflation at the door of the trade unions. They simply attempt to protect and advance the real incomes of their members by raising their rates of pay. The extent to which this is associated with inflation depends, among other things, on the ability of employers to pass on wage increases in higher prices. What our study does suggest is that trade

1 Ward and Zis (74) mention that these measures do not show a close correlation, and construct a 'combined' militancy index using some of these alternative measures.

unions are not ineffectual in the matter of wages as some observers have insisted" ((83) P.83).

The empirical demise of the conventional excess demand model of wage-changes has indicated that policies aimed at influencing aggregate demand will not 'cure' inflation. Attention has shifted onto the design and effectiveness of incomes policies, a matter which lies outside our current brief.

In spite of the robustness of Hines empirical results on the strength of the $(\dot{W}/W)/(\dot{T}/T)$ relation, the underlying hypothesis that union pushfulness determines the rate of wage-inflation remains a matter of some dispute. There seem to be two areas of disagreement. The first is that, as Purdy and Zis argued, (\dot{T}/T) is not an accurate index of union militancy. It is often suggested that the very small variations in union militancy that have occurred over the post-war sample period are unlikely to be reflections of changes in union militancy (see for example Godfrey (21)). Parkin (47) notes the argument that the role of (\dot{T}/T) in the wage-change equation is ambiguous and may arise from aggregation. Suppose that union sector wage rates exceed wage rates in the non-union sector of an economy. In that case, the aggregate rate of wage-change will vary with the fraction of the labour force receiving the union wage, and we should therefore expect to see a relationship between (\dot{W}/W) and (\dot{T}/T) . The second line of argument is that the hypothesis about union behaviour is 'ad hoc', or not derived from any well worked out model of union behaviour. Wilkinson and Burkitt (75) suggest that the power of trade unions to push-up wage-rates (to the extent that it can be adequately measured or proxied) is but only one factor influencing their success in doing so. Other factors,

such as the support of workers in other industries and the attitude of the government and the general public, far from being parameters which define the situation within which trade unions operate, are variables which they seek to manipulate and which help determine the success of wage demands. Within this scenario, they suggest that it does not make sense to concentrate exclusively on union power.

CONCLUSION

The conventional excess demand model of the Phillips curve does not suggest the unemployment rate as a unique determinant of wage-inflation. In fact the curve emerges very much as a ceteris paribus relationship, and in recent years it is a popular view that 'other things', particularly expectations of price inflation, have not been constant. Both Phillips and Lipsey emphasise the influence of changing unemployment on wage-inflation, though with different rationalisations. This is an important point since if (\dot{U}/U) does have an independent influence on (\dot{W}/W) then it is not the case that, in the short-run at least, the Phillips curve can be viewed as a policy frontier. The immediate effect of changing the unemployment rate is to move around a Phillips 'loop' and not to slide along the Phillips curve. The latter as Phillips pointed out, is the relationship between stable unemployment levels and the rate of wage-inflation. Because of the effects of expectations and/or changes in the dispersion of unemployment, the Phillips curve is not a short-run policy frontier. The theory of the Phillips curve does suggest that we should not be surprised to find that in some years (perhaps in most years given that (\dot{U}/U) is generally non zero) the wage-change/unemployment experience of the economy lies 'off' the measured Phillips curve.

The major competing hypothesis about the determination of wage inflation is the union militancy explanation. One difficulty with this view in interpreting the inflationary experience of the United Kingdom is that it seems to ignore the 'global' aspect of the recent experience of stagflation.

The policy implications of this explanation are not clear. The hypothesis offered by Hines explains why (\dot{T}/T) is an index of union militancy. The determinants of (\dot{T}/T) as investigated by Hines do not include measures of the excess demand for labour, but do include previous rates of price inflation, measures of the profitability of industry plus some room for 'socio-economic' explanations. To the extent that changes in aggregate union militancy do reflect the struggles of competing groups in society for increasing shares of the national product, then the appropriate policy would seem to be one which either directly restrains the combatants, or makes that struggle redundant by 'centrally' fixing the shares to the various groups ie some version of 'incomes policy'

II SOME EMPIRICAL ESTIMATES OF THE
WAGE-CHANGE EQUATION - A SUMMARY

I N T R O D U C T I O N

The usefulness of the policy implications of the Phillips curve depends very much on the quantitative explanatory significance and long period stability of the relationship. These determine the extent to which the policy choices are restricted to the trade-off possibilities and stable wage solution along a single Phillips curve, or to the much wider set of choices available from a 'family' of Phillips curve, or indeed whether the theory of the Phillips curve is an appropriate framework within which to operate in the explanation of wage-inflation. This chapter aims to provide a summary of some of the empirical evidence on the determinants of wage-inflation in the United Kingdom. It includes what it is hoped is a representative sample of estimates of the wage-change equation from various studies for different data periods. This evidence provides in addition a basis for discriminating between some of the competing hypotheses which have already been outlined. The chapter is organised along the same lines as the discussion of the theoretical development of the Phillips curve in Chapter I.

I The Relationship Between (\dot{W}/W) and the Unemployment Rate

The Phillips hypothesis predicts a significant negative and non-linear relationship between (\dot{W}/W) and (U/L) , and a negative relationship between (\dot{W}/W) and (\dot{U}/U) . The role of (\dot{P}/P) as a determinant of (\dot{W}/W) is seen as very subdued: it is only during and immediately after years when rapid increases in import prices cause (\dot{P}/P) to exceed (\dot{W}/W) , that cost of living adjustments in money wage-rates are triggered off and lead to an independent effect of (\dot{P}/P) on (\dot{W}/W) . The sample period covered in Phillips study is 1861-1957, and is treated in three sub-periods, namely 1861-1913, 1913-1948, and 1948-1957. The relationship which is estimated is that between (\dot{W}/W) and (U/L) for the period 1861-1913. The form of equation used is,

$$\log (\dot{W}/W) + a = \log b + c \log (U/L) \quad \dots (1)$$

where (\dot{W}/W) is a first central difference.¹ This equation is fitted to six points of 'average' $(\dot{W}/W)/(U/L)$, which were obtained as the average values of the (\dot{W}/W) and (U/L) observations respectively, in each of six groups of $(\dot{W}/W)/(U/L)$ observations, which were derived by allotting each observation according as its value of (U/L) fell into one of six intervals of (U/L) between zero and 11%. In this way Phillips

1 The proportional time rate of change of a variable X defined by the first central difference method is

$$\dot{X}_t = \frac{1}{2} (X_{t+1} - X_{t-1})/X_t$$

where a dot over a variable indicates the first time derivative, and t is a time subscript. Alternatively \dot{X}_t may be defined as a simple proportional difference viz

$$\dot{X}_t = (X_{t+1} - X_t)/X_t$$

eliminated the influence of changing unemployment on (\dot{W}/W) , so as to estimate the relation that would hold between (\dot{W}/W) and (U/L) when (U/U) is zero. The result obtained is,

$$\log (\dot{W}/W) + 0.900 = 0.984 - 1.394 \log (U/L) \dots\dots (1a)$$

This is the measured Phillips curve.

Phillips then considers the $(\dot{W}/W)/(U/L)$ observations for individual years in relation to the curve thus obtained. For the period 1861-1913, the time-path of these observations over the course of a typical trade-cycle traces out an anti-clockwise 'loop' around the curve. Phillips accounts for these anti-clockwise loops in terms of the inverse relationship between (\dot{W}/W) and (\dot{U}/U) . An interesting feature of the $(\dot{W}/W)/(U/L)$ data for the period 1913-1948 is that it groups into two distinct clusters of observations corresponding to unemployment rates at or below 4%, and above 9%. Phillips' data shows that this period yields only one observation (for 1940) that lies within the unemployment range 4% to 9%, (see Phillips *ibid* Figure 10). Although the total range of unemployment values experienced is far wider than for example in the 'high employment' experience post 1948, the distribution of the actual values over that range is such as to deter any strong conclusions on the form and stability of the Phillips curve. A curve fitted to two such distinct clusters of points could be misleading. Phillips accounts for this observed scatter of points in terms of his hypothesis whereby extreme deviations in the (\dot{W}/W) observation are explained by large changes in the price-level, and the consequent cost-of-living adjustments in wage-rates (as for example in 1920, 1921, 1922, 1937, 1940 and 1941),

and by the typical displacement of the (\dot{W}/W) observation that arises as a result of the inverse $(\dot{W}/W)/(\dot{U}/U)$ relation.¹ Phillips suggests that the disturbances arising from cost-of-living adjustments in wage-rates in this period can in part explain the fact that the time paths of the observations for each trade-cycle do not show as clearly the 'loops' that were observed for the nineteenth century trade-cycles. He also mentions an additional factor, the extremely uneven geographical distribution of unemployment, as increasing the rapidity of wage-changes during the upswing of business activity from 1934-1937. This proposition is consistent with the Lipsey dispersion hypothesis which predicts that during the upswing of the trade-cycle, a worsening in the dispersion of unemployment will lead to upward displacements of the $(\dot{W}/W)/(\dot{U}/U)$ observations.

In the final sub-period considered by Phillips, which is 1948-57, it turns out that the time path of observations for the trade cycle show clockwise, not anti-clockwise loops around the Phillips curve. Phillips proposes that such loops are the outcome of the development of a time-lag in the adjustment of wage-rates. By introducing a seven months lag in the adjustment of wage rates to unemployment (ie $(\dot{W}/W)_t = f(U/L)_{t-7}$) the clockwise loop is made to disappear and the offending points for the years 1953-57 are shifted close

1 Some years in this period saw extremely rapid changes in the unemployment percentage eg $(U/L)_{1920} = 2.6\%$ and $(U/L)_{1921} = 17\%$, so that this effect would be quite large in relation to the 'normal' influence of changing unemployment. In those years when prices fell sharply as well as the unemployment percentage, the existence of arrangements for automatic cost-of-living adjustments in wage-rates, would tend to strengthen the relationship between (\dot{W}/W) and (\dot{U}/U) .

to the Phillips curve. No evidence is given as to the choice of an 'institutional' lag of this particular length. Peacock and Ryan (49) found that, over the period 1948-51, there was an average lag of four months between the first presentation of a claim and its final settlement. Evidence cited in Routh (57),¹ shows that in 27 major negotiating groups, the average time between the submission of a wage-claim and its settlement in the 10 years since 1949 has been 117 days, with wide variations in different years eg. 1953, 146 days, 1956, 95 days. These facts suggest a 'negotiating' lag in the order of four months.

Phillips thought that the statistical evidence he presented seemed 'in general' to support his hypothesis of a quantitatively significant relationship between (\dot{W}/W) and (U/L) (and (\dot{U}/U)), and that moreover the estimated Phillips curve seemed to have been stable over the entire period 1861-1948. On this basis he tentatively concludes that,

".... assuming an increase in productivity of 2 per cent per year it seems from the relation fitted to the data that if aggregate demand were kept at a value which would maintain a stable level of product prices the associated level of unemployment would be a little under $2\frac{1}{2}$ per cent. If ... demand were kept at a value which would maintain stable wage-rates the associated level of unemployment would be about $5\frac{1}{2}\%$ " (ibid P.299)

His study attracted attention for several reasons. Firstly it presents a relatively simple hypothesis to account for the rate of wage inflation, and, if we assume a simple

1. Routh (57) P.314 Footnote 1

monotonic relationship between (\dot{W}/W) and (\dot{P}/P) this hypothesis can be extended to the rate of price inflation. Perhaps more important are the policy implications of the study. The Phillips curve demonstrates the incompatibility of the policy goals of full employment and price stability. The apparent long-period stability of the curve suggests that it offers a stable policy frontier along which lower unemployment rates can be traded against higher rates of wage inflation.¹ The non-linearity in the relation suggests that reductions in the cyclical fluctuations of unemployment would reduce the average rate of wage inflation associated with the average level of unemployment over the trade cycle.

The usefulness of these predictions from the Phillips curve, and the choice set which it offers to policymakers, depend crucially on the stability of the curve over time, and on the explanatory significance of (U/L) and (\dot{U}/U) as determinants of (\dot{W}/W) . The only relation estimated in the Phillips study was that between (\dot{W}/W) and (U/L) for the period 1861-1913, with no indication given of the explanatory

1 The long period stability of the curve also implies that the fundamental changes which occurred in the organisation of labour and the arrangements for fixing wage-rates had apparently had no independent influence on the rate of wage inflation. Hicks (24) puts forward the view that the only essential difference was a change in procedure; the collective bargain replacing the individual bargain between employer and employee. In any case the stability of the curve does not deny union influence on (\dot{W}/W) , since that influence is consistent with the excess demand model of the Phillips curve. What is denied in the context of this model is that if we can find a suitable measure of the factors operating from the union side of the wage-bargain, then we should not expect that the proportion of the variation in (\dot{W}/W) that is explained by these factors would exceed the proportion that is explained by an efficient proxy for the level of excess demand for labour.

power of the estimate or of the explanatory significance of the independent variables. Moreover this relation is measured between 'average' (\dot{W}/W) and (U/L) , and is interpreted as a relation between stable unemployment levels and the rate of wage inflation. One implication of the assumed stability of the Phillips curve over the long period is that (U/L) is the most important determinant of (\dot{W}/W) . In a contemporary criticism, Knowles and Winsten (37) doubt that the relation is as determinate as the curve makes it appear. For the period 1861-1913 they note that for unemployment rates below $3\frac{1}{2}\%$, the associated rates of wage inflation that were experienced lie in the range - 1% to 28%. Thus they could not hold with confidence the policy implications of the Phillips curve since although "unemployment may play some part in the causal chain, in this region there is still a very great deal left to explain" (P.118).

A further reason for doubting the accuracy of Phillips' result, which Knowles and Winsten mention, concerns the "possible peculiarities" of the data to which Phillips fitted his curve. The main contention of another contemporary criticism of Phillips' study by Routh (57) is that the use of more appropriate and improved data for the period 1861-1913 might yield 'significantly different' results. The wage index from which (\dot{W}/W) is defined in the Phillips study, is a fixed weight index which Routh argues is an unsuitable measure of wage-rates during a period characterised by substantial occupational and/or industrial shifts, as was the period 1861-1913. This is because the index exaggerates the

depressing effect of unemployment on wage-rates by continuing to give declining high employment industries the same weight in the index (the weights should be reduced as the proportion of workers employed in these industries falls), and by failing to give increasing weights to industries with relatively low but expanding unemployment. The use of a vari-weighted index for this period (which is available) might therefore yield a significantly different (\dot{W}/W) series. Routh also suggests that Phillips did not use a wage series that was appropriate to his hypothesis. The wage-rates described in the Phillips hypothesis are, he argues, "effective rates" (the rates actually paid by employers) whereas the wage index used is based on "standard rates" (the rates laid down in collective agreements or wages council orders), and over the period 1861-1913 the relation between the two is inconstant. The choice between the two is not therefore arbitrary. It is however difficult to test the proposition that earnings, and not wage rates, are the more appropriate indicator of events in the labour market. Many modern studies use earnings series on the grounds that these represent the labour costs to employers which enter into price determination under (widespread) administered price regimes. In addition the phenomenon of 'wage-drift', the divergence between wage-rates and earnings for a standard work week, has yielded a district branch of study in the literature alongside the study of the relationship between wage-rate inflation and unemployment.

As regards the unemployment series used by Phillips for the period 1861-1913 Routh points out that both the coverage and the weighting of this series is not consistent with the

occupations and industries included in the wage series, and with the weighting given to those industries and occupations common to both indexes. He therefore re-estimated the Phillips curve for the period 1861-1913, using the same technique as Phillips, and obtained qualitatively very similar results; on the basis of wage-rate and unemployment data which was adjusted to eliminate the inadequacies in the original data. Lipsey (41) subsequently took the view that these results served to demonstrate the strength of the relation between (\dot{W}/W) and (U/L) which continued to show up "in spite of imperfections in the data". When we turn to comparisons of the data used in the three sub-periods several interesting points arise. As regards the unemployment data, in the period 1861-1913 the available series measures the percentage of the unionised labour force unemployed, and is used as a proxy for the unemployment rate among wage-earners. This introduces two possible sources of error. Firstly, the unemployment percentages for this period may be too high or too low. In this connection Routh (ibid) gives some evidence that, as compared to the inter-war unemployment data, the average trade union unemployment rate for the period 1883-1913 of 4.8% is too low and needs adjusting to about 6%. If this is correct then such an adjustment would entail a rightward shift in the curve measured by Phillips. A second possible source of error is that the trade union unemployment series for 1861-1913 may have understated and overstated the actual rate of unemployment in different degrees at different times. This possibility is not explored by Routh. Similar comparison difficulties with the

unemployment series exist as between the inter-war and post 1948 sample periods. Turner (69) points out that the post 1948 unemployment percentages are not comparable with the inter-war percentages because the latter are calculated on an 'insurable' population which was then much more restricted. The 1948 Insurance Act extended social insurance to the whole occupied population and increased the insurable work force by about one half, mainly via the inclusion of salaried people. The post 1948 unemployment percentages thus measure the number of employees unemployed, both wage and salary earners, as a proportion of the total numbers, whereas the pre-1948 percentages correspond much more closely to the proportion of wage-earners unemployed, (this being the relevant unemployment rate for the Phillips hypothesis). Evidence from the occupational tables of the 1951 population census shows that the unemployment percentage is much higher among wage-earners than among salary earners, so that the inclusion of the latter group in the post-1948 unemployment percentages makes these 'too low'. Routh suggests raising each percentage (post-1948) by a factor of one eighth to establish the rate for wage-earners, while some recalculations given by Turner suggest an upward adjustment in the order of one sixth. Later studies by Lipsey (41) and Hines (27) both use an upward adjustment of the post-1948 unemployment percentage by a factor of one fifth.

A final data problem in connection with the Phillips study concerns the definition of the (\dot{W}/W) variable. In the period 1861-1913, Phillips defines (\dot{W}/W) as a first central

difference of the wage index but in the two subsequent sample periods he uses the annual percentage change in the index. This procedure raises two problems. In the first place, the first central difference device has a smoothing effect on measured rates of change as compared to the use of percentage differences which produce a rate of change series showing greater fluctuations. The second problem concerns the 'time-alignment' of the dependent and independent variables in the wage-change equation. If (\dot{W}/W) is measured as an annual percentage change in the wage index this has the effect of introducing an implicit time-lag (of approximately six months) into the annual $(\dot{W}/W)_t$ series, which the use of the first central difference device avoids.¹ In studies using annual data the appropriate definition of the rate of change variables must be used with respect to the points in the year at which the relevant time series are centred. For example, if the annual unemployment percentage is centred at mid-June, while the wage index is an end-December figure, then the percentage difference definition of $(\dot{W}/W)_t$ will ensure that both variables are measured at the same point in the year. For the period since 1920, Phillips' study uses an end-December wage index and a mid-June unemployment percentage (the twelve monthly average) which leaves the variables correctly 'time aligned'. For the period 1861-1920 Routh argues that the wage index is best regarded as an end-December figure, so that Phillips' use of a first central difference of the wage index effectively advances the $(\dot{W}/W)_t$ series by approximately six

1 The argument demonstrating this is given in Lipsey (41), P.2 Footnote 2.

months as compared with the subsequent period. The estimated Phillips curve thus relates $(\dot{W}/W)_t$ to $(U/L)_{t-6}$, and is a lagged relationship. A final point in connection with the wage index used in the Phillips study is that for the post-1948 sample period Phillips uses an index of weekly wage-rates and not hourly wage-rates as in the previous sample periods. Phillips notes that hourly wage-rate changes will generally exceed weekly wage-rate changes because of the decline in normal weekly hours over the course of the post-1948 period.¹ The possibility exists therefore that the (\dot{W}/W) series measured from weekly and hourly wage indexes will show significantly different variation. This, and other related data problems are taken up in Chapter III.

The careful reconsideration of the statistical base of the Phillips curve in Routh's study refutes the possibility that the curve itself might be a statistical artifact which shows up only, or mainly, in the (rather imperfect) data used by Phillips. Neither study addresses the important issues, at least for policymakers of the determination of the quantitative significance of the Phillips relation, the relative explanatory significance of (U/L) and (\dot{U}/U) , and of additional explanatory variables such as (\dot{P}/P) , and of the measurement of the relation in more recent sample periods than 1861-1913. Lipsey's (41) study provides not only the theoretical background to the relation, but also this essential empirical background.

1 An index of normal weekly hours shows a reduction of 0.2% in 1948 and 1949, and an annual average reduction of approximately 0.04% from 1950 to 1957.

One of the first differences in the Lipsey study is the adoption of a form for the wage-change equation that relates (\dot{W}/W) to a linear combination of non-linear transformations of the unemployment variable viz

$$(\dot{W}/W)_t = a + b(U/L)_t^{-1} + c(U/L)_t^{-2} \quad \dots (2)$$

The advantage of this form of equation is that it can be fitted by standard regression techniques to all the original observations of the 1861-1913 sample period. This is not possible with the logarithmic form chosen by Phillips which cannot accommodate negative values of the variables.¹

Lipsey's estimate of the Phillips curve for the period 1861-1913 is,

$$(W/W) = -1.42 + 7.06 (U/L)^{-1} + 2.31 (U/L)^{-2} \quad \dots (2a)$$

The associated (uncorrected) R^2 indicates that 64% of the variance in money wage-rates is associated with variations in the level of unemployment.² A further improvement in Lipsey's study is the inclusion of additional explanatory variables in the wage-change equation. Lipsey includes both (U/L) and (\dot{U}/U) in a multiple regression equation, where (\dot{U}/U) is defined using first central differences, and obtains this result for the period 1861-1913,

$$(\dot{W}/W) = -1.52 + 7.60 (U/L)^{-1} + 1.61 (U/L)^{-2} - 0.023 (\dot{U}/U) \quad \dots (3)$$

The R^2 indicates that 82% of the variance in (\dot{W}/W) can be associated with variations in (U/L) and (\dot{U}/U) . Phillips is careful to point out that the inclusion of (U/L) and (\dot{U}/U)

1 The choice between the two alternative forms is not, as Lipsey points out, crucial for the form of the Phillips curve (ibid P.4). When equation (2) is fitted to Phillips' six points of 'average' the result is

$$(\dot{W}/W) = -0.44 + 0.023 (U/L)^{-1} + 12.52 (U/L)^{-2}$$

2 This estimate is not based fully on Phillips original data. For the years 1881-85 (\dot{W}/W) is defined from an alternative wage index. See Phillips (ibid P.291) and Routh (ibid P.303).

in a linear multiple regression equation is a legitimate procedure since (U/L) is in this case a trend free variable, and hence (\dot{U}/U) is uncorrelated with (U/L) or any power of (U/L) . The relationship between (\dot{W}/W) and (U/L) which is measured in equation (3) is therefore free of the influence of changing unemployment on (\dot{W}/W) (and Phillips own procedure for estimating the $(\dot{W}/W)/(U/L)$ relation for $(\dot{U}/U) = 0$ is legitimised). Finally Lipsey adds the cost-of-living variable (\dot{P}/P) to the wage-change equation and finds a marginal gain in the R^2 (to 0.85).

$$(\dot{W}/W) = 1.21 + 6.45 (U/L)^{-1} + 2.26 (U/L)^{-2} - 0.19 (\dot{U}/U) + 0.21 (\dot{P}/P) \dots (4)$$

The estimated coefficient on the price-change variable indicates that only one fifth of any change in the cost-of-living is passed on in accelerating the rate of wage-inflation.¹

Lipsey's analysis of the sample period 1861-1913 seems in general to support Phillips' main conclusion. It shows a significant relationship between (\dot{W}/W) and (U/L) , (\dot{U}/U) and (\dot{P}/P) . Hines (27) conducts a similar analysis on the data for this period. Initially he estimates the Phillips relation between (\dot{W}/W) and (U/L) , where the unemployment variable enters non-linearly, and then added (\dot{U}/U) . The proportion of the variance in (\dot{W}/W) associated with the explanatory variables rose from 66% to 80%, and Hines concludes that "... it seems reasonable to accept the conclusion that the level and rate of change of unemployment were significant determinants of the rate of change of money

1 The cost of living variable is also tried with a 6 months lag and yields 'broadly similar' results.

wage-rates in the period 1862-1913" (P.62). Hines also conducts a test on the data for this period to see whether the assumption of non-linearity in the relation between (\dot{W}/W) and (U/L) is supported by the evidence. The test rejected the hypothesis of linearity in the relation for this period. For the sample period 1893-1912¹ Hines is able to add (\dot{T}/T) , the proxy variable for union militancy, and changes in the cost of living lagged six months $(\dot{P}/P)_{t-6}$ as explanatory variables in the wage-change equation. The unemployment variable remains firm, and T shows as a significant explanatory variable. (\dot{U}/U) and $(\dot{P}/P)_{t-6}$ do not however show as significant², but 78% of the variance in (\dot{W}/W) is 'explained' by the chosen explanatory variables.

Another feature of the Lipsey study is the extension of the statistical analysis to the 1913-1957 sample period, in order to test whether the same relationships still held between (\dot{W}/W) and (U/L) , (\dot{U}/U) and (\dot{P}/P) , and whether the relative explanatory significance of the variables had changed. Initially he defines the period of study as 1920-1939→1947-1957 (thus excluding observations for years dominated by the effects of war time) and estimates the $(\dot{W}/W)/(U/L)$ relationship which gives the low R^2 of 0.28. The addition of (\dot{U}/U) and (\dot{P}/P) increases the proportion of 'explained' variance in (\dot{W}/W) to 0.88, and (\dot{P}/P) shows as the predominant explanatory variable with an estimated

1 Adequate data on the proxy variable for union militancy is not available for years before 1893.

2 Hines points out that the coefficient on $(\dot{P}/P)_{t-6}$ is subject to bias (P.65)

coefficient in excess of unity. However some doubt attaches to the representativeness of these results as the variation in the (\dot{W}/W) series is dominated by the extreme experience of just four years. The sample period is thus re-defined as 1923-1929 1948-57 and an equation is fitted to the data of the form

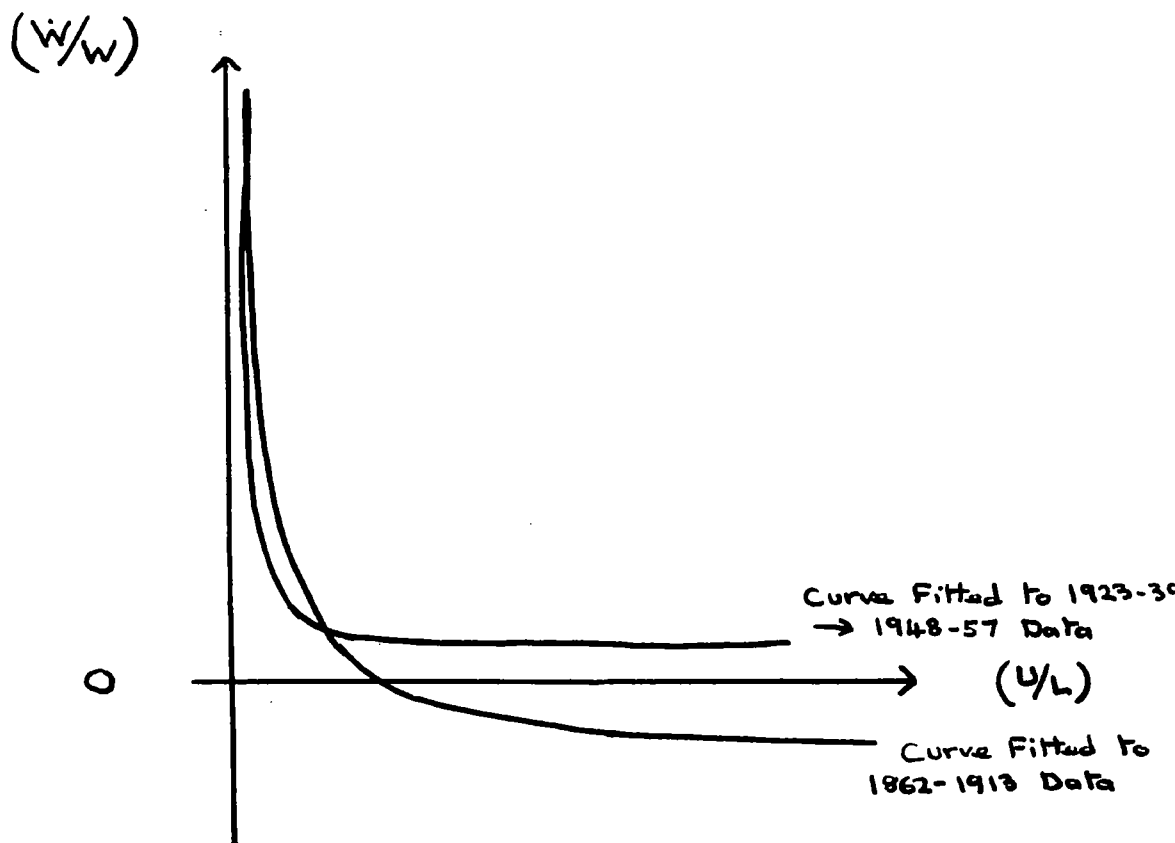
$$(\dot{W}/W) = a + b (U/L)^{-1} + c (U/L)^{-4} + d (\dot{U}/U) + e (\dot{P}/P) \dots (5)$$

The result obtained is

$$(\dot{W}/W) = 0.74 + 0.43 (U/L)^{-1} + 11.18 (U/L)^{-4} + 0.038 (\dot{U}/U) + 0.69 (\dot{P}/P) \dots (6)$$

The overall explanatory power of the equation is high: 89% of the total variance in (\dot{W}/W) is associated with the variation in the explanatory variables. The cost of living variable emerges as the most significant explanatory variable and shows a large increase in its coefficient value (from 0.21 to 0.69) as compared to the period 1861-1913.¹ The fitted Phillips relation changes significantly in this period, as compared to the period 1861-1913. For levels of unemployment above 3% the new curve lies above the old, while for levels less than 3% it lies below the original curve (see Figure II.1). Another significant change that emerges is the positive (not negative) coefficient on the (\dot{U}/U) variable, which, in the context of the Lipsey dispersion hypothesis suggests that upswings of activity in this period were associated with a falling dispersion of unemployment rates. However it appears from the evidence of the standard errors of the coefficient estimates that the unemployment variables $(U/L)^{-1}$ and $(U/L)^{-4}$ are statistically insignificant.

1 This coefficient estimate is probably biased upwards due to the interdependence of price and wage-changes.

FIGURE II. 1

SOURCE: Lipsey (41) P.244

This evidence suggested the conclusion that wage-rate changes in this (twentieth century) period were much more explicable in terms of a wage-price spiral, than in terms of the response of wage rates to the level of excess demand for labour as measured by the unemployment rate.

The Lipsey study thus severely modifies the empirical conclusions reached by Phillips on the long period stability of the Phillips curve. Moreover, it seemed apparent that any particular estimates of the parameters of that relation are very sensitive to the data period chosen for the fit, to the inclusion of additional explanatory variables, and to the form of the chosen estimating equation. These remarks are especially pertinent when we come to consider the results obtained for the post war sample period. The significance of the unemployment rate as an explanatory variable has proved extremely sensitive both to the chosen data period, and to the inclusion of additional explanatory variables. Generally speaking some significant explanatory role, if very weak, has been found for the unemployment rate (but not for its rate of change) in the post war data period up to the mid-1960's. Thus, for the period 1949-61 using annual data Hines (26) estimates the result,

$$(W/W) = 0.404 + \frac{7.170}{(3.154)} (U/L)^{-1} \dots\dots (7)^1$$

and finds that 32% of the variance in (\dot{W}/W) can be associated with variations in the unemployment rate. For the data period 1951-66, using quarterly data, Thirlwall (67) estimates the linear equation,

1 Standard errors of coefficient estimates in parentheses.

$$\dot{(W/W)} = 10.039 - 2.518 (U/L) \quad \dots\dots (8)$$

$$(1.532) \quad (0.848)$$

which gave an R^2 of 0.37. He also found that a log linear form gave a marginally better result, and that the exclusion of the observation for 1952 (a year of excessive wage inflation, which is normally ascribed to the impact of price increases consequent upon the Korean war, and which is therefore dominated by rapid import price increases in the context of the Phillips hypothesis) led to a marked gain in the explanatory power of this 'pure' Phillips curve relationship.

The inclusion of changes in the price-level as an additional explanatory variable in the wage-change equation generally leads to a significant gain in explanatory power for the post war data period. The estimated coefficient on the price-change variable is however subject to bias arising out of feedback effects from previous wage-rate changes as a result of the fact that the wage-change equation is part of an interdependent system. Thus the price-change variable being used as an explanatory variable in the wage-change equation may in part be 'induced' by the wage-rate changes it is being used to explain. A single equation model will only separate out the influence of price changes on wage changes if there is a sufficient time lag between an initial rise in prices, the wage increases that result, and the further price rise that results. If this 'feedback' interval is less than the twelve months interval in terms of which most studies are cast, then if least squares estimates are used there is a general possibility that the coefficient estimates will be biased. Early studies by Klein and Ball (35)

and Dicks-Mireaux (12) overcame this problem by estimating wage change equation as part of interdependent wage and price-change models using estimating procedures that take account of this mutual reaction between price changes and wage changes. The Klein and Ball study presents estimates of a subset of an econometric model of the United Kingdom consisting of equations explaining the annual change in the level of weekly wage rates, the annual change in the excess of weekly earnings over weekly wage rates, the level of hours worked per week and a price formation equation showing the price of final output as a mark up over costs of production. These four equations were estimated from quarterly data for the period 1948-57 using the limited information maximum likelihood estimating procedure. Both the level of unemployment, and the rate of change of prices, are found to be significant determinants of the annual change in the level of weekly wage rates. The level of unemployment enters as an indicator of excess demand for labour where the latter is seen as a constraint upon the bargaining power of labour and not as in the context of the Phillips curve analysis. Moreover, Klein and Ball found that least squares estimates of the coefficients were "hardly distinguishable from those obtained using a consistent method of estimation"(P.474). This suggested that the problem of least squares bias, when no account is taken of the interdependence of the price-wage structure, does not significantly affect the results obtained as long as the price-change variable is included in the wage-change equation with an 'institutional lag'.¹

1 Thus, in the Lipsey estimate (equation (6)) above, where the price-change variable is unlagged, he suggested that the coefficient estimate was biased upwards.

Thus there is sufficient evidence that, at least in the post war sample period up to the mid-1960's both the level of unemployment, and the price-change variable can make a statistically significant contribution to explaining the variance in (\dot{W}/W) , as variously defined from the index of hourly or weekly wage-rates. The effects of extending the sample period up to 1970 are examined in Chapter III. The results of including additional explanatory variables are reported below. While a great deal of work has been done on measuring various forms of the $(\dot{W}/W)/(U/L)$ relationship, the constituent reaction function and mapping relation have received less specific attention. As regards the reaction function, studies by Dicks-Mireaux and Dow (14) and Dicks-Mireaux (12) replaced the unemployment variable in the wage-change equation with an index of the pressure of demand for labour developed in (16). This index is not very different from the simple difference of the vacancy and unemployment rates, and so corresponds closely to the use of directly measured excess demand for labour rather than the unemployment proxy. For the sample period 1950 IV to 1956 IV, the Dow/Dicks-Mireaux study finds that lagged price-changes and the excess demand index can explain 89% of the variation in (\dot{W}/W) , where the latter is the annual (quarter to quarter) percentage change in the weekly wage-rate index. The coefficient estimates suggested that a one point change in the percentage level of excess demand is associated with a change of 3 or 4% in (\dot{W}/W) , and that about one half of any price-change is reflected in subsequent wage increases. These conclusions are only slightly modified in the Dicks-Mireaux (12)

study in which the wage-change equation is estimated as a part of a two equation price-change/wage-change model using the method of two stage least squares. The coefficient estimates obtained by Dicks-Mireaux indicated that a one point change in the level of excess demand is associated with a change of about 2.75% in (\dot{W}/W) , and that about four tenths of any change in prices is subsequently reflected in wage-changes.¹ A comparison of estimates of the wage-change equation obtained by both ordinary and two stage least squares confirmed Klein and Ball's findings that the coefficient estimates are not markedly sensitive to the use of different estimating procedures in the post war period. The ordinary least squares estimate obtained by Dicks-Mireaux for the period 1946-59 is,

$$\begin{aligned}
 (\dot{W}/W) = & 3.72 + 0.38 (\dot{P}/P)_t + 0.14 (\dot{P}/P)_{t-1} + 2.44 D_{t-\frac{1}{4}} \dots (9) \\
 & (0.51) \quad (0.11) \qquad \qquad (0.08) \qquad \qquad (0.66) \\
 & \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad R^2 = 0.91
 \end{aligned}$$

where the t's are time subscripts at annual intervals and D is the index of (percentage) excess demand for labour.

To the extent that we can regard D as being very close to directly measured X, then (9) represents an estimate of a linear and non proportional form of the reaction function in the theory of the Phillips curve. For the early post war sample period the explanatory significance of the relationship

1 The Dicks-Mireaux study measures (\dot{W}/W) as the annual percentage change in average wages and salaries and represents a third variant of the basic wage rate data so far encountered. In addition this study measures price-changes from an index of final prices rather than retail prices. These data differences must always be borne in mind when comparing results from different studies.

seems well established. As Dicks-Mireaux points out the presence of a fairly large constant term in the equation can be interpreted to mean that there is continual upward pressure on wages. We noted in Chapter I that Hansen (23) includes a positive constant in the reaction function to represent the 'spontaneous rate of wage increase' deriving from the inflationary effect of the wage-setting institutions (specifically the trade unions) in keeping wage-rates rising in times of excess labour supplies. Dicks-Mireaux sees the constant term as representing "the average values of the delayed responses to the explanatory variables". (P.285). The basic idea is that the current (\dot{W}/W) is the outcome of levels of excess demand for labour and price-changes over several years, whereas standard models incorporate only recent past changes in these variables. As such, the estimates of the coefficients of the model catch the (major) short term response of (\dot{W}/W) to a change in the explanatory variables but they do not measure the complete response. This idea is investigated with respect to the $(\dot{W}/W)/(\dot{P}/P)$ relation, mainly because most coefficient estimates of the price-change variable have been in the region of 0.5 and not unity,¹ but without finding great support for this interpretation of the constant term. In any case, the 'modern' expectations approach suggests that there is only full adjustment to expected price increases in the long run and that in non-stationary situations, expected and actual inflation will differ.

1 This suggested that money wage rates are not fully adjusted for price increases, whereas a more plausible assumption is that in the long run there is full price compensation.

We turn now to a brief consideration of empirical estimates of the mapping relation between X and (U/L) . As we saw in Chapter I a simple hyperbolic relationship is usually assumed between the vacancy and unemployment rates and, given that $X = (V/L) - (U/L)$, it then follows that we can derive a mapping relation of a form consistent with that postulated in the theory of the Phillips curve. This suggests that, empirically, it is sufficient either to measure the $(V/L)/(U/L)$ relationship or the mapping relation itself. If either shows up as well-defined in the data, then so must the other by definition.¹ As is the case for many of the estimated Phillips curves in the post war sample period, a simple linear form has often been assumed to describe these relationships. The usual justification in both cases is that, given the narrow range of values of unemployment experienced, a linear form will adequately approximate the non-linear relation.² Using annual averages of quarterly data on the unemployment and vacancy rates for the period 1949-1966, Thirlwall (66) estimated a linear unemployment/vacancy relation as,

$$(U/L) = 2.989 - 0.908 (V/L) \quad \dots (10)$$

(0.223) (0.150)

$$R^2 = 0.682$$

He also estimated a linear relation between (U/L) and X as,

$$(U/L) = 1.661 - 0.0079 X \quad \dots (11)$$

(0.038) (0.0009)

$$R^2 = 0.797$$

1 If $(V/L) = m^2 (U/L)^{-1}$, and $X = (V/L) - (U/L)$, then $X = m^2(U/L)^{-1} - (U/L)$.

2 This means that linear estimates of Phillips curves and mapping relations must be used with care for prediction purposes. It will be unwise to extrapolate 'linear' experience far outside of the narrow range of unemployment values for which the linear approximation is adequate.

When the sample period is extended to the end of the 1960's many investigators have noticed an apparent shift in the vacancy/unemployment relationship in the period since 1966. It appears that since the end of 1966 the level of unemployment has been permanently higher relative to the level of vacancies. Using quarterly data Gujarati (22) estimates a log linear form of the relation for the period 1958 IV to 1966 III (roman numerals indicate quarters of the year),

$$\begin{aligned} \log (U/L) = & 0.20737 - 0.75492 \log (V/L) \quad \dots (12) \\ & (0.02731) \quad (0.04254) \\ & + 0.000106 T \\ & (0.000106) \quad \bar{R}^2 = 0.9307 \end{aligned}$$

where T is a time trend, and is insignificant. This equation is used to 'predict' values of (U/L) for the period 1966 IV to 1971 II, and on the basis of the ratio of actual to predicted (U/L) in this period, Gujarati is able to derive a 'correction factor' of 1.44 for dividing into the actual (U/L) in the period since 1968 III to adjust for a permanent upward shift in the (U/L)/(V/L) curve which is identified as having occurred in the period 1966 IV to 1968 IV.

Gujerati attributes this shift to the effects of significant changes in social security payments introduced by the 1965 Redundancy Payments Act and 1966 National Insurance Act which have permanently increased the average time spent in job search, and thus measured unemployment. But this is by no means the only available explanation. Taylor (62) offers the view that this increase in registered unemployment during 1967 and 1968 was the result of a shift of unused labour resources from 'labour hoarding' by firms to registered unemployment. His argument is that firms

deliberately 'shook out' previously hoarded labour during the period 1966 to 1968. This occurred because employers took an increasingly pessimistic view of future aggregate demand in the light of the 1967 Balance of Payments crisis, and the uncertain success of the devaluation of that year. In addition there may have been a more determined effort on the part of employers to raise labour productivity through a shake out. The evidence for this view is that between 1966 IV and 1968 IV there was a sharp fall in Taylor's estimates of labour hoarding. In a reply, Gujerati disputes these explanations given for the presumed 'shake out' in 1966-1968 (and also 1970-71); he also questions the accuracy of the 'labour hoarding' estimates and whether indeed any shake out of hoarded labour occurs. A study by Foster (19) also finds evidence of an upward shift in the unemployment/vacancy relation in the period 1966-68, but suggests that this is not a 'once and for all' shift and that the relation has continued to move outward in the period since mid-1971. Further evidence from the study by Bowers, Cheshire and Webb (4) confirms the view that in post 1966 data the Phillips curve type relation seems to have been broken, and that this is due to a shift in the unemployment/vacancy relationship. In a further study (5), the same authors present evidence that the increase in unemployment in this period was not due to 'special' factors but was largely demand induced. They find that the shift in the vacancy/unemployment curve is due to an increase in vacancies.

As regards the mapping relation in the theory of the Phillips curve, the empirical evidence suggests therefore that in post-1966 data the relation has shifted outwards and was previously fairly well-determined. The theory of the Phillips curve which was outlined in Chapter I suggests various additional explanatory variables, other than the level of unemployment, in the wage-change equation. The extent of the investigations into the role of the unemployment dispersion variable σ_u^2 , the price expectations variable $(\dot{P}/P)^*$, and the proxy measures of union militancy leads us to treat this evidence under separate categories.

Lipsey and Steur (43) looked at the role of the profits variable in the wage-change equation. The theory of this relationship had been advanced by Kaldor (34), and suggested that the observed $(\dot{W}/W)/(U/L)$ relationship represented only a statistical correlation reflecting the more fundamental relationship between the level of profits and (\dot{W}/W) (since (U/L) and the level of profits will generally be significantly correlated). It will be recalled that the Kaldor hypothesis is that (\dot{W}/W) depends on the bargaining strength of labour which in turn depends on the prosperity of industry which determines "both the eagerness of labour unions to demand higher wages, and the willingness and ability of employers to grant them" (P.293). The prosperity of industry is measured by the level of profits, so that the appropriate correlation should be between (\dot{W}/W) and some measure of profits. Furthermore, it is to be expected that this relationship will prove to be more significant than that between (\dot{W}/W) and (U/L) . One immediate difficulty in testing this hypothesis arises since if (U/L)

and some measure of profits prove to be strongly (inversely) correlated, then it will not be possible to separately estimate the relative explanatory significance of each in the wage-change equation. Nor is it clear what the appropriate measure of profits should be. Lipsey and Steur experimented with both money and real profits as explanatory variables, and in all cases found that real profits turned out to have greater explanatory significance.

For the sample period 1949-58 Lipsey and Steur found that the evidence did not appear to support the view that the 'direct' causal variables are highly correlated with (U/L), or that profits were a more important explanatory variable than (U/L). Evidence at the disaggregate level, using industry data, fairly conclusively rejected the Kaldor hypothesis for this sample period, (although in the inter-war period 1926-38, both aggregate and disaggregate data found the profits variable to have greater explanatory power than the unemployment variable). This evidence confirmed Klein and Ball's (35) finding that the level of profits did not make a statistically significant contribution to the explanation of wage-changes in the period 1948-56.

II The Relationship Between (\dot{W}/W) and σ_u^2

In the Lipsey theory of the Phillips curve, aggregation over micro Phillips curves introduces the dispersion of unemployment into the aggregate wage-change equation. In Chapter I we saw that this dispersion hypothesis rests upon a positive dispersion effect $(\delta W/W)/\delta \sigma_u^2 > 0$, whereas subsequent analysis has concluded that there can be no a priori assumption about the sign of the dispersion effect. In addition, the Lipsey theory of the loops requires that changes in σ_u^2 are systematically related to (\dot{U}/U) . For anti-clockwise loops σ_u^2 and (\dot{U}/U) are inversely related, and vica-versa for clockwise loops. On this argument (\dot{U}/U) enters the wage-change equation as a proxy for σ_u^2 . Archibald (2) has estimated aggregate wage-change equations which include a measure of the dispersion of unemployment using annual data for the period 1950-66. His study usefully illustrates some of the problems associated with the empirical testing of the significance of the dispersion variable in the wage-change equation. This is an important question since, on the Lipsey argument, reductions in the dispersion of unemployment (and excess demand for labour) over micro labour markets represent one policy option for slowing down wage inflation.

An initial problem is the choice of an appropriate measure of dispersion over micro labour markets. The data offers disaggregation to the industry and regional levels, which must therefore be taken as the nearest empirically available counterparts of 'true' labour markets. The 'regional' dispersion variable is then defined as the

weighted variance of regional unemployment.¹ An 'industrial' dispersion variable is similarly defined and it must then be assumed that these dispersion measures computed from the available data are good proxies for the 'true' dispersion of excess demand over micro labour markets. However, for reasons given in Chapter I this may not be so. There it is shown that, given the nature of the mapping relation from X to (U/L) , the dispersion of unemployment inevitably declines as the aggregate level of unemployment falls even though σ_x^2 may be unchanged. It also turns out that the distribution of unemployment rates over micro labour markets inevitably becomes skewed as the aggregate level of unemployment falls. There are then theoretical grounds for doubting the efficiency of σ_u^2 as a proxy for σ_x^2 . Archibald is aware of these difficulties and finds that (U/L) and σ_u^2 are in fact positively correlated and that, rather surprisingly, σ_u^2 and a measure of skewness are also positively correlated.² He did not find a significant correlation between σ_u^2 and (\dot{U}/U) such as is postulated by the Lipsey theory of the loops, and nor did he find a significant role for (\dot{U}/U) in the wage-change equation. However, the dispersion hypothesis still predicts that changes in σ_u^2 of a nonsystematic nature will shift the Phillips curve.

1 Specifically

$$\sigma_u^2 = \sum f_i (U/L)_i - (\bar{U/L})^2$$

where

f_i is the proportion of the labour force in the i 'th region

$(U/L)_i$ is the percentage unemployment in the i 'th region

(U/L) is the national unemployment percentage.

2 Our arguments have assumed no direct relation between the dispersion and skewness of the unemployment distribution, but suggest that any observed relation should be inverse.

For the period 1950-66 Archibald obtained the following result using the regional dispersion variable,

$$\begin{aligned} (\dot{W}/W) = & -4.398 + 8.321 (U/L)^{-1} + 0.315 (\dot{P}/P) + 1.709 \sigma_u^2 \\ & (2.3) \quad (3.6) \quad (2.5) \quad (3.1) \dots (13) \end{aligned}$$

$$\bar{R}^2 = 0.78 \quad D.W. = 1.19$$

where the t values are shown in parentheses beneath the coefficient estimates. The significance of the dispersion variable thus suggested that policies which reduce the regional dispersion of unemployment rates will shift the Phillips curve inwards.¹ The results obtained using the industry dispersion variable are qualitatively similar although the coefficient estimate on the dispersion variable is much smaller, and the overall fit is not quite as good, (Archibald ascribes this to problems specific to the 'unemployment by industry' data).

Another study which measures the effects of changes in the dispersion of unemployment on aggregate wage-inflation is that by Thirlwall (67). One improvement in this study is the use of consistent regional data in the computation of the regional dispersion variable (the regional data used by Archibald included several regional boundary changes during the sample period). Another problem in the Archibald paper is that of multicollinearity, arising from the positive correlation between σ_u^2 and (U/L). This problem is minimised in the Thirlwall study by dividing the dispersion measures by (U/L).² Thirlwall finds that the industrial measure of

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- 1 For recent discussions on this point see Burns (7) and Leslie (40)
 - 2 In Archibald's formulation of the wage-change equation the positive correlation between σ_u^2 and (U/L) meant that the separate influences of each variable on (\dot{W}/W) would be offsetting. (U/L) and ($\sigma_u^2 / (U/L)$) show a positive correlation not significantly different from zero in the case of the industrial dispersion variable, but in the case of the regional dispersion variable there was significant negative correlation.

unemployment dispersion makes a significant contribution to the explanation of aggregate wage-inflation, with the expected positive coefficient estimate. This evidence favoured the view that changes in the average degree of the distribution of unemployment over industrial labour markets had exerted a significant independent influence on the rate of (hourly) wage inflation (Archibald uses weekly wage-rate data) over the period 1951-66. The regional measure of unemployment dispersion showed as statistically insignificant, and did not add to the explanatory power of the wage-change equation. Unfortunately the high degree of negative correlation found between the regional dispersion variable and (U/L) makes these estimates obtained unreliable. On balance therefore, this empirical evidence does find a significant role for some measure of unemployment dispersion in the wage-change equation, and for a positive dispersion effect. The evidence rejects the idea of a simple relation between σ_u^2 and (\dot{U}/U) , but this does not mean we can necessarily reject the theory of the loops. As suggested in Chapter I it might be more appropriate to test for such a relation separately in cyclical upswing and downswing data.

According to Lipsey, the dispersion variable gets into the aggregate wage-change equation as a result of aggregation over identical non-linear micro Phillips curves. Increases in σ_u^2 which lead to increases in (\dot{W}/W) are also consistent with some alternative hypotheses, namely the demand shift/wage-spread propositions mentioned by Schultz (58). Given the assumption that wages are more flexible upwards than downwards, changes in σ_u^2 as of a given level of (U/L) which lower unemployment in some sectors will lead to wage increases in those sectors, but there will be no corresponding fall in wages in those sectors in which unemployment increases.

As a result (\dot{W}/W) and σ_u^2 will both increase. The wage spread hypothesis implies that rising wage-rates originating in any sector, will be followed by wage increases in other sectors for the purpose of maintaining relative wage differentials. This will tend to reinforce the effect on (\dot{W}/W) of any changes in σ_u^2 .

A feature of the study by Thomas and Stoney (68) is that they separately consider the 'pure' dispersion effect of changes in σ_u^2 on (\dot{W}/W) , and the further effect of a wage spread mechanism by which wage increases obtained in low unemployment markets are transmitted to other labour markets thus magnifying the effect on (\dot{W}/W) of the initial changes in σ_u^2 . This latter 'wage spread' dispersion effect is independent of the factors causing an initial rise in wage-rates in some 'leading sector', and will magnify the effect of any factor which causes wages in leading sector labour markets to rise. This study does not question the existence of Phillips curves at the micro level so that, given this assumption, the wage-spread mechanism should generally operate to spread wage increases that initially occur through changes in σ_u^2 . This means that if $(U/L)_i$ is the most significant determinant of $(\dot{W}/W)_i$, then 'leading' markets can be identified as those with the lowest $(U/L)_i$'s. In constructing the "non-linearity" dispersion variable the authors assume identical micro Phillips curves,¹ and using

1 In each i'th sector

$$(\dot{W}/W)_i = k (\dot{P}/P) + f (U/L)_i$$

where (\dot{P}/P) is the rate of change of the aggregate price-level. On the assumption that it approximates expected inflation $(\dot{P}/P)^*$, then this means that (\dot{P}/P) is the same in all markets. Brechling (6) has developed a multi-sector model into which he introduces inter-sectoral relationships in the expectations generating process.

a quadratic approximation for the micro Phillips curve, they show that the (regional) unemployment dispersion variable does not enter simply as the weighted variance of unemployment rates, as in Archibald's formulation. The 'wage-spread' dispersion variable is taken as the difference between $(\dot{W}/W)_1$ in some leading sector, or as the average $(\dot{W}/W)_1$ of the markets comprising the leading sector, and the 'normal' wage adjustment which would have occurred in the absence of the mechanism. Aggregate wage-rates are assumed to be adjusted by a proportion of this difference, that proportion being an index of the strength of the wage-spread mechanism. Two possible modes of operation of the transfer mechanism are considered. A model in which wage-rates in non leading sectors are assumed to be adjusted by a proportion of the difference between average wage-changes in a leading sector of 3 (regional) markets, and the wage-change that would occur in non-leading markets in the absence of any wage-spread mechanism, provides the better results. The estimated wage-change equation therefore includes (\dot{P}/P) as a proxy for $(\dot{P}/P)^*$, (U/L) (three non-linear forms were tried), the regional unemployment dispersion variable σ_u^2 , and a wage-spread mechanism variable (A). An a priori restriction that the coefficients on the (U/L) and σ_u^2 variables be equal meant that these could be combined into a composite variable (S^*) which by-passed the problem of intercorrelation with the (U/L) variable. Equations (14) and (15) below show the estimates of the wage-change equation for the period 1950-66, using the reciprocal non-linear form for the $(\dot{W}/W)/(U/L)$ relationship. Equation (15) combines the unemployment

dispersion variable and (U/L) in the composite variable S^* ,

$$\dot{(W/W)} = 1.31 + \frac{0.417}{(0.047)} \dot{(P/P)} + \frac{1.15}{(1.60)} \dot{(U/L)}^{-1} + \frac{4.55}{1.71} \sigma_u^2 / (U/L)^3 + 7.62A \quad \dots (14)$$

$$\bar{R}^2 = 0.51 \quad D.W. = 1.81$$

$$\dot{(W/W)} = 0.83 + \frac{0.419}{(0.047)} \dot{(P/P)} + \frac{2.79}{(0.42)} S^* + \frac{7.26A}{(2.15)} \quad \dots (15)$$

$$\bar{R}^2 = 0.95 \quad D.W. = 2.08$$

where the standard errors of the coefficient estimates are in parentheses, and the $\dot{(W/W)}$ are hourly wage-rates. Both the dispersion and wage-spread mechanism variables are significant, and, as the authors demonstrate, may have exerted an upward pressure on $\dot{(W/W)}$ of more than two percentage points in the post war period.

For the period 1925-38 the authors find that the unemployment dispersion variable and (U/L) do not perform well. In this period the level of unemployment varied between 10% and 20% so that over this range of unemployment experience the Phillips curve is rather 'flat' and a linear approximation to it would be appropriate. Unemployment dispersion effects arising from aggregation over micro Phillips curves are not likely to be very significant during this period when, presumably, most micro labour markets were in excess supply. Storey and Thomas therefore estimate a wage-change equation which included (U/L) linearly, and only included the wage-spread mechanism variable and $\dot{(P/P)}$ as additional explanatory variables. This gives the result,

$$\dot{(W/W)} = -0.079 + \frac{0.437}{(0.079)} \dot{(P/P)} - \frac{0.268}{(0.104)} (U/L) + \frac{0.964}{(0.350)} A \quad \dots (16)$$

$$\bar{R}^2 = 0.889 \quad D.W. = 1.54$$

The important feature of this result is the finding that, in the presence of the significant wage-spread mechanism variable, the unemployment rate shows as statistically significant in an equation which provides a good statistical explanation of wage-changes in this inter-war period. We may recall Lipsey's (41) findings for the twentieth century period, which suggested that (U/L) was insignificant and stressed the influence of (\dot{P}/P) as a factor which kept wage-rates rising even in times of excess labour supplies. In addition, both Hines (26, 27), and Lipsey and Steur have found, for a similar sample period, that (U/L) does not make a statistically significant contribution in the wage-change equations in which it is included.

Hines (29) rationalises the observed relationship between σ_U^2 and (\dot{W}/W) by arguing that it is no more than a statistical artifact which arises out of the operation of a wage-transfer mechanism as outlined above. Whatever the cause of wage increases in leading sectors, the effect is to bring into operation the wage-spread mechanism whereby unions in following sectors become more militant and will attempt to negotiate wage adjustments to preserve the previously existing inter-sector wage differential. The extent of their success in this determines the strength of the wage-spread mechanism, and may be "modified by such factors as demand conditions, the militancy of unions, the degree of countervailing monopoly power and hence the strategy and attitude of managements in the following sectors." Union activity in following sectors is thus the motivating force behind the wage-spread mechanism but as a result of the

operation of this mechanism (\dot{W}/W) is observed to rise. But we may also observe a simultaneous increase in the measured dispersion of unemployment, which is unrelated to the operation of the wage spread mechanism, but leads us to observe the $(\dot{W}/W)/\sigma_u^2$ relationship. An ideal test of this hypothesis requires some measure of the sectoral variance of the proxy for union militancy, the rate of change of unionisation. Data problems on the disaggregate unionisation data prevent the construction of such a variable, but in any case regional and industrial dispersion measures of unionisation may not be very meaningful since unions are not organised on these bases. The fact that unions are organised across the regional and industrial disaggregates of the data suggested to Hines that changes in union militancy in following sectors may well be captured by the variations in aggregate unionisation. If this is so then changes in (\dot{T}/T) the Hines proxy variable for union militancy may adequately capture the effect of the wage-spread mechanism on (\dot{W}/W) . In that case, if both σ_u^2 and (\dot{T}/T) are simultaneously included in the wage-change equation, then we should expect to find that σ_u^2 is not statistically significant since this hypothesis implies that it has no independent influence on (\dot{W}/W) . Hines finds that, for the period 1951-66, σ_u^2 (and (U/L)) are not significantly different from zero, when they are included with (\dot{T}/T) as explanatory variables in the wage-change equation.

The policy implications of the observed $(\dot{W}/W)/\sigma_u^2$ relation thus depend importantly on the determinants of wage-changes in leading sectors, according to this wage-spread

interpretation of the σ_u^2 variable, whereas the results obtained by Storey and Thomas outlined above do find in addition a significant and positive non-linearity dispersion effect such as is suggested by the Lipsey dispersion hypothesis. In addition, the Hines argument suggests that the wage-spread mechanism operates between workers in different 'bargaining areas', and that these bargaining areas may not correspond to the regional and industrial disaggregates offered in the data. However investigations have had to proceed with this disaggregate data on the assumption that the sub aggregates in the data must serve as the nearest available proxies for the appropriate micro markets. Studies using regional data have had to use earnings and not wage-rates as the dependent variable in the wage-change equation, since data on wage-rates is not available on a regional base.

Most contributors have commented on the fact that whereas the regional unemployment levels show considerable regional disparities, regional rates of change of earnings have risen at much the same rate. This limited inter-regional variation in earnings is consistent with another variant of the wage-spread mechanism which suggests that earnings increases in high demand regions spill over into low demand regions. Earnings changes in high demand areas are assumed to be determined by 'local' labour market conditions and these are then transmitted to low demand regions subject to modification by labour market conditions in these regions. Cowling and Metcalf (11) estimated two relations; a regional earnings adjustment equation for high employment and low

employment regions respectively, where the latter equation includes the rate of change of earnings in a high employment region (taken as London and the South East) as an additional independent variable to the local labour market variables, the 'local' level and rate of change of unemployment.¹ They found that the coefficient on the rate of change of earnings in London and the South East was significant and quite large, and suggested that there is considerable spill over of earnings increases from high demand to low demand regions. This effect is modified by 'local' conditions as represented by the significant coefficient estimates obtained on the local rate of change of unemployment, while the local level of unemployment proved an insignificant explanatory variable. These results suggested that regional anti-inflation policies would be most effective if concentrated on reducing the regional imbalance in unemployment via increasing unemployment in high demand regions. In these regions the 'local' effect of changes in (\dot{U}/U) is measured as quite strong, and more particularly the 'spill over' effect from these regions would be correspondingly reduced. Thirlwall (65) has also tested this regional earnings spread hypothesis. He introduced a lag of six months on the 'spill-over' variable (the rate of change of earnings in London and the South East) on the assumption that such an earnings spread phenomenon takes time. Thirlwall introduced this 'spill over' variable into the earnings-change equation for each region for the period 1962-68 and found that it was statistically insignificant and generally had the incorrect sign. Similar results were found by

1 The significant degree of correlation between the local labour market variables in the high employment group of regions made it difficult to separate out the effect of each on the rate of change of earnings in these regions. The data period in this study is 1960-65.

Metcalf (45) in his analysis of regional earnings adjustment equations for the period 1960-68, so that the regional earnings spread hypothesis to account for the observed regional uniformity of earnings increase has not found great empirical support. In the context of the Hines wage spread mechanism outlined above this may merely reflect the fact that the region is not the appropriate bargaining unit.

An alternative hypothesis to account for this uniformity rests on the finding by Dicks-Mireaux and Shepherd (13) that "changes in wage-rates have been a major determinant of changes in earnings" (P.38). The proposition is that wage-rates rise uniformly across regions as a result of national bargaining, and that earnings will do the same if they are largely dependent on changes in wage-rates. Thirlwall (65) therefore included $(\dot{W}/W)_{U.K.}$ (the national rate of change of wage-rates) as an additional explanatory variable in earnings-change equations for each of eight regions using data for the period 1962-68. The estimated coefficient on $(\dot{W}/W)_{U.K.}$ was significant in all but two regions, and the estimated relations showed reasonable explanatory power (the R^2 's ranged from 0.5 to 0.9). He concluded that the rate of increase of wage-rates in the United Kingdom appeared to have been a major determinant of the rate of change of regional earnings, and accounts for the similarity of earnings increases between regions. Metcalf (45) fitted a similar equation to data from ten regions for the period 1960-68, and found that the coefficient on $(\dot{W}/W)_{U.K.}$ had the expected positive sign in all regions, and was statistically significant in all but one region. Moreover, the size of

of the coefficient in most regions (≥ 0.8) indicated the explanatory significance of the $(\dot{W}/W)_{U.K.}$ variable.

One point of difference in the results from these regional studies concerns the role found for $(\dot{U}/U)_R$, the regional rate of change of unemployment. Cowling and Metcalf found that it was always a significant explanatory variable, whereas Thirlwall found that in a fully specified regional earnings-change equation, it was generally insignificant. All the studies provided evidence of no significant relation between earnings-changes and regional unemployment levels in the presence of $(\dot{U}/U)_R$ or $(\dot{W}/W)_{U.K.}$. These results suggested that reductions in the dispersion of regional unemployment rates will have little effect on aggregate earnings inflation, since 'local' demand conditions are not important determinants of regional earnings changes. The most sensible area for policy action seems to centre on the rate of aggregate wage inflation and the practice of 'national' bargaining for wage-rates.

As regards the industry disaggregate data, the early study by Dicks-Mireaux and Dow (14) for the period 1950-56 found that wage-changes in seven major industry groups could be satisfactorily explained in terms of changes in the aggregate index of excess demand for labour, rather than in terms of local demand, via its influence on the general 'climate' of wage-negotiations. Lipsey and Steur (43) examined the role of the profits variable in the earnings-change equation for ten individual industry groups.¹ For the

1 This study use earnings-changes instead of wage-rate changes. Evidence is given which suggests that earnings changes adequately mirrored wage-changes without being distorted by "the various forces which cause the rate of change of wage-rates to differ from the rate of change of earnings" (ibid P.143).

period 1949-58, the results showed that the level of unemployment was generally a significant explanatory variable, while the profits variable generally showed as insignificant. This evidence thus suggested the existence of 'industry' Phillips curves. However Hines (28) estimated wage-change equations at the industry group level for the period 1948-62 to see if the proxy variable for union militancy the rate of change of unionisation was as successful in explaining wage-changes at this level as had been the case at the aggregate level. He found "evidence of a statistically significant relationship between the rate of change of money wage rates and the rate of change of unionisation at the industry level" (P.70). Further experiments suggested that $(U/L)_i$ was not the dominant factor determining $(\dot{T}/T)_i$, although the rather low explanatory power of the industry equations explaining $(\dot{T}/T)_i$ meant that no dominant factor was identified, and led Hines to suggest that some of the variation in $(\dot{T}/T)_i$ may be due to political and sociological factors "which are usually regarded as exogenous in economic models" (P.74). When $(U/L)_i$ was included in wage-change equations with $(\dot{T}/T)_i$ and a profits variable, $(\dot{T}/T)_i$ showed up as the most significant explanatory variable. The profits variable was generally insignificant, and $(U/L)_i$ showed as rather weak in the equations in which it was significant. Another wage-change model related $(\dot{W}/W)_i$ to aggregate (U/L) , $(\dot{P}/P)_{t-\frac{1}{2}}$ and (\dot{T}/T) on the argument that such phenomena affect the climate in which the wage-bargain takes place. In these equations the most important aggregate variable was the cost of living variable $(\dot{P}/P)_{t-\frac{1}{2}}$. Experiments were also made to see if $(\dot{W}/W)_i$ could be explained in terms of the rate of

wage inflation in some lead sector, the lead sector being the industry group dominated by the general unions the majority of whose members are unskilled and semi-skilled.¹ The results obtained were consistent with the lead sector hypothesis, but they might also just reflect the fact that the large unions are organised across industries and simultaneously negotiate wage increases in a number of industries. To the extent that Hines' definition of the leading sector industry groups represents the leading bargaining area in his version of the wage-spread mechanism, then we can reject the latter proposition.

Thus it seems fairly clear that the evidence of the disaggregate data that we do have, rejects the notion of micro Phillips curves and the associated non-linearity dispersion effect (with the exception of the Thomas and Storey result already discussed). Consequently there is not strong empirical support for the policy of reducing the regional distribution of unemployment as a means to reducing aggregate wage-inflation.

1 This industry group comprised Chemicals and Allied Trades, Other Manufacturing, Gas, Water, Electricity, Transport and Communications. For a reconsideration of these Hines results see Wilkinson and Burkitt (75).

III The Relation Between (\dot{W}/W) and Expected Inflation

In Chapter I we have seen that the strict 'simple' version of the expectations hypothesis requires the expected (not actual) rate of change of prices $(\dot{P}/P)^*$ to enter the wage-change equation with the a priori restriction of a coefficient of unity. The obvious empirical problem is that $(\dot{P}/P)^*$ is not directly observable, and has therefore to be related to observable quantities if it is to become operational. A first approach to this problem is to suppose that $(\dot{P}/P)^*$ depends on past levels of (\dot{P}/P) , as is postulated in error-learning schemes such as adaptive expectations. According to adaptive expectations,

$$(\dot{P}/P)_t^* = (\dot{P}/P)_{t-1}^* + \alpha((\dot{P}/P)_{t-1} - (\dot{P}/P)_t^*)$$

where $0 \leq \alpha \leq 1$. The choice of a value for α is arbitrary within the prescribed limits. The nearer it is to zero then the more past experience of (\dot{P}/P) is taken into account in the formation of current expectations.

Using annual British data for the period 1948-66 Solow (60) constructed a number of $(\dot{P}/P)^*$ series for assumed values of α from 0.1, 0.2, 0.9. He used an iterative procedure beginning from initial (1948) values of $(\dot{P}/P)^*$ and (\dot{P}/P) . Since there was no clear choice for the initial value of $(\dot{P}/P)^*$, different values were tried (representing 2%, 4% and 8% expected rates of inflation respectively), but the resulting $(\dot{P}/P)^*$ series were found to give similar results. Solow's chosen vehicle for testing the expectations hypothesis was a price change model which incorporated annual percentage changes in unit labour costs and in the index of prices of imported raw materials, an index of capacity utilisation to represent the direct effect of the pressure of demand in the

final goods markets, and two dummy variables to catch any effects of the Cripps (1948 and 1949) and Lloyd (1961) attempts to 'talk down the price level'. Each $(\dot{P}/P)^*$ series, for each value of α , was additionally included as an explanatory variable, and the equation estimated by ordinary least squares.¹ The estimated coefficient on the $(\dot{P}/P)^*$ variable was in the region of 0.2 in all the regressions, and was significant for the $(P/P)^*$ series based on values of $\alpha \geq 0.4$. However, similar estimates based on quarterly data for the period 1956-66 found significantly different regression coefficients. The coefficient on $(\dot{P}/P)^*$ was significantly larger (about 0.8), the Lloyd dummy variable became insignificant, and the index of demand pressure showed as significant in all cases and had the correct sign. These results suggested there was a change in price formation behaviour after 1956. When the model was re-estimated from

1 The trade-off equation being estimated can be represented as

$$(\dot{P}/P) = f(x) + k (\dot{P}/P)^* \quad 0 \leq k \leq 1 \quad \dots (1)$$

"where x stands for a whole list of the relevant real characteristics like the unemployment rate, the level of output, and any others" (P.3). The strict expectations model requires that $k = 1$, so that when $(\dot{P}/P) = (\dot{P}/P)^*$,

$$(\dot{P}/P) - (\dot{P}/P)^* = 0 = f(x) \quad \dots (2)$$

and the rate of inflation has no effect on the level of unemployment. If $k < 1$ and $(\dot{P}/P) = (\dot{P}/P)^*$ then

$$(\dot{P}/P) = 1/1 - k, f(x) \quad \dots (3)$$

is the long run trade-off equation. Since $k < 1, 1/1 - k > 1$, so that in the long run the effect of any change in x is built up after expectations become fully adjusted by $1/1 - k$ times the short run effect of that change on (P/P) .

To the extent that this price fixing assumption is unrealistic, the specification of the price-change equation falls down as the most efficient vehicle for testing the expectations hypothesis.

annual data for the period 1956-66, the regression coefficients were hardly different to those initially obtained from annual data for the period 1948-66. Solow was led by these results to conclude that there must be some inconsistency between the annual and quarterly data. This evidence rejected the strict expectations hypothesis and suggested that since there is partial adjustment to the expected rate of inflation, the permanent trade-off, when expectations have fully adjusted, is less favourable than the short run trade-off between inflation and unemployment.

A subsidiary task in the study by Parkin (48) involved estimating a wage-change equation which included $(\dot{P}/P)^*$ instead of (\dot{P}/P) , and found that the coefficient on $(\dot{P}/P)^*$ was less than one half. This tended to confirm Solow's finding against the strict expectations hypothesis for Britain. Taylor and Godfrey (63) similarly find no evidence that inflationary expectations are fully anticipated in earnings-changes in the United Kingdom for the period 1954-70. These studies have generally approached the construction of the $(\dot{P}/P)^*$ variable using the adaptive expectations scheme which essentially computes $(\dot{P}/P)^*$ as a weighted average of previous levels of (\dot{P}/P) with exponentially declining weights that sum to unity. Expectations generating schemes of this sort, where price expectations are generated in accordance with some general distributed lag of past price changes lead to the presence of past values of (\dot{P}/P) in the wage-change equation. Such distributed lags on past price-changes can arise for different reasons eg. there may be lags in the 'catch up' demand for current wage increases. It may be,

as Turnovsky (70) suggests, that ".... workers, in bargaining over current wage contracts, are more concerned with being compensated for price increases which have occurred since their last contract, than with worrying about the indefinite future", (P.6). An alternative approach used by Turnovsky (70) and Turnovsky and Wachter (71) which answers this problem of ambiguity over interpretation is to use 'direct' price expectations data in the wage-change equation. This data consists of a series available since 1949 in the United States of six monthly (and annual) forecasts of the Consumer Price Index made by a group of 'informed business economists'. It may still be the case, as these authors mention that these expectations do not correspond to those of the decision makers mentioned in the expectations hypothesis. For the United States over the period 1949-69 Turnovsky and Wachter find estimated coefficients on $(\dot{P}/P)^*$ variables defined from error-learning schemes, and on the 'directly observed' expectations variable, which are all below 0.5. However Turnovsky (70) finds that similar expectations variables in a parallel study for Canada showed estimated coefficients in the neighbourhood of unity in the wage-change equation, and favoured the strict expectations hypothesis. Turnovsky attributes his findings in favour of strict expectations for the Canadian economy to that economy's high degree of competitiveness (as compared to the United States) which makes it "conform more closely to the neo-classical assumptions" (P.16).

Parkin (47) reports similar approaches to the measurement of expectations using this type of direct quantitative data, and also using qualitative information. This latter data takes the form in the United Kingdom of

monthly surveys of individuals' expectations of retail prices dating from 1960, and businessmen's expectations of both domestic and export selling prices on a tri-annual and subsequently quarterly basis dating from 1958. Parkin reports some work which has converted this qualitative data on expectations into quantitative estimates of the expected rate of change of retail, wholesale and export prices, and of the significance of these price expectations variable in explaining (weekly) wage-inflation in the United Kingdom for the sample period 1956 (2) to 1971 (4), (ibid P.21). An additional approach described by Parkin uses the fact that over short periods of time at least, the relation between real and financial asset prices should reflect expectations of inflation, and changes in financial asset interest rates should reflect changes in inflation expectations. These are indirect market manifestations of inflation expectations, and can be used to measure inflationary expectations. (In (39) Laidler uses the prediction "that the rate of interest on those assets whose value is fixed in nominal terms - typically bonds - would tend to exceed that on those assets which represent a claim on real physical assets - typically equities - by the expected rate of price inflation" (P.8), to infer that in the United Kingdom over the period 1967-71 there occurred a rapid upward adjustment of price expectations).

IV The Relationship Between (\dot{W}/W) and Trade Union Pushfulness

The investigation of the role of trade union pushfulness as a determinant of (\dot{W}/W) has been a recurring theme in studies of post war British wage-change equations. Dicks-Mireaux and Dow (14) tried an essentially subjective index of pushfulness in the wage-change equation for the period 1946-56 but found rather inconclusive results. Klein and Ball (35) used a dummy variable to try and catch the influence of an hypothesised change in union pushfulness after 1952, with more success. In Chapter I we have already outlined the work of Hines (26). In an exhaustive statistical analysis of data from the period 1893-1961,¹ he establishes that the rate of change of unionisation (\dot{T}/T) and not the level (T) was the appropriate index of union pushfulness, except during periods characterised by marked increases in the level of unionisation consequent upon the unionisation of previously unorganised sectors. (\dot{T}/T) shows as a significant explanatory variable in all the periods considered, and is particularly impressive in the inter-war period (1921-38) where the \bar{R}^2 is in the region of 0.9. Hines also found that the addition of T to the influence of (\dot{T}/T) gave significantly improved results for the inter-war and 1948-61 periods combined, and for all three periods taken together.

Two features of these results are worth noting. Hines measured an increase in the slope of the relationship between

1 The period was treated as separate sub-periods (1893-1912, 1921-38 and 1949-61), as one long period (excluding years dominated by the effects of war) and as a single period beginning in 1921.

(\dot{W}/W) and (\dot{T}/T) between the inter-war, and post 1948 periods. Two explanations were suggested to account for this. In the first place, it seemed likely that a given increase in the level of unionisation was indicative of a greater degree of militancy and thus more pressure on wage-rates, the higher the level of unionisation from which the increase occurred. The second explanation runs in terms of the (familiar) leading/following sector type of mechanism. Suppose there is an annual bargaining 'queue' and that the increases in wage-rates obtained by militant unions in leading sectors are followed in sectors farther back in the queue. In that case we might find that there is a relatively small change in aggregate (\dot{T}/T) (reflecting increased militancy in only one sector) associated with a relatively much larger change in (\dot{W}/W) , so that aggregate wage-changes would appear as increasingly responsive to changes in aggregate unionisation. Hines also observed that the $(\dot{W}/W)/(\dot{T}/T)$ relation shifted outwards between the two sample periods, and suggested that this might be due to an upward shift in the level of unionisation as a result of the unionisation of some previously unorganised sector.

The main assertion of the Hines hypothesis is that trade unions can force up wages independently of the level of excess demand for labour. As we have already discussed in Chapter I the evidence strongly supports this view, in that (\dot{T}/T) is not associated with the conventional indicators of the level of excess demand for labour and shows up clearly as the causal variable in the $(\dot{W}/W)/(\dot{T}/T)$ relation. The main impact of the union militancy variable

in the wage-change equation in the period 1948-61 is that (U/L) becomes insignificant as an explanatory variable, (as it is in any case in the inter-war period). The estimated coefficient on (\dot{T}/T) is however significant in all the periods considered and increases in size and significance over time.¹ These results, and the results in (27, 28), led Hines to conclude that in the period since 1921 "demand as measured by the level and rate of change of unemployment has made a negligible contribution to the explanation of the variance in money wage rates" (27 P.66). Such an empirical conclusion effectively denies all of the policy implications of the Phillips curve relationship.

The major criticism of Hines results and the hypothesis that underlies them has come from Purdy and Zis (55). In Chapter I we outlined the theoretical criticism they put forward but an equally important part of their work is empirical and consists of re-estimates of the $(\dot{W}/W)/(\dot{T}/T)$ relationship on the basis of adjusted labour force data. The major difference they find concern the corrections they make on the inter-war period labour force data and the effects on the equations estimated from the pooled inter-war and post war period data. In (31), Hines and Dogas

1 Hines notes in (27) that the ordinary least squares estimates of the single equation model of wage-changes yield biased estimates of the coefficient on the lagged price-change variable. This is because of feedback from (W/W) in this annual model, and also because of the close correlation between (\dot{T}/T) and (P/P) , and (W/W) and (T/T) . In fact the price-change variable is insignificant in these estimates. In (26) Hines estimates the wage-change equation by two stage least squares as part of a three equation model explaining in addition (P/P) and (T/T) . Here there is a significant coefficient estimate in the order of 0.7 on (\dot{P}/P) for the period since 1921 (excluding the war years), which accords with all the other evidence thus far considered.

have effectively shown that the robustness of $(\dot{W}/W)/(\dot{T}/T)$ relationship is unchallenged by the use of improved labour force data for measuring (\dot{T}/T) (and T), and show that the Purdy and Zis findings to the contrary seem to be largely the product of fitting to different data periods, of inadequacies in the 'improved' labour force data they use and of differences in the statistical definition of the rate of change variables. One interesting feature of the results is though worth noting. This is that, in the post war sample period, the explanatory power of the $(\dot{W}/W)/(\dot{T}/T)$ relation, and the size of the estimated coefficient on (\dot{T}/T) are peculiarly sensitive to the exclusion of the year 1970 from the sample period. For example, for the period 1949-70, Hines and Dogas find,

$$(\dot{W}/W) = 5.5311 + \frac{2.5783}{(0.3849)} (\dot{T}/T) \quad \dots (17)$$

$$\bar{R}^2 = 0.6762 \quad D.W. = 2.0506$$

while for the period 1949-69, Purdy and Zis find

$$(\dot{W}/W) = 5.5573 + \frac{2.5683}{(0.6632)} (\dot{T}/T) \quad \dots (18)$$

$$\bar{R}^2 = 0.4117 \quad D.W. = 1.8496$$

Indeed, for the arbitrarily chosen sub-period 1960-69, Purdy and Zis find that (\dot{T}/T) is insignificant, with a coefficient estimate of 0.8 and \bar{R}^2 of 0.047, while Hines and Dogas show that extending the sample to the period 1960-70 raises the \bar{R}^2 to 0.76 and the (significant) coefficient estimate on (\dot{T}/T) to 2.3. Of course it may always be possible to choose carefully a small sample period which gives an apparently unrepresentative result. Nevertheless it is surprising that the apparently well-determined $(\dot{W}/W)/(\dot{T}/T)$

relation should be so sensitive to such (marginal) redefinitions of the sample period. In a footnote Hines and Dogas suggest that this anomalous result may be due to the fact that conventional wage-change equations "are mis-specified in as much as they do not allow for the fact that the number of workers covered by the wage-index - (the behaviour of which is being explained) - who obtain a settlement in any given year, exhibits considerable annual fluctuations" (P.21). They note some considerable differences in the number of workers obtaining a settlement in the years 1968-70, and suggest that "an appropriately specified settlements inclusive equation will remove the anomalous result for 1960-69". (P.21)

Other studies of post war wage-change equations, for example Knight (36), Godfrey (21), have used alternative proxies for union pushfulness, (usually some measure of strike activity), and have also found a statistically significant role for the union pushfulness variable. Such evidence would seem to provide more support for the union militancy explanation of inflation. The main feature of the post war period is the 'stagflation' experience of the late 1960's and early 1970's. Many contributors have also pointed out the similarity in the inflation and unemployment experience of the main industrial countries, which suggests that 'local' explanations for particular countries may by no means tell the whole story. In this context, the study by Ward and Zis (74) which makes an international comparison of union militancy explanations of wage inflation is of interest. They estimate wage-change equations of the

form

$$(\dot{W}/W) = f \left[(U/L)^{-1}, (\dot{P}/P)^*, M \right]$$

where M is some measure of trade union militancy and $(\dot{P}/P)^*$ is proxied by a one quarter lag on (\dot{P}/P) . The study covers the United Kingdom, France, Germany, Belgium, Italy, and the Netherlands. Data problems meant that the Hines militancy index (\dot{T}/T) could only be constructed ^{for} the U.K., Germany and Netherlands. Alternative indicators for militancy, which are available for all countries except Germany, were essentially strike activity variables measuring the number of strikes, the number of workers involved in strikes, the number of working days lost through strikes, or some 'composite' of the three. The wage-change model was fitted to annual data for the period 1956-71. The results obtained are not very clear cut. The significance of the strike activity variable proved to be sensitive to the way it was defined (which is not surprising as the alternative measures are not closely correlated) but the evidence fairly clearly rejects the union militancy explanation of wage inflation as a global explanation. The authors suggest that only in the case of Italy, and perhaps France is this explanation supported.¹

1 The authors find, rather surprisingly, that the strike activity measures of militancy are insignificant in the United Kingdom data. In view of the findings to the contrary by most other studies which have included such an index of militancy, Ward and Zis suggest that this is due to their use of annual, and not quarterly or six monthly data, as is used in these other studies.

CONCLUSION

As might be expected the evidence from studies using various data series for different sample periods does not throw light upon a very large set of clear cut conclusions. Nevertheless, it is possible to go some way into the light. For the nineteenth century sample period the unemployment rate (and its rate of change) shows as a significant determinant of the rate of wage inflation. So also do the price-change, and union militancy variables. For the inter war sample period the union militancy and price-change variables are consistently significant. The exceptional result is the Storey and Thomas finding that in the presence of the wage-spread unemployment dispersion variable, the unemployment rate does have a significant role to play. In the post war sample period the evidence fairly conclusively rejects a consistent well-determined Phillips curve type relationship, especially in the presence of the union militancy variable whose explanatory significance is rarely in question. Some significant role has generally been found for some measure of the dispersion of unemployment. The (lagged) price-change variable always appears as significant, and, in the context of the expectations augmented Phillips curve, is to be interpreted as a proxy variable for the expected rate of inflation. Much recent work has concentrated on building variously based price expectations variables. Those coming from expectations generating schemes such as adaptive expectations have not shown coefficient estimates near to unity, from United Kingdom data.

The weakness of the measured Phillips curve in the post war sample period seems to stem (in the absence of the union militancy variable) from the 'stagflation' experience of the years since 1966. A popular rationalisation of this weakness, and explanation of this occurrence, is provided by the 'expectations' argument, in particular when this is put in a global context. Thus, in the latter half of the 1960's aggregate price expectations were rising (based on a rising and to some extent 'imported' rate of inflation) and were given an upward boost by the 1967 devaluation, and this led to the mounting wage increases to protect real income positions, and to rising unemployment as the restored real wage rates led to a reduced demand for labour. The real problem then is to resolve this view with the impressive empirical support that has been found for the union militancy explanation of inflation. It is true that the Hines union militancy proxy measure shows some dependence on previous price-changes, and it is tempting to see changes in union militancy in the context of this expectations argument. Thus increased militancy is the response to perceived diminutions in real incomes consequent upon adjustments of price expectations. No doubt this is some part of the story. But it still remains the case that, as Hines points out, the proportion of the variance in $\dot{(W/W)}$ that can be associated with a wage-change equation including $\dot{(T/T)}$ exceeds that associated with an equation without $\dot{(T/T)}$ but which does include proxy variables for expected inflation.

III SOME MEASUREMENT PROBLEMS IN
THE EMPIRICAL ANALYSIS OF THE
WAGE-CHANGE EQUATION

I N T R O D U C T I O N

Economic theories are usually couched in terms of quantities over which, in the purely theoretical framework, no confusion arises. In Chapter I we saw that the theory of the Phillips curve involves quantities such as the money or real wage-rate and its rate of change, the (expected) rate of change of 'the' aggregate price-level, and the aggregate unemployment rate and its rate of change. Also within the framework of the theory these quantities are all unambiguously related in time via the time subscript device so that everything is measured at a 'period t'. Finally, the quantities themselves are measured at the micro or macro level, where the aggregate quantity is obtained by aggregation over appropriately weighted micro quantities.

When this theoretical model is confronted with the data, problems arise which concern the choice of appropriate 'money wage' and 'unemployment' variables, the choice between the alternative statistical definitions for measuring time rates of change, and the necessity for correctly relating the variables in time in the wage-change equation. Our survey of some of the empirical work indicates that there is no consensus on some of the answers to these problems. Accordingly in this chapter we intend to explore the sensitivity of the statistical results to the use of 'different' wage and unemployment data, 'different' definitions of the time rate of change, and to the introduction of implicit time lags.

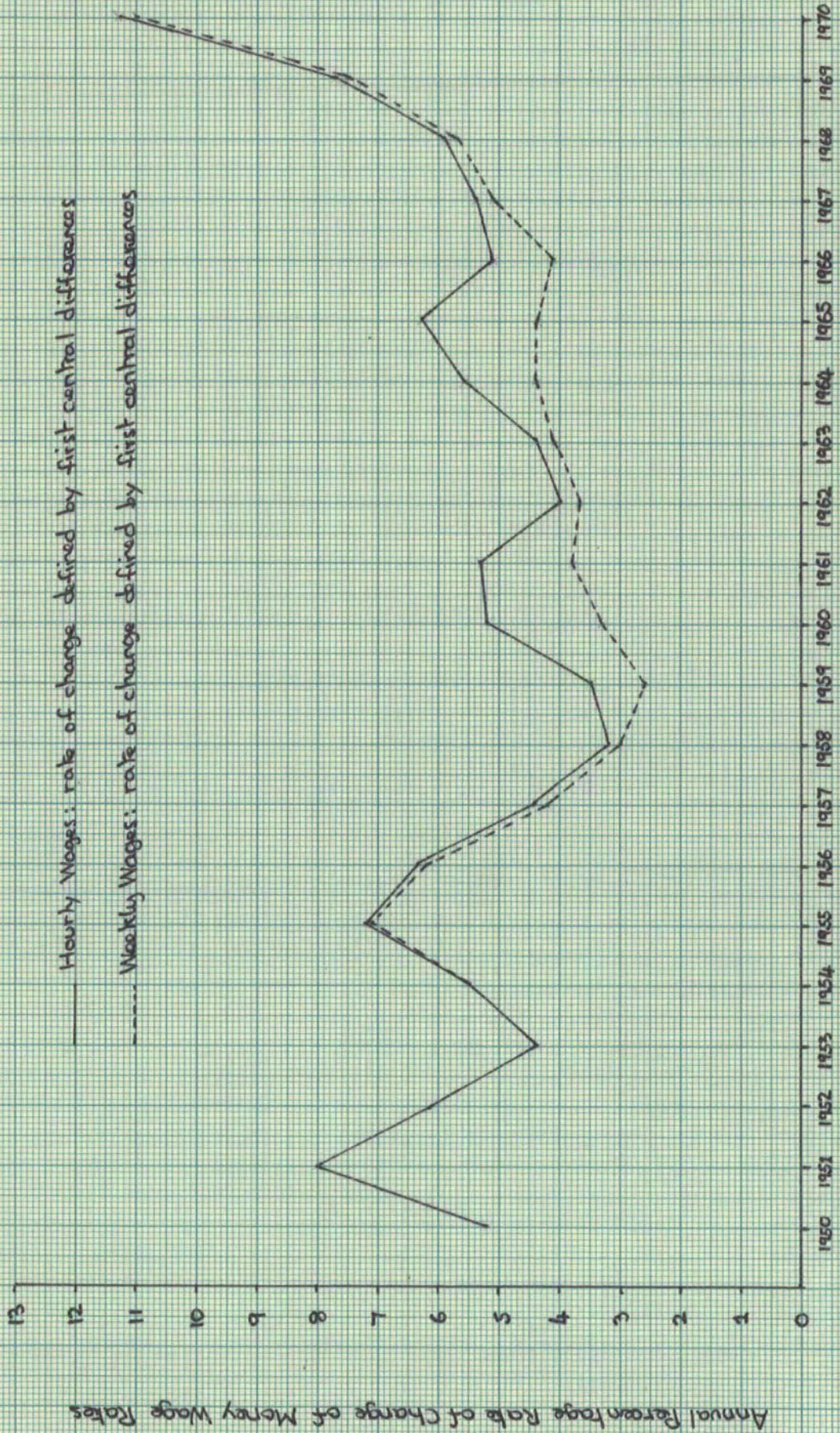
I Some Measurement Problems

The data¹ on money wage-rates allows the choice between an index of hourly wages and an index of weekly wages, where the former index is obtained by dividing the latter index by an index of normal weekly hours. The theory of labour supply does not enable us to identify a 'man week' or a 'man hour' as the appropriate unit of labour supply. However, there are at least two reasons why the choice between hourly or weekly wage-rates is important. The latter is the full time basic weekly rate paid for 'normal' weekly hours worked. Over the period 1948-68 normal weekly hours fell from 44.6 to 40.2. Hines (30) has pointed out that since "the primary objective in the estimation of wage equations is to see how the chosen explanatory variables affect wages (or earnings) rates, rather than how they may affect the length of the normal working week", (P.166), then the appropriate wage-rate to use is the hourly wage-rate. Secondly, because normal weekly hours have not remained constant, we might expect that the two indexes will not show an identical pattern of variation over time.

The analysis of wage-change equations proceeds with the time rate of change of the wage index as the dependent variable. Graphs 3.1 and 3.2 show the relevant rate of change time series of hourly and weekly wage-rates, where the rate of change is defined by first central differences in Graph 3.1 and percentage differences in Graph 3.2 for the period 1950-70.

1 All the data is described in the Appendix.

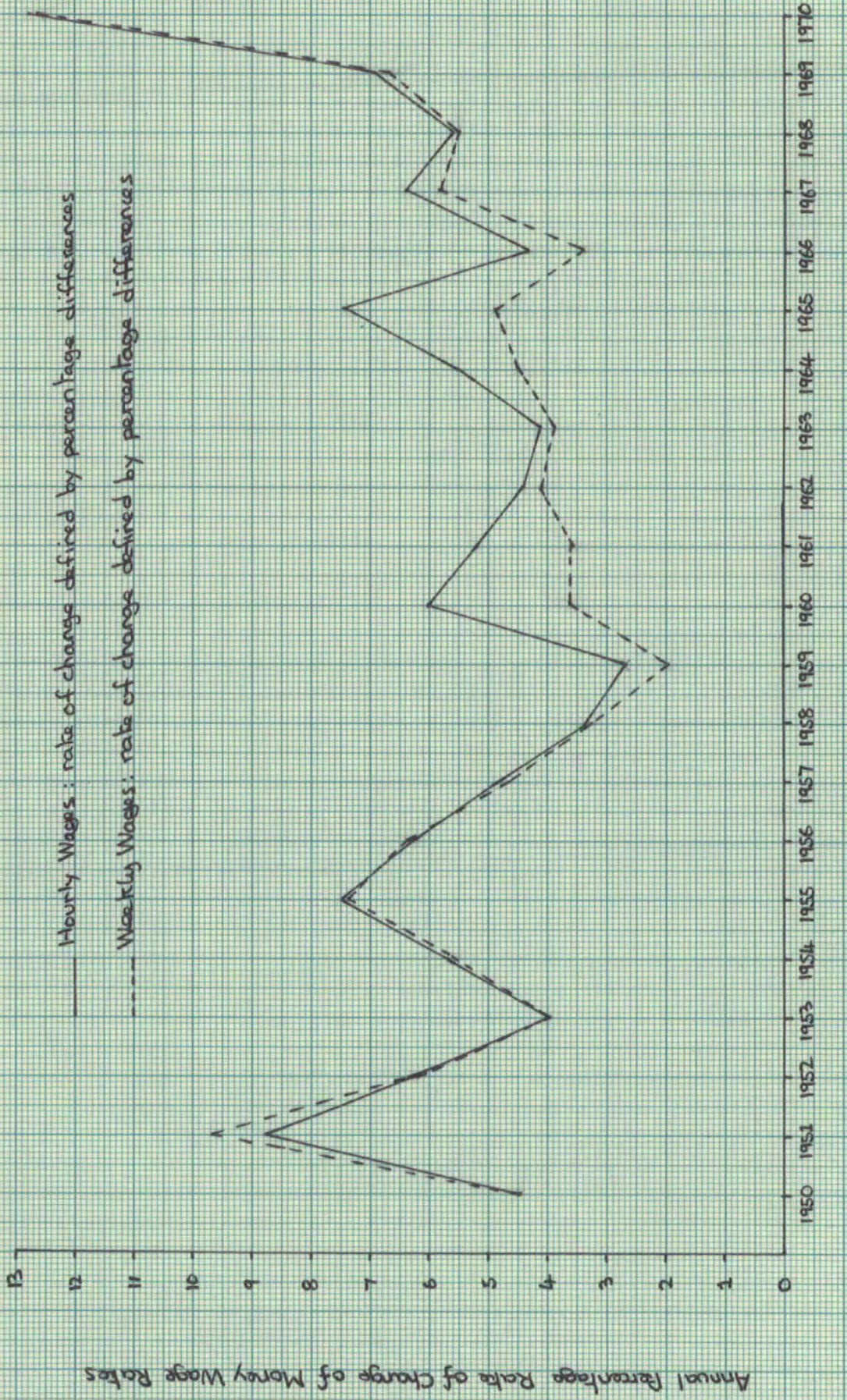
GRAPH 3.1



Years

Data Source: Appendix, columns 1 and 4

GRAPH 3.2



Data Source: Appendix, columns 2 and 5

In each case the weekly (\dot{W}/W) series shows a significantly different pattern of variation for the years 1957-68/69. In the sample of annual observations of (\dot{W}/W) for the period 1950-70, the coefficient of variation for hourly wage-rates (where the rate of change is defined by first central differences) is 0.297 as compared to 0.364 for weekly wage-rates. When (\dot{W}/W) is measured by percentage differences the coefficient of variation for hourly wages is 0.352 as compared to 0.411 for weekly wages. This suggests that, for the chosen sample period using annual data, the estimates obtained from identically specified wage-change equations may differ significantly if we choose to use weekly and then hourly wage-rates for the dependent variable. The results of performing this experiment are reported below.

It is well known that the available unemployment series take no account of changes in participation rates, and therefore do not accurately measure or reflect the total size of the 'reserve army' of unemployed. In the next chapter we attempt an adjustment of the unemployment data to overcome this deficiency. The efficiency of the unemployment rate as a proxy for the degree of excess demand for labour also depends on the stability over time of the mapping relation between X and (U/L) . A subsequent chapter examines the evidence to see if there has been an upward shift in that relationship in recent years. For the moment we pass over these difficulties. A choice problem still remains with respect to the available unemployment series. These measure the numbers wholly unemployed, or the total numbers registered as unemployed, respectively expressed as a percentage of the (mid year) estimated total number of employees, and each

series is available for Great Britain and the United Kingdom. It is standard procedure to use the 'wholly' unemployed percentage rate $(U/L)_W$ rather than the 'registered' unemployed percentage rate $(U/L)_R$.¹ The latter percentage includes those who are 'temporarily stopped' (those working short time or otherwise suspended from work, but who will shortly return to their former employment) but who are not 'jobless', and is therefore susceptible to disturbances such as the effect of strikes which may well swell the numbers temporarily stopped. In that case the consequent increase in $(U/L)_R$ would not reflect an increase in the numbers of workers without jobs. The $(U/L)_W$ percentage rate is not subject to disturbances from this source and is therefore to be preferred.

Both the hourly and weekly wage indexes cover the principal industries and services in the United Kingdom, so that consistency in the coverage of the unemployment percentage requires the use of the United Kingdom unemployment series. Phillips (54) notes that the relevant $(U/L)_W$ series for the United Kingdom was not then available for the period 1948-57, and was careful to adjust the published series for Great Britain, $(U/L)_{WGB}$, so that it more readily represented the United Kingdom percentages.² We therefore conclude that the appropriate unemployment series to use in the wage-change model is the 'wholly' unemployed percentage

1 Nevertheless some studies appear to have used the $(U/L)_R$ percentage rate. Thirlwall (67) in an appendix lists the data he has used for the period 1951-66. This unemployment percentage, which is listed as 'the rate of unemployment in the United Kingdom', appears to be the $(U/L)_R$ percentage.

2 This adjustment added 0.1% to the percentage for Great Britain.

rate in the United Kingdom, $(U/L)_{WUK}$.¹ Other studies have shown that there is no unanimity in the use of the relevant $(U/L)_W$ series: for example the study by Hines (26) uses the $(U/L)_{WGB}$ series. Since the difference between the two series is generally in the order of 0.1% it does not seem likely that estimates of the wage-change model will be significantly altered by the use of one series or the other for the unemployment variable. We report below the results of experimenting with each series in an otherwise identically specified wage-change equation.

It is fairly standard procedure to define the (\dot{P}/P) variable in the wage-change equation from the Index of Retail Prices which relates to the United Kingdom. We have noted that in an annual single equation model such as we use here, there is a general possibility that the ordinary least squares estimates of the parameters will be biased because of the interdependence between price-changes and wage-changes. This possibility is reduced if the (\dot{P}/P) variable is introduced with a time-lag. We report below the results of trying the (\dot{P}/P) variable with a zero lag, and with a six-month lag. In the context of the expectations hypothesis we interpret the (\dot{P}/P) variable as a proxy for $(\dot{P}/P)^*$.

1 Our study uses annual averages of a monthly $(U/L)_{WUK}$ series, as is described in the Appendix. Our unemployment data is not corrected for school leavers and adult students seeking vacation work. All the data was originally collected before the recent changes in the presentation of the unemployment statistics, (see 'Department of Employment Gazette' November 1972). At that time the $(U/L)_{WUK}$ series was not presented with this correction, whereas the $(U/L)_{WGB}$ series was. We therefore constructed a $(U/L)_{WGB}$ series which includes school leavers and adult students seeking vacation work, and which is therefore directly comparable with the $(U/L)_{WUK}$ series.

Two of the most frequently used methods of defining the time rate of change of a variable are the first central difference and percentage difference definitions.¹ Following Phillips' original study it has become standard procedure to use the average percentage, and not the average absolute, rate of change of the relevant variables in the wage-change equation. The theory of the Phillips curve relates the time rate of change of money wage-rates to, among other variables, the time rates of change of the unemployment and the price-level variables. It is important to see that these rate of change variables are all measured at the same point in time, i.e. that they are correctly 'time aligned' in the wage-change equation. Our study uses twelve monthly averages of all the variables as the appropriate annual observations, which leaves the observations centred at mid-June each year. It is well-known that the use of the percentage difference measure on such data would centre the rate of change at approximately mid-December of the previous year, whereas the first central difference measure would leave the rate of change centred at mid-June.² If we therefore define the rate of change variables by percentage differences then we are measuring them at approximately mid-December of the previous year, whereas the 'level' variables (such as (U/L)) remain as mid-June figures of the current year. In Phillips' study the definition of (\dot{W}/W) was changed from first central differences for the period 1861-1913 to percentage differences in the subsequent periods. In the later periods this means that the variables are 'correctly' time-aligned (since the

1 See Chapter II P. 86 Footnote 1

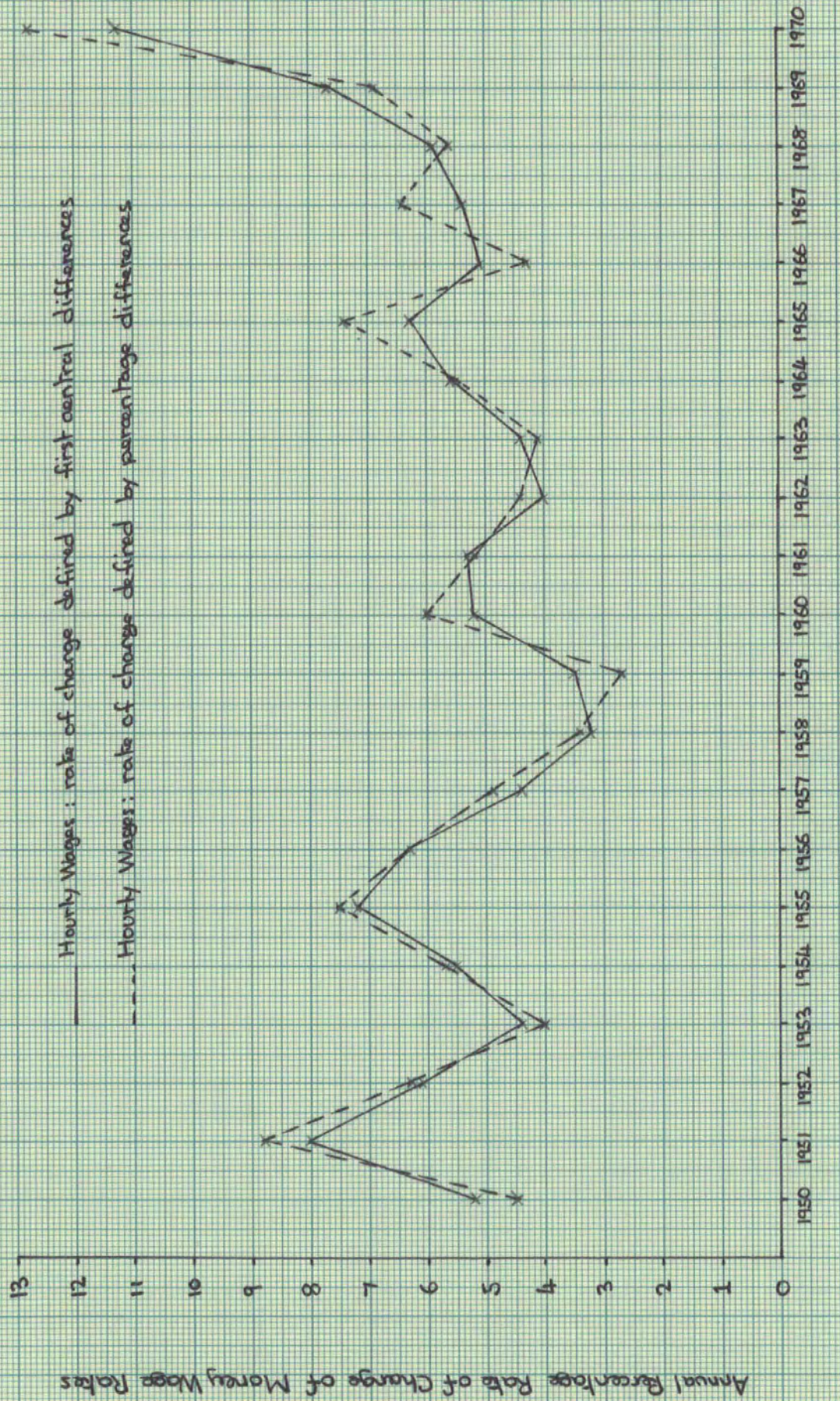
2 The argument demonstrating this is given by Lipsey (41) P.2. footnote 2.

wage-series is composed of end-December observations, while the (U/L) series is centred at mid-June), but that in the earlier period the level of unemployment is effectively lagged by six-months since, as Routh (57) argued, the wage index is best regarded as centred at the end of the year while the unemployment percentage is a mid-year figure. For our purposes, implicit time lags are avoided if we use first central differences to define rates of change as this leaves all variables measured at mid-June of each year.

There is a further difference which arises out of the alternative definitions for the rate of change variables. The first central difference device, since it is measured over two years observations, has a smoothing effect on the measured rates of change as compared to the use of percentage differences which produce a rate of change series showing greater fluctuations. Percentage differences are measured over only one year and will therefore catch any very short term fluctuations in the original series. In Graph 3.3 we show the hourly (\dot{W}/W) series for the period 1950-70 by first central differences and percentage differences, where each rate of change is centred at mid-June of each year.¹ The percentage difference series shows a greater amplitude in cyclical variation together with irregular short-term fluctuations over the years 1965-1968 which are not present

1 Twelve monthly averages of the wage index centred at mid-December of each year were found as the average of monthly observations from July of the current year to June of the next year. The percentage difference (\dot{W}/W) was then defined over this annual wage series which centres the rate of change variable at approximately mid-June of the current year.

GRAPH 3.3



Data Source: Appendix, columns 1 and 2

in the first central difference series. We report below the results of experimenting with (\dot{W}/W) variously defined in an otherwise identical wage-change model. As an indicator of the difference between the two series, the coefficient of variation for the hourly (\dot{W}/W) by percentage difference series is 0.354 as compared to 0.297 for the first central difference hourly (\dot{W}/W) series.

METHOD

Our main aim in this chapter is to see to what extent if any the results obtained from estimating a given wage-change model are sensitive to the various problems which arise when the theoretical model is recast in terms of observable quantities. The problems with which we are concerned have been outlined above and essentially concern the choice of the appropriate statistical variables from among the alternatives available, the time rate of change definitions and the associated time alignment problem. In Chapter I we found that, according to the theory of the Phillips curve, the wage-change equation can be specified in terms of the variables which are parameters of shift of the labour demand and supply equations, in which case any proxy for excess demand becomes redundant i.e.

$$\dot{(W/W)} = \lambda h \left[\overline{(W/P)} / Y, \overline{Z} \right] + B \dot{(P/P)} \quad \dots 1a$$

where

Y, Z are sectors of exogenous variables, the elements of which are parameters of shift of the demand and supply curves.

$\dot{(P/P)}$ is the proportional rate of change of prices

$\dot{(W/W)}$ is the proportional rate of change of money wages

(W/P) is the real wage rate

Alternatively we can use a formulation which merely involves a proxy variable for X, rather than the determinants of X.

The theory of the Phillips curve chooses (U/L) as a proxy for X;

$$\dot{(W/W)} = \lambda X = \lambda [e(U/L)] \quad \dots 1b$$

In addition, following the arguments of Hines (30), a correct specification of the model includes (\dot{P}/P) (because the model is correctly specified in real wage not money wage terms) and (\dot{U}/U) (which enters as a joint proxy with (U/L) for X).

$$(\dot{W}/W) = \lambda [e(U/L), (\dot{U}/U)] + B (\dot{P}/P) \quad \dots 1c$$

Our approach is to build up to a specification which yields a non-trivial degree of explanatory power but which is consistent with one of these formulations. This particular specification can then be used as a model which has a sufficient degree of explanatory power to enable us to identify any significant changes which might arise out of the experiments we shall perform. We begin with a 'simple' Phillips relation consistent with the specification of equation 1b, and then add alternative explanatory variables to try and improve the explanatory power of the model. All the estimates were obtained by ordinary least squares and relate to annual data for the period 1950-70.

RESULTS

A representative selection of the results we obtained is shown in Table III.1. Equation (1) is consistent with the specification of (1c) above, and shows that the wholly unemployed percentage in the United Kingdom $(U/L)_{WUK}$, and its rate of change $(\dot{U}/U)_{WUK}$ are both insignificant explanatory variables,¹ while the rate of change of prices

1 We found no statistical evidence to support a relationship in which the unemployment variables alone were used to 'explain' $(\dot{W}/W)_{HPD}$. Experiments with (\dot{W}/W) differently defined, using weekly wage rates, and with (U/L) entered non-linearly, did not alter this conclusion.

TABLE III.1

The Dependent Variable is $(\dot{W}/W)_{HPD}_t$

	Constant	$(U/L)_{WUK}$	$(\dot{U}/U)_{WUK}$	$(U/L)_{WUK}^{-1}$	X	$(\dot{P}/P)_{FCD}_{t-6}$	(\dot{T}/T)	\bar{R}^2	D.W.
(1)	1.0661	0.9096 (0.8620)	-0.0147 (0.0243)			0.8171 (0.2129)		0.3799	1.6139
(2)	3.5469		-0.0121 (0.0248)	-1.3606 (2.7062)		0.8037 (0.2213)		0.3490	1.5176
(3)	2.6477				-0.2856 (0.5452)	0.7828 (0.2094)		0.3796	1.5708
(4)	6.5420	-0.9737 (0.4893)	-0.0142 (0.0118)			0.2038 (0.1321)	2.1745 (0.2910)	0.8532	2.7005*
(5)	2.9326		-0.0139 (0.0113)	3.2263 (1.3481)		0.1917 (0.1256)	2.1356 (0.2625)	0.8652	2.8181*
(6)	5.5555						2.1687 (0.2555)	0.7804	1.6714*
(7)	4.4786					0.2861 (0.13)	1.8388 (0.2770)	0.8174	2.1392*

* indicates that the durbin watson test showed no serial correlation. For other values the test is inconclusive. Standard errors of coefficient estimates are in parentheses.

(defined by first central differences) with a six month time lag shows as the only significant explanatory variable, with an estimated coefficient in the order of 0.8. The dependent variable in this and subsequent equations is the time rate of change of hourly wages, measured by percentage differences, and centred at mid-June, $(\dot{W}/W)_{HPD}_t$. The explanatory power of equation (1) is rather weak: the \bar{R}^2 indicates that about 40% of the total variation in $(\dot{W}/W)_{HPD}_t$ is associated with the chosen explanatory variables. In equation (2), consistent with the theory of the Phillips curve, the 'level' unemployment variable is entered non-linearly but with no significant effects. The price-change variable remains as the only significant explanatory variable with an estimated coefficient of 0.8, and the \bar{R}^2 is marginally lower at 0.35. Rather than using the unemployment variables as proxies for the degree of excess demand for labour, equation (3) incorporates the level of excess demand for labour directly (variable X)¹, together with the lagged price-change variable. Again the result is very similar. The excess demand variable, like its proxies, shows as insignificant and gets the 'wrong' sign, whereas the price-change variable is significant, with an estimated coefficient in the region of 0.8. About 40% of the total variation in $(\dot{W}/W)_{HPD}$ is 'explained' by these variables.

Equation (4) adds the proxy variable for trade union militancy (\dot{T}/T) (the rate of change of the percentage of the unionised labour force), and moves toward a specification consistent with that of equation (1a) above. (U/L) and (\dot{U}/U)

1 Where $X = (V/L) - (U/L)$: V = vacancies

replace (W/P) as proxies for "the levels of X associated with the adjustment of (W/P) to its equilibrium level as of given demand and supply curves", (30)P.149. (\dot{T}/T) enters as a parameter of shift of the labour supply curve.

Alternatively it might be that union militancy operates endogenously by altering the slope of the reaction function. At any given level of X , (\dot{W}/W) will be higher (lower) depending on whether trade unions are being more (less) militant. With the introduction of (\dot{T}/T) , the overall explanatory power of the equation increases markedly: the \bar{R}^2 increases to 0.85. In the presence of the unionisation variable the lagged price-change variable becomes insignificant, and the size of the estimated coefficient falls from 0.8 to 0.2.¹ Both unemployment variables remain insignificant, but (U/L) now shows the 'correct' sign. The size of the constant term has now increased to 6.5. Equation (5) is identically specified to (4) except that the unemployment variable is entered non-linearly. As a result of this there is a marginal gain in the \bar{R}^2 (to 0.86) and, more significantly, the level of unemployment shows up as a significant explanatory variable with the correct sign. The price-change variable remains insignificant, and (\dot{T}/T) remains equally firm. Equation (5) thus provides the 'best' explanation of the variation in $(\dot{W}/W)_{HPD}$ over the period 1950-70 with (\dot{T}/T) and (U/L) showing as significant explanatory variables, and (\dot{U}/U) and (\dot{P}/P) showing as insignificant.

1 In this single equation model "Given the existence of the wage-price spiral, as well as the close correlation between $(\dot{W}/W)_t$ and $(\dot{T}/T)_t$, and hence between $(\dot{P}/P)_t$ and $(\dot{T}/T)_t$, the coefficient on $(\dot{P}/P)_{t-\frac{1}{2}}$ is subject to bias", Hines (27) P.65.

Equation (6) in Table III.1 shows that 78% of the total variation in $(\dot{W}/W)_{HPD}$ is accounted for by the variation of (\dot{T}/T) alone. The addition of $(\dot{P}/P)_{t-6}$ in equation (7) yields a marginal gain in the \bar{R}^2 to 0.81, although the variable itself is insignificant. The further addition of the unemployment variables, as in equation (5), has the effect of increasing the proportion of 'explained' variation in $(\dot{W}/W)_{HPD}$ to 86%.

As Hines (30) has pointed out, we should not expect to find that the proportion of the variation in (\dot{W}/W) that is accounted for by the specification in (1a) above exceeds that explained by (1c) above. Equations (1) - (3), and (4), (5) in Table III.1 demonstrate that there is a significant gain in the explanatory power of a wage-change model which includes (\dot{T}/T) as an explanatory variable. This conclusion is inconsistent with the predictions of the excess demand model of the Phillips curve, unless it can be shown that (U/L) and (\dot{U}/U) are not accurate proxies for X . In Chapters IV and V we investigate the effects of mis-statement error in the unemployment statistics arising out of cyclical variation in participation rates. We construct an unemployment series which more accurately measures the 'reserve army' of unemployed, and should therefore be a more sensitive proxy for the degree of excess demand for labour.

The results in Table III.1 are broadly consistent with the findings of other researchers. The main surprise is the significance of $(U/L)^{-1}$ in equation (5) which seems to arise from the use of the non-linear form. We have used equation (5) as the specification with a sufficient degree of explanatory power to enable us to identify any significant

TABLE III.2

The Dependent Variable is $(\dot{W}/W)_{HPD}_t$

	Constant	$(U/L)_t^{-1}$	$(U/L)_{t-7}^{-1}$	$(U/L)_{t-4}^{-1}$	(\dot{U}/U)	$(\dot{P}/P)_{FCD_{t-6}}$	$(P/P)_{FCD_t}$	(\dot{T}/T)	\bar{R}^2	D.W.
1)	2.9326	3.2263 (1.3481)			-0.0139 (0.0113)	0.1917 (0.1256)		2.1356 (0.2625)	0.8652	2.8181*
2)	3.4574		2.5131 (1.5974)		-0.0240 (0.0117)	0.1681 (0.1337)		2.0814 (0.2890)	0.8591	2.7348*
3)	3.2278		2.8250 (1.7322)			0.1627 (0.1456)		2.1144 (0.3143)	0.8328	2.4362*
4)	3.0712			3.1536 (1.5587)		0.1520 (0.1372)		2.1324 (0.2924)	0.8441	2.5796*
5)	3.1632			2.9492 (1.4741)	-0.0192 (0.0108)	0.1767 (0.1301)		2.1094 (0.2776)	0.8615	2.7802*
6)	2.7187	3.0784 (1.2623)			0.0094 (0.0105)		0.2633 (0.1278)	1.9516 (0.2869)	0.8779	2.9207*

* indicates that the durbin watson test showed no serial correlation. Standard errors of coefficient estimates are in parentheses.

changes as a result of the experiments we perform. For purposes of comparison equation (5) is reproduced as equation (1) in Table III.2.

Equations (2) to (5) in Table III.2 incorporate the unemployment variable with various time-lags. We have seen that Phillips' explanation of clockwise 'loops' in the post war period ran in terms of a lag in the relationship between (\dot{W}/W) and (U/L) , such that the current (\dot{W}/W) should be related to the unemployment rate seven months previously. Equation (2) introduces the level of unemployment lagged by seven months in an otherwise identically specified equation to equation (1).¹ The main effects of doing this are that the 'level' unemployment variable no longer shows as significant, whereas the 'rate of change' unemployment variable does. The constant term is larger at 3.5, and the overall explanatory power of the equation is virtually unchanged. This evidence thus contradicts the predictions of the Phillips' explanation of clockwise loops. Equation (3) of Table III.2 further confirms this impression. The (\dot{U}/U) variable is excluded, and the lagged unemployment variable remains insignificant. Following some evidence quoted by Peacock and Ryan (49), we also tried introducing the unemployment variable with a shorter four month lag. In equation (4), which excludes (\dot{U}/U) , $(U/L)_{t-4}^{-1}$ does show as a significant explanatory variable, while in equation (5), which includes (\dot{U}/U) , the latter variable shows as insignificant. This evidence suggests that the size and significance of the estimated coefficient on the non-linear

1 In equations (2) and (5), the rate of change of unemployment measures the rate of change in the appropriate lagged level of unemployment variable.

TABLE III.3

	Dependent Variable	Constant	(U/L)	(U/L) ⁻¹	(U/U)	(P/P) _{FCD_{t-6}}	(T/T)	R ²	D.W.
1)	(\dot{W}/W) _{HPD_t}	2.9326		3.2263 (1.3481)	-0.0139 (0.0113)	0.1917 (0.1256)	2.1356 (0.2625)	0.8652	2.8181*
2)	(\dot{W}/W) _{HPD_{t-6}}	1.3997		4.1814 (1.7229)	0.0202 (0.0144)	0.3850 (0.1606)	1.2540 (0.3355)	0.7476	2.1888*
3)	(\dot{W}/W) _{HFCDD_t}	3.3864		2.1380 (0.8781)	-0.0183 (0.0074)	0.2261 (0.0818)	1.7041 (0.1710)	0.9150	1.4673
4)	(\dot{W}/W) _{HFCDD_t}	5.5899	-0.5597 (0.3291)		-0.0189 (0.0079)	0.2444 (0.0889)	1.7037 (0.1958)	0.9014	1.4155
5)	(\dot{W}/W) _{WPD_t}	2.0318		2.5883 (1.8657)	-0.0074 (0.0156)	0.3966 (0.1739)	1.8761 (0.3633)	0.7803	1.6470
6)	(\dot{W}/W) _{WFCD_t}	2.7217		1.3785 (1.6075)	-0.0124 (0.0135)	0.3855 (0.1498)	1.4692 (0.3130)	0.7641	0.9922

* indicates that the durbin watson test showed no serial correlation.
 For other values the test is inconclusive
 Standard errors of coefficient estimates are in parentheses.

unemployment variable is worsened when that variable is introduced with short time lags. Equation (6) introduces the price-change variable with a zero time lag, and as compared to equation (1) it now shows as a significant explanatory variable with a larger coefficient estimate of 0.26. The \bar{R}^2 increases marginally to 0.88, and the other explanatory variables show smaller estimated coefficients. This demonstrates the effects of ignoring the simultaneous equation bias which is introduced when (\dot{P}/P) is unlagged. A final experiment with the unemployment variables was tried in which (U/L) and (\dot{U}/U) were defined from the wholly unemployed percentages for Great Britain instead of the United Kingdom. As might be expected, the results, which are not reported, are very similar to those obtained when the United Kingdom data is used.

In Table III.3 we report the results of the experiments we performed which are directly relevant to the main issues discussed at the outset of this chapter. Again, for purposes of comparison, equation (1) of Table III.2 is reproduced as equation (1) of Table III.3. In equation (2) of Table III.3, (\dot{W}/W) is defined by percentage differences from a mid-June centred wage index which leaves the time rate of change centred at approximately mid-December of the previous year. Since all the other variables in equation (2) are measured at mid-June of the current year, then the equation is incorrectly time aligned. This equation effectively relates current wage-changes to future levels of unemployment, future changes in trade union militancy, and to current changes in retail prices. As compared to equation (1) the overall explanatory power of equation (2), as indicated by

the \bar{R}^2 , is lower at 0.75. Some significant changes do occur in the size of the estimated coefficients. The constant term is halved, while the coefficient on the unionisation variable is reduced by over 40%. The size of the estimated coefficient on the unemployment variable is significantly larger at 4.2. As we might expect in an equation in which (\dot{W}/W) and (\dot{P}/P) are both measured at the same point in time, the latter variable now shows as significant with a coefficient estimate nearly twice as large as before. The effect of this type of incorrect time alignment seems to be to strengthen the evidence in favour of a relationship between (\dot{W}/W) and (U/L) .¹

In equation (3) (\dot{W}/W) is defined by first central differences instead of percentage differences. As compared to equation (1) the proportion of 'explained' variation in (\dot{W}/W) rises to over 90%. All the explanatory variables now show as significant, although the size of the coefficient estimates on the $(U/L)^{-1}$ and (\dot{T}/T) variables is reduced. The durbin watson test is now inconclusive. Equation (4) is identically specified to (3), except that (U/L) is entered linearly. Equation (4) can thus be compared with equation (4) in Table III.1. Once more, the equation with $(\dot{W}/W)_{FCD}$ as the dependent variable shows a slight gain in explanatory power as measured by the \bar{R}^2 . (\dot{T}/T) remains as a significant explanatory variable, as is $(\dot{P}/P)_{t-6}$, and the level of unemployment, although not its rate of change, remains as insignificant. The coefficient estimates on the

1 Recent work confirms and supports this relationship with a forward lag on the unemployment variable. See D.I. Mackay and R.A.Hart "Wage Inflation and the Phillips Relationship" MANCHESTER SCHOOL June 1974.

(\dot{T}/T) and (U/L) variables are again lower, and the durbin watson test is inconclusive. These results suggest that the main effect of defining (\dot{W}/W) by first central differences rather than percentage differences is to raise the \bar{R}^2 to 0.9, and to significantly change the size of some of the coefficient estimates. The explanatory significance of the (U/L) and (\dot{T}/T) variables remains unaltered, while both (\dot{U}/U) and $(\dot{P}/P)_{t-6}$ tend to show as significant, when previously they were insignificant.

Equations (5) and (6) in Table III.3 show the effects of measuring the rate of change of weekly rather than hourly wage-rates. Equation (5) is directly comparable with equation (1). 76% of the total variation in weekly wage-changes is explained by the same set of regressions as explained 86% of the total variation in hourly wage-changes. In equation (5) (\dot{T}/T) and $(\dot{P}/P)_{t-6}$ show as significant explanatory variables: the level of unemployment is not a significant determinant of the rate of change of weekly wage-rates. $(U/L)^{-1}$, (\dot{T}/T) and (\dot{U}/U) all show smaller coefficient estimates, but the size of the coefficient estimate on $(\dot{P}/P)_{t-6}$ increases from 0.19 to 0.4. Exactly parallel changes emerge in comparing equation (6) with equation (3) in Table III.3. The unemployment variables no longer show as significant, the estimated coefficients on $(U/L)^{-1}$, (\dot{U}/U) and (\dot{T}/T) are smaller, and the overall explanatory power of the equation as measured by the \bar{R}^2 is significantly lower. Clearly these are important differences to the results arising from the use of weekly, instead of hourly wage-rates.

CONCLUSION

We have found that the chosen explanatory variables (U/L) , (\dot{U}/U) , $(\dot{P}/P)_{t-6}$ and (\dot{T}/T) can be associated with approximately 85% of the total variation in $(\dot{W}/W)_{HPD}$. We also found that, in the presence of the trade union militancy variable (\dot{T}/T) , these other variables showed as insignificant. In the absence of (\dot{T}/T) we found that the lagged price-change variable showed as a significant explanatory variable. However, when (U/L) was entered into the fully specified equation in non-linear form, it did show as a significant explanatory variable with a coefficient estimate of 3.2. It is tempting to view this as arising specifically from the use of the non-linear form. Previous studies have generally found that the results are not affected when (U/L) is incorporated non-linearly. In our sample of annual observations for the period 1950-70 the fluctuation of the unemployment rate has been more extreme than in earlier shorter post war periods. Given that the underlying relationship between (\dot{W}/W) and (U/L) is of the non-linear form that Phillips suggested then it may be that, for the range of unemployment values now experienced, a linear approximation to this relationship is no longer appropriate.

Our experiments with the chosen 'preferred' specification (equation (5) in Table III.1) have largely produced the results which were anticipated. The effects of defining (\dot{W}/W) from the weekly rather than the hourly wage index are quite pronounced: the explanatory power of the wage-change equation is lowered, the unemployment variables become insignificant

and the coefficient estimates on all but the price-change variable are lowered. Significant effects also followed the use of the first central difference, as compared to the percentage difference measure of $\dot{(W/W)}$. The proportion of 'explained' variation in $\dot{(W/W)}$ increased to over 90% and there were also some significant changes in both the size and statistical significance of some of the coefficient estimates. The introduction of an implicit forward lag on the unemployment variable $(U/L)^{-1}$ resulted in a significantly larger coefficient estimate. However, when the time alignment of the wage-change equation was deliberately upset by the introduction of short (seven and four month) time lags on $(U/L)^{-1}$, the effect was to weaken the explanatory significance of the variable.

It seems clear that, in the chosen sample period, the explanatory significance of the level of unemployment in the wage-change equation is sensitive to the presence of implicit and explicit forward and backward time lags, to the choice of the wage index from which the time rate of change is measured, and to the form specified for the $\dot{(W/W)}/(U/L)$ relationship. It is noteworthy that in all the experiments conducted with the preferred fully specified equation, the explanatory significance of the trade union militancy proxy variable $\dot{(T/T)}$ was never in doubt.

IV CYCLICAL VARIATION IN THE SIZE OF
THE REPORTED LABOUR FORCE AND THE
IMPLICATIONS FOR THE PHILLIPS CURVE

I N T R O D U C T I O N

It is well known that the reported unemployment statistics are not an accurate measure of the numbers actually unemployed. The Phillips curve relies on the unemployment rate as an efficient proxy for the degree of excess demand for labour. Changes in the degree of excess demand for labour are reflected in changes in the number of unemployed workers. To the extent that the reported unemployment rate does not accurately measure the 'true' unemployment rate, then it becomes an inefficient proxy for the degree of excess demand for labour.

In this chapter we discuss some of the main sources of error in the reported unemployment rate. We concentrate on the observed cyclical variation in participation rates and examine the implications of this for the theory of the Phillips curve. Our main objective is to obtain more accurate estimates of the 'true' unemployment rate, which take into account this cyclical variation in participation rates.

I Cyclical Variation in the Size of the Reported Labour Force

The theory of labour supply assumes that the supply of labour is measured in terms of a unit such as man hours. Changes in the aggregate supply of man hours reflect the net effect of two different forms of adjustment. Firstly, variations in the average hours worked by each participant in the labour force will change the aggregate supply of labour. Alternatively, this aggregate will change when variations occur in the number of participants in the labour force. Our analysis is in terms of discretely measured quantities and is therefore primarily concerned with the latter form of adjustment. An interesting, but separate task, would be to see if less discrete measures of labour market quantities such as employment (unemployment) and vacancies could be constructed. Turner (69) has suggested that an index of total hours worked per operative in manufacturing industry is a sensitive indicator of the degree of excess demand for labour. Such an index measures the initial reactions to, say, a fall in the demand for labour, which is the organisation of some form of 'work sharing'; in particular to reduce overtime hours worked and to introduce short-time working. This sort of adjustment is clearly not going to be reflected in the statistics of the numbers of workers employed and unemployed.

Long run variations in the number of participants in the reported labour force will arise as a result of the natural rate of growth in the population, which gradually

increases over time the 'base' from which the work force is drawn.¹ We are not interested in this type of variation in the reported labour force and so our analysis proceeds in terms of variations in the 'overall' participation (or activity) rate. The participation rate can be expressed as (L/P) where

L = the size of the reported labour force

P = the population of working age i.e. aged 15 years or more.

Another long-term demographic influence on L concerns variations not in the level of P but in the age-sex composition of P . To the extent that males and females, or young people and older people, show different participation rates, then changes in the age and sex balance of the population will have a long run influence on the size of the reported labour force. Merely working with (L/P) rather than L does not enable us to take account of variation from this source, and nor do we attempt to take explicit account of this source of variation in (L/P) . Our concession to this, and other sources of long term variation in (L/P) is to use a time-trend. Other sources of long term variation in (L/P) are sociological trends such as the trend to longer schooling and to earlier retirement. These trends are more clearly brought out by the analysis of 'disaggregate' participation rates defined by particular age-sex groups.

Our interest in this chapter centres on short-term fluctuations in the reported labour force which may reflect changes in the supply of labour in response to cyclical

1 This is subject to there being no change in 'institutional' factors such as the school leaving and retirement ages. During the period 1951-70 with which this study is concerned these factors were unchanged.

changes in the demand for labour. For these purposes it is useful to consider the labour force as composed of two different types of workers. 'Primary' workers can be defined as those workers who are more or less permanently attached to the reported labour force, while 'secondary' workers are those workers who are in the reported labour force when they are employed, and tend to drop out of it when not employed.¹ Primary workers are motivated to remain in the reported labour force because of the availability of unemployment benefits for which such workers are qualified and which operate to raise the opportunity cost of leaving the labour force. In addition, by registering as unemployed, these workers remain in permanent close contact with the labour market in which they are active job seekers. Thus cyclical variation in (L/P) essentially involves the flow of secondary workers into and out of the reported labour force at different stages of the trade-cycle.

However, secondary workers form in no sense an homogeneous group. Most studies have drawn attention to the importance of married women because of their increasing participation in the labour force over the post-war period, and because of the cyclical nature of that participation. But other groups of workers are also important. Identification of the secondary work force has usually proceeded by looking at the participation rates of various age-sex groups over time. Those groups for which the participation rate shows strong trend and variation are then taken to represent

1 These definitions follow those given by Simler and Tella (59). Turner (op cit) defines primary workers as those workers who depend on paid employment or on unemployment relief, and secondary workers as those workers who have some other support (P.183).

a group whose attachment to the reported labour force is essentially non-permanent. Thus Simler and Tella (59) working with the United States labour force data are able to identify the permanent 'primary' members as males aged 25-54 years while, more recently, Wachter (73) defines the secondary labour force to include males aged 16-19 years and 65 + years, and females aged 16-65 + years. The evidence of these, and other studies, is that secondary workers are predominantly female and 'young' and 'old' male workers. The evidence has further suggested that, over the post-war period in both the United States and United Kingdom labour markets, secondary workers form an increasing proportion of the total labour force and that, as a result, significant variations have occurred in (L/P).¹ This variation takes the form of long-term 'sociological' trends such as result from the trend to longer schooling and earlier retirement, and short-term fluctuations of a cyclical nature.

Having identified in general terms the main characteristics of the 'secondary' worker group we must now turn our attention to the explanations which are offered to account for the observed cyclical nature of the participation of this group of workers in the labour force. The main thesis which we shall advance here is that the availability of employment opportunities is a major determinant of the decision to participate on the part of the secondary worker. This is because secondary workers tend to be

1 See for example Tella (64), Simler and Tella (op cit) and Dernburg and Strand (61) for evidence on the United States labour market, and Turner (op cit) and Corry and Roberts (10) for evidence on the United Kingdom labour market.

workers who are interested in selling their labour in very specific "wage/hour" bundles. In particular married women tend to predominate in 'part time' work which leaves time available to be allocated to necessary household duties. (The spread of 'part time' work probably underlies the post war secular increase in the female participation rate in both the United States and Great Britain). Hence it is the availability of such employment bundles which, given that certain other requirements such as wage rates and conditions of work are satisfied, becomes a critical factor in the participation decision of the secondary worker. The importance of the availability of appropriate employment opportunities is reinforced by other sociological and institutional factors which operate to restrict the menu of employment choice open to secondary workers. This arises because, as Turner (op cit) argues, society has devised mechanisms which reserve available jobs for primary workers and avoid creating a surplus of labour which would depress real wage levels. These mechanisms include the restrictions on entry operated by many unions and professional bodies, state inducements to early retirement and the raising of the school leaving age (to keep young workers off the labour market). Their effect is to increase the competition for the 'unprotected' jobs which are open to secondary workers.

In the short-run, a cyclical decrease in employment opportunities will lead secondary workers simply to withdraw from the reported labour force for several reasons. For many secondary workers the opportunity cost of leaving the reported labour force is zero because they are not eligible for unemployment benefit. This is particularly true for

married women who opt out of making National Insurance contributions,¹ and for workers over retirement age who have taken a similar option. It is also true for those workers who leave their jobs voluntarily and so disqualify themselves from benefit.² Another source of cyclical variation in the participation rates of secondary worker groups concerns the potential entrants to the labour force (school leavers) who may postpone the decision to enter the reported labour force at times when employment opportunities in general are restricted, as they are during the downswing of the trade-cycle. At such times older workers in the labour force who are approaching retirement age may bring forward the retirement decision. Finally, secondary workers as a group tend to be geographically and occupationally restricted in mobility and, coupled with the special nature of their job requirements, this severely limits the alternatives to dropping out of the labour force during downswings of activity.³ For all of these reasons we expect that secondary workers will leave the labour force during downswings of activity, and will tend to re-enter on the upswing when employment opportunities improve. This effect has been termed the "discouraged worker" effect in the literature.

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- 1 Corry and Roberts (op cit) cite the case of married women who only insure against industrial injury: in 1966 3.5 million out of a total of 8.6 million were thus insured.
 - 2 This particular group of workers, the 'voluntary quits', are discussed separately below.
 - 3 Secondary workers may view the current employment opportunities situation as temporary and expect to be re-employed subsequently on the upswing of activity.

The participation rates of secondary worker groups will, for similar reasons, tend to remain depressed for longer time periods during periods of prolonged economic depression which are marked by the heavy unemployment of primary workers. At such times there is likely to be a chronic shortage of work suitable for secondary workers to the extent that work in the labour market ceases to be considered as a serious possibility. Again, Turner suggests essentially sociological factors may take a hand in that there are "conventions, prejudices and traditions which may influence the secondary workers themselves against desiring work when jobs are scarce" (op cit P.193). This kind of non-participation, as Metcalf and Richardson (46) point out, is different in nature to the more temporary 'discouraged worker' type that we have already described. It represents a 'hidden' supply of labour in that the scarcity of appropriate employment opportunities, especially for women, in certain areas, means that women and other potential secondary workers in such areas never consider the possibility of employment.

A specific and opposite (to the "discouraged worker" effect) form of cyclical participation behaviour on the part of married women is proposed in the "additional worker" hypothesis. This hypothesis predicts that the participation rate of secondary workers, particularly married women, increases at low levels of economic activity when secondary workers enter the labour force under the pressure of loss of work by the primary worker. The rationale for this hypothesis rests on the propositions that supply of labour decisions are taken in the context of the family and that;

within the family, the family supply of labour is always varied to effect adjustments of the current level of family income to the family's perceived 'permanent income' level.¹ If, on the downswing of activity the primary worker in the family becomes unemployed, then the wife goes out to work to try and maintain the family's permanent income level. All that we observe in the data is the net effect of the rival "discouraged" and "additional" worker hypotheses which will indicate which effect dominates. The evidence for the United States suggests that the "discouraged worker" effect is the dominant effect, and that both effects can find statistical support (see Dernburg and Strand op cit). The inverse relationship found between participation and unemployment rates for certain age-sex groups (predominantly female) using United Kingdom data is also consistent with the dominance of the discouraged worker effect, (see Corry and Roberts op cit).

1 It is at this point that we have intruded the theory of labour supply into the discussion. The additional worker hypothesis does slot into the Mincer neo-classical framework of analysis of labour supply. In general though we have not used this approach in our discussion of the determinants of the participation decision of secondary workers. This is not an easy position to defend. The neo-classical approach stresses the importance of the income and substitution effects between the alternatives of work, non market work and leisure, and offers 'permanent income' levels and 'real wage rates' attached to jobs as the relevant variables to the participation decision. It clearly is possible to specify a participation rate model for secondary workers based on this approach; for examples see Wachter (73) and Fair (18). (Both of these papers include as well variables designed to measure the extent of money illusion in the supply function of labour). Our approach seeks to justify the use of a proxy variable for 'employment opportunities' to explain variations in the participation rate. Our main aim is not to develop and test a model of participation behaviour, but to measure a participation rate relationship which offers us accurate predictions.

Our approach then is to explain short-term variations in the participation rate of secondary workers in terms of variations in the employment opportunities open to such workers. To the extent that the discouraged worker effect dominates, then the withdrawal of secondary workers from the recorded labour force on the downswing of activity means that the official estimates of unemployment will always be underestimates during periods of less than full employment. One form of 'non-registration' by workers which was noted above was the phenomenon of 'voluntary quits'. Turner (op cit) sees this as a 'new' phenomenon in the post war high employment labour market in which it has become common for workers to voluntarily quit their current employment in search of a 'better' employment opportunity. However, it may not be the case that such 'frictional' unemployment tends to increase on the downswing of activity, and to decrease on the upswing, which is the pattern of variation predicted by our employment opportunities approach. According to Holt (33) an increase in the stock of vacancies consequent upon an upswing in the demand for labour will encourage voluntary quits by workers seeking to exploit the improved opportunities in the labour market. However, such 'unregistered' unemployment is likely to be of very short duration given the greater probability in this situation of obtaining satisfactory worker-job matches (as compared to the situation in which the stock of vacancies shrinks on the downswing of economic activity). Hence the effects of increasing numbers of voluntary quits during the upswing may

be to slow down any increases in the participation rate.¹ Turner (op cit) argues that voluntary quits may by no means cease during recessions. Workers, in anticipation of lay-offs may quit to search for new permanent employment before the labour market is flooded with lay-offs. The effects of 'voluntary quits' on the participation rate over the course of the trade cycle may not therefore be consistent with the direct relationship between job opportunities and the participation rate which we have suggested so far. Along with the "additional worker" effect, 'voluntary quits' could operate to weaken any observed relation of this nature.

At this stage we may state our main proposition in more detail. Short term variations in the overall participation rate are related positively to changes in the level of employment opportunities facing secondary workers. The problem now is to find an observable proxy for the level of employment opportunities. Two obvious candidates which have been used in most previous studies are the unemployment rate (U/L) and the employment rate (E/L). Given that variations in the level of employment opportunities will be reflected in variations in the level of employment, then they should also be reflected in variations in an accurately measured flow of unemployed workers. However the major hypothesis under investigation here is that the reported unemployment statistics are not an accurate measure of

1 It is an open question if, and to what extent, the level of the participation rate is reduced as a result of increases in the number of voluntary quits during the upswing. The flow of voluntary quits may increase on the upswing but, if the hiring rate increases similarly the stock of employed workers may not be influenced. All that occurs is an increase in labour turnover.

unemployment because they fail to record the secondary workers who leave the reported labour force when they become unemployed.¹ We therefore conclude that the reported unemployment rate is not the most efficient available proxy for 'employment opportunities'. The level of employees in employment (E) is a much more direct index of employment opportunities. Changes in the measured stock of employed workers at any given time, can be expected to be sensitive to variations in the level of employment opportunities. Following Tella (64) and Simler and Tella (59), we express (E) as a proportion of (P), the population of working-age, to yield the 'employment population ratio'. This will allow for the effect of demographic changes on (E), which reflect a change in 'relative' job opportunities. It will also enable us to dispense with (E/L) as an independent variable in our participation rate equation for, as Tella (64) points out, to relate (L/P) to (E/L) would mean that L is negatively related to itself in the equation which would "tend to obfuscate the relationship between the dependent and independent variables" (ibid P.457).

The chosen regression equation thus relates changes in (L/P) to changes in (E/P). (E/P) is a variable which is essentially associated with short-term cyclical influences on (L/P). To allow for longer term trends in (L/P), such as result from the trend to longer schooling and earlier

1 This is not the only source of error in the unemployment statistics. We have mentioned above the occurrence of unrecorded 'voluntary quits' and 'hidden reserves'. The statistics also fail to catch labour hoarding by firms. Estimates of this type of unemployment have been made by Taylor (62). For a discussion of the inadequacies in the unemployment data see Metcalf and Richardson (46), and Bosanquet and Standing (3).

retirement, a time trend (T) is included in the regression equation which takes the form

$$(L/P)_t = a + b (E/P)_t + c T$$

where a, b and c are constants

T = time trend, 1951 = 1

t = time subscript, the equation is to be fitted to annual data for the period 1951-70.

The Data¹: Some Provisional Remarks

This study defines the reported labour force (L) in the following way,

$$L = E + U$$

where

E = employees in employment

U = number of employees (wholly) unemployed.

This definition is important for the categories in the 'Total Working Population' of the Department of Employment that it excludes; namely the Armed Forces, the employers and the self-employed. (Some studies of the United States labour market, such as Tella (op cit) include the Armed Forces on the assumption that their members would otherwise be employed in civilian jobs). Our definition of L is chosen to be consistent with the participation rate data published by the Department of Employment. For any given L_i , where i represents a particular sub grouping of the labour force, for example by region, or by age-sex group, we can define the corresponding participation rate of the i'th sub group as $(L/P)_i$. The problem then arises that some of the variation we might observe in the $(L/P)_i$ series, and

1 The data is fully described and presented in the Appendix.

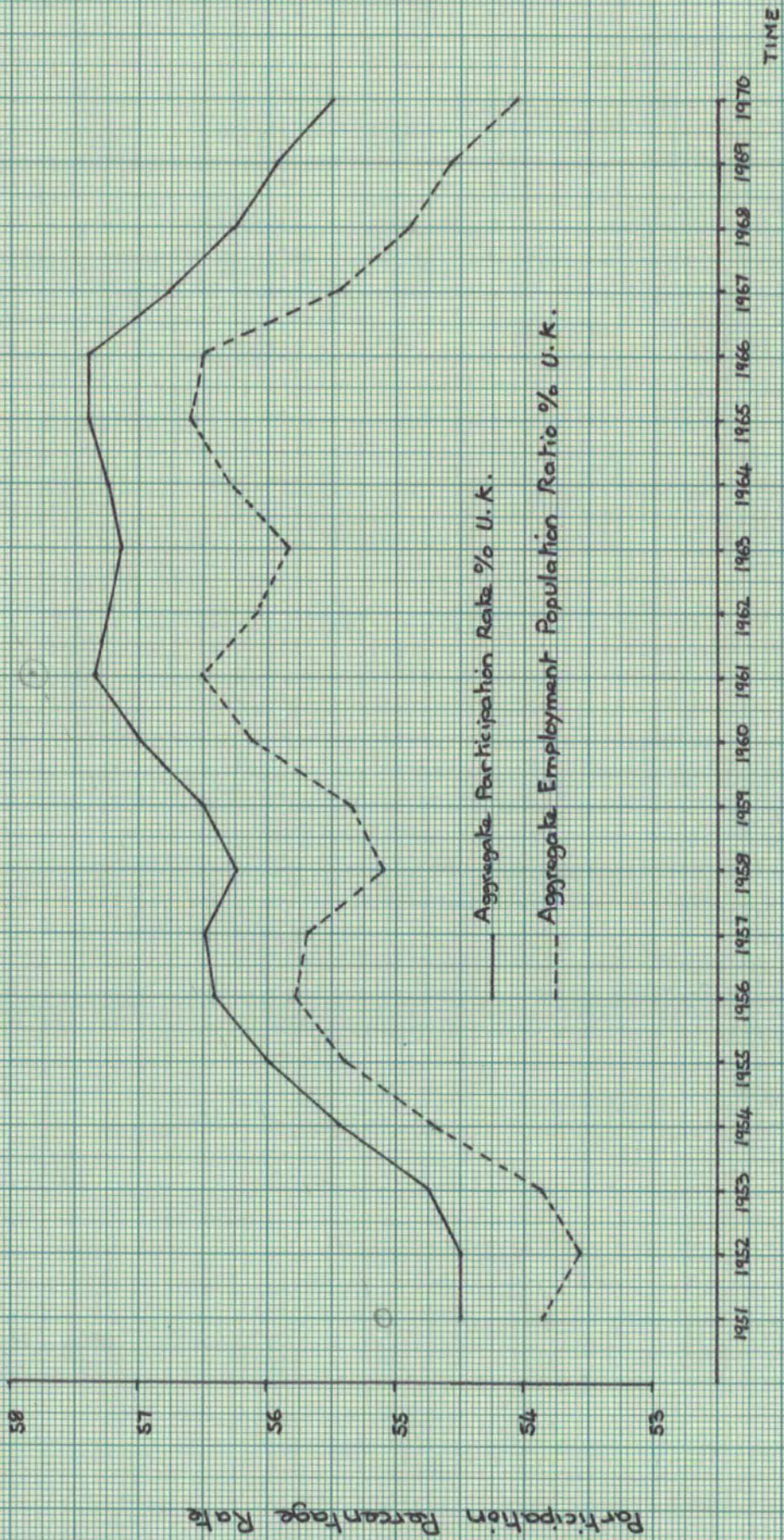
between different $(L/P)_i$ series, may be due to the fact that the excluded categories in the working population represent different proportions of P_i for different i 's.

To the extent that this is true then it may vitiate any comparisons made between variations of different $(L/P)_i$'s. For example Bowers (76) has shown that the addition of the excluded categories to the definition of L considerably reduces the observed dispersion of regional male participation rates in the United Kingdom, while the differences in female rates are not explained by the inclusion of these groups.¹ This is not surprising since the excluded groups, the Armed Forces, the employers and the self-employed are more typically composed of males rather than females. However, it is not our purpose to analyse the dispersion of participation rates defined by particular sub-groups, so this is a subsidiary issue here.

It is, however, true that if there is significant worker mobility between the excluded categories and L as we have defined it then this will cause (L/P) to change. We have argued above that short run variations in (L/P) are due to the flow of secondary workers units and out of the measured labour force in response to economic stimuli; in particular the availability of appropriate employment opportunities. Thus any variation in (L/P) arising from this type of worker mobility which is not a response to a change in employment opportunities (and will not therefore be

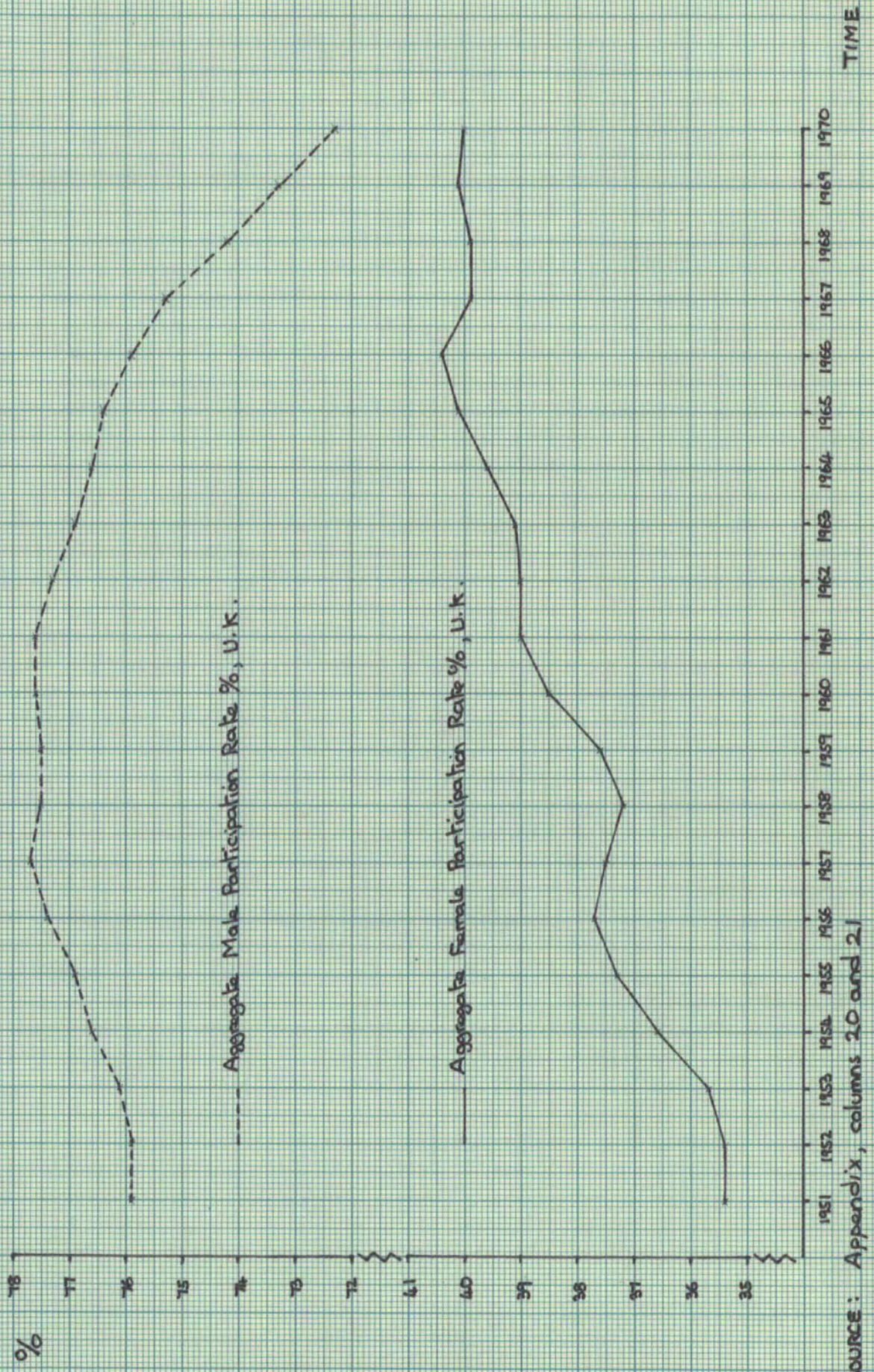
1 Similar conclusions are reached in an article in the Department of Employment Gazette January 1971. Since "regional comparisons between employee activity rates for males are not very meaningful" (ibid P.69) the activity rate for males is no longer compiled and published.

GRAPH 4.1



DATA SOURCE: Appendix columns 19 and 33

GRAPH 4.2



DATA SOURCE: Appendix, columns 20 and 21

caught by an efficient proxy for employment opportunities) is for our purposes a spurious variation which is a result of the way in which we have defined L. Corry and Roberts (ibid) note that whereas the theory of labour supply assumes that those workers eligible for unemployment benefits will normally remain in the reported labour force when unemployment rises and they become unemployed, an alternative which is open to them is to change their labour force status and perhaps move into one of the excluded groups.

Graph 4.1 shows the time-series, using annual data for the period 1951-70, of the overall participation rate¹ (expressed as a percentage) in the United Kingdom. The graph shows a clear upward trend from 54.5% in 1951 to about 57.25% in 1961, and a strong downward movement from about 57.25% in 1966 to 55.5% in 1970. This recent fall of about 2% in only four years represents a rapid decline in view of the fact that over the fifteen year period from 1951 the participation rate rose by only 3%. The effect of cyclical variations in economic activity is reflected in the variations in the upward trend of the series up to 1965/66. 'Peak' values occurred in 1957, 1961 and 1965/66 with 'trough' values in 1952, 1958, 1963. In Graph 4.2 we have plotted the time-series of the participation rate defined by sex groups. This shows us that the pattern of trends in the overall participation rate is the outcome of opposite trends in the male and female participation rates. The male participation rate rises from 75.9% in 1951 to 77.7% in 1957. Thereafter the rate is 'steady' up to 1961 since

1 The 'overall' participation rate is the size of the reported labour force expressed as a percentage of the population of working age.

when it has fallen continuously, particularly in the years since 1966, to its 1970 level of 72.3%. The female participation rate shows a strong upward trend from 35.4% in 1951 to 40.4% in 1966, and has levelled off thereafter at about the 40% mark. It would appear that between 1957 and 1966 the increase in the female participation rate outweighed the fall in the male rate so that the aggregate rate continued to rise, while after 1966 the levelling off in the female rate has allowed the falling male rate to pull the aggregate rate down. The effects of cyclical variation in economic activity are clearly visible in the female participation rate graph; 'peak' values occurring in 1956, 1961 and 1966, and 'trough' values in 1952, 1958, 1963. The male participation rate time-series graph is clearly not dominated to any extent by short term cyclical variations. This does indicate that, as our arguments have suggested, the secondary worker group is more typically composed of female rather than male workers.

To try and obtain further information on the composition of the secondary work force we also looked at some 'disaggregate' participation rate time series graphs.¹ The data enabled us to disaggregate into age-sex groups in order to see the features which underly the observed variation in the overall male and female participation rates. The disaggregate data is defined over Great Britain rather than the United Kingdom. This probably does not matter too much since as might be expected the aggregate participation rate for Great Britain parallels closely that for the United Kingdom.

¹ These graphs are included in the 'Supplementary Appendix'. The data from which they were drawn is described and listed in the Appendix. We have contented ourselves merely to describe and summarise the information they show.

The participation rate of males aged 15-24 shows an upward trend from the 1953 value of 71.4% to a 1966 peak value of 79%. Since 1966 a sharp decline has occurred to the 1970 level of 71%. The series shows marked short term variation, 'peak' values occurring in 1961 and 1966 with a clear interruption to the rising trend during the years 1956-58. There is some suggestion of cyclical variation in this evidence which is explicable in terms of the effect of periods of higher unemployment in causing potential entrants to the labour force to postpone their entry by taking advantage of opportunities to continue education. A priori we might have expected to see a secular decline in this participation rate. This would reflect the tendency for more young people to remain in full time education; a tendency which in the years since 1966 can, together with the deteriorating domestic employment situation, explain the dramatic fall of 8% in the participation rate for this age-sex group. The participation rate for females in the same (15-24 years) age group shows a strong negative trend from 73% in 1954 to 62.1% in 1970 which would seem to reflect more strongly the 'sociological' trend to longer schooling.¹ Short term variation in this series is much less marked than in that for males. There is some indication from the time-series graph that in years of cyclical upswing eg. 1953/54, 1956/60 and 1963/64 the participation rate does increase.

1 Over the period June 1966 to June 1968 the number of young people in full-time education increased by 79,000 males and 63,000 females. See 'The fall in the Working Population since 1966' in the Employment and Productivity Gazette' of June 1970.

Moving on to the age-group 25-44 years we find that the male participation rate is quite noticeably trend dominated. From 1951 to 1958, the rate rises from 88.2% to 90.5% and thereafter it falls almost continuously to 83.8% in 1970. (The only exception being that in 1963/64 the rate remains constant at 88.5%). There is no discernible pattern of cyclical variation in this series. This contrasts quite sharply with the observed variation in the participation rate for females in the 25-44 years age-group. The series shows a general positive trend from a 1951 value of 38.2% to a 1970 level of 45.6%. Cyclical variation is quite evident : 'peak' values occurring in 1956/57, 1962 and 1966, and trough values in 1952, 1958, 1963 and 1967/68.

The participation rate for males in the 45-64 years age-group is unique in that it is the only male age group for which the participation rate shows an upward trend from 82.7% in 1951 to 84.8% in 1970, although this is not a very great change. The series does show significant short-run variation; 'peak' values occurring in 1957 and 1966 (in which year this rate was at its post-war maximum of 86%), and 'trough' values in 1960 and 1968. Explanations for short-run variations in the participation rate of this ostensibly primary worker group are not easy to find.¹ Any general tendency to earlier retirement does not seem to be in evidence. The participation rate for females in the 45-59 years age-group is striking evidence of the increasing importance of this

1 The 'discouraged worker' argument offers us the notion that in years of recession older workers bring forward retirement decision, and that in years of recovery such decisions are postponed. However such an explanation is inconsistent with the fact that the participation rate increased throughout the recession periods 1951-53 and 1962-63 and declined during the 'recovery' year 1959/60 (although it did subsequently increase).

group of secondary workers over the post war period. It increases from 33.1% in 1951 to 51.2% in 1970. This large increase reflects the re-entry into the labour force of married women who have completed their families and who are increasingly prepared to engage in market work. The very marked upward trend is clearly interrupted between 1957-59, 1962/63 and 1966/67, which is suggestive of the effects of low-employment recession years.

The participation rate for 'retired' males (aged 65 and over) increases from 23.1% in 1951 to 26.1% in 1956/67, and has thereafter declined to 16.9% in 1970. This decline is interrupted during the years 1959/60 and 1964/65, perhaps reflecting the influence of cyclical recovery. The participation rate for females aged 60 and over rises continuously from 6.3% in 1951 to 10.4% in 1966, and has since levelled off to the 1970 value of 10.3%. No significant short term variation is exhibited in the time series graph for this participation rate.

We do not think that, on the basis of this data, it is possible to identify with any precision a secondary work force. Certainly the evidence does point to the inclusion of females aged 25-59, and perhaps males aged 15-24 and 65 and over. From the other side of the coin though it is hard to find any age-sex group for which the participation rate does not show some evidence of short term variation perhaps in response to changes in the level of economic activity, and who might therefore be included in the primary worker group. The group of males aged 25-44 would probably be the only candidates since the participation rate of this age-sex

group seems to be trend dominated. However, for our purposes, we need not attempt to identify the primary and secondary worker groups. Our interest is in the cyclical variation in the overall participation rate which, we hypothesise, is largely due to the flow of secondary workers into and out of the reported labour force in response to changes in, among other variables, the employment opportunities open to secondary workers. In Graph 1 we have seen that this type of response seems to be evidenced in the shorter term variations in the overall participation rate for the United Kingdom.

In Graph 4.1 we also plot the time series of the employment to population ratio which is our index of the level of employment opportunities. Since E is such a large part of L , we would expect that the (L/P) and (E/P) series show very similar patterns of variation and that consequently we shall be able to associate a large part of the variation in (L/P) with the variation in (E/P) using conventional statistical techniques. The corollary of this is that our participation rate equation will not, when it is measured statistically, enable us to make conclusions as to the strength of our 'employment opportunities' explanation of this kind of variation in aggregate labour supply. A better test of the hypothesis would be provided if we were to relate (L/P) to, for example, the vacancy rate as an index of employment opportunities, or if we were to relate changes in (L/P) to changes in (E/P) . However, our main aim is not to devise tests of alternative explanations of the observed variation in the aggregate participation rate.

We wish to measure a relationship in which (L/P) is the dependent variable and which shows good predictive power. In a subsequent section we explain how such a relationship can be used to obtain estimates of the extent of non registration by (secondary) workers.

Graph 4.1 shows clearly the decline in the size of the reported labour force since 1966 as it is reflected in the decline in the aggregate participation rate. This sustained fall in the size of the reported labour force is a unique feature in the experience of the post war period, and has consequently excited a good deal of speculation as to the causes. In the terms of our analysis this fall, which is clearly evident in the (E/P) ratio, could be due to the effect of an unprecedented decline in employment opportunities, and to longer term trend factors. The fall in the (E/P) ratio has two aspects. The ratio will decline due to increases in (P) which are not matched by similar proportional increases in (E) . Other things being equal, we might expect that when (P) rises (E) rises as well due to the increase in the 'base' from which the work force is drawn. If similar proportional changes in (E) do not occur, then we have a decline in employment opportunities in relation to the size of the population of working age. The (E/P) ratio will also decline when there is an absolute decrease in (E) reflecting a decline in the number of 'employment opportunities'. The longer term trend factors which are relevant to recent experience would include the increased numbers in full-time further education, any trend to earlier retirement by older workers, and the effects of changes in the composition of

the work force. Metcalf and Richardson (46) suggest that there has been a change in the composition of the population towards those age-sex groups less frequently found in the labour force (namely the higher age-groups), which makes a declining labour force largely inevitable. Of course our employment opportunities explanation focuses on increases in non-registration by secondary workers as a main cause, but our look at the participation rate data by age-sex groups points out clearly that ostensibly primary worker groups are involved. We noted above that the participation rate of males aged 25-44 years has been falling continuously since 1958. An article in the Employment and Productivity Gazette June 1970 (P.492-495) finds that the main change which requires explanation is the fall in the participation rates of males aged 25-64. Part of the explanation of this fall is that some workers have changed their labour force status by moving from 'employee' to 'self-employed', a change which is usually ascribed to the effects of the introduction of Selective Employment Tax in 1966. It is estimated that between June 1966 and June 1967 the numbers of self-employed men increased by 69,000. Another part of the explanation is that during the period June 1966 to June 1968 there was an increase of 15,000 in the number of workers classified as long term sick.

It remains to be seen whether or not our participation rate equation can accurately predict the experience of these years, which would at least suggest that the underlying 'employment opportunities' explanation might have some validity, though this in no way constitutes a test of this

hypothesis. One final point on the decline of the participation rate since 1966 needs to be made. The measured decline in (L/P) is subject to measurement errors on the population estimates. It is possible that the population estimates for the years 1966-70 are 'too high', and thus exaggerate the fall in the participation rate since 1966. As is pointed out in the 'Gazette' (ibid), these estimates are based on the last complete census, which was in 1961, with allowance for subsequent births and deaths and estimates of net migration. Information from the 1966 sample census is incorporated in the population estimates for the years up to 1966, but in the years since 1966 the accuracy of the figures depends largely upon the accuracy of the estimates of net migration since 1966. The population estimates for these 'inter censal' years 1966-70 will be subject to adjustment in the light of information from the 1971 census. Another source of measurement error in the data concerns the estimates of the 'self-employed' group of workers. These are most reliably estimated from census data, and in intervening years are 'worked up' from small samples of national insurance records analysed by the Department of Health and Social Security. Errors here will concern estimates of the flow of workers from 'employee' to the 'self employed' category during the period 1966-70.

II The Implications for the Theory of the Phillips Curve

The theory of the Phillips curve assumes there is a stable non-linear transformation between the level of excess demand for labour (X^*) and the unemployment rate $(U/L)^*$, where $(U/L)^*$ is measured to take into account cyclical changes in the participation rate and other types of measurement error, and $X^* = (V/L) - (U/L)^*$ ((V/L) is the vacancy rate). This 'mapping relation', which is shown in Figure IV.1 as the curve MM takes the general form

$$X^* = \Theta (U/L)^*$$

$$\text{where } \lim_{(U/L)^* \rightarrow 0} X^* = \infty$$

$$(U/L)^* \rightarrow 0$$

$$\text{and } \lim_{(U/L)^* \rightarrow a} X^* = 0$$

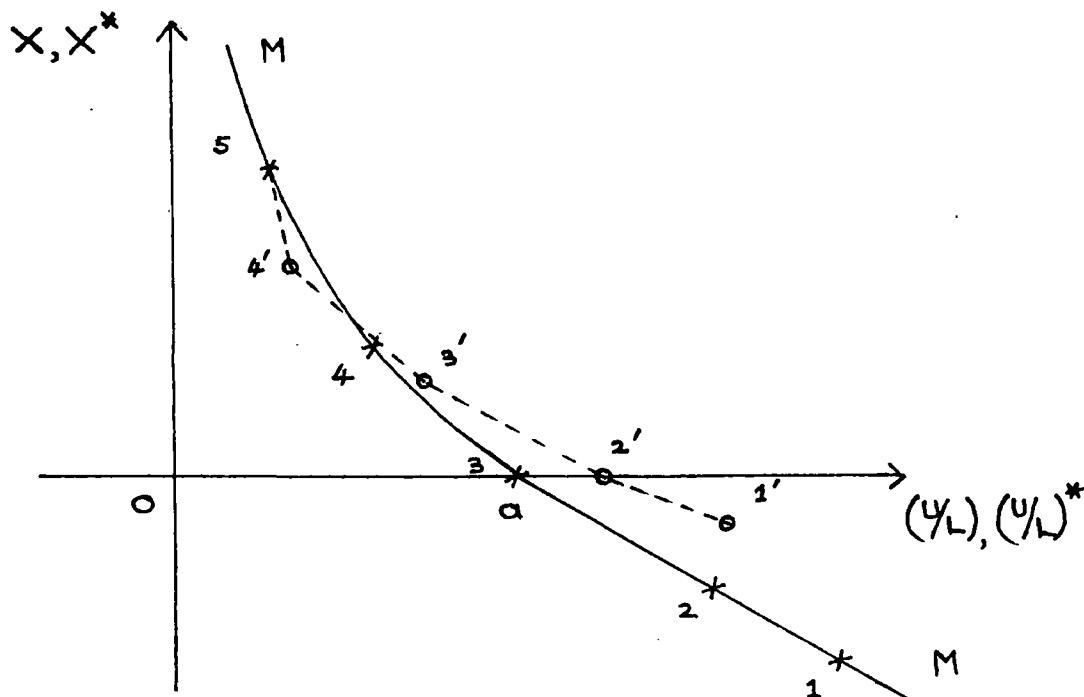
$$(U/L)^* \rightarrow a, a > 0$$

We now examine this relationship as it might be measured in practice given the existence of cyclical changes in the overall participation rate which occur because of the operation of a 'discouraged worker' effect. This effect means that when the demand for labour rises, secondary workers enter the reported labour force by moving directly into employment, and conversely that when it falls they leave the reported labour force and do not register as unemployed.

The reported unemployment rate (U/L) will differ from the rate $(U/L)^*$ in the following manner. When the demand for labour rises, unemployed primary workers find jobs and secondary workers enter the reported labour force by also finding employment. Hence the reported number unemployed falls (U) and the size of the reported labour force (L) rises, so that (U/L) falls. At this point $(U/L) < (U/L)^*$ since the

secondary workers outside the reported labour force are excluded from both U and L , and so (U/L) understates the actual level of unemployment. The corollary of this is that (U/L) overstates the actual degree of excess demand for labour. Given that the reported excess demand for labour (X) is measured as $(V/L) - (U/L)$, and that $X^* = (V/L) - (U/L)^*$, then since $(U/L) < (U/L)^*$, $X^* < X$. We can suppose that as the demand for labour increases on the upswing of economic activity secondary workers continue to enter employment and the reported labour force. In that case as $(U/L)^*$ tends to some very low level consistent with a very high level of economic activity, then $(U/L) \rightarrow (U/L)^*$ and the number of secondary workers outside the reported labour force gradually diminishes to some very low level. Thus, as X^* tends to some 'full employment' value, $[(U/L)^* - (U/L)]$ and $(X - X^*)$ can be assumed to tend to zero.

Figure IV.1



In Figure IV.1 the points numbered one to five and marked by small crosses represent points on the actual mapping relation MM. Let us suppose that point 5 $\left[(U/L)_5^*, X_5^* \right]$ represents some full employment level of activity. From our arguments above it follows that point 5 also lies on the 'observed' mapping relation between X and (U/L). Point 4 represents a less than full employment situation at which the actual unemployment rate $(U/L)_4^*$ exceeds the reported rate $(U/L)_4$, and the reported excess demand for labour X_4 exceeds the actual excess demand for labour X_4^* . Hence, the corresponding point on the observed mapping relation must lie north and west of point 4, and is exemplified on the diagram by the small circle labelled 4', which is drawn to satisfy the condition that $\left[(U/L)_4^* - (U/L)_4 \right] = (X_4 - X_4^*)$. At point 3 $X^* = 0$ and $(U/L)^* = (U/L)_3^*$. Again since $X > X^*$, and $(U/L)^* > (U/L)$ the corresponding point on the X/(U/L) curve must lie north and west of point 3. Our arguments above also suggest that $\left[(U/L)^* - (U/L) \right]$ and $(X - X^*)$ become progressively larger the further away X^* is from its 'full employment' value. Accordingly the lateral and vertical displacements of the $(U/L)_3, X_3$ point from point 3 are drawn correspondingly larger than the deviations of point 4' from point 4. The small circle labelled 3' illustrates this point on the diagram. Similar arguments enable us to derive the two other corresponding points which appear on the diagram as small circles labelled 1' and 2'. On the assumption that the flow of secondary workers into the reported labour force on the upswing of activity is more or less symmetrical with the rate at which they leave the

the reported labour force on the downswing of activity, then the dotted line joining these points in Figure IV.1 represents the relationship between X and (U/L) , the 'observed' mapping relation. Thus for the 'additional worker' effect has been ignored. A non-dominant 'additional worker' effect would mean that, at low levels of economic activity, the fall in the reported labour force would be smaller than otherwise, and that consequently the reported unemployment rate would be lower than otherwise. Hence the entry into the reported labour force of 'additional' workers would operate to partly mask the 'true' extent of the number of 'discouraged' secondary workers who leave the reported labour force, but would increase $[(U/L)^* - (U/L)]$ at low levels of economic activity.¹ Diagrammatically, this means that at high levels of unemployment the lateral and vertical displacement of the 'observed' mapping relation from the 'true' relation MM is increased by the existence of a non dominant additional worker effect.

The exact shape and location of this relationship depends upon the size of $[(U/L)^* - (U/L)]$ at each stage, and on the rate at which it increases as X^* falls from some 'high employment' level. However, it is evident that the degree of curvature of the 'observed' mapping relation differs from that of the actual mapping relation, as does the unemployment rate at which $X = 0$ and $X^* = 0$. In particular it seems

1 The entry of additional workers into the reported labour force at low levels of economic activity enlarges the denominator of the reported unemployment rate but not the numerator (given our implicit assumption that such workers move directly into employment, or at least do not register as unemployed).

likely that for values of $(U/L)^*$ on the observed mapping relation will be much flatter than the actual relation. Given the assumed stable relationship between X^* and the rate of wage inflation this suggests that the observed Phillips curve will, at these levels of unemployment, be much flatter than the 'theoretical' curve. The analysis also points out a source of instability in the 'observed' Phillips curve. As the proportion of secondary workers in the labour force increases both L and (L/P) can be expected to show greater cyclical variation, and so the 'average' degree of understatement of $(U/L)^*$ by (U/L) will increase at each stage of the trade cycle (except full employment). Changes in this degree of mis-statement of $(U/L)^*$ by (U/L) over different trade cycles would cause the dotted line in Figure IV.1 to rotate outwards from the origin about point 5. Thus the 'observed' Phillips curve would appear to rotate outwards over time giving the impression that the rate of wage inflation associated with any given level of unemployment has increased over time.

However, in order to get to the relationships between X^* and $(U/L)^*$, and between (\dot{W}/W) and $(U/L)^*$ it is necessary to adjust the unemployment statistics to take into account this type of cyclical variation in participation rates. The method we shall follow is adapted from that developed and used by Tella (64). The first stage of this method involves estimating what the participation rate would have been had the economy been run at a steady (arbitrarily chosen) high level of economic activity in each of the years 1951-70.

To do this we begin by estimating our participation rate equation viz

$$(L/P)_t = a + b (E/P)_t + c T_t \quad \dots (1)$$

Using the fact that,

$$(E/P)_t = (E/L)_t (L/P)_t \quad \dots (2)$$

we can rewrite (1) as

$$(L/P)_t = \frac{a}{1 - b (E/L)_t} + \frac{c}{1 - b (E/L)_t} T \quad \dots (1a)$$

We then choose a 'full employment' value for (E/L) , which is denoted $(E/L)_{F.E.}$, and substitute this into (1a) to obtain estimates of the full employment value for (L/P) , which is denoted $(L/P)_{F.E.}$.

$$(L/P)_{F.E.} = \frac{a}{1 - b (E/L)_{F.E.}} + \frac{c}{1 - b (E/L)_{F.E.}} T \quad \dots (1b)$$

$$= A + B T$$

where $A = \frac{a}{1 - b (E/L)_{F.E.}}$ $B = \frac{c}{1 - b (E/L)_{F.E.}}$

In this way we derive an $(L/P)_{F.E.}$ series for the period 1951-70 using the estimated values of the coefficients obtained from (1), and an arbitrarily chosen 'full employment' (E/L) value.

For each $(L/P)_{F.E.}$ we can now go on to adjust $(U/L)_t$ in the following manner

$$(L/P)_{F.E.} \cdot P_t = L_{F.E.} : \text{the potential full employment labour force}$$

$$L_{F.E.} - L_t = \Delta L_t : \text{the number of workers outside the reported labour force}$$

$$U_t + \Delta L_t = U_t^* : \text{the adjusted numbers of unemployed workers}$$

$$U_t^*/L_{F.E.} = (U/L)_t^* : \text{the adjusted unemployment rate}$$

Thus from estimates of the 'full employment' participation rate in each year we obtain estimates of the size of the

potential labour force in each year. We then subtract the size of the reported labour force to give us an estimate of the numbers of secondary workers who would have been in the reported labour force had the economy been at full employment, and who are therefore essentially unemployed. This number is then added to the numbers reported as wholly unemployed each year to yield the estimate of the total numbers actually unemployed. Finally this number is expressed as a percentage of the full employment labour force to arrive at the adjusted unemployment rate $(U/L)^*$.

III The Results

The first stage involved the estimation of the regression equation (1) using annual data for the period 1951-70. The equation was fitted to aggregate data, and to data by sex groups only, for the United Kingdom and Great Britain respectively. Our reason for estimating overall male and female participation rate equations, was to see if the results confirmed our view that the female participation rate is the more responsive to cyclical variations in employment opportunities. Ideally we should have liked to disaggregate further by age-sex groupings, but data problems prevented our doing this.¹ Although our main aim is to adjust the United Kingdom unemployment statistics, we also estimated participation rate equations using data for Great Britain, and so obtained adjustments on the Great Britain unemployment statistics. This was done to provide some guide or 'control' on the United Kingdom results. The main results are presented in Tables 4.1 and 4.2 for the United Kingdom and Great Britain respectively. In each case the regression equation was estimated by ordinary least squares, with and without the time trend.

All the coefficient estimates are significant at conventional levels, and the \bar{R}^2 's indicate that in all cases over 90% of the total variation in the respective participation rate can be associated with the variation in the chosen independent variables. As we noted above this

1 E is not directly available defined by age-sex groups, but $(E + U) = L$ is. E must therefore be approached using data for U by age-sex groups. Such data are now published twice-yearly in the 'Gazette', but the series is only available since 1963.

TABLE 4.1 UNITED KINGDOM: PERIOD 1951-70

$$(L/P)_t = a + b (E/P)_t + c T_t$$

Data	a	b	c	\bar{R}^2	D.W.
1.	3.4126	0.9563 (0.0647)		0.9197	0.5305
MALES and FEMALES 2.	7.8740	0.8681 (0.0392)	0.0397 (0.0063)	0.9743	1.1271 †
3.	17.2210	0.7901 (0.0406)		0.9522	0.6399
MALES 4.	9.2085	0.8908 (0.0442)	0.0461 (0.0137)	0.9695	1.3031 †
5.	2.6236	0.9419 (0.0259)		0.9858	2.2545*
FEMALES 6.	8.2318	0.7798 (0.0705)	0.0508 (0.0209)	0.9888	2.2058*

* Indicates that the Durbin Watson test showed no evidence of serial correlation

† Indicates that the Durbin Watson test was inconclusive
Standard errors of coefficient estimates are in parentheses

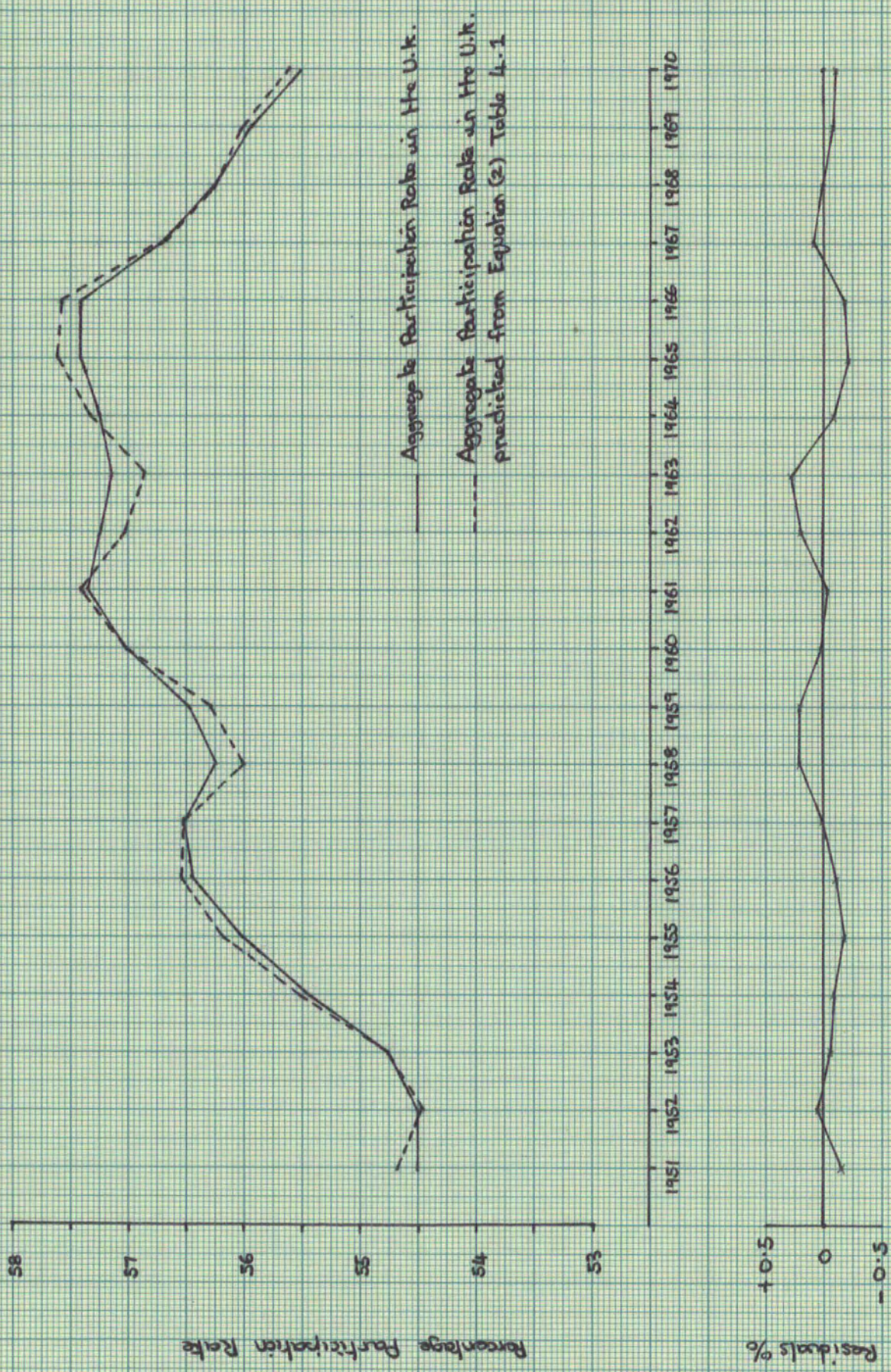
TABLE 4.2 GREAT BRITAIN: PERIOD 1951-70

$$(L/P)_t = a + b (E/P)_t + c T_t$$

Data	a	b	c	\bar{R}^2	D.W.
1	3.4832	0.9539 (0.0667)		0.9146	0.5122
MALES and FEMALES 2	7.8352	0.8678 (0.0406)	0.0414 (0.0067)	0.9722	1.0970
3	18.1472	0.7769 (0.03771)		0.9571	1.0896
MALES 4	11.88	0.8552 (0.0460)	0.0364 (0.0147)	0.9666	1.6692*
5	1.0879	0.9799 (0.0204)		0.9918	1.3886 †
6	6.2872	0.8301 (0.0581)	0.0464 (0.0172)	0.9940	1.3472 †

See notes to Table 4.1

GRAPH 4.3



kind of result was to be expected since E is such a large part of L , and the regression equation relates (L/P) to (E/P) . Thus we cannot infer that these results represent evidence that can discriminate in favour of the 'employment opportunities' explanation of participation rate behaviour. The addition of the time trend generally increased the proportion of 'explained variation', and the reliability of the results, particularly in the cases of the 'aggregate' equations (1), (1'), (2) and (2'). As we anticipated, the estimates obtained for the 'female' regression equations ((3), (3'), (4) and (4')) show greater explanatory power, and are more reliable than those obtained for the 'male' regression equations.

We have used the 'aggregate' equations (2) and (2') as vehicles for adjusting the reported unemployment percentages in the United Kingdom and Great Britain respectively. As a first step, we examined the predictive accuracy of the estimated equation for the United Kingdom. Graph 4.3 shows the actual and predicted values of (L/P) in the United Kingdom over the period 1951-70, together with a plot of the residuals from equation (2). The pattern of the residuals shows a tendency for the equation to underestimate (L/P) in the order of 0.25%, at upturns of the trade cycle as for example in the years 1958/59 and 1962/63. There is also a tendency to overestimate (L/P) at the downturn of the cycle as for example in the years 1954-56 and 1964-65.

It is tempting to regard the tendency to underestimate (L/P) during the later stages of the downswing as being due

to the fact that our specified regression equation ignores the "additional worker" effect which operates to counter the "discouraged worker" effect at these lower levels of economic activity. According to the hypothesis, additional workers tend to be housewives and other family members who enter the labour force under pressure of loss of work by the head of the household, in an effort to try and maintain the household's perceived real income position. When the head of the household is re-employed on the upswing of activity additional workers leave the labour force. It is not therefore the case that such workers would normally be in the reported labour force were the economy to be run at a stable 'full employment' level of activity. The potential 'full employment' labour force does not include additional workers, but concentrates on 'discouraged' workers who are not counted in the reported unemployment statistics. This interpretation of the positive residuals obtained for the years of cyclical downturn suggests that our estimates of the adjusted unemployment rate $(U/L)^*$ may be too low. In these years we shall be subtracting from the $L_{F.E.}$ estimate the size of the reported labour force L , where the latter includes the transient 'additional worker' members. Our estimates of the numbers of 'discouraged workers' in these years will therefore be too low, and so will the adjusted unemployment rate $(U/L)^*$, (to the extent that the latter is regarded as a measure of unemployed primary and "discouraged" secondary workers).¹

1 In years of cyclical downturn we can, on this interpretation of the positive residuals obtained, regard the adjusted unemployment rate $(U/L)^*$ as a measure of unemployed primary + discouraged secondary workers - employed 'additional' secondary workers.

A symmetrical argument would imply that the tendency for equation (2) to overestimate the participation rate at the upper turning point of the trade cycle is in part due to the exit of 'additional workers' from the reported labour force which is disguising the true extent of the flow of 'discouraged workers' into the reported labour force. The size of the reported labour force thus increases more slowly than the regression equation, which takes no account of the 'additional worker' effect, predicts it will. Our estimates of the number of unemployed discouraged workers in these years (ΔL) will therefore be 'too large', and so will the adjusted unemployment rate $(U/L)^*$. These arguments suggest that, unfortunately, our estimates of $(U/L)^*$ will tend to be too large during cyclical peak years, and too small in cyclical trough years. Furthermore, to the extent that the regression equation is overestimating the participation rate in cyclical peak years then it will be the case that our estimates of the potential 'full employment' labour force ($L_{F.E.}$) will be too large. It seems therefore that we must expect the estimated $(U/L)^*$ series to be 'too large' on average together with the cyclical pattern of error outlined above.

Of course it is entirely possible that the observed pattern of residuals does not reflect the operation of an 'additional worker' effect at all. We put this forward as one possible explanation which is consistent with an hypothesis about the behaviour of participants in the labour market. It may be that the observed pattern of residuals could be rationalised in terms of the effects of 'voluntary quits'. Whatever is the explanation for the prediction errors, they still remain as do our conclusions on the nature

of the error that we might consequently expect to see in our adjusted unemployment estimates. As regards the extent of the error the largest absolute residual obtained is 0.287% for the year 1963, a year in which an extremely severe winter impinged on the performance of the economy. When multiplied by the appropriate population total, this corresponds to an underestimate of the reported labour force of about 118,000 or $\frac{1}{2}$ %. The average positive residual over the whole period is 0.127, and the average negative residual is 0.104. This corresponds approximately to an underestimate of the reported labour force of an average 0.22%, and to an overestimate of an average 0.18%. It is worth noting that in the years since 1966 the residuals are very small and show no tendency to consistent over or underestimation of the participation rate.

As we outlined above, the method of adjusting the unemployment series uses an arbitrary 'full employment' value of (E/L) to yield estimates of $(L/P)_{F.E.}$ We identified the cyclical 'peak' years from the period under observation as 1951, 1955, 1961 and 1965. Differences in the value of (E/L) in these years reflect the effects of differences in the peak levels of aggregate demand, and of changes in the minimum attainable levels of unemployment. It is therefore by no means obvious what the appropriate peak year value of (E/L) is. Initially we chose to average the (E/L) value in the cyclical peak years, and obtained average $(E/L)_{F.E.}$ values of 0.987 and 0.988 for the United Kingdom and Great Britain respectively. After substituting these values of $(E/L)_{F.E.}$ in equations (2) and (2') in the manner outlined above, the

following stationary solutions were obtained

$$(L/P)_{F.E.} = 54.908 + 0.277T \text{ (United Kingdom)} \quad \dots (6)$$

$$(L/P)_{F.E.} = 54.931 + 0.290T \text{ (Great Britain)} \quad \dots (6a)$$

The next stages of the calculation are shown in Tables 4.3 and 4.4 where for convenience the totals are rounded up at each stage. The actual calculations were all done to six decimal places to avoid the considerable rounding errors which would otherwise occur during the early stages. In column 1 of Table 4.3 are listed the full employment participation rates in each year as generated by equation (6). These are multiplied by the respective population totals (divided by 100) in column 2, to yield the full employment labour force estimates in column 3. From these we deducted the size of the reported labour force in column 4, and obtained an estimate of the number of secondary workers currently outside the reported labour force in column 5. These were added to the numbers currently registered as unemployed (U in column 6) to yield the adjusted numbers unemployed in column 7. Finally column 8 shows the adjusted unemployment rate, which expresses the adjusted numbers of unemployed as a percentage of the potential full employment labour force in column 3. Table 4.4 is derived in an analogous fashion.

TABLE 4.3 RESULTS FOR UNITED KINGDOM DATA

	1	2	3	4	5	6	7	8
Date	(L/P) _{F.E.} %	P/100 000's	L _{F.E.} 000's	L 000's	ΔL 000's	U 000's	U* 000's	(U/L)* %
1951	55.19	388.99	21,466	21,206	260	264	525	2.44
1952	55.46	389.89	21,624	21,255	370	368	738	3.41
1953	55.74	390.78	21,781	21,394	388	356	744	3.42
1954	56.02	391.61	21,939	21,713	227	303	530	2.41
1955	56.29	392.68	22,104	21,992	113	244	356	1.61
1956	56.57	393.55	22,262	22,209	54	258	312	1.40
1957	56.85	394.93	22,450	22,316	134	327	461	2.05
1958	57.12	396.36	22,641	22,291	350	451	801	3.53
1959	57.40	398.76	22,889	22,527	361	480	842	3.68
1960	57.68	401.71	23,169	22,904	265	377	643	2.77
1961	57.95	404.44	23,439	23,189	250	347	596	2.54
1962	58.23	409.90	23,869	23,461	408	467	875	3.67
1963	58.51	412.82	24,153	23,592	560	558	1,118	4.63
1964	58.78	415.47	24,423	23,782	641	404	1,045	4.28
1965	59.06	417.68	24,669	23,977	691	347	1,038	4.21
1966	59.34	419.16	24,872	24,059	813	361	1,174	4.72
1967	59.61	419.80	25,026	23,833	1,193	559	1,752	7.00
1968	59.89	421.09	25,220	23,695	1,525	586	2,111	8.37
1969	60.17	422.23	25,405	23,624	1,781	581	2,362	9.30
1970	60.45	423.13	25,578	23,489	2,089	618	2,707	10.58

NOTES TO TABLES 4.3, 4.4

Column 3 = Column 1 x Column 2

Column 5 = Column 3 - Column 4

Column 7 = Column 5 + Column 6

Column 8 = Column 7 / Column 3 x 100

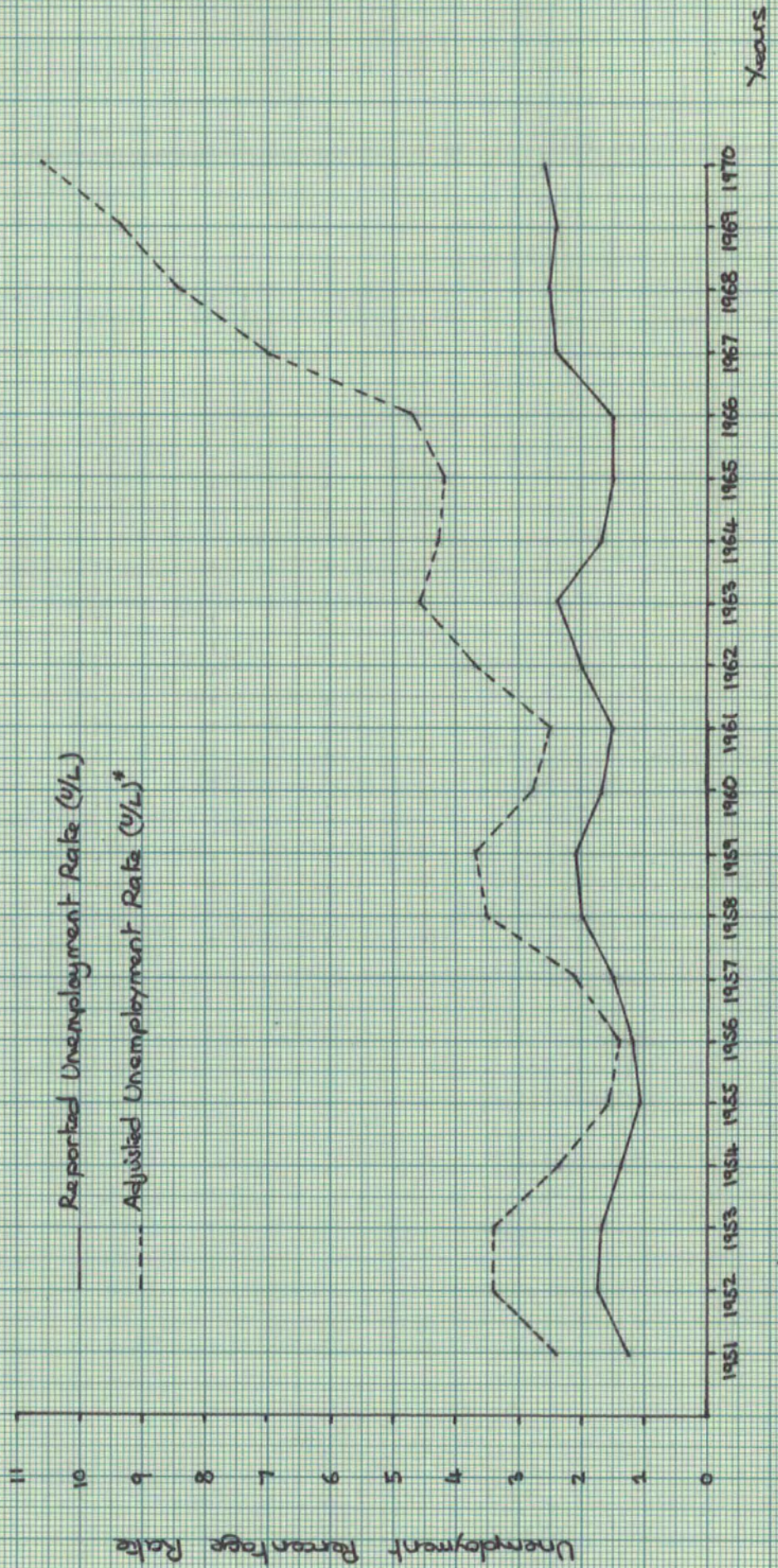
All figures have been 'rounded up' for the purposes of the tables. The calculations on the (L/P)_{F.E.} series were performed to 6 decimal places, and thereafter to 2 decimal places.

TABLE 4.4 RESULTS FOR GREAT BRITAIN DATA

	1	2	3	4	5	6	7	8
DATE	(L/P) _{F.E.} %	P/100 000's	L _{F.E.} 000's	L 000's	ΔL 000's	U 000's	U* 000's	U/L)* %
1951	55.22	379.07	20,933	20,739	194	237	431	2.06
1952	55.51	380.00	21,094	20,787	307	329	636	3.01
1953	55.80	380.83	21,251	20,925	326	320	646	3.04
1954	56.09	381.71	21,411	21,188	224	272	495	2.31
1955	56.38	382.71	21,578	21,519	60	213	273	1.26
1956	56.67	383.58	21,739	21,735	4	230	233	1.07
1957	56.96	384.97	21,929	21,840	89	295	384	1.75
1958	57.25	386.38	22,122	21,819	303	410	713	3.22
1959	57.54	388.73	22,369	22,047	322	445	767	3.43
1960	57.83	391.60	22,648	22,419	230	346	575	2.54
1961	58.12	395.0	22,918	22,705	214	312	526	2.29
1962	58.41	399.69	23,348	22,972	376	432	808	3.46
1963	58.70	402.53	23,631	23,098	533	521	1,053	4.46
1964	58.99	405.11	23,899	23,285	615	372	987	4.13
1965	59.29	407.25	24,144	23,472	672	317	989	4.10
1966	59.58	408.69	24,348	23,544	804	331	1,135	4.66
1967	59.87	409.32	24,504	23,318	1,187	521	1,708	6.97
1968	60.16	410.56	24,698	23,177	1,521	549	2,070	8.38
1969	60.45	411.65	24,882	23,103	1,779	543	2,323	9.34
1970	60.74	412.46	25,051	22,968	2,083	585	2,668	10.65

See Table 4.3 for Notes

GRAPH 4.4



Data Source: Appendix column 6 and Table 4.5

Graph 4.4 shows the time series of (U/L) and $(U/L)^*$ in the United Kingdom for the period 1951-70. A priori we expect that the adjusted series will approach the reported series on cyclical upswings (as 'discouraged' secondary workers enter the reported labour force), and will diverge from the reported series on cyclical downswings (as 'discouraged' secondary workers leave the reported labour force). This pattern shows up quite clearly for the 'boom' year of 1956, and to less marked degree for the 'boom' year of 1961. Our estimates of the size of the 'unemployed' secondary work force (L) indicate that in 1956 the economy was virtually 'fully employed'.¹ In 1961 the economy appears to have attained a 'less than full employment' cyclical peak with approximately 250,000 workers remaining outside the reported labour force. The most striking feature of these results is that during the upswing to the 'boom' year of 1965, the adjusted unemployment rate fell by only 0.4% and in the downswing of activity since late 1966 has diverged considerably from the reported unemployment series. By 1970 the adjusted unemployment rate is in the region of 10.5% as compared to a reported rate of 2.6%. Some disturbing factor seems to have operated to magnify considerably the 'normal' cyclical divergence between the (U/L) and $(U/L)^*$ series, particularly in the years since 1966. The pattern of the time-series in Graph 4 does however strongly suggest that this trend towards a widening in the two series is evident in each year since about 1960.

1 In 1956 L in the U.K. was only 54,000. The reported unemployment rates of 1.1% and 1.16% for 1955 and 1956 respectively, suggest that 1% was at that time the minimum attainable level of 'structural' and 'frictional' unemployment.

Our arguments above have suggested that our adjusted unemployment series may show a systematic cyclical error ((U/L)* will be 'too large' in peak years and too small in trough years) and may also show a constant tendency to be too large. To the extent that error of this nature exists in the (U/L)* series (and is significant) it could not account for this increasing divergence between the (U/L) and (U/L)* series. It is a popular view, and one which we discuss later, that certain structural changes have occurred in the U.K. labour market which may have influenced the size and nature of the unemployment experienced in recent years; again particularly since 1966. Of course our estimates are all based on the presumption of unchanged structure over the period studied and will not therefore be appropriate if certain significant structural changes have in fact taken place which are at variance with the structure implied by our model.

Table 4.4 shows the results we obtained for Great Britain. As might be expected the results are very similar. One feature worth noting is that in the years since 1968, the (U/L)* estimates for Great Britain are marginally higher than those for the United Kingdom, which reverses the normal relationship between the two unemployment series. As we indicated above we have reason to suspect that our estimates may be subject to cyclical error to the extent of $\frac{1}{2}\%$ so that it is no great surprise to find that in 1970 the adjusted unemployment rate in Great Britain exceeds that in the United Kingdom by as much as 0.07%. The probable extent of the error in each estimated series will always make such

a result possible.¹

It is clear that the adjusted unemployment series obtained with the method we have used is likely to vary with the particular full employment assumption that is made during the early stages of the calculation. Thus far we have used the average (E/L) of all cyclical peak years in the period 1951-70. By taking a 'simple' average we implicitly gave each cyclical peak year an equal weight when, as judged by the reported unemployment rates, the years 1961 and 1965 were 'less than full employment' peak years as compared to 1955. We are also assuming that the minimum attainable 'full employment' level of frictional and structural unemployment remains unchanged over the whole period. In the next chapter we shall use our estimates of adjusted unemployment to shed some light on this question. For the moment we wish to see how sensitive these estimates are to alternative full employment assumptions. Accordingly, we used the maximum (E/L) achieved over the period 1951-70 in the United Kingdom, which was 0.9889 in 1955, as our assumed 'full employment' value for (E/L). Obviously this represents the 'strongest' full employment assumption that could reasonably be made, and we shall expect to generate adjusted unemployment estimates which are consistently larger than those previously obtained. After substituting this value for $(E/L)_{F.E.}$ into equation (2) Table 4.1 we

1 However the evidence of the durbin watson test in Table 4.2 suggests the presence of positive serial correlation in the residuals from equation 2. The test is inconclusive with respect to equation (2) in Table 4.1. This suggests that the results for Great Britain are less reliable than those for the United Kingdom.

derived the following predicting equation for the United Kingdom,

$$(L/P)_{F.E.} = 55.533 + 0.281 T \quad \dots (7)$$

The adjusted unemployment estimates we obtained were derived in analagous fashion to those shown in Tables 4.3 and 4.4 and are shown in Table 4.5 (where for convenience the original estimates are shown). The new full employment assumption yields an adjusted unemployment series for the United Kingdom which is consistently approximately 1.2 percentage points larger than the series previously obtained. Given that the new full employment assumption involves a higher (E/L) value we thus derive a higher $(L/P)_{F.E.}$ series and a higher set of $L_{F.E.}$ estimates from which we then subtract the same set of L values. There is no difficulty in accounting for the fact that the new adjusted series is therefore consistently larger than that previously obtained. The new series shows as well a virtually identical pattern of variation as the original series. This will always be the case no matter what 'full employment' assumption is made since that assumption only affects the values of the slope and intercept terms in the $(L/P)_{F.E.}$ predicting equation which remains as a linear upward trend.¹ The pattern of variation in the $(U/L)^*$ series reflects the variation in the L and U reported statistics which are respectively subtracted from, then added to the $L_{F.E.}$ estimates. Hence we should not expect differences in the 'full employment' assumption to markedly influence the pattern of variation shown by the adjusted unemployment series.

1 This is subject to there being no large changes in the slope and intercept terms. Comparison of the terms in equations (6) and (7) suggests that what changes occur in response to an alternative full employment assumption will be slight.

TABLE 4.5 SUMMARY OF ADJUSTED UNEMPLOYMENT ESTIMATES

1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Adjusted unemployment % U.K. : original estimates based on 'average' (E/L) of cyclical peak years																			
2.44	3.41	3.42	2.41	1.61	1.40	2.05	3.53	3.68	2.77	2.54	3.67	4.63	4.28	4.21	4.72	7.00	8.37	9.30	10.58
Adjusted unemployment % U.K.: estimates based on 1955 value of (E/L)																			
3.71	4.67	4.67	3.68	2.89	2.68	3.33	4.79	4.93	4.04	3.81	4.92	5.87	5.52	5.46	6.06	8.21	9.56	10.48	11.74
Adjusted unemployment % U.K.: figures obtained by combining estimates for sex groups																			
3.65	4.63	4.71	3.74	3.02	2.87	3.57	5.07	5.26	4.38	4.54	5.56	6.57	6.30	6.27	6.81	9.00	10.4	11.42	12.78

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However, the extent of the difference between the first two sets of $(U/L)^*$ estimates in Table 4.5 does suggest that the estimates themselves are quite sensitive to alternative full employment assumptions. The two series may differ by a similar absolute amount but at 'low' unemployment levels this gap is proportionally very large. The original estimates represent some sort of 'middle ground' being based on the 'averaged' high employment experience of the economy over the whole period, while the second set of estimates is based on the highest possible 'realised' full employment assumption. Estimates were also calculated based on a 'low' full employment assumption (namely the minimum 'peak' (E/L) value experienced during the period 1951-70) but these proved unsatisfactory as they contained negative unemployment rates for some years. This occurred because in some years the excess of the reported labour force over the potential full employment labour force was larger than the numbers reported as unemployed. The range of possible full employment assumptions is not therefore very wide and is we feel adequately represented by the particular assumptions that we have made.

The third set of adjusted unemployment estimates shown in Table 4.5 is derived in a rather different manner. In this case the final adjusted unemployment series was obtained by combining estimates of the total adjusted numbers of unemployed males and females respectively, expressed as a percentage of the sum of the estimates of the potential 'full employment' male and female labour forces. We used equations (4) and (6) in Table 4.1 to derive predictions of the 'full

employment' male and female participation rates, based in each case on the largest (E/L) value experienced over the period 1951-70. In the case of males this was 0.9888 in 1955, and in the case of females it was 0.9911 in 1966. We then multiplied the 'full employment' participation rate series by the respective population totals for males and females to yield the potential 'full employment' labour force estimates for males and females. The reported labour force totals were deducted and the reported unemployment totals added giving estimates of the adjusted numbers unemployed for males and females respectively. These were combined in the manner described above to yield the third series of adjusted unemployment estimates shown in Table 4.5. The procedure is identical to that used in Tables 4.3 and 4.4 except that it was separately applied to the male and female estimated participation rate equations.

However our suspicions are that the adjusted unemployment estimates obtained from this different procedure are the least reliable of all the estimates. Our objective was to see if a different angle of approach would yield us quantitatively similar results. In fact these final estimates are greater than both previously estimated series for all years since 1952; the gap between the series widening continuously until by 1970 it is 1.04 percentage points between the final and the second series, and 2.2 percentage points between the final and the original series. Our first reservation concerning this approach is that the estimated male participation rate equation (4) is not as reliable as the estimate of the female participation rate equation (6).

The Durbin Watson statistic indicates the presence of serial correlation in the residuals from equation (4). Secondly, to approach the problem of estimating the extent of non registered unemployment in this way may be illegitimate. The approach ignores the fact that the sizes of the male and female labour forces may be inter-related. We have discussed above hypotheses about labour market behaviour which suggest that the participation of the secondary worker group is to some extent influenced by the labour market status of primary workers, where the latter are more typically males, and the former females. If this is the case, then we cannot proceed to determine the participation rate behaviour of males and females under certain economic conditions when one group is considered as independent of the other. This argument suggests that it is safer to work with the overall participation rate, as we do above, rather than to work with the participation rate of specific groups, such as secondary workers in the case of Simler and Tella (64). Finally, this approach makes the choice of 'representative' full employment values of (E/L) a more difficult matter, especially when years of maximum male and female employment differ as they do in practice.

Conclusion

We have derived three series of adjusted unemployment estimates for the United Kingdom over the period 1951-70 which attempt to take into account the phenomenon of non-registration by 'discouraged' secondary workers. The validity of these estimates rests very much on the validity of the specified participation rate model which is used to predict 'full employment' values of the labour force. Behaviourally,

this model relies on an underlying 'employment opportunities' explanation of cyclical changes in the aggregate participation rate together with a simple time trend to catch the influence of long term factors. Thus our procedure of using 'full employment' values of the employment rate to predict $(L/P)_{F.E.}$ assumes that changes in the employment rate are the outcome of cyclical variations in the demand for and supply of labour, and that over the period as a whole the participation rate shows a positive long term trend. This time trend is intended to measure the net effects of long term factors such as changes in the age-sex composition of the population of working age and the trends to longer schooling and earlier retirement. The time trend part of the explanation of the variation in the aggregate participation rate is probably the weakest part of that explanation. This is because it represents only the average trend experience of the sample period as a whole,¹ and as such would not pick up a change in the underlying trend which is not significant enough, or of sufficient duration to dominate that experience. It is always possible then that we are interpolating in our $(L/P)_{F.E.}$ estimates a measurement of trend which is a statistical illusion.

Notwithstanding these remarks, and bearing in mind our discussion above of other possible errors in our estimates, we present our $(U/L)^*$ estimates only as more accurate indicators of the true extent of unemployment in the economy

1 Different sample-periods may yield significantly different estimates of the trend.

than are the reported unemployment statistics. The three series of estimates are each based on a different 'full employment' assumption and show a similar pattern of variation, and exhibit the same divergence from the reported unemployment statistics in the course of the last decade of the sample period. It remains to be seen whether the $(U/L)^*$ series will perform better than (U/L) in a fully specified wage-change equation. This seems a priori unlikely. The high rates of wage-inflation and unemployment which have characterised recent years have called into question both the stability and indeed the existence of the wage-change/unemployment relationship. Our estimates of adjusted unemployment show an unprecedented increase in the years since 1966, much more so than the reported unemployment series, and so exacerbate this recent experience.

V THE NATURE OF THE TRANSFORM
BETWEEN THE EXCESS DEMAND FOR
LABOUR AND THE LEVEL OF
UNEMPLOYMENT

I N T R O D U C T I O N

In the previous chapter we have obtained an 'adjusted' unemployment series which we hypothesise is a more accurate measure of 'true' unemployment than the reported unemployment rate because it takes into account cyclical variation in the participation rate. In section I of this chapter we examine the 'theoretical' relationships between the degree of excess demand for labour, the level of unemployment and the level of vacancies. Using these relationships we obtain an expression for the level of 'maladjustment' unemployment in terms of the reported unemployment and vacancy statistics, and the 'statement ratios' which attach to these statistics. The 'statement ratios' indicate the extent to which the reported unemployment and vacancy rates differ from the 'true' rates. The level of 'maladjustment' unemployment is the level of unemployment associated with zero excess demand for labour. We argue that this level of maladjustment unemployment is likely to show a cyclical variation, and a longer term variation, due to changes in 'structural' unemployment. The implications of this type of variation for the mapping relation, and consequently the Phillips curve, are then examined.

In section II we have constructed series of values for the statement ratios attaching to the vacancy and unemployment statistics and using these we have obtained estimates of 'maladjustment' unemployment for the period 1950-70. Section III shows the procedure for correcting the unemployment and vacancy statistics for changes in 'maladjustment' and we present estimates of unemployment which are thus corrected.

Section IV discusses the 'mapping relation' between excess demand and unemployment and examines the phenomenon of 'Phillips loops' in that relation. Finally section V explores the explanatory significance of our 'final' unemployment estimates in the wage-change equation.

I Theory

In Chapter I we saw that the level of unemployment enters the theory of the Phillips curve as a proxy for the (proportional) degree of excess demand for labour (X). We also noted that (X) can be stated in terms of directly observable quantities as

$$X = (V - U)/L \quad \dots (1)$$

where

U = number of unemployed workers

E = number of employed workers

V = number of job vacancies

L = the size of the labour force = E + U. This statement thus ignores variations in the supply of and demand for labour which take the form of changes in the average hours supplied by, or demanded from, each worker, and concentrates on variations in the supply of and demand for numbers of workers. The statement assumes that E, V and U are all accurately measured quantities: in particular that U is measured to take into account such phenomena as non-registration by 'discouraged' workers, 'voluntary quits' and labour hoarding by firms. The natural rate of growth in the population will lead to gradual increases over time in E, V and U. The effect of this natural growth is suitably removed by working with these quantities expressed as a proportion (percentage) of L.

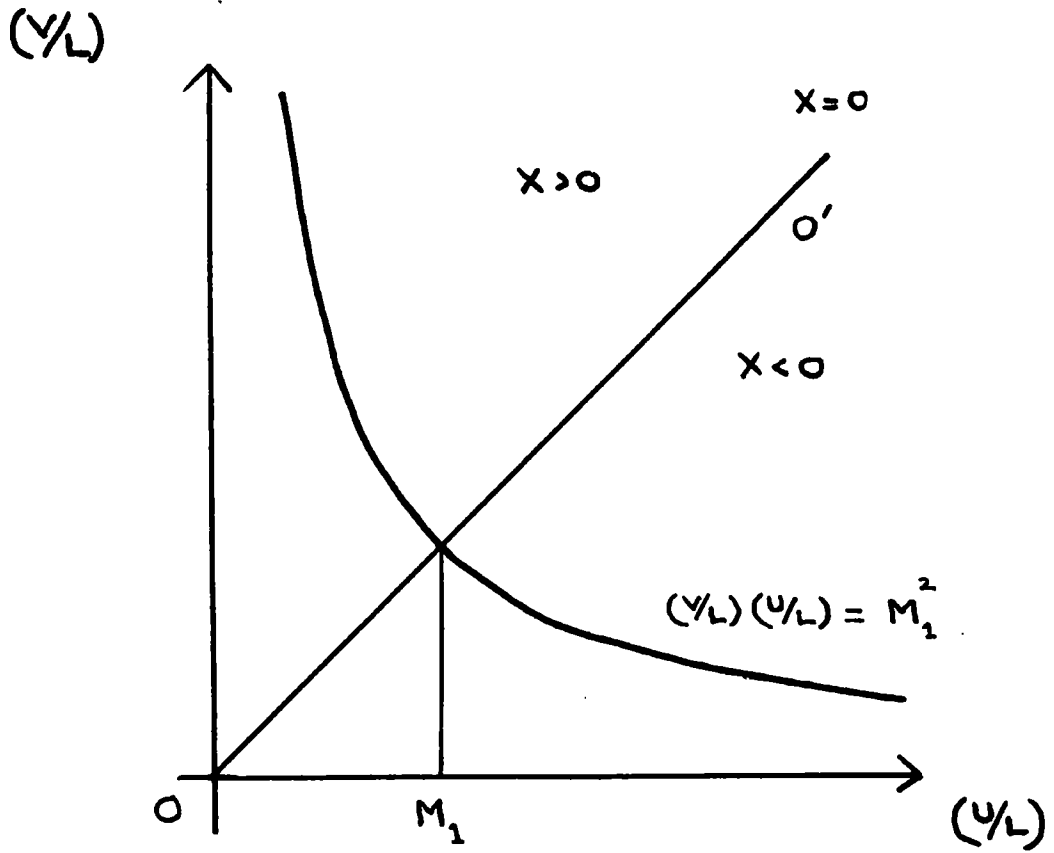
The relationships between (U/L) and (V/L), X and (U/L), and X and (V/L) have been explored by Dow and Dicks-Mireaux (16). They thought that *ceteris paribus*,

" An increase in the pressure of demand will then always increase the level of unfilled vacancies reported,

and reduce unemployment. But even at very high levels of demand there would remain some unemployment ie above a certain point unemployment is decreasingly sensitive to demand. The reverse is true of the statistics of unfilled vacancies. Even when demand was clearly deficient, some unfilled vacancies would remain, so that below a certain point the level of vacancies must be reckoned as decreasingly sensitive to demand" (P.4). These relationships were taken to hold between the 'pressure of demand' (for labour) and the 'statistics of unemployment and unfilled vacancies', and were deduced from observing the relationship between the (U/L) and (V/L) time-series ie they were not derived from any hypothesis or empirical knowledge about processes of dynamic adjustment in the labour market.

It is convenient to begin with the relationship between (V/L) and (U/L) which is shown in Figure V.1, and is described by a curve which is convex to the origin. The line OO' is the locus of points where $X = 0$ ie $(V/L) = (U/L)$ and divides the $(U/L)/(V/L)$ space into areas of high ($X > 0$) and low ($X < 0$) demand for labour. Dow and Dicks-Mireaux define the level of unemployment associated with zero excess demand for labour as a measure of 'maladjustment' (M) in the labour market. The curve in Figure V.1 is drawn on the assumption that equilibrium in the labour market is associated with an unchanged level of 'maladjustment' unemployment M_1 . We argued in Chapter I that in a perfectly competitive (frictionless) labour market, we should not expect to see the co-existence of vacancies and unemployment in equilibrium. In this case there is no maladjustment, and the relationship between (V/L) and (U/L) lies along the axes. Given the

FIGURE V.1



existence of such markets, positive levels of (V/L) and (U/L) can then only simultaneously occur as a result of aggregation over micro labour markets, given a non-zero dispersion of micro unemployment rates. In this context the hyperbolic $(V/L)/(U/L)$ curve can be seen as an aggregate relationship. Alternatively though, the co-existence of vacancies and unemployment in the same market can occur as a result of 'frictional' unemployment which is due to market imperfections. In that case, the curve can be interpreted as a 'micro' relationship. The general form of the vacancy/unemployment relationship can be written,

$$(V/L) = f_1 (U/L) \quad \dots (2)$$

$$f_1' < 0, f_1'' > 0$$

$$\text{Lim } (U/L) = 100\%$$

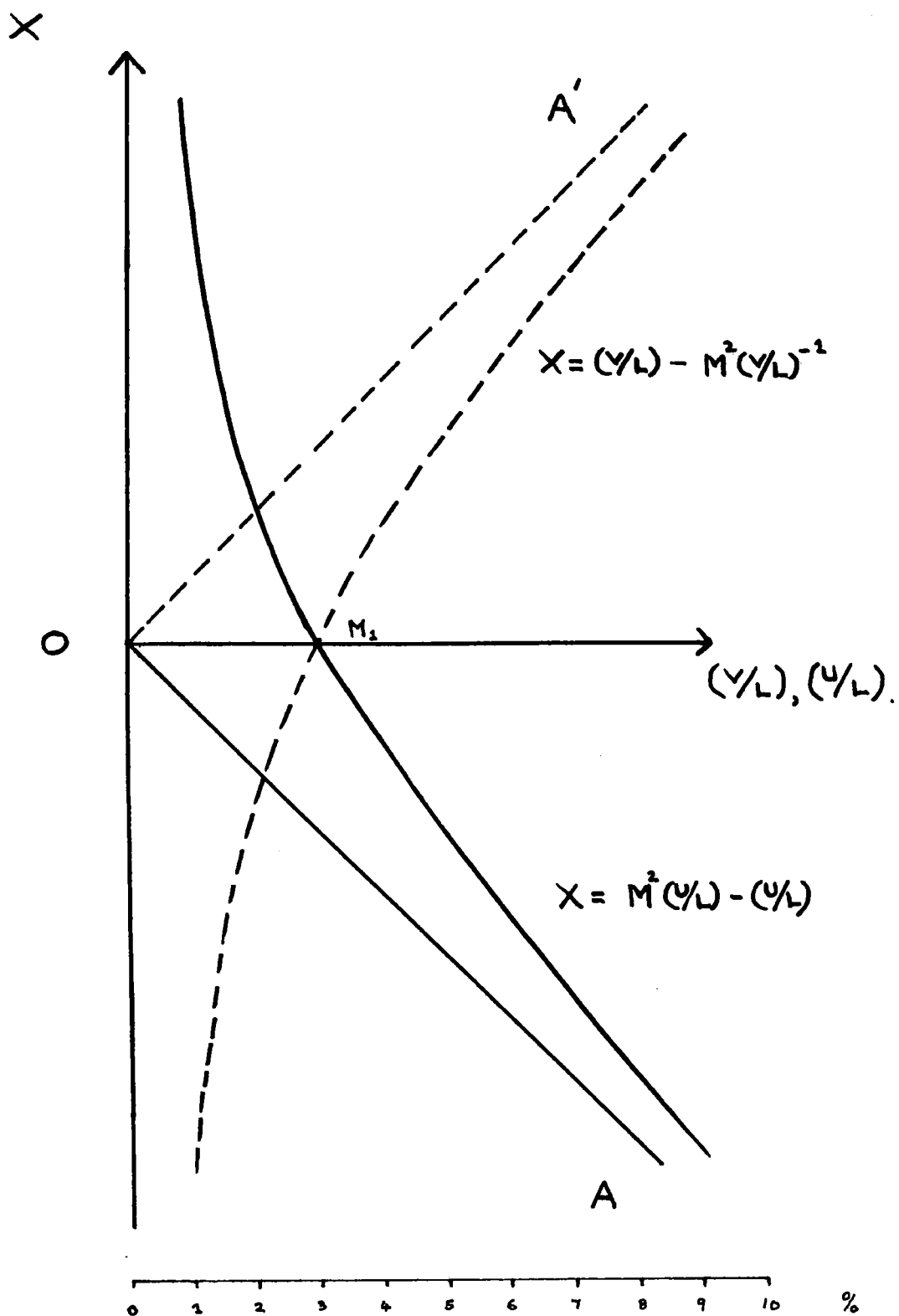
$$(V/L) \rightarrow 0$$

$$\text{Lim } (V/L) = \infty$$

$$(U/L) \rightarrow 0$$

Thus when $X > 0$ and $(V/L) > (U/L)$, then (U/L) declines continuously but is decreasingly sensitive to increases in (V/L) since (U/L) is bounded at zero. Conversely, when $X < 0$ and $(U/L) > (V/L)$ we expect that (V/L) declines continuously but is decreasingly sensitive to increases in (U/L) . Note that (U/L) has a finite limit of 100% since it is impossible for the unemployment rate to exceed 100%. Dow and Dicks-Mireaux propose that f_1 in equation (2) might be approximated by a rectangular hyperbola of the simplest form (when the axes are the asymptotes). They suggest that, for the purposes of describing the relationship between the statistics of the vacancy and unemployment rates, this assumption about the shape of the curve will not be critical given the narrow range of observations experienced.

FIGURE V.2



The equation of this curve takes the form

$$(V/L) = M^2 (U/L)^{-1} \quad \dots (2a)$$

and this enables us to write the level of 'maladjustment' unemployment (M) as

$$M = \sqrt{(V/L) (U/L)} \quad \dots (3)$$

when the labour market is in equilibrium, $((V/L) = (U/L))$.

However, as long as M is unchanged and we are on the same curve, it follows that the value of M is obtainable from (3) in disequilibrium situations when $(V/L) \neq (U/L)$.¹

The relationship between X and (U/L) is the mapping relation of the theory of the Phillips curve. In a (frictionless) perfectly competitive labour market there is no maladjustment and so as X rises to zero (U/L) falls to zero - this relationship is described by the line OA in Figure V.2. In the case where $M > 0$, as X rises from negative values to zero, (U/L) falls to some positive level of 'maladjustment' unemployment which is shown as $OM_1 = 3\%$ in Figure V.2. Thereafter, (U/L) continues to approach zero but is decreasingly sensitive to further increases in X . The general form of this mapping relation is

$$X = f_2 (U/L) \quad \dots (4)$$

$$f_2' < 0, f_2'' \geq 0$$

$$\text{Lim } X = \infty$$

$$(U/L) \rightarrow 0$$

$$\text{Lim } X = 0$$

$$(U/L) \rightarrow M, M > 0$$

The various hypotheses concerning the sign of the second

1 In the context of the Dow and Dicks-Mireaux argument equation (2a) is an aggregate relationship. In Chapter I we showed the derivation by Hansen (23) of a similar vacancy/unemployment relationship by introducing frictional unemployment into a simple model of a competitive labour market.

derivative of this function have been discussed in Chapter I. For the specific hyperbolic form of (2a) we can write the mapping relation as

$$X = M^2 (U/L)^{-1} - (U/L) \quad \dots (4a)$$

This relationship is plotted in Figure V.2

Finally we must describe the relationship between X and (V/L). As X falls from positive values, (V/L) falls to some positive level equal, when X = 0, to the level of maladjustment unemployment M (for the case where M > 0). Thereafter (V/L) continues to decline with X, but is decreasingly sensitive to further decreases in X. In the case where M = 0 the relationship is only defined for X > 0 and is shown as the dotted line OA' in Figure V.2. The general form of the (V/L)/X relationship is,

$$X = f_3 (V/L) \quad \dots (5)$$

$$f_3' > 0, f_3'' > 0$$

$$\lim_{(V/L) \rightarrow M, M > 0} X = 0$$

$$\lim_{(V/L) \rightarrow 0} X = -100\%$$

$$\lim_{(V/L) \rightarrow 0} X = -100\%$$

$$(V/L) \rightarrow 0$$

For the specific hyperbolic form of (2a), the equation is

$$X = (V/L) - M^2 (V/L)^{-1} \quad \dots (5a)$$

This relationship is plotted in Figure V.2 for M = M₁

It seems a priori unlikely that the forms of the relationships between the variables X, (U/L) and (V/L) which have been set out so far will be observed when they are confronted with the actual statistics on aggregate unemployment and vacancies. One reason, proposed by Dow and Dicks-Mireaux, is that the statistics of (V/L) and (U/L) might not accurately measure or reflect the number of job

vacancies, and unemployed workers respectively. We have already discussed the sources of measurement error in the unemployment statistics. Dow and Dicks-Mireaux thought that there were

" good prima facie reasons for distrusting the statistics of unfilled vacancies since they neither record transactions nor register decisions, but represent a sort of queue. The size of the queue may be either more or less than the real unsatisfied demand " (P.2). The existence of private employment agencies, and the possibilities of advertising jobs in the national and local press means that it is by no means certain that every job vacancy will be notified to the employment exchanges. Another possibility is that the same job vacancy may be notified with a number of employment exchanges, and will thus be counted more than once in the statistics. We can assume then that both the unemployment and vacancy statistics might not accurately measure the actual unemployment and vacancy quantities. Using the following notation,

$(V/L)'$ = statistics of unfilled vacancies, percentage rate

(V/L) = 'true' vacancy rate

S = $(V/L)' / (V/L)$: the statement ratio attaching to $(V/L)'$

$(U/L)'$ = statistics of unemployment, percentage rate

d = $(U/L)' / (U/L)$: the statement ratio attaching to $(U/L)'$

(U/L) = 'true' unemployment rate.

then the relationships in equations (2a), (4a) and (5a),

and illustrated in Figures V.1 and V.2 are defined for

$S = d = 1$. Using equation (3) we can now write the level of maladjustment unemployment as

$$M = \left[(U/L)' / d \cdot (V/L)' / S \right]^{1/2} \quad \dots (3a)$$

This in principle gives us a means of approaching the 'true' unemployment and vacancy rates, and hence the level of maladjustment unemployment, provided that we can make some estimates of the values of S and d respectively. This task is taken up below.

To the extent that the statement errors attaching to the vacancy and unemployment statistics are not equal to unity, then we should not expect that those statistics will yield observations that lie along a hyperbolic curve such as that in Figure V.1. Changes in the level of maladjustment unemployment associated with equilibrium in the labour market will also influence the pattern of observations yielded by the data. We now turn to a discussion of the nature of this maladjustment unemployment.

As we saw in Chapter I, both Lipsey (41) and Hansen(23) postulated the existence of frictional unemployment at zero excess demand for labour in micro labour markets. Frictional unemployment refers to those unemployed workers who are unemployed merely because they are between jobs ie because it takes time to change jobs. As Thirlwall (66) puts it " 'pure' frictional unemployment arises from a lack of instant labour mobility" (P.23).¹ It exists because of specific labour market imperfections, namely the absence of efficient information networks and the search costs which are consequently imposed on the individual worker. Zero aggregate excess demand for labour which is associated with a zero dispersion of excess demand (and unemployment) over micro

1 Definitions of different types of unemployment are not unambiguous. Thirlwall (66) discusses the alternative 'causal' and 'cure' classifications within which definitions can be made.

labour markets, will therefore be associated with a positive level of 'frictional' maladjustment unemployment. According to the Lipsey model, as excess demand for labour in micro labour markets increases, the level of frictional unemployment falls because the average time spent in job search falls (there being no completely offsetting increase in the number of employees moving between jobs). Hence the mapping relation is negatively sloped for positive values of excess demand for labour in micro labour markets. Maintaining our assumption of a zero dispersion of excess demand for labour over micro labour markets, it then follows that the aggregate mapping relation is negatively sloped for positive values of aggregate excess demand for labour. This relationship is implied by the hyperbolic form we have adopted for the vacancy/unemployment relationship in equation (2a), and the definition of excess demand in (1). X increases as (U/L) falls, because as (U/L) falls (V/L) increases by more than (U/L) falls for positive values of X . Specifically if we differentiate (2a) then,

$$d(V/L) = -M^2 (U/L)^{-2} d(U/L) \quad \dots (2b)$$

in which case $d(V/L)$ always exceeds $d(U/L)$ when (U/L) is falling because $d(U/L) < 0$. As long as $(U/L) < M$, in which case $X > 0$, then it also follows that $/d(V/L)/ > /d(U/L)/$

The relationships we have defined in equations (2a), (4a) and (5a) above can therefore be seen as aggregate relationships. Equilibrium in this aggregate labour market is associated with a positive level of frictional maladjustment unemployment, which declines as aggregate excess demand increases. Remembering our arguments in Chapter I, we now suppose that, when aggregate excess demand for labour is zero, the

unemployment rates and excess demands for labour in micro labour markets are not identical ie we have a non zero dispersion of excess demand for labour and unemployment. Aggregation over micro labour markets now introduces an additional 'structural' unemployment element at zero aggregate excess demand for labour. This arises because the dispersions of labour demand and supply over micro labour markets, as defined by such characteristics as geographical location, age, experience, occupation, skill etc., are not identical. Part of the higher level of maladjustment unemployment is therefore 'structural' in nature, where in broad terms structural unemployment refers to those unemployed workers who are not of the right 'type' (by occupation, age, skill etc.) to match the demand for labour, or who are in the wrong place. In practice, such unemployment tends to arise and become concentrated in particular occupational groups and geographic areas as a result of a change in the relationship between the pattern of labour supply and demand. The pattern of labour supply in terms of its geographical distribution and its composition by occupation, age, skill etc., is slow to adjust to the changing pattern of labour demand. This suggests that the structural component of maladjustment unemployment is likely to show some longer term variation as the pattern of labour supply slowly adjusts to the pattern of labour demand. (Over the longer term labour is not as geographically and occupationally immobile as it tends to be in the short run.)

There are also some good reasons, as discussed in Chapter I, for supposing that the structural unemployment

component of 'equilibrium' maladjustment unemployment will also show short run cyclical variation. The Lipsey dispersion explanation of the Phillips loops is the source of this argument. This explanation supposes that in the course of the upswing of the trade-cycle time lags occur in the speed of recovery of different (factor and product) markets eg. the consumer goods industries might recover first, while the capital goods sector might not recover until significant excess demand has developed in the consumer goods industries. Thus, in the initial stages of the recovery, Lipsey supposed that the distribution of excess demand for labour becomes more unequal, while in the later stages of the recovery, as excess demand for labour is transmitted to all labour markets, it becomes more equal. On the downswing of economic activity his presumption was that the fall in demand occurs more uniformly in all markets, so that no great inequality in the distribution of that demand arises. If the dispersion of excess demand for labour eventually falls as the aggregate level of excess demand for labour increases on the upswing of economic activity then this implies that the 'structural' component of 'equilibrium' maladjustment unemployment must also eventually fall.¹ Although this is a disequilibrium situation maladjustment as defined by (3) and (3a) will fall, indicating that adjustment is not along an unchanged vacancy/unemployment curve, or mapping relation, when this measure of maladjustment would be unchanged (indicating a constant equilibrium level of maladjustment unemployment). Changes in maladjustment

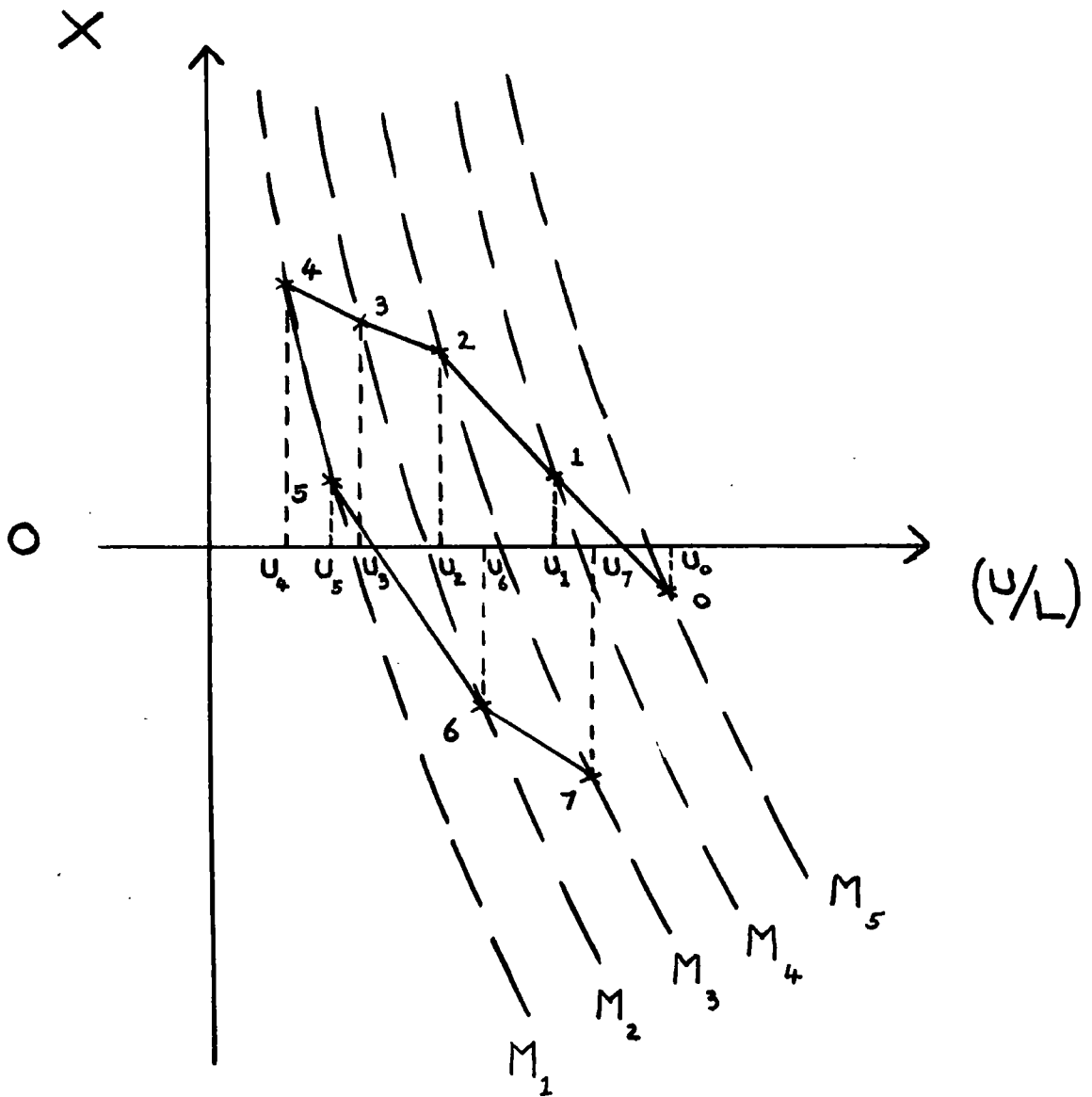
1 Here structural unemployment changes as a result of a cyclical variation in the geographical pattern of labour demand.

imply that the relationships described by (2a), (4a) and (5a) are shifting. This argument suggests then that the relationships shift systematically over the course of the trade-cycle, while our previous arguments suggest a gradual shifting of the relationships over time. Cyclical variations in structural unemployment are expected also by Rees (56), as we mentioned in Chapter I. He argues that a decrease in structural rather than frictional unemployment will initially accompany an increase in the demand for labour (see above P. 30)¹

We have already discussed the phenomena of anti-clockwise and clockwise 'loops' around the Phillips curve. Such loops could arise as a result of loops in the $X/(U/L)$ space consequent upon a systematic pattern of cyclical variation in M , such as that just suggested. In Figure V.3 curves M_1 through to M_5 are members of the family of 'mapping relations' corresponding to different levels of maladjustment unemployment. Suppose that in period 0 we are on M_5 and the level of unemployment is U_0 (see point 0). X increases and so unemployment falls to U_1 in period 1 and we observe the point 1 on curve M_4 . 'Maladjustment' unemployment has therefore fallen ($\Delta M_1 < 0$). By period 2 the level of unemployment falls further to U_2 and we observe the point 2 on curve M_3 ; maladjustment unemployment having again fallen ($\Delta M_2 < 0$). In periods 3 and 4 unemployment is assumed to fall to a cyclical minimum at U_4 , and we observe points 3 and 4 on curves M_2 and M_1 respectively,

1 If the mobility of labour, particularly its in geographical aspect, is related directly to changes in excess demand for labour, then this would further reinforce any tendency for structural unemployment to vary inversely with excess demand for labour.

FIGURE V.3



indicating that maladjustment unemployment falls in both periods ($\Delta M_3, \Delta M_4 < 0$). Periods 5 through to 7 are characterised by rising unemployment on the downswing of activity. We have assumed that M remains constant in period 5 ($\Delta M_5 = 0$), and then increases, so that we observe points 5, 6 and 7 in Figure 3. The time-path of observations $0 \rightarrow 7$ forms an anti-clockwise loop in the $X/(U/L)$ space. However, the direction of the loop which is generated depends on the sign and magnitude of ΔM_t and $\Delta(U/L)_t$ in each period. We could reverse the time-ordering of the points $0 \rightarrow 7$ so that the loop in Figure 3 becomes a clockwise loop. A priori, such loops are consistent with the inverse relationship we have postulated between the structural component of maladjustment unemployment and X .¹

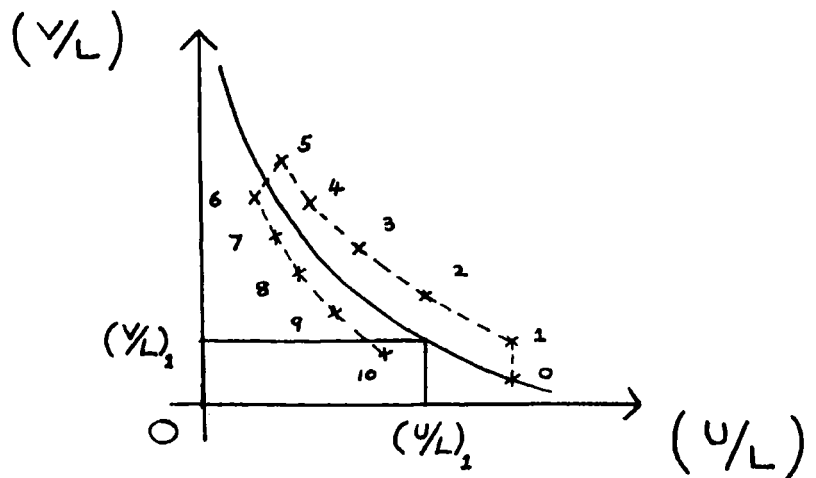
This explanation has several implications. It implies that any systematic cyclical variation in M will lead to clockwise or anti-clockwise loops in the mapping relation depending on the magnitude of ΔM and $\Delta(U/L)$ over time. This will depend upon the level of X at each stage and on the slope of the mapping relation at that point, and on the rate at which M falls as X rises. Secondly it implies that the statistically identified mapping relation is essentially a 'statistical artifact' which may not correspond with any 'true' mapping relation. Thirdly it suggests that any significant non-cyclical increase in M will disturb the loop pattern and could lead to observations over short periods of time which generate a time-path over which (U/L) and X

1 Going round the loop in Figure V.3 in a clockwise direction we should need to alter the pattern slightly to ensure this. The level of X associated with point 4 needs to be greater than the level of X associated with point 3.

increase together. Such changes could occur as a result of longer term variation in the structural component of maladjustment unemployment. Given a stable linear relationship between the rate of wage inflation and X these explanations are consistent with the observations of 'Phillips loops' and longer term shifts in the Phillips curve.

Alternative rationalisations for loops in the mapping relation are available. Hansen (23) suggests that while vacancies may respond to a sudden upturn in the demand for labour during the early recovery phase of the trade-cycle unemployment may not because of "the well-established tendency for employment to lag behind demand and output" (ibid P.17). As the demand for labour continues to increase vacancies increase contemporaneously, but unemployment begins to fall only after a lag. In Figure V.4 we can imagine, for simplicity, that at period 0 the point 0 is observed on the vacancy/unemployment curve during the recession. In period 1 X increases and so does (V/L) but (U/L) remains unchanged, generating the point 1. in Figure V.4. By period 2, X and (V/L) have both increased again, and unemployment adjusts with a lag. In the diagram we assume that unemployment falls in the current period to the level consistent with the (V/L) of the previous period. Thus we observe point 2 in period 2

FIGURE V.4



with unemployment having fallen to (U/L) , consistent with (V/L) , the vacancy rate observed in period 1. Points 3 through to 10 are derived in analagous fashion with the assumption that (V/L) reaches a cyclical peak at point 5, and thereafter declines. As is evident from the diagram the lagged adjustment of (U/L) means that in contemporaneous data of (V/L) and (U/L) we observe not the curve but the anti-clockwise loop of points 0 through to 10. Of course the actual form of the loop depends upon the length and time-form of the lag, but the main result ie the anti-clockwise loop, still stands. In terms of our analysis this result is equivalent to outward/upward shifts of the vacancy/unemployment curve on the upswing; these shifts being reversed on the downswing. This is equivalent to increases in the parameter M on the upswing, and decreases on the downswing. The mapping relation will therefore shift outwards during the upswing and inwards on the downswing. This explanation therefore predicts that a statistically measured M will vary directly with X .¹

1 This lagged unemployment explanation of anti-clockwise loops means only that M , as defined and measured in (3) and (3a) which are unlagged relationships, appears to vary directly with X . In terms of a lagged specification of (3), the actual level of M need not vary at all.

II Estimating The Level of Maladjustment

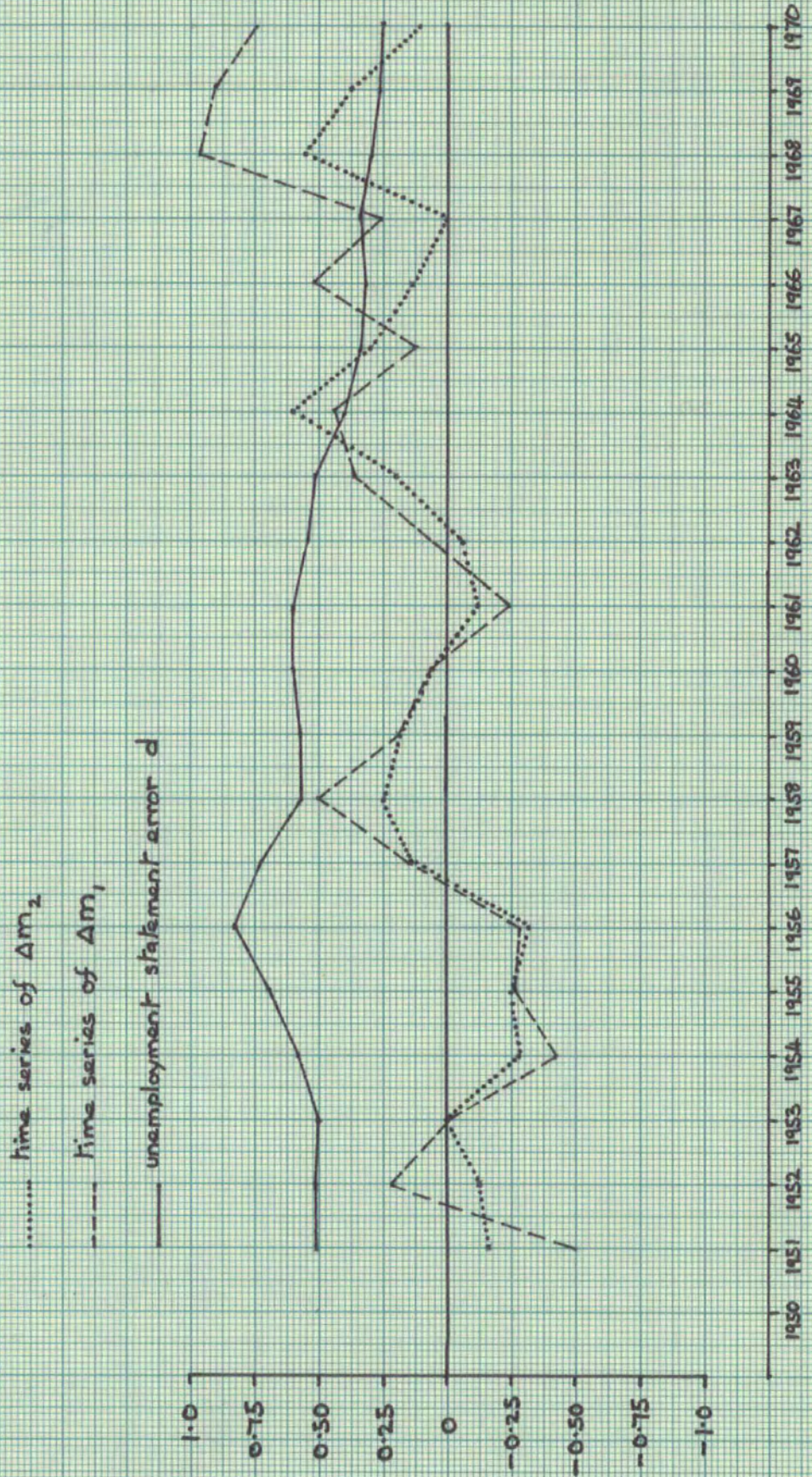
Initially Dow and Dicks-Mireaux (16) favoured the view that the unemployment statistics were fairly reliable, or as they put it 'hard'. Dow¹ subsequently suggested that, at or below the point of zero excess demand, d might be in the order of 0.5 because of non-registration by secondary workers. We shall use our "adjusted" unemployment rate $(U/L)^*$ as an estimate of (U/L) , since $(U/L)^*$ at least takes into account this source of error in the reported statistics. By so doing we are ignoring the effects of other sources of errors in the reported statistics such as 'voluntary quits' and labour hoarding by firms. An estimate of the statement error which attaches to $(U/L)'$ is then obtained as $(U/L)' / (U/L)^*$. In Chapter III we presented three sets of $(U/L)^*$ estimates for the period 1951-70. We decided to work with the first set of estimates obtained which it will be re-called, were based on the 'average' full employment experience of the period as measured by the average (E/L) experienced in cyclical peak years. This series was preferred to the final set of $(U/L)^*$ estimates obtained on the grounds that the latter series is less reliable for the reasons given above. The choice between the first two sets of $(U/L)^*$ estimates is arbitrary, especially as both show a virtually identical pattern of variation. The first series was chosen on the grounds that the full employment assumption on which it is based is more realistic simply because it is not 'extreme' as is the case for the full employment assumption which

1 'The Management of The British Economy' 1945-60' N.I.E.S.R. 1964 P.340 Footnote 3.

underlies the second set of $(U/L)^*$ estimates. Using the first set of $(U/L)^*$ estimates we found that the average statement error (\bar{d}) which attaches to $(U/L)'$ over the period 1951-70 was 0.495, which is very similar to the value suggested for it by Dow. Over the period d varied between the limiting values of 0.247 and 0.829. A priori we should expect the value of d to vary with the level of X . This follows from the nature of the cyclical mis-statement of (U/L) by $(U/L)'$. At less than full employment points $(U/L)'$ always understates (U/L) because of the "discouraged worker" effect. On the upswing of activity the entry into the reported labour force of such workers means that $(U/L)'$ tends toward (U/L) ($d < 1$ but increasing towards 1), while on the downswing, as discouraged workers leave the reported labour force, the discrepancy between $(U/L)'$ and (U/L) widens ($d < 1$ but getting smaller). Graph 5.1 shows the time-series of d . This cyclical pattern is quite clear for the 1952-1958/59 trade-cycle. Thereafter d shows a slight tendency to increase during the 1960/61 peak of activity, but has since declined steadily and is in the region of 0.25 by the end of the period. This secular decline reflects the levelling off we have previously observed in the overall participation rate after 1960, and its sharp decline after 1966.

Any method of arriving at an estimate of the true vacancy rate must be essentially ad hoc since there is no specific hypothesis concerning the relationship between $(V/L)'$ and (V/L) . Given the existence of alternative methods than employment exchanges for advertising vacancies, then we have an a priori expectation that $S < 1$. Dow (op cit) suggested that (V/L) was understated, and that S was in the region of 0.5. This estimate of S was arrived at by assuming ".... tha

GRAPH 5.1

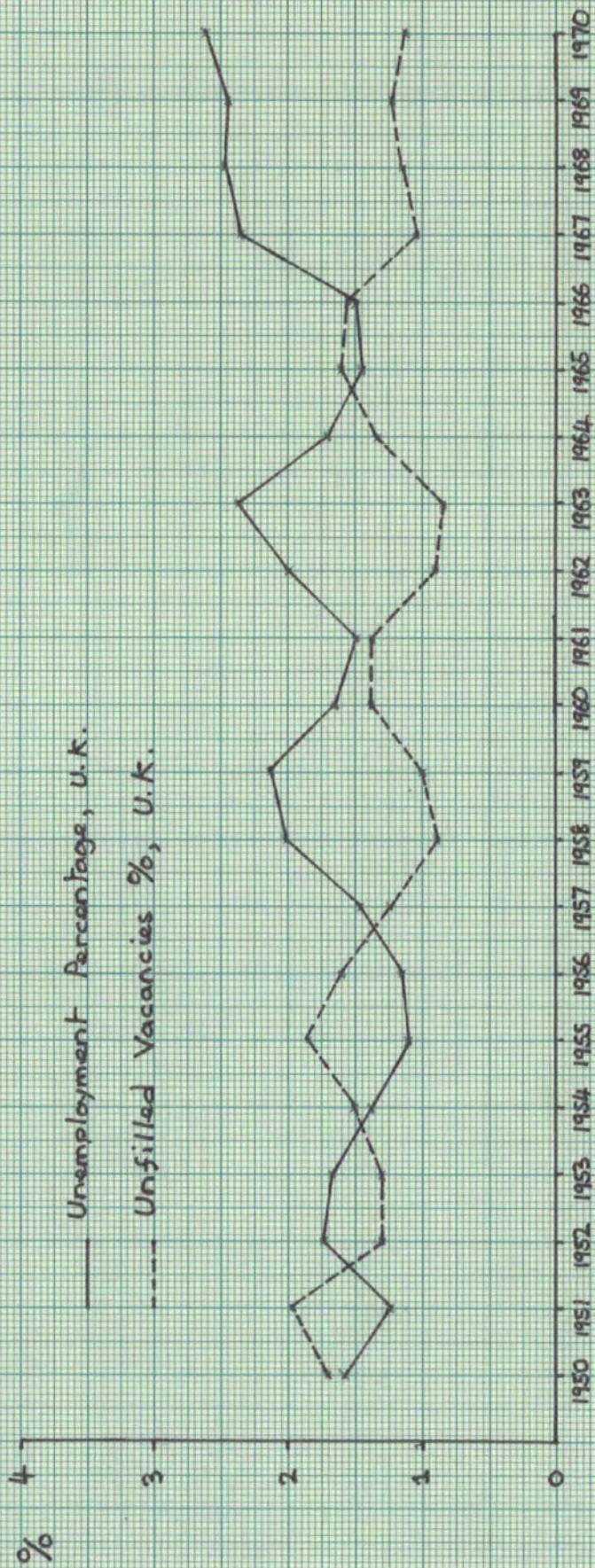


DATA SOURCE: TABLE 5.2 for Am series. d is obtained from the $(1/L)^d$ series of Table 4.3 and the reported unemployment rate series in Appendix, column 6.

the unemployment statistics showed only half the changes in 'true' unemployment and that since the inverse fluctuations in registered unemployment and unfilled vacancies in response to changes in demand were generally of similar size, the vacancy statistics also understated true vacancies by a factor of two" (ibid P.341). The germ of this idea is thus that if both series show a similar pattern and amplitude of variation, then we can assume that $S = \bar{d}$. Graph 5.2 shows the time-series of $(U/L)'$ and $(V/L)'$ on an annual basis for the period 1950-70. Changes in X appear to be equally well reflected in both series which show a similar pattern and amplitude of variation, visually at least, up to 1968. On this basis we can infer that the magnitude of the average value of S is unlikely to differ significantly from that of \bar{d} . Taken over the period as a whole it is likely to be in the region of 0.5 as Dow suggested. A more difficult question is whether we expect that S will vary over time, and if so what pattern will that variation take. Dow and Dicks-Mireaux (ibid P.27) suggested that S is unlikely to be a decreasing function of X since in general it is only the vacancies which are hardest to fill which are notified to employment exchanges, and an increase in X is likely to make vacancies even more difficult to fill.

However it is possible to gain some idea of the size of S using an 'indirect' approach. Firstly an inspection of the $(U/L)' / (V/L)'$ scatter might enable unambiguous identification of certain years for which $X \gtrsim 0$. In that case, for any year in which $X > 0$, then $(V/L)' / S > (U/L)' / \bar{d}$ ie $S < (V/L)' \bar{d} / (U/L)'$; if we assume that $(U/L)' / \bar{d} = (U/L)^*$,

GRAPH 5.2

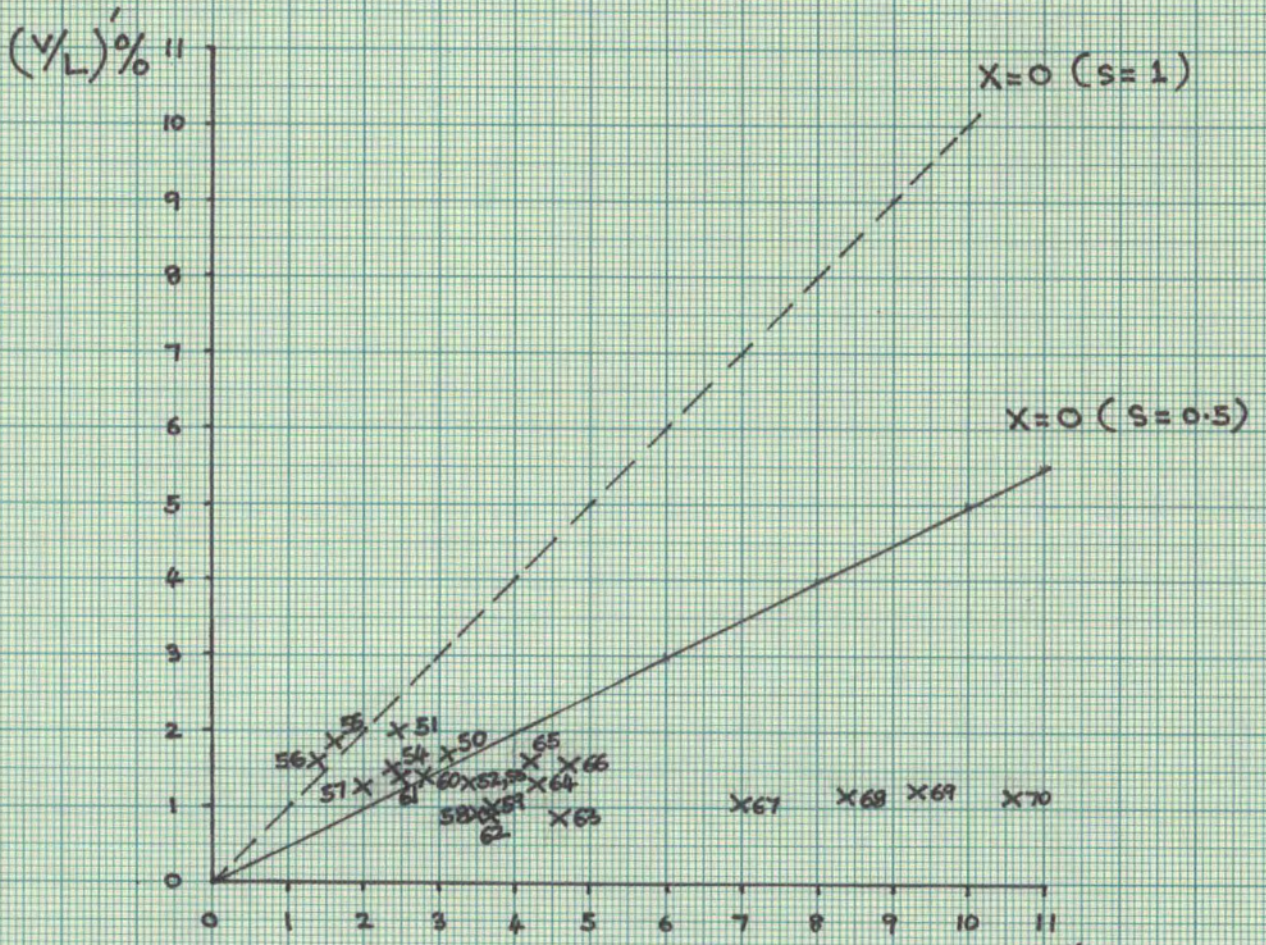


DATA SOURCE: Appendix, columns 6 and 12

then $S < (V/L)' / (U/L)^*$. Conversely if $X < 0$, then it follows that $S > (V/L)' / (U/L)^*$. This method should enable us at least to set some limits on the value of S .

Graph 5.3 shows the scatter of points in the $(U/L)^* / (V/L)'$ space for the period 1950-70. The broken line $X = 0$ ($S = 1$) divides the space into areas of high (> 0) and low (< 0) demand on the assumption that S is constant and equal to unity. Since there are good reasons for supposing that $S < 1$ then we can be fairly certain in identifying the years 1955 and 1956 as years in which $X > 0$ in which case $(V/L)' / S > (U/L)^*$ and $S < (V/L)' / (U/L)^*$ ie we find that in these years $S < 1.14$. The unbroken line in Graph 5.3 divides the $(U/L)^* / (V/L)'$ space into areas of high and low demand on the assumption that S is constant and equal to 0.5. Points to the left of this line are thus years of negative excess demand as long as $S \geq 0.5$ in each corresponding year. We assume that this is the case and on this basis allocate the years 1952, 1958, 1959 and 1962-70 into the set of years in which $X < 0$. The remaining years were allocated to a third category in which the 'X status' of each year is ambiguous, so that the corresponding limit on S may be an upper or a lower limit. In Table 5.1 column 1 lists the 'X status' of each year in the period 1950-70, and column 2 shows the limiting values that must then bound X in each year. Taken overall, the picture that emerges is that S has never exceeded 1.14, and has never been below 0.11. A clearer picture of this information is gained from Graph 5.4, in which an unambiguous limit on S is denoted as a small horizontal bar which is met from below by a curve segment for an upper limit, and from

GRAPH 5.3



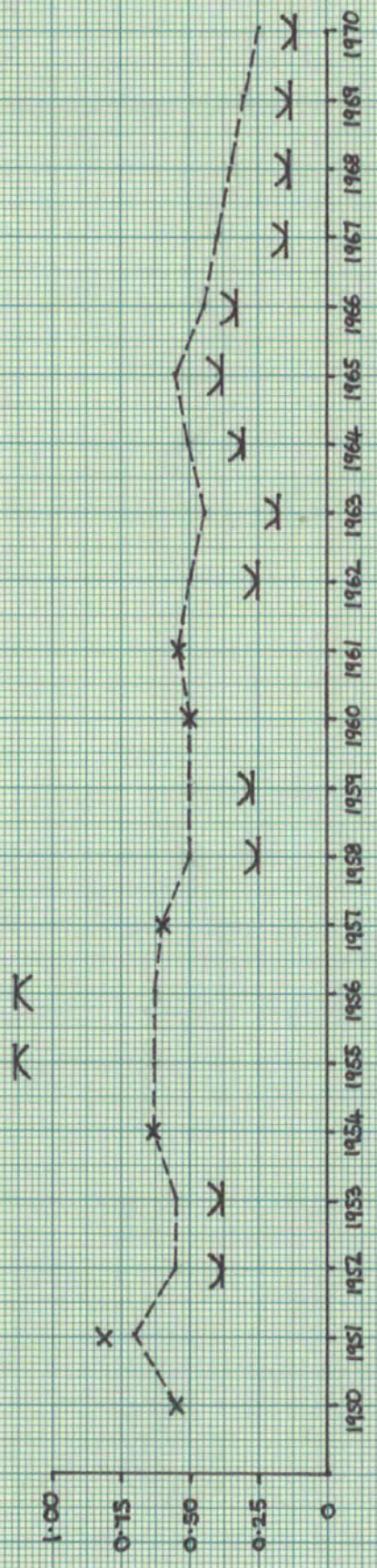
NB: $(y/L)^*_{1950} = (y/L)'_{1950} \cdot \frac{1}{d}$ where $d = 0.5$

DATA SOURCE: $(y/L)^*$ estimates are from Table 4.3
 (y/L) series is listed in Appendix, column 12

above for a lower limit, and an ambiguous limit is shown as a cross. One impression that emerges from this graph is that over the period as a whole S has tended to decline, as judged from the downward trend in its lower limiting values. Between 1963 and 1967 this downward trend is interrupted. The intervening years were years of relatively high economic activity and this suggested to us that S may show some cyclical variation: specifically that S may vary directly with X. (One other possibility is that we have incorrectly ranked these years by 'X status' and that the S limits may therefore be maxima and not minima. We were discouraged from accepting this view because of the relatively low S values which in fact occurred in these years).

We decided therefore to devise a scheme of assumed values for S, within the constraints indicated to us, which would show an overall downward trend (indicating that vacancies were increasingly understated over the period 1950-70) and which would further show some cyclical variation (indicating that vacancies are decreasingly understated during cyclical upswings, and increasingly understated on the downswing). As a first step, we decided to use the upper/lower limiting values of S, which correspond to the years for which the X status is ambiguous, as reasonable estimates of the actual value of S in these years. From Graph 5.3 it will be seen that this procedure is akin to assuming that in these years (1950, 1954, 1957, 1960 and 1961) the actual level of X was in the region $X = 0$. (we decided, on the grounds that the evidence of the (U/L)' and (V/L)' time series in Graph 2 shows 1951 to be a year in which excess demand was at a cyclical peak, to re-allocate the observation for 1951 into

GRAPH 5.4



DATA SOURCE: Table S.1, columns 1-3.

- : lower limiting value of S
- : upper limiting value of S
- x: upper/lower limiting value of S
- : assumed value of S

the $X > 0$ category). As regards the cyclical variation to be built into the scheme of S values, a reasonable estimate of the amplitude of this variation seemed to be in the order of 0.15, which is approximately the change in the lower limit of S between 1962 and 1965. Cyclical peak years were identified from Graph 5.2 as 1951, 1955, 1961 and 1965, and in these years we let S take the values 0.7, 0.65, 0.54 and 0.55 respectively. Cyclical 'trough' years were identified as 1952, 1958, 1959 and 1963 when S takes the values 0.55, 0.50, 0.50 and 0.45 respectively. After 1965 we let S decline linearly to 0.25. The choice of $S = 0.25$ in 1970 is difficult to justify and was chosen to be of similar magnitude to d in 1970. The chosen scheme of S values, which is shown in column 3 of Table 5.1 and on Graph 5.4, is consistent with the 'limiting values' of S, and with the view that S has shown an overall downward trend with a cyclical pattern of variation.

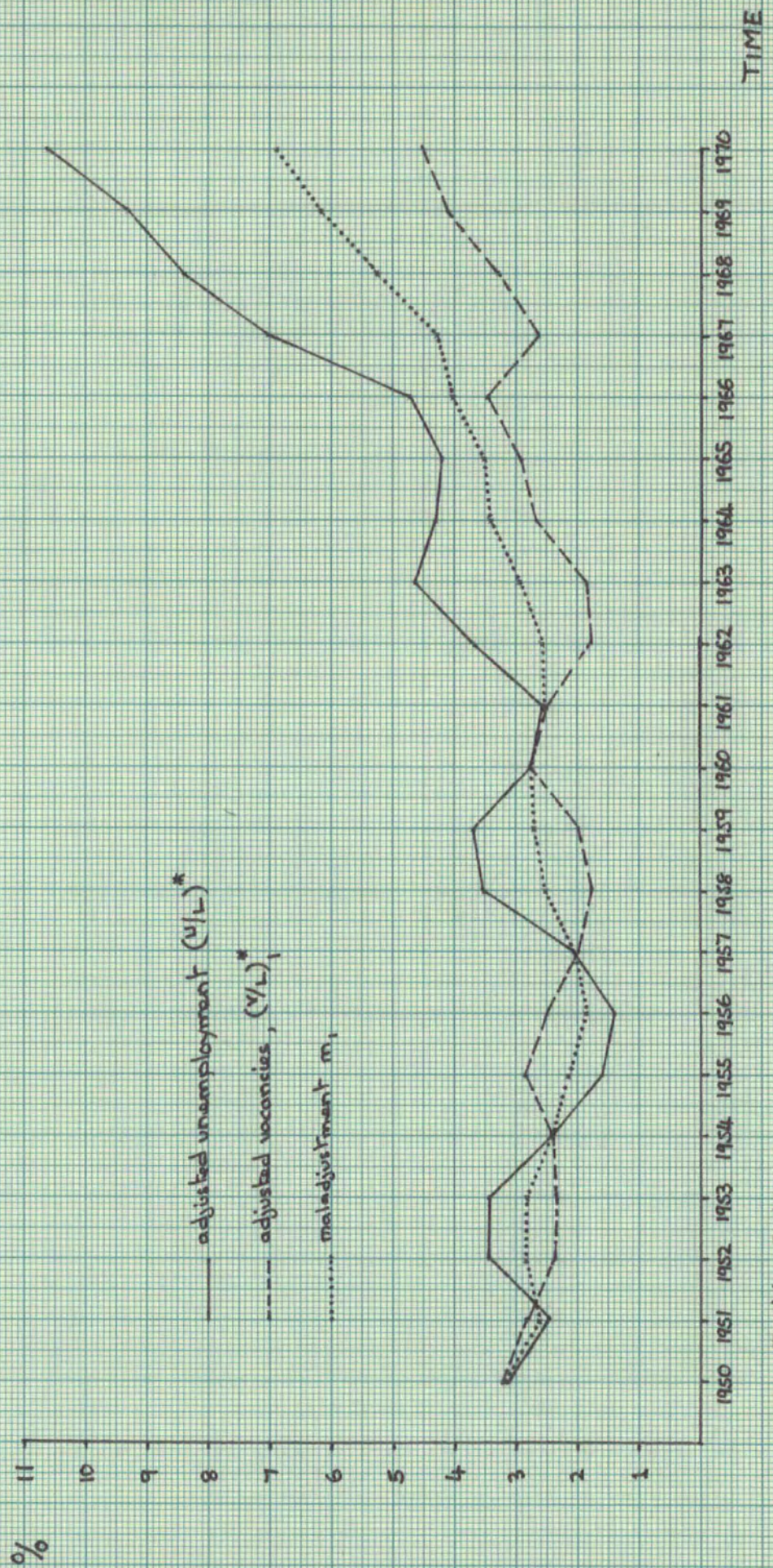
In column 5 of Table 5.1 we list the 'adjusted' vacancy series $(V/L)_1^*$, where $(V/L)_1^* = (V/L)' / S$ and is an estimate of the 'true' vacancy rate (V/L) . Column 6 of the same table shows the estimates of maladjustment M, which are derived from the $(U/L)^*$ and $(V/L)_1^*$ series as an equation (3a) above. Because of the essentially ad hoc way in which we derived the S series, we also constructed an 'adjusted' vacancy $((V/L)_2^*)$ and maladjustment (M_2) series on the assumption that S remained constant at 0.5 throughout the period 1950-70, (the scheme of S values in column 3 of Table 5.1 has an average value of 0.51). This was done to give us some idea of the effects if any which derive directly from the particular pattern of variation we have built into S.

TABLE 5.1

	1	2	3	4	5	6	7	8
DATE	X status	Limit on S	Assumed S	(U/L)*	(V/L) ₁ *	M ₁	(V/L) ₂ *	M ₂
1950	≥ 0	0.55	0.55	3.10	3.11	3.13	3.42	3.26
1951	≥ 0	0.81	0.70	2.44	2.81	2.62	3.94	3.10
1952	< 0	0.38	0.55	3.41	2.36	2.84	2.60	2.98
1953	< 0	0.38	0.55	3.42	2.35	2.83	2.58	2.97
1954	≥ 0	0.63	0.63	2.41	2.40	2.40	3.02	2.70
1955	> 0	1.14	0.65	1.61	2.85	2.14	3.70	2.44
1956	> 0	1.14	0.65	1.40	2.48	1.86	3.22	2.12
1957	≥ 0	0.61	0.61	2.05	2.00	2.01	2.48	2.26
1958	< 0	0.25	0.50	3.53	1.78	2.51	1.78	2.51
1959	< 0	0.27	0.50	3.68	1.98	2.70	1.98	2.70
1960	≥ 0	0.50	0.50	2.77	2.76	2.76	2.76	2.77
1961	≥ 0	0.54	0.54	2.54	2.51	2.52	2.76	2.65
1962	< 0	0.25	0.50	3.67	1.82	2.59	1.82	2.59
1963	< 0	0.18	0.45	4.63	1.87	2.94	1.68	2.79
1964	< 0	0.31	0.50	4.28	2.68	3.39	2.68	3.37
1965	< 0	0.38	0.55	4.21	2.93	3.51	3.22	3.68
1966	< 0	0.33	0.45	4.72	3.44	4.03	3.10	3.83
1967	< 0	0.15	0.40	7.00	2.63	4.29	2.10	3.83
1968	< 0	0.14	0.35	8.37	3.29	5.25	2.30	4.39
1969	< 0	0.13	0.30	9.30	4.01	6.11	2.44	4.76
1970	< 0	0.11	0.25	10.58	4.48	6.89	2.24	4.89

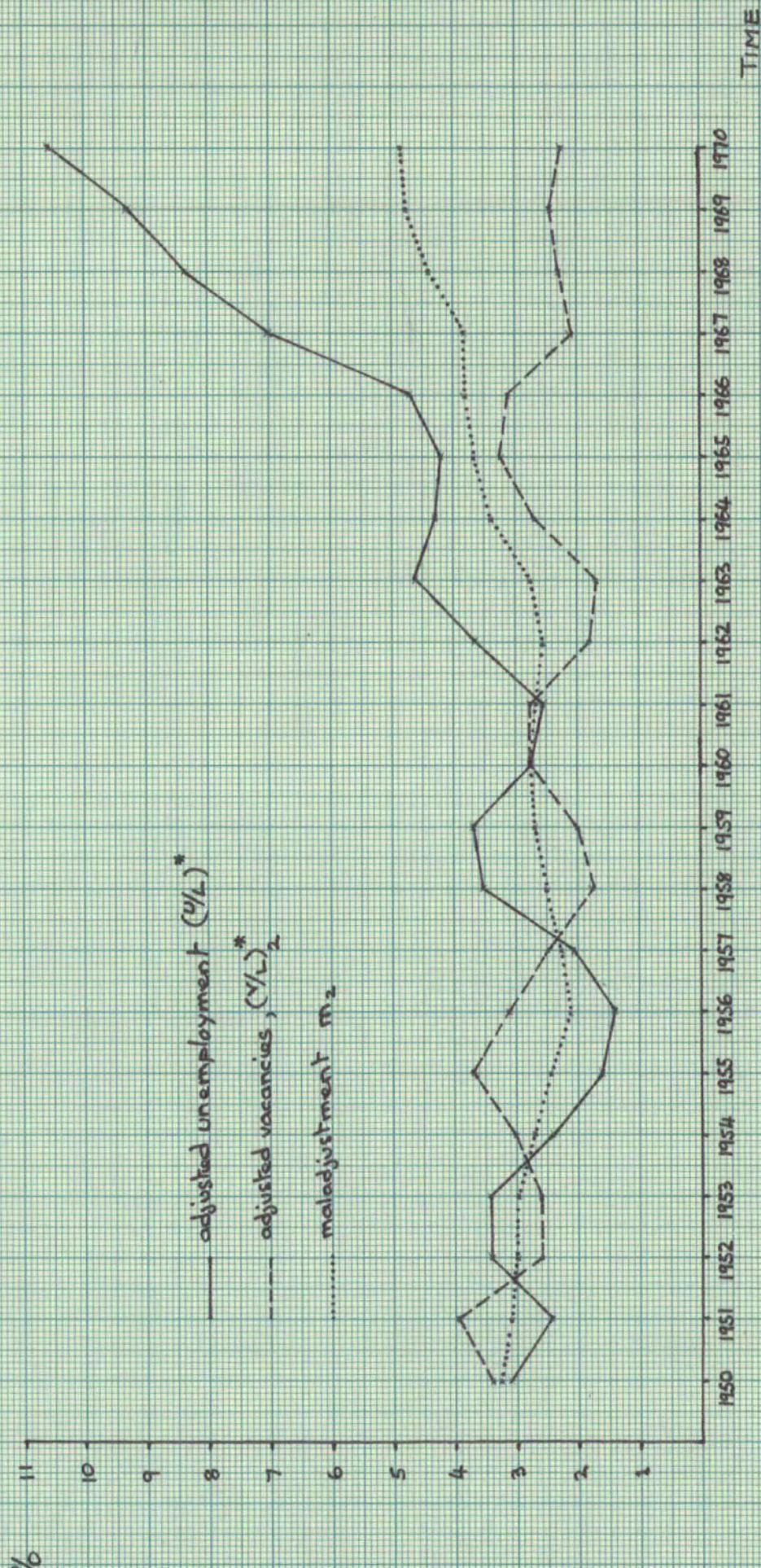
Graphs 5.5 and 5.6 show the time series of $(U/L)_1^*$ $(V/L)_1^*$, M_1 and $(U/L)_1^*$ $(V/L)_2^*$ and M_2 respectively. As we would expect, the cyclical fluctuations in $(V/L)_1^*$ are damped in comparison with those shown by $(V/L)_2^*$. This is because of the cyclical variation we have allowed in S which effectively gives less weight to cyclical 'peak' values of $(V/L)_1^*$ than does the scheme which lets S stay constant. Both maladjustment variables show similar patterns of variation over time. It appears that the level of maladjustment fell from 1950 to 1956; the magnitude of the decline being in the order of 1.1%. This accords with the interpretation of the statistics over the period 1946-56 given by Dow and Dicks-Mireaux (ibid P.26). Since 1956 the level of maladjustment has been on an upward trend, which is particularly marked after 1966. Both graphs therefore show a marked divergence between the unemployment and vacancy rate time-series after 1966. However, the evidence of the maladjustment estimates M_1 and M_2 , and casual observation of the graphs, suggest that the two series have been diverging since about 1962, and that the experience of recent years therefore represents an acceleration of this trend. As regards the two series of estimates of 'true' vacancies that we have obtained, inspection of the graphs does suggest that $(V/L)_2^*$ is to be preferred to $(V/L)_1^*$. The latter, which is based on the scheme of S values with 'built-in' cyclical and long-term variation, increases sharply after 1967 at the same time as the unemployment series shows its most rapid rate of increase. The simultaneous increase of vacancies and unemployment over time is of course consistent with an outward-shifting vacancy/unemployment curve.

GRAPH 5.5



DATA SOURCE: Table 5.1

GRAPH 5.6



DATA SOURCE: Table 5.1

Indeed, between 1967 and 1969 $(V/L)_2^*$ also increases slightly. However, the quite large increases in $(V/L)_1^*$ over the years 1967-70, when compared to the small increase and subsequent decline in $(V/L)_2^*$ over the same years, suggests to us that $(V/L)_1^*$ is unduly dominated by the variation we built into it in these years. Hence we see that the main difference between the two maladjustment series is that up to 1958 M_1 lies below M_2 (the difference being in the order of 0.3%) and that after 1966 M_1 lies above, and increases more rapidly than M_2 . This occurs because after 1966 we let S decline linearly to 0.25 in 1970 so that $(V/L)_1^* > (V/L)_2^*$ in these years.

Each maladjustment series shows a clear shorter-run cyclical variation, with M falling during the upswing of activity, and increasing on the downswing. As we suggested above, this may well reflect the decline of the structural component of 'maladjustment' unemployment on the upswing of activity and vica-versa. It does appear then, than the vacancy/unemployment curve, and the mapping relation, each shift inwards during years of cyclical upswing, and outwards on the downswing of activity. The evidence is not therefore in favour of explanations for 'loops' which rely on outward shifts in these relationships during the upswing and vica-versa. However, the reliability of this evidence rests upon the reliability of our estimates of $(U/L)^*$ and $(V/L)^*$. In particular we need to know whether the short-run variation in $(U/L)^*$ and $(V/L)^*$ reflects changes in the pressure of demand for labour, or some systematic pattern of error in the estimates. As regards the short-run variation in the $(V/L)^*$ estimates we can be confident that this is a 'true'

picture since, especially in the case of $(V/L)_2^*$, the estimates are directly based on the reported statistics. As regards our estimates of $(U/L)^*$ we argued above (P.205) that these estimates will tend to be 'too large' during cyclical peak years, and 'too small' in trough years ie that they may exhibit a systematic pattern of error. In that case we have

$$(U/L) = (U/L)^* + E$$

where E is the error term which will be negative during cyclical peak years, and positive during years of cyclical downswing. Our estimate of maladjustment is therefore

$$M = (V/L)^* \left[(U/L)^* + E \right]^{\frac{1}{2}} \quad \dots (3b)$$

If these arguments are correct then our estimates of M will tend to be 'too large' in cyclical peak years, and 'too small' during years of cyclical downswing. Thus, in the absence of any error, we should expect that the particular pattern of short-run variation exhibited by our estimates of M would become more pronounced, and would therefore re-inforce the conclusions we have reached.

The relationship between the reported vacancy and unemployment statistics has recently attracted a good deal of attention in the literature. Gujarati (22), working with quarterly seasonally corrected data for the period 1958-71,¹ demonstrates with the aid of a time-series graph and a scatter diagram, that during the period 1966 IV to 1968 III an upward shift occurred in the unemployment/vacancies

1 Gujarati works with the numbers wholly unemployed and the number of unfilled vacancies respectively expressed as a percentage of the working population and not the total number of employees. He points out that "This difference should not ... distort the analysis" (P.199) and does not affect the main results.

curve.¹ His explanation is that this upward shift is a latent result of the 1965 Redundancy Payments Act (which entitles workers to a lump sum cash payment on being made redundant) and the 1966 National Insurance Act (which introduced a system of wage-related unemployment benefit). The effect of these acts has been "an 'artificial' increase in registered unemployment: an unemployed person is now under less pressure to look for a job immediately and may spend more time searching for a job" (ibid P.195). This 'once and for all' increase in unemployment means that we cannot meaningfully compare pre-1966 unemployment rates with post 1968 rates without some adjustments on the latter rates. Post 1968 unemployment rates are 'too high' in relation to pre-1966 rates. Gujarati estimates a 'correction factor' for adjusting post 1968 rates, and a variable correction factor for adjusting rates from 1966 to 1968, to maintain the unemployment rate as a reliable and consistent index of the pressure of demand for labour.

A subsequent study by Foster (19) argued that the vacancy/unemployment curve is liable to show a cyclical shift: specifically that during a cyclical recovery the curve shifts outwards because, while vacancies respond immediately to an increase in demand for labour, unemployment shows a lagged response. This is the argument which we presented above,²

1 It is unclear why, on each of these graphs, the unemployment and vacancy scales are different and not consistent in origin. However though we may question the form in which the evidence is shown, plotting on consistent scales leads us to a similar conclusion.

2 According to our argument, this kind of explanation leads to the observation of anti-clockwise loops in contemporaneous data in the $(V/L) / (U/L)$ space. Foster, however, shows that clockwise 'loops' appear which he takes to be consistent with the explanation offered. Such loops are consistent with the proposition put forward here that M varies inversely with X because the structural unemployment component of M varies inversely with X .

and which we argued implies that M varies directly with X , and not inversely as our arguments and the evidence we have presented, suggest. The upshot of Foster's study is that he finds evidence that the vacancy/unemployment curve does not show a 'once and for all' outward shift over the period 1966-68 as Gujarati implied, but that the curve is shifting out as well during 1968/69 and after 1970. Thus, while the effects of social security legislation in 1965 and 1966 (especially the 1966 National Insurance Act) can perhaps explain the 1966-68 'shift', these do not seem to account satisfactorily for the experience after 1968.

Our analysis does throw some light on the problem being analysed in these studies by Gujarati and Foster. We have argued that, since there are good reasons for expecting M to vary inversely with X over the trade cycle, systematic cyclical shifts in the vacancy/unemployment curve are to be expected. We also expect that M will show longer run variation reflecting changes in the 'structural' unemployment component of M , as the pattern of labour supply adjusts slowly to the pattern of labour demand. Our estimates of M have confirmed these expectations. They also confirm the fact that, since 1966, there has been a particularly rapid increase in M . The more reliable estimate is M_2 which does show an accelerated rate of increase over the period 1966-68. The introduction of a structure of earnings related unemployment benefits via the 1966 National Insurance Act, which may have occasioned a 'once and for all' increase in the average duration of unemployment and thus the level of frictional unemployment, seems a plausible explanation for this 'spurt' in M_2 .¹

1 As Foster (op cit) points out, it is unclear how the 1965 Redundancy Payments Act might be expected to affect the duration of unemployment. (P.196 et seq).

But our estimates of M_2 also suggest that there has been a long-run trend increase in M since the cyclical downswing year of 1957. Subsequent cyclical peak 'minimum' values of M are all on rising trend, while during the cyclical recovery from 1963 to 1965, M did not fall at all, but increased. The experience of recent years seems therefore to be underlain by longer term structural changes. Dow and Dicks-Mireaux (op cit) explained the fall in maladjustment to 1956 in terms of the gradual return to 'normality' following post-war dislocation. The explanation of the increasing level of maladjustment during the 1960's probably lies in the increasingly technological nature of production techniques and the spread of 'automatic' production processes, which are creating a pool of unskilled unemployed labour. Bosanquet and Standing (3), using evidence from the 1966 sample census, show that in 1966, the unemployment rate amongst unskilled workers is more than twice as high as the general rate. Moreover, it seems that the occupational composition of the unemployed is heavily weighted towards the unskilled worker group, and that the skill composition of the unemployed has not varied with the changes in the general level of unemployment since 1966.¹

Taylor (62) suggests an alternative explanation for the observed shift in the vacancy/unemployment curve over the period 1966-68. The shift occurred because of increases in unemployment due to the fact that there occurred a deliberate "shake-out" of previously hoarded labour by firms in 1967/68,

1 They suggest, tentatively, that the unemployment rate amongst 'unskilled' workers in 1970 could have been as high as 15% (op cit P.188).

and again in 1970/71. To support this argument he presents estimates of the rate of labour hoarding for the period 1954-71, and argues that these demonstrate that, during the 1967/68 economic recovery the rate of labour hoarding showed its usual cyclical decline whereas the rate of registered unemployment, instead of declining, actually increased. This explanation highlights one of the deficiencies of our $(U/L)^*$ estimates, which take no account of this source of mis-statement error in the unemployment statistics. Taylor explains this sudden change in the employment policies of firms in terms of the effects of businessmen's pessimism over the prospects for the post-devaluation United Kingdom economy, the introduction of the 1965 Redundancy Payments Act which makes employers less willing to increase labour inputs via increasing the number of employees when they can raise average hours worked per employee, and in terms of a stronger drive by employers to raise labour productivity. In a reply, Gujarati produces some convincing arguments which suggest that the evidence of a "shake out" of hoarded labour which Taylor presents is not conclusive.

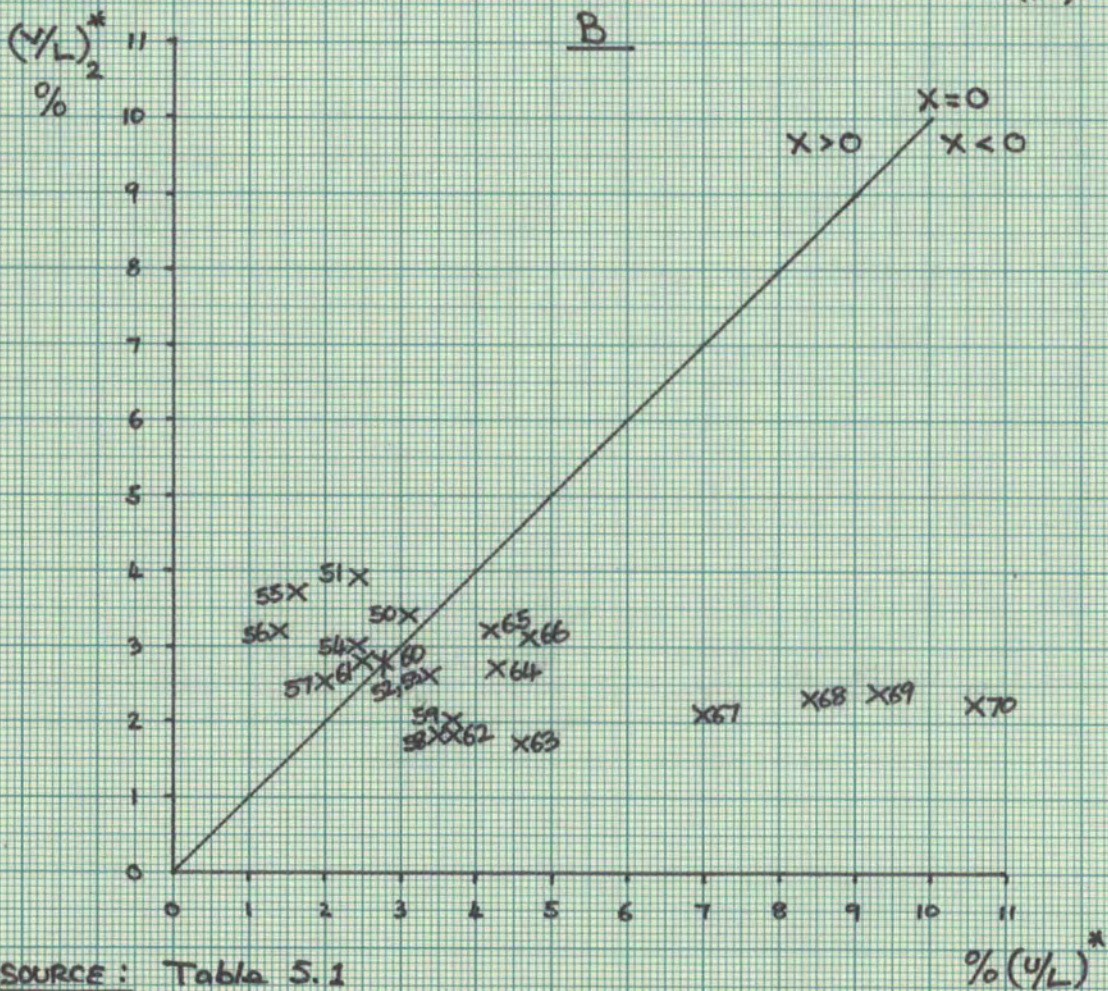
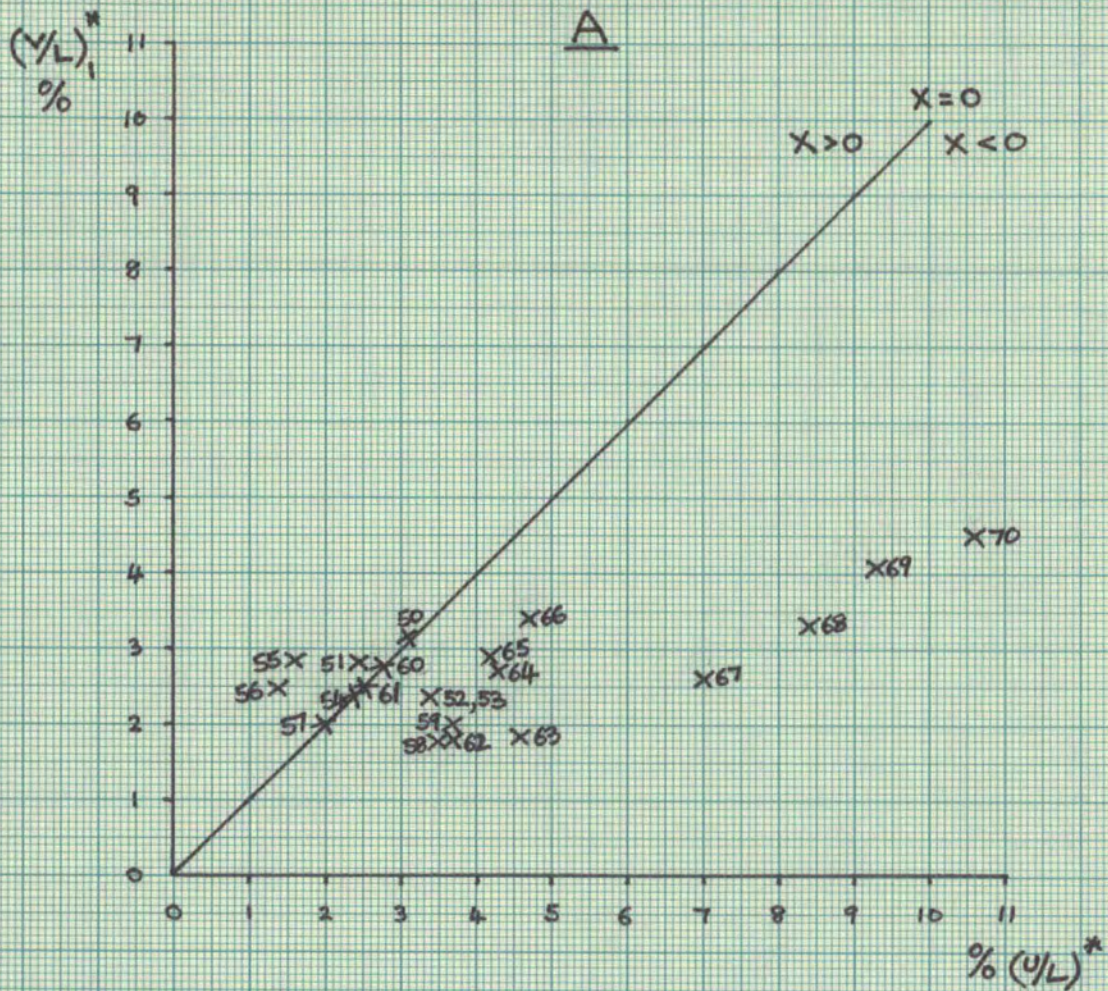
A feature of all the studies which have examined the vacancy/unemployment relationship is their pre-occupation with the shift which occurred in the period 1966-68. Our analysis sees this as a sudden spurt in the rate of increase in maladjustment which is nevertheless, explicable in terms of the hypotheses advanced so far. Other explanations are available in a study by Bowers, Cheshire and Webb (4). These alternative explanations stress the possible effects of the introduction of Selective Employment Tax in 1966, 'structural' changes in the age-skill pattern of labour

demand and changes in the geographical distribution of labour demand, the effects of devaluation on the pattern of the demand for labour, and the effects of incomes policies on 'voluntary quits'. Most of these arguments seek to account for a 'permanent' inflation of the unemployment statistics due to special factors. In a subsequent study (5) the same authors propose the view that the increase in unemployment is not due to such special factors but that it is the level of recorded vacancies which is the cause of the shifting unemployment/vacancy curve. There may have been a permanent upward shift in vacancies in the late 1960's. Such an increase is shown by our $(V/L)_1^*$ series, although this is specifically due to our assumption that 'true' vacancies were increasingly understated over this period.

III Correcting For Changes in Maladjustment

Graph 5.7 shows the scatter of observations in the $(U/L)^*/(V/L)_1^*$ and $(U/L)^*/(V/L)_2^*$ spaces respectively. Any differences between the two scatters are due to the effects of allowing the vacancy statement ratio S to vary (for $(V/L)_1^*$) rather than remain constant (for $(V/L)_2^*$). This has the effect of shifting vertically the observations for certain years in scatter diagram B as compared A. Thus in B, observations for the years 1957, 1960 and 1961 are moved onto or above the $X = 0$ line. Both diagrams suggest that we can reasonably place observations for the years 1950, 1951, 1954, 1955, 1956, 1957, 1960 and 1961 into the area in which $X \geq 0$. According to the theory outlined in section 4, ceteris paribus we should expect the observations shown to lie closely around a typical vacancy/unemployment curve such as that shown in Figure 5.1. In addition the theory suggests that, since these statistics are assumed to be corrected for mis-statement, then it must be because of changes in the level of maladjustment that the observations remain quite widely scattered. In this section we shall adjust unemployment statistics for changes in maladjustment which have occurred since 1950, since our hypotheses about the behaviour of the structural unemployment component of 'maladjustment' unemployment suggest that this has varied, albeit in different ways, over the period 1950-70. We also make symmetrical adjustments on the vacancy statistics, since M can equally be interpreted as the level of 'maladjustment' vacancies. It seems reasonable to suppose that, as the

GRAPH 5.7



DATA SOURCE: Table 5.1

average duration of unemployment falls on the upswing of activity then so does the average duration of vacancies, and that the average duration of unemployment and vacancies may correspondingly be expected to increase on the downswing. On the downswing, the fall in the degree of excess demand for labour reduces the level of vacancies and increases the level of unemployment. This is the 'pure demand' effect and represents the movement along a given vacancy/unemployment curve. In addition, the deterioration in the state of job opportunities can be taken to lessen the probability of the obtaining of 'worker-job' matches, which increases the average duration of both vacancies and unemployment.

It also seems likely that a change in the structural component of maladjustment unemployment is likely to find reflection in a change in the level of vacancies. Longer-term shifts in the pattern of final demand between industries leads to shifts in the derived demand for labour between industries. Thus the demand for labour in some industries may fall, while in other industries it increases. We may therefore expect that employment and vacancies in some industries will fall (and unemployment increase) while in other industries vacancies and employment increase (and unemployment falls). Assuming for the moment that labour is a homogeneous commodity, a simple transfer of labour would leave aggregate vacancies and unemployment unaffected only if the extra labour demand in expanding industries matches the fall in demand in the contracting industries i.e. aggregate demand for labour is unchanged. If aggregate demand for labour increases or decreases overall then we shall observe vacancies increasing and unemployment decreasing, and

vica versa, in the manner dictated by a move along a given vacancy/unemployment curve. Moving one step away from such a frictionless world we might suppose that new vacancies are created in one geographic area, and unemployment is created in another area, and that no simple transfer of labour is possible between industries because labour is geographically immobile. In this situation we should expect to observe an increase in aggregate vacancies matched by an increase in aggregate unemployment. Both 'maladjustment' vacancies and unemployment might increase by equal amounts due to this particular type of 'friction' in the labour market. So far, a symmetric adjustment on the vacancy and unemployment figures for changes in maladjustment is permissible. Moving a further step nearer an adequate description of the real world, we can suppose that labour is not homogeneous and that the age-skill composition of the increased labour demand in the expanding industries does not match the composition of the extra labour supply available from the contracting industries. Job vacancies now exist for types of workers different to those types of workers who have become unemployed, and we have the emergence of 'pure' structural unemployment. But this argument also suggests that there will be a matching stock of 'structural' vacancies in the expanding industries.

If these arguments are correct then it is legitimate for us to correct both the unemployment and the vacancy statistics for changes in maladjustment. A priori we should therefore expect that, if the relationship between (U/L) and (V/L) is adequately approximated by a rectangular hyperbola of the form already specified, then all the observations in

the $(U/L)/(V/L)$ space which we obtain after correction for maladjustment, should lie closely around such a curve. The position of the curve is determined by the level of maladjustment in the initial year of the period, since it is from this base year that our adjustments are made. We should further expect that the points in the corresponding $X/(U/L)$ space should now lie along a single curve which corresponds to the mapping relation in 1950. In addition we have noticed that part of the variation in M is cyclical in nature, and have argued that this leads to the phenomenon of 'loops' in the mapping relation. Since our adjustments will correct for all the variation in M , any loop pattern of observations in time around the mapping relation, should not be present in the mapping relation we shall identify.

The method of correction is simply described using the adjusted unemployment rate $(U/L)^*$ as the example. First of all the absolute change in unemployment each year is computed, ie $\Delta (U/L)_t^* = (U/L)_t^* - (U/L)_{t-1}^* \dots (6)$ where t is a time subscript, and $(U/L)_t^*$ is listed in column 1 of Table 5.2. Our hypothesis is that the change in the level of unemployment has two components: the actual change in the level of unemployment due to a change in X (which corresponds to a movement along the curve in the $(U/L)/(V/L)$ space), and the change in the level of maladjustment (which corresponds to the movement from one curve to another in the $(V/L)/(U/L)$ space). Using the following notation,

$\Delta (\widehat{U/L})_t =$ the change in the level of unemployment which arises out of the movement along the curve in the $(U/L)/(V/L)$ space.

ΔM_t = the change in the level of 'maladjustment'
unemployment

then

$$\Delta (U/L)_t^* = \Delta (\widehat{U/L})_t + \Delta M_t \quad \dots (7)$$

Since we are interested in correcting $(U/L)^*$ for changes in the level of maladjustment, then we require for each year

$$\Delta (\widehat{U/L})_t = \Delta (U/L)_t^* - \Delta M_t \quad \dots (8)$$

As we are working with two schemes of S values for adjusting the (V/L) series, we have derived two maladjustment series M_1 and M_2 . In column 2 of Table 5.2 we have computed ΔM_{1t} which is the absolute change each year in M_1 (the maladjustment series for which S is not constant). Column 3 shows the corresponding change in unemployment as we move along a curve in the (U/L)/(V/L) space, and is derived as in equation (8) above. In column 4 we begin with the level of $(U/L)^*$ in 1950 which represents a point on the (V/L)/(U/L) curve and on the mapping relation corresponding to the level of maladjustment in that year. The remainder of column 4 is derived by moving along this curve in the manner indicated by the relevant value of $\Delta (\widehat{U/L})_t$, in column 3. The resulting unemployment series, which we have denoted as $(\widehat{U/L})_1$, shows the variation of unemployment over the period 1950-70 as of a given (1950) level of maladjustment unemployment. Columns 5 - 7 in Table 5.2 show the construction of an analagous unemployment series based on correcting for changes in the M_2 maladjustment series. This unemployment series is denoted as $(\widehat{U/L})_2$.

In principle we could obtain different $(\widehat{U/L})$ series based on the level of maladjustment unemployment in each of the 21 year of the sample period. The 'base year' series which we

TABLE 5.2

	1	2	3	4	5	6	7
Date	$(U/L)_t^*$	ΔM_{1t}	$\Delta(\hat{U/L})_t$	$(\hat{U/L})_{1t}$	ΔM_{2t}	$\Delta(\hat{U/L})_{2t}$	$(\hat{U/L})_{2t}$
1950				3.10			3.10
1951	-0.66	-0.51	-0.15	2.95	-0.16	-0.40	2.70
1952	0.97	0.22	0.75	3.70	-0.12	1.09	3.80
1953	0.01	-0.01	0.02	3.72	-0.01	0.02	3.81
1954	-1.01	-0.43	-0.59	3.14	-0.27	-0.74	3.01
1955	-0.80	-0.27	-0.54	2.60	-0.26	-0.54	2.53
1956	-0.21	-0.28	0.07	2.67	-0.32	0.11	2.64
1957	0.65	0.15	0.50	3.17	0.13	0.52	3.16
1958	1.48	0.50	0.98	4.15	0.25	1.23	4.39
1959	0.15	0.19	-0.04	4.11	0.19	-0.04	4.35
1960	-0.91	0.07	-0.98	3.14	0.07	-0.98	3.37
1961	-0.23	-0.24	0.01	3.15	-0.12	-0.11	3.26
1962	1.13	0.06	1.07	4.22	-0.06	1.19	4.45
1963	0.96	0.357	0.60	4.82	0.20	0.76	5.21
1964	-0.35	0.444	-0.79	4.02	0.60	-0.95	4.26
1965	-0.07	0.127	-0.20	3.83	0.30	-0.37	3.89
1966	0.51	0.517	-0.01	3.82	0.14	0.37	4.26
1967	2.28	0.261	2.0	5.84	0.01	2.27	6.53
1968	1.37	0.957	0.41	6.25	0.55	0.82	7.35
1969	0.93	0.897	0.03	6.29	0.38	0.56	7.90
1970	1.28	0.740	0.54	6.83	0.11	1.18	9.08

have constructed represent a logical choice in that we are correcting for changes in maladjustment unemployment over the course of the sample period. As such, we are measuring the variation of unemployment along the vacancy/unemployment curve, and mapping relation for the base year of the sample period. However, our arguments above have suggested that these relationships shift systematically over the course of the trade-cycle, and have shown longer term 'structural' shifts, so that we cannot identify these relationships in any particular year as being in any sense the 'correct' relationships for the purposes of the Phillips curve. The mapping relation is not a stable relationship over time, which makes it difficult to choose a representative year. To the extent that the mapping relation shifts inwards on the upswing of activity, and outwards on the downswing, then it would be appropriate to choose a year in which the economy is between the cyclical peak and trough, either on the upswing or the downswing, as a year in which a representative or 'average' mapping relation can be identified. Thus it might be more appropriate to measure the (U/L) series from years such as 1953, 1957, 1960, 1962, 1966/67. But we must also consider the structural shift in maladjustment. Graphs 5.5 and 5.6 suggest that there are three main phases of structural shift over the sample period: a fall in maladjustment from 1950-1958/59; an increase from 1959 to 1966, and a much sharper rise after 1966. This suggests that it might be appropriate to identify 'typical' mapping relations, and thus (\hat{U}/\hat{L}) series for each of these sub-periods. We have in fact been content to use the (\hat{U}/\hat{L}) series already derived based on the 1950 level of maladjustment. The effect of basing the

$\widehat{(U/L)}$ series on any other single year is merely to change the constant level of maladjustment from which the $\Delta(\widehat{U/L})$ are measured so that the pattern of variation in the resulting $\widehat{(U/L)}$ series will not be radically altered by the choice of different 'base' years. The $\widehat{(U/L)}$ series would be radically altered if it were constructed from different sub-periods in the manner suggested above.

We have also corrected the vacancy figures for changes in maladjustment. The method of adjustment follows equations (6), (7) and (8) if we substitute $\Delta(V/L)_t^*$ for $\Delta(U/L)_t^*$, and $\Delta(\widehat{V/L})_t$ for $\Delta(\widehat{U/L})_t$, where $\Delta(\widehat{V/L})_t$ now refers to the change in the level of vacancies which arises out of movement along the vacancy/unemployment curve. In Table 5.3 columns 1-3, and 5-7, show the derivation of the two vacancy series $(\widehat{V/L})_1$ and $(\widehat{V/L})_2$. $(\widehat{V/L})_1$ is the $(V/L)^*$ series corrected for changes in M_1 , and $(\widehat{V/L})_2$ is the $(V/L)^*$ series corrected for changes in M_2 . Graphs 5.8A and 5.8B show the scatter of points for the period 1950-70 in the $(\widehat{U/L})_1/(\widehat{V/L})_1$, and $(\widehat{U/L})_2/(\widehat{V/L})_2$ spaces respectively. As we suspected, after correcting the $(U/L)^*$ and $(V/L)^*$ series (for M_1 and M_2) for changes in maladjustment, we find that in both diagrams most of the observations now lie closely along a single curve in the $(\widehat{U/L})/(\widehat{V/L})$ space. Moreover we should expect that this curve corresponds to the level of maladjustment in our base year 1950. In Graphs 5.8A and 5.8B these curves have been drawn in.¹ Columns 4 and 8 in

1 These base years values are in fact the 1951 values which are $\widehat{M}_1 = 3.13$ and $\widehat{M}_2 = 3.33$. The 1950 values were not used because these are less reliably estimated. The $(U/L)^*$ and $(V/L)^*$ estimates for this year were obtained directly from the reported statistics on the assumption that $d = S = 0.5$, (the average value of the unemployment and vacancy statement ratios over the period 1951-70).

TABLE 5.3

	1	2	3	4	5	6	7	8
Date	$\Delta(V/L)_{1t}^*$	$\Delta(\widehat{V/L})_{1t}$	$(\widehat{V/L})_{1t}$	\widehat{M}_{1t}	$\Delta(\widehat{V/L})_{2t}^*$	$\Delta(\widehat{V/L})_{2t}$	$(\widehat{V/L})_{2t}$	M_{2t}
1950			3.17	3.14			3.42	3.26
1951	-0.36	0.15	3.32	3.13	0.52	0.68	4.10	3.33
1952	-0.45	0.67	2.65	3.13	-1.34	-1.22	2.88	3.31
1953	-0.01	0	2.65	3.14	-0.02	-0.01	2.87	3.31
1954	0.05	0.48	3.13	3.13	0.44	0.71	3.58	3.32
1955	0.45	0.72	3.84	3.16	0.68	0.94	4.52	3.38
1956	-0.37	-0.09	3.75	3.16	-0.48	-0.16	4.36	3.39
1957	-0.51	-0.66	3.09	3.13	-0.74	-0.87	3.48	3.32
1958	-0.19	-0.69	2.40	3.16	-0.70	-0.95	2.53	3.33
1959	0.20	0.01	2.41	3.15	0.20	0.01	2.54	3.32
1960	0.78	0.72	3.13	3.13	0.78	0.71	3.25	3.31
1961	-0.25	-0.01	3.12	3.13	0	0.12	3.37	3.31
1962	-0.69	-0.75	2.37	3.16	-0.94	-0.88	2.49	3.33
1963	0.05	-0.31	2.06	3.15	-0.14	-0.34	2.15	3.35
1964	0.81	0.37	2.42	3.12	1.0	0.40	2.55	3.30
1965	0.25	0.12	2.55	3.12	0.54	0.24	2.80	3.30
1966	0.51	-0.01	2.54	3.11	-0.12	-0.26	2.53	3.29
1967	-0.81	-1.07	1.47	2.93	-1.0	-1.01	1.53	3.16
1968	0.66	-0.30	1.17	2.71	0.2	-0.35	1.17	2.93
1969	0.77	-0.13	1.05	2.56	0.14	-0.24	0.94	2.72
1970	0.42	-0.32	0.73	2.23	-0.20	-0.31	0.63	2.39

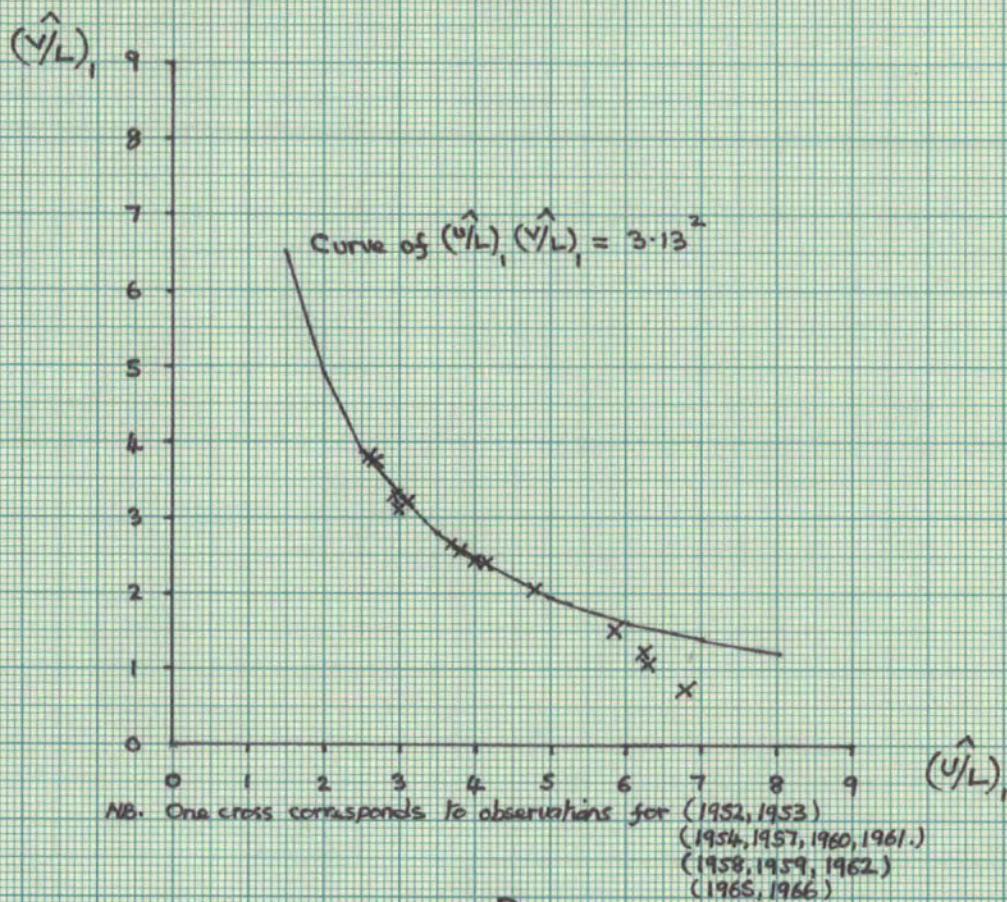
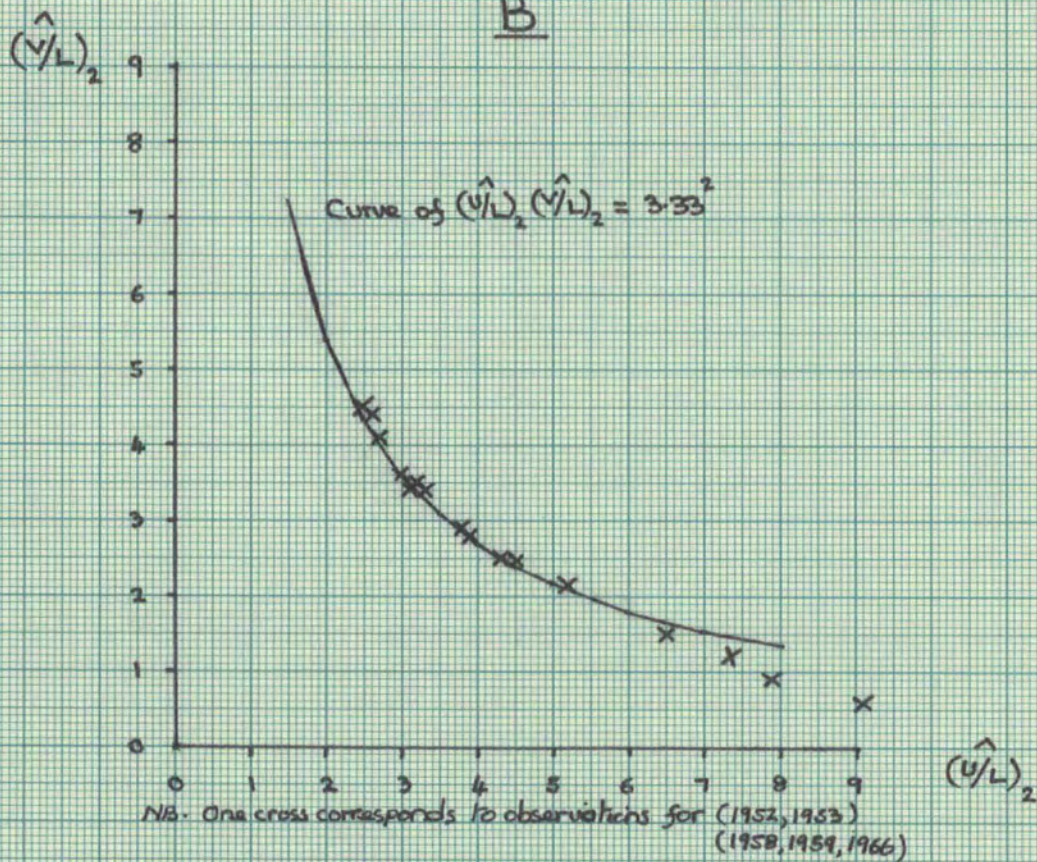
GRAPH 5.8ABDATA SOURCE: Tables 5.2 and 5.3

Table 5.3 show respectively the series M_1 and M_2 , where $M_1 = (V/L)_1(U/L)_1^{\frac{1}{2}}$ and $M_2 = (V/L)_2(U/L)_2^{\frac{1}{2}}$. A priori we expect that all the M_1 and M_2 values should be constant at their base-year values at the start of the period. This expectation is borne out in both M series up to 1966. From 1967-70 M_1 , declines by 0.88% and M_2 by 0.9%. This is why in the graphs 8A and 8B it is only the observations corresponding to these years which do not lie closely along the curves which are drawn in.

Our correction for changes in maladjustment has therefore succeeded in shifting all the points for the period 1950-66 onto or very near a curve in the $(U/L)/(V/L)$ space. Thereafter the observations lie off the curve, implying that in these years the levels of unemployment associated with a given level of vacancies have been lower than in previous years or that the level of vacancies associated with the given levels of unemployment have been lower than in previous years. The fact that the observations for these years do lie off the curve, suggests that our estimates of the levels of maladjustment in these years are too high. As a result M in these years may be too large (see Table 5.2 column 2,5) and the resulting estimates of (U/L) and (V/L) are correspondingly reduced. It is possible therefore that the explanation of the apparent failure of our correction for changes in maladjustment in the year 1967-70 is caused by our having overestimated $(V/L)^*$ and $(U/L)^*$, either individually or collectively, in these years. We think that $(V/L)^*$ is more likely to have been overestimated than $(U/L)^*$. This is because our assumed schemes of S values, on which the $(V/L)^*$ estimates are based, are largely inferred from 'indirect'

evidence and inference, whereas the $(U/L)^*$ estimates for these years are derived from the participation rate approach. (It will be recalled from Chapter IV above that for the years 1966-70 the participation rate equation showed its most accurate predictions).¹ It may therefore be that for the years 1966-70 we have underestimated the value of the vacancy statement ratio S . An alternative explanation may be that there is no serious error in our estimates, but that the assumed hyperbolic form of the $(U/L)/(V/L)$ relationship is only an adequate approximation of the actual relationship over the fairly narrow range of values of (U/L) and (V/L) which was experienced up to 1966. In the years since 1966 the level of unemployment has taken on relatively extreme values, taking us into a range of values over which the assumed hyperbolic form may not adequately approximate the true relationship.

However, taking the period as a whole, the relationship between $\widehat{(U/L)}$ and $\widehat{(V/L)}$ does seem to be fairly well determined. Statistically, we found that a linear form gave the greater explanatory power in the case of both the relationship between $\widehat{(U/L)}_1$ and $\widehat{(V/L)}_1$, and $\widehat{(U/L)}_2$ and $\widehat{(V/L)}_2$, as compared to a log linear form. The results in Table 5.4 show that the linear form gave in each case an \bar{R}^2 in excess of 0.90, and that the relationship between $\widehat{(U/L)}_1$ and $\widehat{(V/L)}_1$ is firmer than that between $\widehat{(U/L)}_2$ and $\widehat{(V/L)}_2$. In the case of the log

1 This would mean that we can have some confidence in our estimates of the 'full employment' participation rate estimates in these years. We must bear in mind though that the accuracy of the potential full-employment labour force estimates depends also on the accuracy of the population estimates for these years. If these are too high, then so will be the estimates of non-registered unemployment (L) and the final (U/L) estimates. The vacancy estimates are not subject to error from this source.

TABLE 5.4

Equation	constant	$\log (\widehat{V/L})_1$	$(\widehat{V/L})_1$	$\log (\widehat{V/L})_2$	$(\widehat{V/L})_2$	\bar{R}^2	D.W.
(1) $\log (\widehat{U/L})_1, \log (\widehat{V/L})_1$	0.6999	-0.3211 (0.0531)				0.6405	1.0689
(2) $(\widehat{U/L})_1, (\widehat{V/L})_1$	7.7435		-1.4549 (0.0517)			0.9753	1.2233 [‡]
(3) $\log (\widehat{U/L})_2, \log (\widehat{V/L})_2$	0.7196			-0.3169 (0.0436)		0.7211	1.2796 [‡]
(4) $(\widehat{U/L})_2, (\widehat{V/L})_2$	8.9585				-1.6466 (0.1139)	0.9123	0.8581

Standard Errors of coefficient estimates are in parentheses
[‡] indicates that the durbin watson test was inconclusive at the 5%
 significance level. For other values the test showed evidence of
 positive serial correlation.

linear form, the estimate of the $(\widehat{U/L})_2/(\widehat{V/L})_2$ relationship shows as the firmer. We also found that the 'statistical' explanation could be improved marginally in the cases of equations (1) to (3) by the addition of a shift dummy to the regressors (taking the value of zero up to 1966 and unity thereafter). We have not reported these results since in the first place they were to be expected following on from our observations of the $(\widehat{U/L})/(\widehat{V/L})$ relationships above, and in the second place we only look to these statistical estimates to provide us with a measure of the explanatory power shown by the $(\widehat{U/L})/(\widehat{V/L})$ relationships. What these estimates show is that a linear form of the $(\widehat{U/L})/(\widehat{V/L})$ relationship yields a 'strong' result for the period 1950-70. Given the existence of an equally well-determined 'reaction function' we should therefore expect that $(\widehat{U/L})$ should appear as an important explanatory variable in the wage-change equation.

For the purposes of comparison we also estimated linear and log linear relationships between the statistics of vacancies and unemployment, and obtained the following results;

$$(\widehat{U/L})' = 3.3232 - 1.1557 (\widehat{V/L})' \quad \dots (9)$$

(0.2044)

$$\bar{R}^2 = 0.6077 \text{ D.W.} = 0.3180$$

$$\log (\widehat{U/L})' = 0.3128 + 0.0584 \log (\widehat{V/L})' \quad \dots (10)$$

(0.1622)

$$\bar{R}^2 = -0.0455 \text{ D.W.} = 2.259$$

* indicates that the durbin watson test shows no evidence of positive serial correlation.

It is evident therefore that the relationships between the reported statistics are statistically much weaker than those between our estimates of $(\widehat{U/L})$ and $(\widehat{V/L})$.

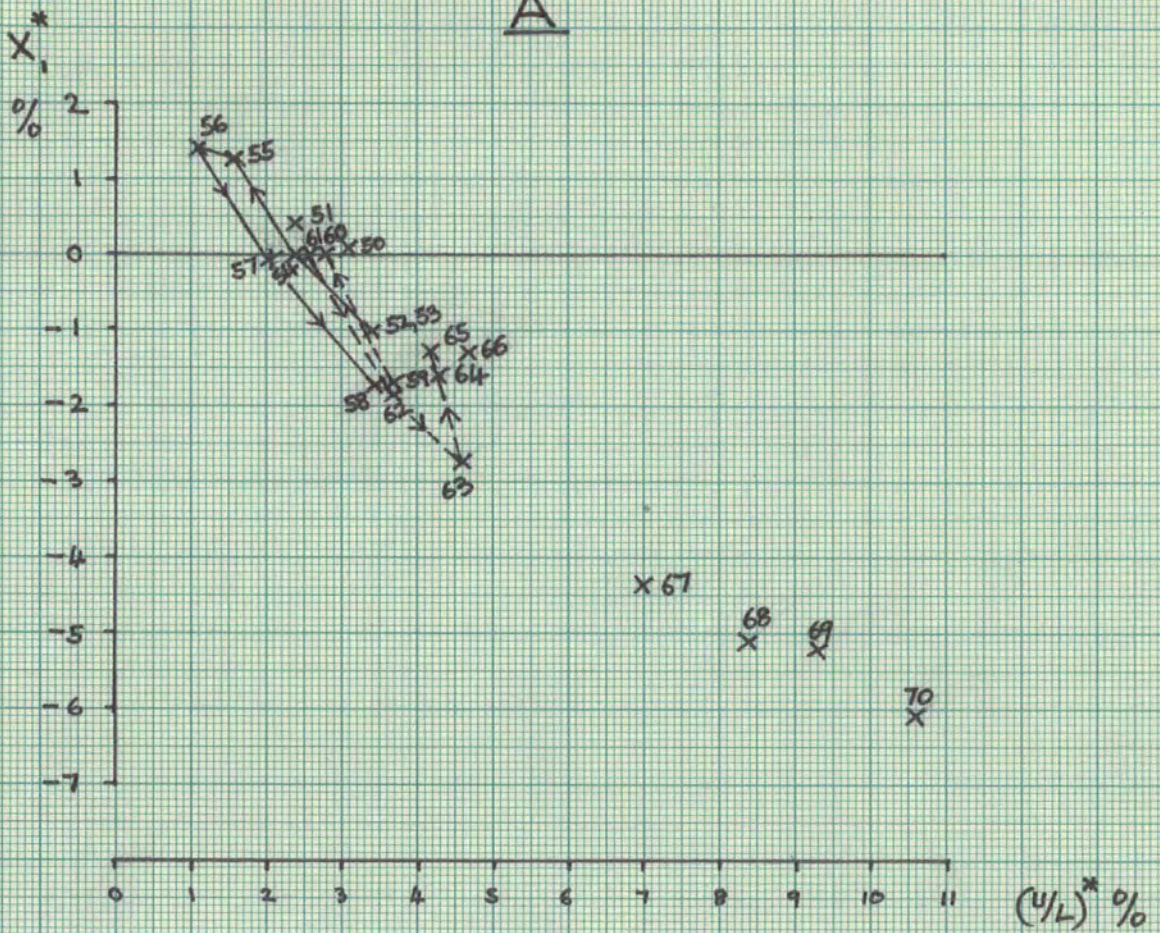
IV The Mapping Relation and Phillips Loops

We hypothesised above that the loops which Phillips observed around the fitted Phillips curve might derive from loops around a fitted mapping relation. A loop of points in time in the $X/(U/L)$ space can arise out of cyclical variation in M accompanying the cyclical variation in (U/L) . The estimated mapping relation will then approximately bisect this loop and need not coincide with any member of the family of 'true' mapping relations. In particular the non-linear form of the mapping relation, and consequently the Phillips curve, may arise directly from the process of fitting to the loop patterns of observations a chosen non-linear form. It is readily seen from Figure 5.3 that the assumption of linearity in the mapping relation will not affect the generation of a loop of points in time in the $X/(U/L)$ space. We have found that both maladjustment series exhibit a cyclical pattern of variation, where M varies inversely with X . This was the sort of pattern of variation in M which we incorporated in explaining the generation of a loop in Figure 5.

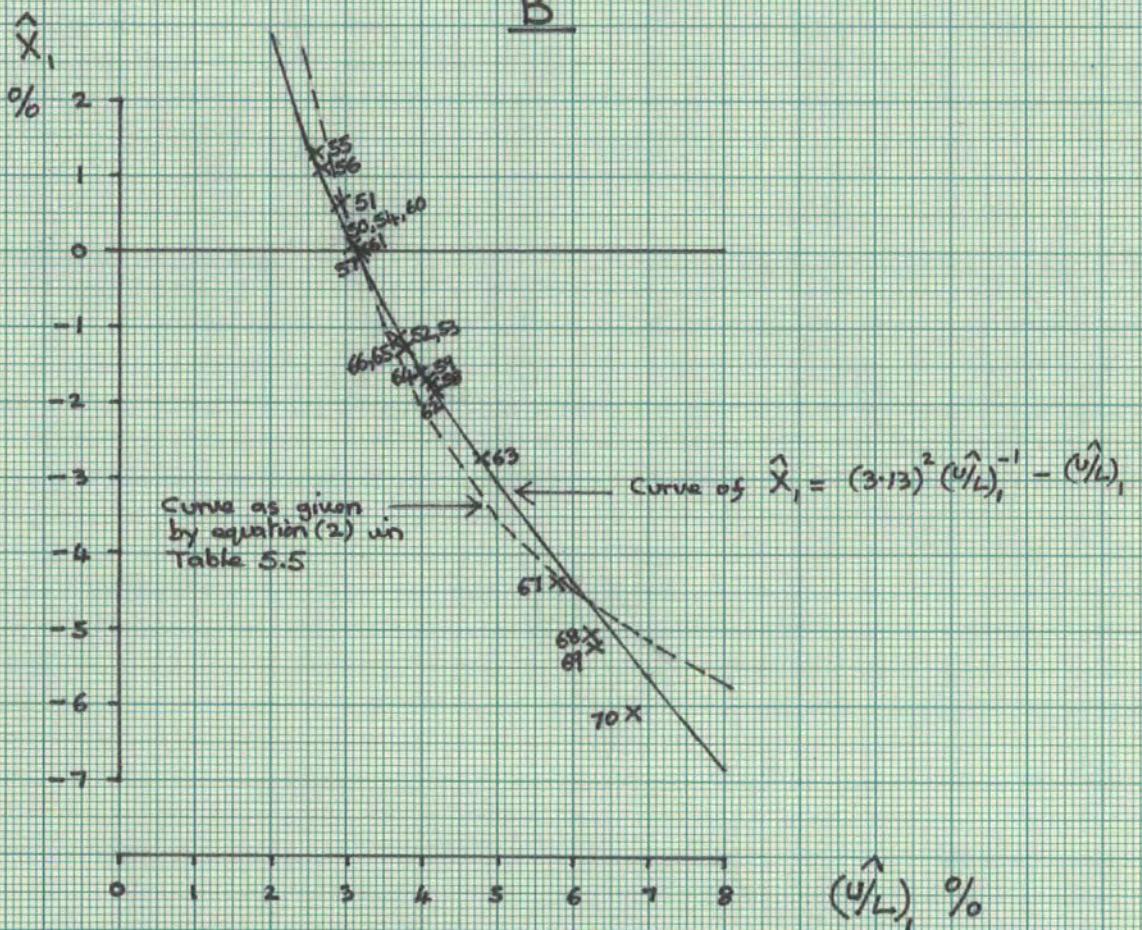
Graph 5.9A shows the scatter of points in the $X_1^*/(U/L)^*$ space $X_1^* = [(V/L)_1^* - (U/L)^*]$ for the period 1950-70. Anti-clockwise loops in time show up quite clearly for the 1952-1958 trade-cycle (shown by the unbroken line) and for the 1959-65 trade-cycle (shown by the broken line). Both Phillips and Thirlwall (67) have previously found clockwise loops in the reported $(\dot{W}/W)/(U/L)$ space for the post-war period. If we are correct in assuming that Phillips loops arise out of loops in the mapping relation, then it follows that the change in the direction of the loops which we find arises out

GRAPH 5.9

A



B



DATA SOURCE : Tables 5.1 and 5.2

of mis-statement errors in the reported unemployment statistics for which we have corrected. Graph 5.9B shows the scatter of points in the $\hat{X}_1 / (\hat{U/L})_1$ where $\hat{X}_1 = [(\hat{V/L})_1 - (\hat{U/L})_1]$ and shows that, after correction for changes in maladjustment, the observations no longer show any clear loop pattern in time. Moreover these observations must, a priori, lie closely around the mapping relation in the base year of the period. We found similar results with respect to the scatters between X_2^* and $(U/L)^*$ (where $X_2^* = (V/L)_2^* - (U/L)_2^*$), and between \hat{X}_2 and $(\hat{U/L})_2$ (where $\hat{X}_2 = (\hat{V/L})_2 - (\hat{U/L})_2$).

Statistically we found that, taking the whole period 1950-70, a linear relation between \hat{X} and $(\hat{U/L})$ showed greater explanatory power than a non-linear form (where the reciprocal of $(\hat{U/L})$ is entered linearly), and gave more reliable results as gauged from the durbin watson statistics. In all cases though over 90% of the variation in X can be associated with the variation in $(\hat{U/L})$ (the results are shown in Table 5.5). A priori, these estimates are of the mapping relation in the base year of the sample period and represent, we think, convincing evidence that the family of mapping relations in the $X/(U/L)$ space are individually negatively sloped and can adequately be approximated by a linear relation. In Graph 5.9B we have drawn the mapping relation as described by equation (4a) (above P.230) for the 'base year' level of maladjustment, (shown by the unbroken line) and also the relation as it is estimated by equation (2) in Table 5.5 above. The non-linearity in the latter relationship is more marked than in the 'theoretical' relationship described by equation (4a), and lies above that relationship for values of $X > 0$.

TABLE 5.5

Equation	constant	$(\hat{U/L})_1$	$(\hat{U/L})_1^{-1}$	$(\hat{U/L})_2$	$(\hat{U/L})_2^{-1}$	\bar{R}^2	D.W.
(1) $\hat{X}_1, (\hat{U/L})_1$	5.3232	-1.6845 (0.0302)				0.9936	1.4827*
(2) $\hat{X}_1, (\hat{U/L})_1^{-1}$	-9.3801		29.5708 (1.4861)			0.9518	0.6100
(3) $\hat{X}_2, (\hat{U/L})_2$	5.2170			-1.5563 (0.0385)		0.9879	0.9929
(4) $\hat{X}_2, (\hat{U/L})_2^{-1}$	-10.2088				33.3609 (2.0646)	0.9286	0.6035

Standard errors of coefficient estimates are in parentheses
 * indicates that the durbin watson statistic shows no evidence of serial correlation. For other values the test showed evidence of positive serial correlation.

However, what both curves show is that the observations for the years 1967-70 are again well displaced from their 'expected' values. This is, as we would expect, exactly what we found in the case of the vacancy/unemployment curve for these years. Hence, both the 'theoretical' and measured relationships between the variables X , (U/L) and (V/L) would not yield accurate predictions for the years 1967-70. In spite of this though, we have measured a strong statistical association between these variables over the sample period 1950-70.

The (U/L) estimates we have obtained show how the unemployment rate varies with the level of excess demand for labour along a given mapping relation as of a constant equilibrium level of maladjustment unemployment. We have also found that the level of maladjustment unemployment shows a cyclical variation. This means that the (U/L) estimates ignore the cyclical changes in unemployment and vacancies, which are due to cyclical changes in maladjustment. We have found that maladjustment varies inversely with the level of excess demand for labour. These changes are measured by ΔM_1 and by ΔM_2 , the time-series of which are plotted on Graph 5.1. However ΔM_1 and ΔM_2 also include the longer-term trends in maladjustment over the period 1950-70, so that ideally we need to separate this out from the cyclical variation. Graphs 5.5 and 5.6 show the time-series of M_1 and M_2 respectively, for the period 1950-70. We decided to use a simple 'trend through peaks' procedure in order to get estimates of the longer term changes in M_1 and M_2 . In the case of M_1 we identified 'peak' values from Graph 5.5 as occurring in the years 1952, 1960, 1964, 1966 and 1970. The procedure

we followed then was to identify the absolute change in M_1 between successive peak values, and to divide this by the number of observations falling within the period between any two peak values. For example, between 1952 and 1960 M_1 declined by 0.075% from 2.84% to 2.765%. Over the eight year period this represents an 'average' fall of 0.009% p.a. We then interpret the absolute change between successive peak values of M_1 as an estimate of the 'long run' structural change in M_1 over that period which is allocated on a simple annual average basis between the years of the period. Our justification for this interpretation of these measured changes in 'peak' values of maladjustment is that since the peak values are measured at approximately the same stage of the trade cycle then any change in those peak values over time must be due to long term and not cyclical structural change.

Ideally the 'peaks' in the maladjustment series should be of equal strength for this argument to hold true. In practice we can only assume that our chosen peak values are reasonably in accord with this condition. Another problem concerns the choice of the observation for the final year of the sample period as a peak value, since it will only in fact be a peak value if in subsequent years maladjustment declines. Finally, this procedure assumes that maladjustment varies along a linear time-path between successive peak values. Again we must assume that this is a reasonable approximation to the form of the actual time-path of long run adjustment of maladjustment. Notwithstanding these difficulties, we used this procedure to derive estimates of the long run change in maladjustment in each year for each maladjustment series.

We are now in a position to adjust the unemployment rate $(U/L)^*$, for structural changes in maladjustment of a longer term nature only. The change in maladjustment unemployment each year is composed of a long term (M_t) and short term (M_{s_t}) change. We can rewrite equation (7) above as

$$\Delta(U/L)^* = \Delta(\hat{U}/L) + \Delta M_{\ell t} + \Delta M_{s_t} \quad \dots (7a)$$

Since we have estimates of $\Delta M_{\ell t}$ and $\Delta(U/L)_t^*$ we can derive an unemployment series, notated as \hat{U}_t , which is the $(U/L)^*$ series corrected for long-run structural changes in maladjustment. We have,

$$\Delta \hat{U}_t = \Delta(\hat{U}/L)_t + \Delta M_{s_t} = \Delta(U/L)_t^* - \Delta M_{\ell t} \quad \dots (8a)$$

To derive the \hat{U} series we begin with the 1950 value of $(U/L)^*$ as in columns 4 and 7 of Table 5.6 and then for each successive year add in the values for $\Delta \hat{U}$ as shown in columns 3 and 6 of Table 5.6. The two \hat{U} series derived in Table 5.6 are based respectively on the maladjustment estimates M_1 and M_2 . The \hat{U} series differs from the (U/L) series in that while the latter is corrected for all changes in maladjustment from the base year, the former is corrected for long term changes only. The \hat{U} series, which includes the cyclical variation of maladjustment, may be a more appropriate indicator of excess demand for labour than the (U/L) series.

TABLE 5.6

	1	2	3	4	5	6	7
Year	$\Delta(U/L)_t^*$	ΔM_{1t}	$\Delta \hat{U}_{1t}$	\hat{U}_{1t}	ΔM_{2t}	$\Delta \hat{U}_{2t}$	\hat{U}_{2t}
1950				3.1			3:1
1951	-0.66	-0.009	-0.651	2.45	-0.0494	-0.61	2.49
1952	0.97	-0.009	0.979	3.43	-0.0494	1.0194	3.51
1953	0.01	-0.009	0.019	3.45	-0.0494	0.0594	3.57
1954	-1.01	-0.009	-1.00	2.45	-0.0494	-0.961	2.61
1955	-0.80	-0.009	-0.791	1.66	-0.0494	-0.751	1.86
1956	-0.21	-0.009	-0.201	1.46	-0.0494	-0.161	1.70
1957	0.65	-0.009	0.659	2.11	-0.0494	0.6994	2.40
1958	1.48	-0.009	1.489	3.6	-0.0494	1.529	3.93
1959	0.15	-0.009	0.159	3.76	-0.0494	0.1994	4.13
1960	-0.91	-0.009	-0.901	2.86	-0.0494	-0.8606	3.27
1961	-0.23	0.155	-0.385	2.48	0.1834	-0.413	2.85
1962	1.13	0.155	0.975	3.45	0.1834	0.947	3.80
1963	0.96	0.155	0.805	4.26	0.1834	0.777	4.58
1964	-0.35	0.155	-0.505	3.75	0.1834	-0.533	4.04
1965	-0.07	0.322	-0.392	3.36	0.1834	-0.253	3.79
1966	0.51	0.322	0.188	3.55	0.270	0.24	4.03
1967	2.28	0.714	1.566	5.11	0.270	2.01	6.04
1968	1.37	0.714	0.656	5.77	0.270	1.10	7.14
1969	0.93	0.714	0.216	5.99	0.270	0.66	7.80
1970	1.28	0.714	0.566	6.55	0.270	1.01	8.81

NOTES;

column (3) = column (1) - column (2)

column (6) = column (1) - column (5)

V. The Phillips Curve and The Adjusted Unemployment Rate

This section presents ordinary least squares estimates of a single equation wage-change model using data for the period 1950-70. The main objective is to examine the role played by the adjusted unemployment rates (\hat{U}/L) and \hat{U} in such a model. The (\hat{U}/L) series show how the level of unemployment varies in response to changes in the degree of excess demand for labour as of a given (1951) level of maladjustment unemployment. The \hat{U} series include the cyclical variation of maladjustment unemployment.

Table 5.7 shows a selection of the results we obtained. We began by estimating a simple linear and non-proportional relation between the rate of wage inflation $(\dot{W}/W)_{HPD}$ and the level of excess demand for labour. Equations (1) and (3) show that both X_1 and X_2 are insignificant explanatory variables and get the incorrect sign. Equations (2) and (4) add the lagged price-change variable $(\dot{P}/P)_{t-6}$ and so represent a correctly specified 'reaction function' in theoretical terms, where $(\dot{P}/P)_{t-6}$ can be viewed as a proxy for the expected rate of inflation. The price-change variable shows as significant with a coefficient estimate in the order of 0.7, while both excess demand variables remain insignificant with the incorrect sign. The overall explanatory power of the relation is low, being in the order of $\bar{R}^2 = 0.45$. This does represent a significant gain in explanatory power due to the addition of $(\dot{P}/P)_{t-6}$ to X , since in the cases of equations (1) and (2) the \bar{R}^2 is not significantly different from zero. We conclude therefore that we can measure no significant statistical association between (\dot{W}/W) and X for this sample period.¹

1 We also experimented with $X' = (V/L)' - (U/L)'$, and got similar results.

TABLE 5.7

The Dependent Variable is $(\dot{W}/W)_{HPD}_t$

	Constant	$(\dot{P}/P)_{t-6}$	\hat{X}_1	\hat{X}_2	$(\hat{U}/L)_1$	$(\hat{U}/L)_2$	$(\hat{U}/L)_1^{-1}$	$(\hat{U}/L)_2^{-1}$	\bar{R}^2	D.W.
1)	5.4005		-0.2897 (0.2279)						0.0299	1.3982
2)	2.5739	0.7376 (0.1926)	-0.2507 (0.1742)						0.4352	1.7375*
3)	5.4356			-0.2435 (0.1670)					0.053	1.4413*
4)	2.6200	0.7324 (0.1894)		-0.2115 (0.1271)					0.4541	1.8036*
5)	1.0548	0.7309 (0.1900)			0.4732 (0.2904)				0.45	1.7513*
6)	4.0704	0.7566 (0.1994)					-4.4825 (5.4590)		0.3929	1.6243*
7)	1.3337	0.7138 (0.1848)				0.3869 (0.1941)			0.4840	1.8489*
8)	3.9146	0.7647 (0.1990)						-4.1684 (4.6142)	0.3975	1.6668*

* indicates that the durbin watson test shows evidence of no positive serial correlation
standard errors of coefficient estimates are in parentheses

TABLE 5.7 (continued)

	Constant	$(P/P)_{t-6}$	$(\hat{U}/L)_1$	$(\hat{U}/L)_2$	$(\hat{U}/L)_1^{-1}$	$(\hat{U}/L)_2^{-1}$	(\dot{T}/T)	\bar{R}^2	D.W.
9)	6.0670	0.2158 (0.1314)	-0.3335 (0.2026)				2.1768 (0.3350)	0.8332	2.4250*
10)	2.9804	0.2045 (0.1246)			6.7022 (3.1227)		2.1388 (0.2889)	0.8487	2.5342*
11)	5.9405	0.2010 (0.1318)		-0.2678 (0.1504)			2.2809 (0.3607)	0.8370	2.3846*
12)	3.2518	0.1778 (0.1246)				6.2786 (2.6488)	2.1943 (0.2891)	0.8546	2.5180*

* indicates that the durbin watson test shows evidence of no positive serial correlation standard errors of coefficient estimates are in parentheses

Equation (5) in Table 5.7 introduces $(\hat{U/L})_1$ linearly as the proxy variable for \hat{X}_1 , and so represents a typical Phillips relationship. $(\hat{U/L})_1$ shows as an insignificant explanatory variable, and gets the incorrect sign. $(\dot{P/P})_{t-6}$ is again significant with a coefficient estimate of about 0.6, and the \bar{R}^2 is again in the order of 0.45. This result is very much to be expected given the strong statistical relationships we have previously measured between \hat{X}_1 and $(\hat{U/L})_1$, and given that we have merely substituted one variable for the other in an otherwise identically specified equation to equations (2) and (4). In equation (6) of Table 5.7 $(\hat{U/L})_1$ is entered non-linearly, but remains insignificant with the incorrect sign. The \bar{R}^2 is marginally lower at 0.4. Equations (7) and (8) repeat the same experiments with $(\hat{U/L})_2$ replacing \hat{X}_2 in linear and non-linear form. The results obtained are very similar, and lead to the conclusion that we can measure no significant statistical association between $(\hat{U/L})$ and $(\dot{W/W})_{HPD}$.

Equations (9) and (11) add the trade union militancy proxy variable $(\dot{T/T})$ to equations in which $(\hat{U/L})_1$ and $(\hat{U/L})_2$ are respectively incorporated linearly. As the evidence presented in Chapter III leads us to expect, there is now a significant gain in explanatory power (the \bar{R}^2 is 0.83) and the $(\dot{T/T})$ variable is the only significant explanatory variable. However each $(\hat{U/L})$ variable now shows with the 'correct' sign. In equations (10) and (12) each $(\hat{U/L})$ variable is entered non-linearly. Again as we saw in Chapter III using the reported unemployment rates, the non-linear unemployment variable now shows as statistically significant. It is evident therefore that the use of the adjusted unemployment

rate (\hat{U}/L) does not alter in any way the weakness of the empirical relationship between the rate of wage inflation and the unemployment rate.

However, it may be the case as we suggested above that (\hat{U}/L) is itself an inefficient proxy for the degree of excess demand for labour since it takes no account of cyclical changes in the 'structural' component of maladjustment unemployment. We therefore tried the \hat{U} series in the wage-change equation, and obtained the results shown in Table 5.8. These results do not lead us to alter any of our previous conclusions. \hat{U} shows as insignificant but with the 'correct' sign when it is entered linearly, and when it is entered non-linearly it tends to show as a significant explanatory variable.

We therefore conclude that the weakness of the statistical relationship between the rate of wage inflation and the reported unemployment rate is not due to the fact that, over the post war period, the latter has become an increasingly inefficient proxy for the level of excess demand for labour. The fact that we have measured statistically significant relationships between our estimates of the level of excess demand for labour and the unemployment rate thus leads us to the view that the empirical weakness of the Phillips curve derives from the empirical weakness of the 'reaction function' between (\dot{W}/W) and X , as is evidenced by equations (1) and (3) in Table 5.7.

TABLE 5.8

The Dependent Variable is $(\dot{W}/W)_{HPD}$

	Constant	(\dot{T}/T)	$(\dot{P}/P)_{t-6}$	U_1	U_1^{-1}	U_2	U_2^{-1}	\bar{R}^2	D.W.
1)	5.8081	2.1669 (0.3192)	0.2226 (0.1277)	-0.3165 (0.1766)				0.8373	2.3794*
2)	3.6872	2.0201 (0.2722)	0.2316 (0.1235)		3.0095 (1.5084)			0.8433	2.4104*
3)	5.7223	2.2519 (0.3531)	0.2113 (0.1304)			-0.2472 (0.1414)		0.8361	2.3528*
4)	3.6816	2.0863 (0.2790)	0.2091 (0.1243)				3.6340 (1.7129)	0.8471	2.4389*

* indicates that the durbin watson test showed evidence of no positive serial correlation
Standard errors of coefficient estimates are in parentheses

SUMMARY AND CONCLUSIONS.

The measured statistical relationship between the rate of wage inflation and the level of unemployment has weakened considerably over the course of the post-war period, especially when the 'stagflation' experience of recent years is included in the sample period. At the same time much firmer relationships have been established in which proxy variables for union militancy, and the expected rate of inflation, show as significant explanatory variables, while the level of unemployment shows as insignificant. This experience has cast doubt upon the existence of an empirically viable Phillips curve.

The main thesis which we have been investigating is that over the period 1950-70 the reported unemployment statistics have increasingly mis-stated the 'true' level of unemployment, and that they have consequently become an increasingly inefficient proxy for the degree of excess demand for labour which, in the context of the theory of the Phillips curve, determines the rate of wage inflation. As a result, the statistical relationship between the rate of wage-inflation and the reported unemployment rate has become increasingly tenuous. We have adjusted the reported unemployment statistics to take into account cyclical variation in participation rates, and changes in the level of 'maladjustment' unemployment over the sample period. These changes have the effect of shifting the 'mapping relation' in the theory of the Phillips curve so that any given level of excess demand for labour has, at various times, been associated with different levels of unemployment. Given the

existence of a stable 'reaction function' between the rate of wage inflation and the degree of excess demand for labour, such changes would therefore shift the 'measured' Phillips curve over time.

We have identified long term and 'cyclical' changes in the level of maladjustment unemployment, and have argued that the latter variation gives rise to 'loops' in time around the mapping relation, and in consequence, the Phillips curve. We have obtained an adjusted unemployment series ($\hat{U/L}$) which shows the variation of the level of unemployment in response to changes in the degree of excess demand for labour as of a given level of 'maladjustment' unemployment. We also obtained a corresponding vacancy series ($\hat{V/L}$) and measured a strong linear statistical relationship between ($\hat{U/L}$), ($\hat{V/L}$) and the degree of excess demand for labour defined from these variables over the period 1950-70. We found that the observations from the sample period for the years since 1966 are displaced from the theoretical and estimated non-linear relationships between these variables, which probably explains why the linear form for these relationships performs better in statistical terms than the non-linear form. We found no evidence of 'Phillips loops' around the mapping relation defined from the ($\hat{U/L}$) and ($\hat{V/L}$) variables. We also obtained an adjusted unemployment series \hat{U} which is corrected for 'structural' changes in maladjustment unemployment only, and as such we suggest is a more efficient proxy than ($\hat{U/L}$) for the degree of excess demand for labour since it takes specific account of cyclical changes in the level of frictional maladjustment unemployment.

When these adjusted unemployment rates replaced individually the reported unemployment rate in a wage-change equation, we were unable to find any evidence in favour of the Phillips relationships. Our results, which are ordinary least squares estimates based on annual data for the period 1950-70, confirmed the explanatory power of the proxy variable for union militancy in the wage-change equation. In view of the firm results found in the mapping relation which we estimated it seems clear that the weakness of the Phillips relationship derives from the weakness of the relationship between the rate of wage-inflation and the degree of excess demand for labour. This view was confirmed by our estimates of this relationship.

APPENDIX

SOURCES OF DATA

(1) Indices of Basic Hourly Rates of Wages

For 1950-1968 from "British Labour Statistics - Historical Abstract 1886-1968" Table 27 P.79
For 1968-1970 from issues of the "Monthly Digest of Statistics".

(2) Indices of Basic Weekly Rates of Wages

For 1950-68 from "British Labour Statistics - Historical Abstract 1886-1968" Table 13 P.53
For 1968-70 from issues of the "Monthly Digest of Statistics".

(3) Index of Retail Prices

For 1950 to 1956 from "British Labour Statistics - Historical Abstract 1886-1968" Table 90 P.172, the 'Interim Index of Retail Prices'.
For 1956 to 1968 from "British Labour Statistics - Historical Abstract 1886-1968" Tables 95 and 96, P.178-190, the 'General Index of Retail Prices'.
For 1968-1970 from issues of the "Monthly Digest of Statistics"

(4) Unemployment

(a) Numbers Wholly Unemployed

Monthly data on numbers wholly unemployed in the United Kingdom for the period 1950-68 was taken from "British Labour Statistics - Historical Abstract 1886-1968", Table 165, P.316; for the period 1968-70 from issues of the "Monthly Digest of Statistics". Monthly unemployment percentages were obtained by expressing the numbers wholly unemployed in each month of each quarter as a percentage of the estimated total number of employees in the United Kingdom in the final month of each quarter. The latter data was obtained from Table 118, P.220 of "British Labour Statistics - Historical Abstract 1886-1968" (for the period 1950-68) and from the "Monthly Digest of Statistics" 'Distribution of the Working Population' table (for the period 1968-70) as the sum of 'Employees in Employment' plus 'Wholly Unemployed'.

Similar data covering Great Britain was obtained from "British Labour Statistics - Historical Abstract 1886-1968". Tables 165 and 121, the "Monthly Digest of Statistics" and the "Department of Employment Gazette".

(b) Total Numbers Registered as Unemployed

Data covering the United Kingdom and Great Britain respectively were obtained from the same sources as in (a).

Prior to January 1973 the main emphasis of the unemployment statistics as presented by the Department of Employment was on the 'total registered unemployed'. This was composed of numbers 'wholly unemployed' and 'temporarily stopped'. Currently the 'total registered unemployed' is abolished in favour of the 'numbers wholly unemployed' (See the Department of Employment Gazette November 1972 P.971). This total, and the data we have used, includes school leavers and adult students, but is also available excluding school leavers and adult students.¹ We used seasonally unadjusted data: firstly because we are anyway working with annual data obtained as twelve monthly averages so that normal seasonal influences should cancel out; and secondly because over the period 1950-70 the method of seasonal correction has been changed several times and at the time the data was collected the most recently adopted method of reasonably correcting the unemployment series had not been applied retrospectively to data from the whole sample period (See the 'Ministry of Labour Gazette' September 1965 "Seasonally Adjusting the Unemployment Series", and the 'Employment and Productivity Gazette April 1970 "New Method for Seasonally Adjusting the Unemployment Series" P.285).

(5) Vacancies

Statistics of unfilled vacancies for the United Kingdom were obtained by adding the number of vacancies in N. Ireland to those in Great Britain; these are available from the 'Monthly Digest of Statistics'. The numbers of unfilled vacancies were obtained as quarterly averages and expressed as a percentage of the estimated total number of employees, for the United Kingdom and Great Britain respectively, in the final month of each quarter.

In the early part of the sample period there were in existence various orders controlling engagements. These are fully described in Dow and Dicks-Mireaux (14) who concluded that ".... These statutory changes appear to have had relatively little effect on the level of vacancies recorded as unfilled."

1 See the Ministry of Labour Gazette March 1960 P.89

(6) Unionisation

The union membership statistics are end of year estimates. For the period 1950-68 the figures are from Table 196 'British Labour Statistics Historical Abstract 1886-1968', and for 1968-70 from Table 78 of the 'British Labour Statistics Year Book 1970'. The figures are of the aggregate membership of trade unions in the United Kingdom.

One problem with this data is that the figures published in any one year are provisional, and the figures for earlier years are revised in accordance with the latest information. Thus the estimates for the years 1962-72 published in the 'Department of Employment Gazette' November 1973 P.1147 differ in all cases from the estimates for 1962-70 obtained from the sources above.

(7) Participation Rates (Activity Rates)

Activity rates by age-sex groups for Great Britain for the period 1951-70 were obtained from the following sources:

For 1951-63	from	'Ministry of Labour Gazette'	March	1965
" 1961-66	"	" " " "	July	1967
" 1966-68	"	" " " "	July	1969
" 1969	"	'Abstract of Regional Statistics'	No.6	1970
" 1970	"	" " " "	No.7	1971

Aggregate, and aggregate male and female activity rates for the United Kingdom and Great Britain were obtained from the same source.

To obtain consistent series all the statistical estimation was done using 'constructed' activity rates in the aggregate, and by aggregate sex groups, for the United Kingdom and Great Britain respectively. For the different groups the activity rate was calculated by expressing 'total employees' as a percentage of the mid year estimates of the Home population aged 15 and over. Mid-year estimates of the 'Home' population aged 15+ were obtained from the 'Annual Abstract' No.108 1971 (for the years 1967-70) and from other issues of the 'Annual Abstract' for the earlier years of the sample period 1951-70. The data is in the form of age-sex groupings. Estimates for the total male and female populations were obtained by summing appropriate sub-groupings. Data covering Great Britain was obtained by subtracting the estimates for N. Ireland from those for the United Kingdom, (series for the United Kingdom, N. Ireland, Scotland and 'England and Wales' are available in the 'Annual Abstract').

The employment population ratio percentages express the total number of employees in employment as a percentage of the mid-year estimates of the Home Population aged 15 and over. They have been calculated as aggregates, and by sex groups, for the U.K. and Great Britain respectively. The 'employees in employment' series are annual averages of the quarterly series taken from "British Labour Statistics - Historical Abstract 1886-1968" Tables 165 and 121, the "Monthly Digest of Statistics" and the "Department of Employment Gazette".

D A T A

Column 1	Percentage Rate of Change of Hourly Wage Rates - First Central Difference - Time t
Column 2	Percentage Rate of Change of Hourly Wage Rates - Percentage Differences - Time t
Column 3	Percentage Rate of Change of Hourly Wage Rates - Percentage Differences - Implicit t-6
Column 4	Percentage Rate of Change of Weekly Wage Rates - First Central Differences - Time t
Column 5	Percentage Rate of Change of Weekly Wage Rates - Percentage Differences - Time t
Column 6	Wholly Unemployed Percentage, United Kingdom - Time t
Column 7	Wholly Unemployed Percentage, United Kingdom - Time t-7
Column 8	Wholly Unemployed Percentage, United Kingdom - Time t-4
Column 9	Wholly Unemployed Percentage, Great Britain - Time t
Column 10	Registered Unemployed Percentage, United Kingdom - Time t
Column 11	Registered Unemployed Percentage, Great Britain - Time t
Column 12	Unfilled Vacancy Percentage, United Kingdom - Time t
Column 13	Percentage Rate of Change of Retail Prices, - Time t
Column 14	Percentage Rate of Change of Retail Prices - Time t-6
Column 15	Absolute Change in the Percentage of the Labour Force Unionised
Column 16	Percentage Rate of Change of The Wholly Unemployed Percentage in the United Kingdom at Period t
Column 17	Percentage Rate of Change of The Wholly Unemployed Percentage in the United Kingdom at Period t-7

Column 18	Percentage Rate of Change of The Wholly Unemployed Percentage in the United Kingdom at Period t-4.
Column 19	Aggregate Participation Percentage Rate in the United Kingdom
Column 20	Aggregate Male Participation Percentage Rate in the United Kingdom
Column 21	Aggregate Female Participation Percentage Rate in the United Kingdom
Column 22	Aggregate Participation Percentage Rate in Great Britain
Column 23	Aggregate Male Participation Percentage Rate in Great Britain
Column 24	Aggregate Female Participation Percentage Rate in Great Britain
Column 25	Participation Percentage Rate of Males aged 15-24 in Great Britain
Column 26	Participation Percentage Rate of Males aged 25-44 in Great Britain
Column 27	Participation Percentage Rate of Males aged 45-64 in Great Britain
Column 28	Participation Percentage Rate of Males aged 65 and over in Great Britain
Column 29	Participation Percentage Rate of Females aged 15-24 in Great Britain
Column 30	Participation Percentage Rate of Females aged 25-44 in Great Britain
Column 31	Participation Percentage Rate of Females aged 45-59 in Great Britain
Column 32	Participation Percentage Rate of Females aged 60 and over in Great Britain
Column 33	Aggregate Percentage Employment to Population Ratio in the United Kingdom
Column 34	Aggregate Male Percentage Employment to Population Ratio in the United Kingdom
Column 35	Aggregate Female Percentage Employment to Population Ratio in the United Kingdom

Column 36	Aggregate Percentage Employment to Population Ratio in Great Britain
Column 37	Aggregate Male Percentage Employment to Population Ratio in Great Britain
Column 38	Aggregate Female Percentage Employment to Population Ratio in Great Britain

	1	2	3	4	5	6	7	8	9	10
1950	5.2	4.5	2.0	5.2	4.5	1.58	1.58	1.6	1.46	1.6
1951	8.0	8.8	8.4	8.0	9.7	1.25	1.44	1.33	1.14	1.3
1952	6.1	6.3	8.2	6.1	6.2	1.74	1.37	1.53	1.56	2.2
1953	4.4	4.0	4.7	4.4	4.0	1.67	1.82	1.77	1.53	1.8
1954	5.5	5.7	4.4	5.5	5.6	1.39	1.57	1.50	1.29	1.5
1955	7.2	7.5	6.8	7.1	7.4	1.11	1.23	1.17	0.95	1.2
1956	6.3	6.3	8.0	6.2	6.4	1.16	1.08	1.10	1.05	1.3
1957	4.4	4.9	5.2	4.2	4.7	1.47	1.35	1.40	1.33	1.6
1958	3.2	3.4	3.8	3.0	3.3	2.02	1.72	1.76	1.90	2.2
1959	3.5	2.7	2.7	2.6	2.0	2.13	2.07	2.22	2.0	2.3
1960	5.2	6.0	4.7	3.3	3.6	1.65	1.91	1.79	1.53	1.7
1961	5.3	5.2	6.3	3.8	3.6	1.49	1.51	1.48	1.38	1.6
1962	4.0	4.4	4.6	3.7	4.1	1.99	1.64	1.78	1.88	2.1
1963	4.4	4.1	3.7	4.1	3.9	2.36	2.34	2.40	2.25	2.6
1964	5.6	5.5	5.2	4.4	4.5	1.70	2.03	1.89	1.55	1.7
1965	6.3	7.4	6.3	4.4	4.9	1.45	1.54	1.49	1.34	1.5
1966	5.1	4.3	6.7	4.1	3.4	1.50	1.39	1.37	1.40	1.6
1967	5.4	6.4	4.0	5.1	5.8	2.35	1.90	2.14	2.23	2.5
1968	5.9	5.6	6.8	5.7	5.5	2.47	2.44	2.47	2.35	2.5
1969	7.7	6.9	5.4	7.5	6.7	2.44	2.40	2.40	2.35	2.5
1970	11.3	12.8	10.3	11.0	12.6	2.61	2.50	2.55	2.53	2.7

	11	12	13	14	15	16	17	18
1950	1.5	1.71	6.04	3.94	-0.81	-10.45	-6.65	-8.13
1951	1.2	1.97	8.75	7.92	0.85	6.40	-7.29	-2.63
1952	2.0	1.30	5.73	7.98	0.09	12.10	13.87	14.38
1953	1.6	1.29	2.42	3.38	-0.72	-10.48	5.49	0.84
1954	1.3	1.51	3.15	2.45	-0.42	-20.15	-18.79	-20.0
1955	1.1	1.85	4.66	4.41	0.21	-10.36	-19.92	-17.1
1956	1.2	1.61	4.21	4.43	-0.10	15.52	5.55	20.9
1957	1.4	1.24	3.26	3.77	0.09	29.25	23.71	23.57
1958	2.1	0.89	1.73	2.69	-0.87	16.34	20.93	23.30
1959	2.2	0.99	0.77	0.85	-0.70	-8.69	4.59	0.68
1960	1.6	1.38	2.23	1.24	0.17	-19.40	-14.66	-20.67
1961	1.5	1.38	3.35	3.20	0.09	11.41	-8.94	-0.34
1962	2.0	0.91	2.64	3.24	-0.11	21.86	25.30	25.85
1963	2.5	0.84	2.64	2.14	-0.14	-6.15	8.34	2.29
1964	1.6	1.34	3.94	3.26	0.25	-26.77	-19.71	-24.08
1965	1.4	1.61	4.22	5.41	0.10	-6.90	-20.78	-17.45
1966	1.5	1.55	3.12	3.73	-0.06	30.0	12.95	23.72
1967	2.4	1.05	3.56	2.12	0.03	20.64	27.60	25.7
1968	2.4	1.15	4.96	4.24	0.19	1.82	10.25	5.27
1969	2.4	1.22	5.67	5.33	1.36	2.87	1.25	1.67
1970	2.6	1.12	7.75	6.55	3.31	18.97	8.80	12.94

	19	20	21	22	23	24	25	26	27	28
1950										
1951	54.52	75.9	35.4	54.71	76.3	35.3	75.7	88.2	82.7	23.1
1952	54.51	75.9	35.4	54.70	76.6	35.3	73.0	89.0	83.6	23.7
1953	54.75	76.1	35.7	54.95	76.4	35.6	71.4	89.2	83.7	24.2
1954	55.44	76.6	36.6	55.51	76.9	36.4	73.6	89.5	84.0	24.1
1955	56.0	76.9	37.3	56.23	77.1	37.2	74.3	89.5	84.4	25.3
1956	56.43	77.4	37.7	56.66	77.8	37.6	75.4	89.8	85.0	26.1
1957	56.51	77.7	37.5	56.73	78.0	37.8	75.4	90.2	85.4	26.1
1958	56.24	77.5	37.2	56.47	77.8	37.3	75.5	90.5	85.1	24.7
1959	56.49	77.5	37.6	56.72	77.6	37.5	75.8	90.7	84.5	21.5
1960	57.02	77.6	38.5	57.25	77.8	38.4	78.6	90.2	84.3	21.6
1961	57.34	77.6	39.0	57.58	77.8	39.0	78.7	89.6	84.9	21.1
1962	57.24	77.3	39.0	57.47	77.5	39.1	78.5	88.8	84.9	20.0
1963	57.15	76.9	39.1	57.38	77.3	39.1	77.8	88.5	85.3	19.4
1964	57.24	76.6	39.6	57.48	76.8	39.5	77.1	88.5	85.4	18.4
1965	57.41	76.4	40.1	57.64	76.7	39.9	77.9	88.1	85.8	19.2
1966	57.40	76.9	40.4	57.61	76.3	40.5	79.0	87.6	86.0	19.1
1967	56.77	75.3	39.9	56.97	75.5	40.0	77.9	86.2	85.4	18.4
1968	56.27	74.2	39.9	56.45	74.4	40.0	75.5	85.4	85.2	17.1
1969	55.95	73.3	40.1	56.12	73.5	40.2	72.4	84.6	85.5	17.4
1970	55.51	72.3	40.0	55.69	72.5	40.2	71.0	83.8	84.8	16.9

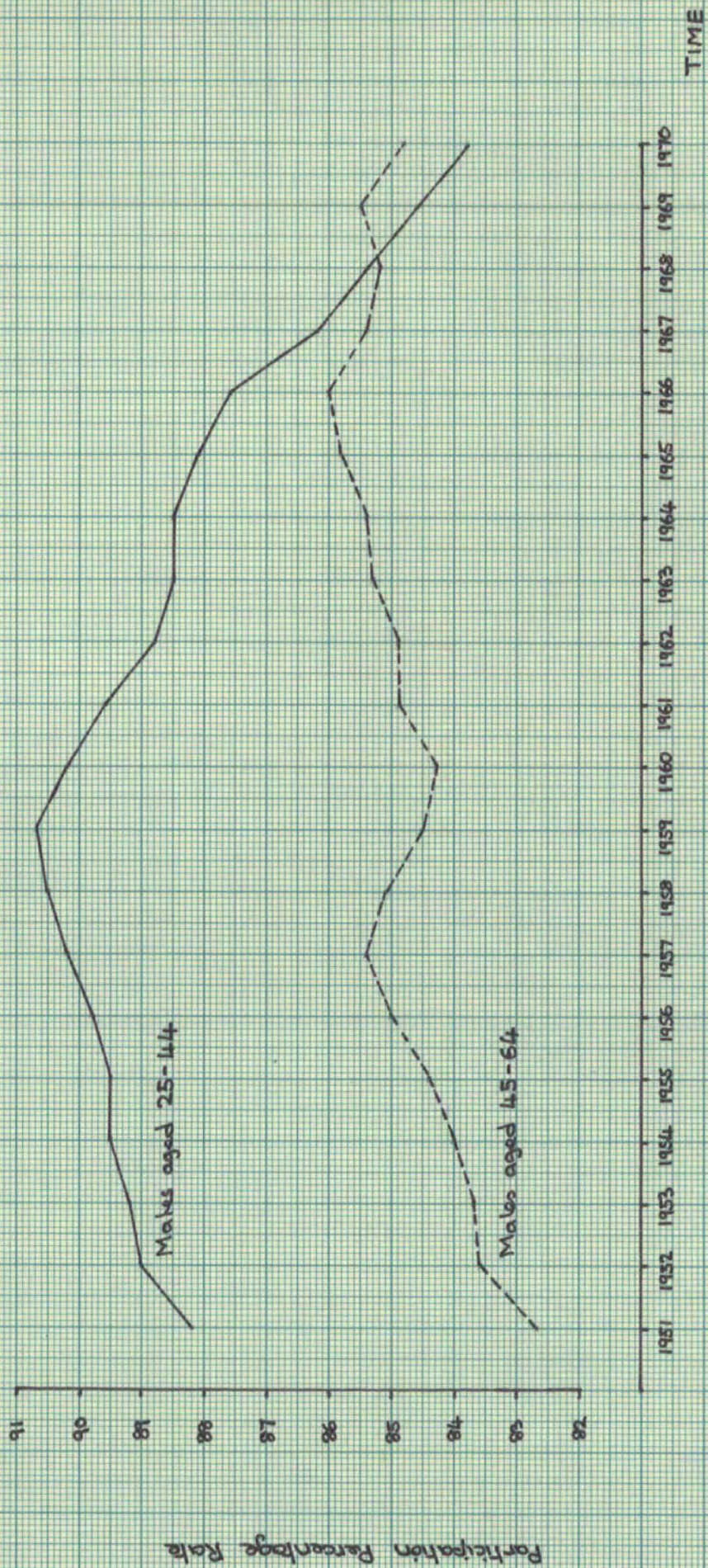
	29	30	31	32	33	34	35	36	37	38
1950										
1951	72.2	38.2	33.1	6.3	53.86	75.0	35.0	54.11	75.5	35.1
1952	72.4	37.8	34.1	6.6	53.57	74.7	34.7	53.84	75.2	34.8
1953	72.1	38.1	34.8	7.2	53.87	74.9	35.1	54.14	75.4	35.2
1954	73.0	39.4	36.2	7.3	54.70	75.5	36.1	54.97	76.0	36.2
1955	73.2	40.6	37.3	7.8	55.41	76.1	36.9	55.69	76.6	37.0
1956	73.0	40.9	38.6	8.5	55.78	76.4	37.3	56.06	76.9	37.4
1957	72.4	40.9	39.8	8.8	55.69	76.5	37.1	55.98	77.0	37.2
1958	70.5	40.3	40.3	8.9	55.09	75.8	36.6	55.4	76.3	36.7
1959	69.4	40.7	40.4	8.9	55.35	75.8	37.0	55.63	76.2	37.2
1960	69.7	41.5	42.0	9.1	56.12	76.2	38.0	56.41	76.7	38.2
1961	69.5	42.1	43.2	9.2	56.50	76.3	38.6	56.81	76.8	38.7
1962	67.5	42.4	44.6	9.3	56.08	75.5	38.45	56.38	75.9	38.6
1963	67.3	42.1	44.6	9.6	55.84	74.9	39.5	56.13	75.3	38.7
1964	66.5	42.8	45.8	9.8	56.32	75.1	39.2	56.61	75.6	39.3
1965	67.9	43.3	47.2	10.0	56.62	75.1	39.7	56.98	75.5	39.9
1966	67.3	44.2	48.7	10.4	56.52	74.5	40.1	56.79	74.9	40.3
1967	66.1	43.6	48.7	10.2	55.45	73.0	39.4	55.70	73.4	39.6
1968	64.3	43.8	50.1	10.1	54.91	71.8	39.5	55.14	72.2	39.6
1969	63.3	45.1	50.6	10.3	54.59	71.1	39.7	54.81	71.4	39.9
1970	62.1	45.6	51.2	10.3	54.07	69.9	39.6	54.29	70.2	39.8

SUPPLEMENTARY APPENDIX

see Chapter IV P.185

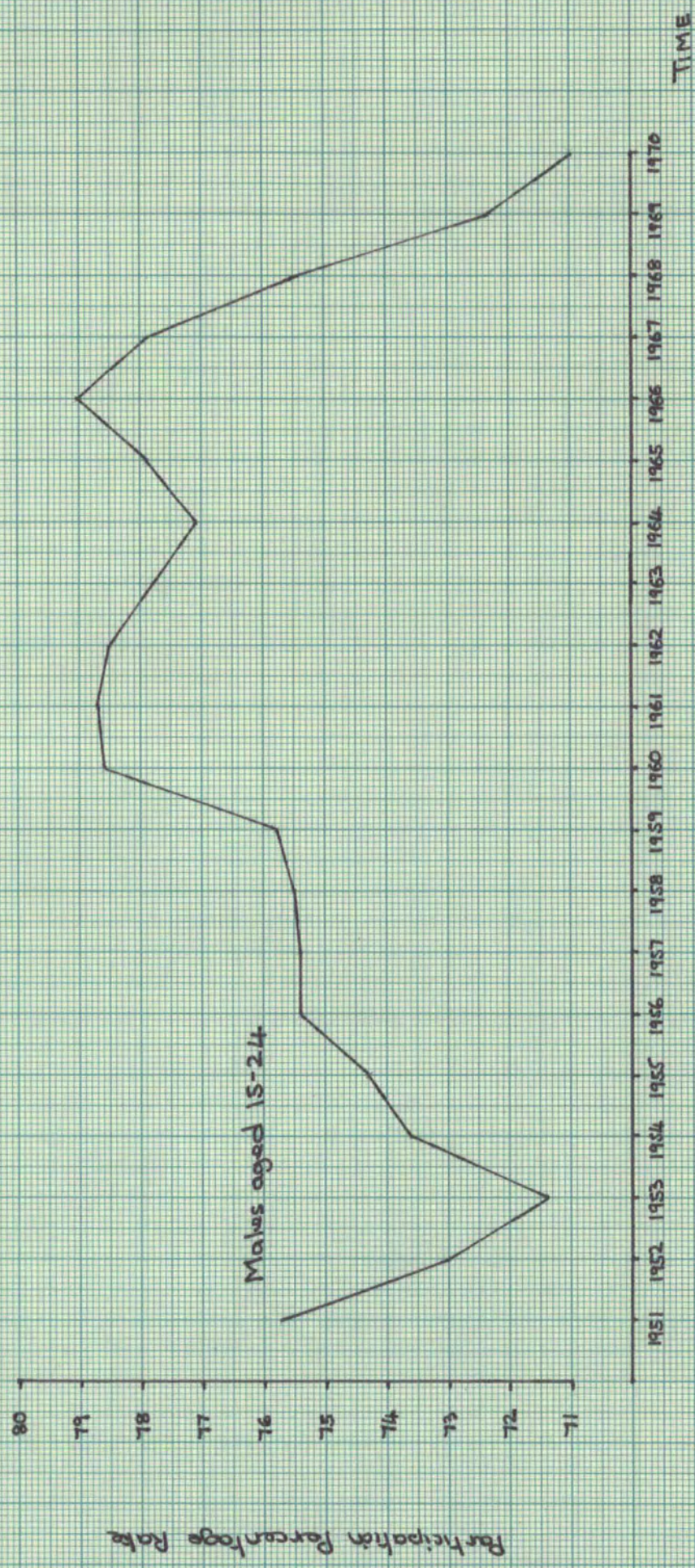
PARTICIPATION RATES BY AGE-SEX GROUPS FOR GREAT BRITAIN, 1951-70

1

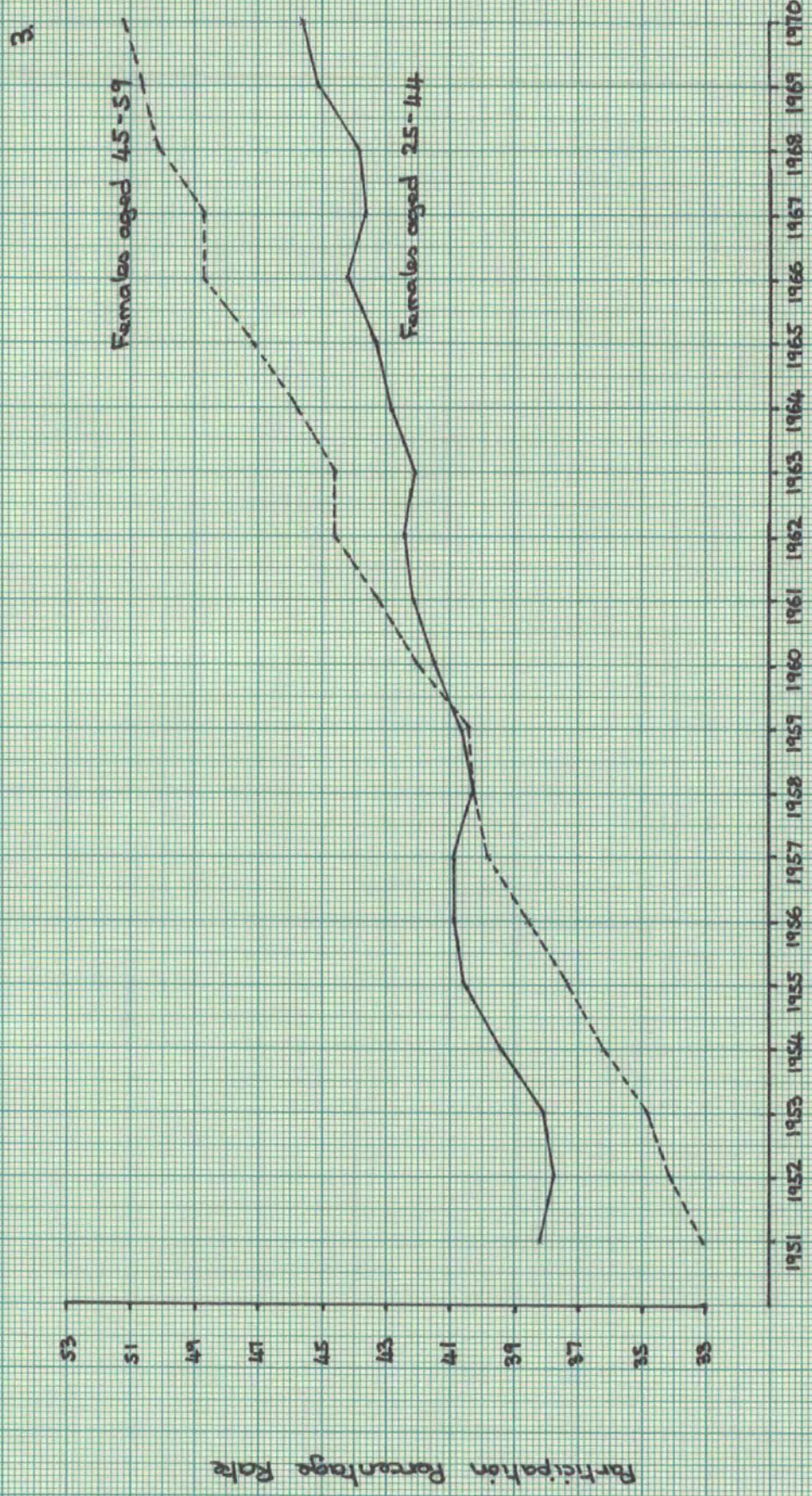


DATA SOURCE: Appendix, columns 2.6 and 2.7

2.



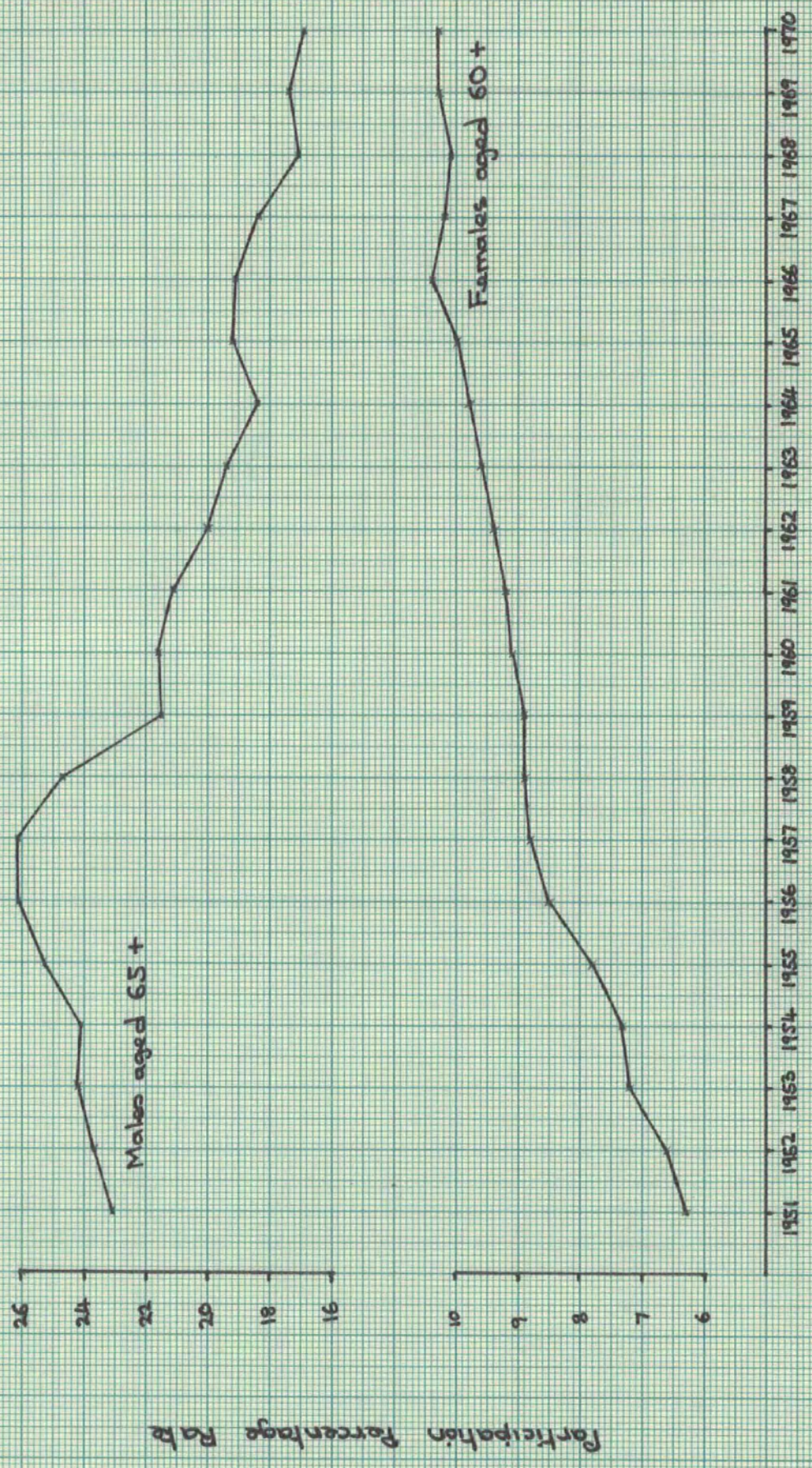
DATA SOURCE: Appendix, column 25



DATA SOURCE: Appendix, columns 30 and 31

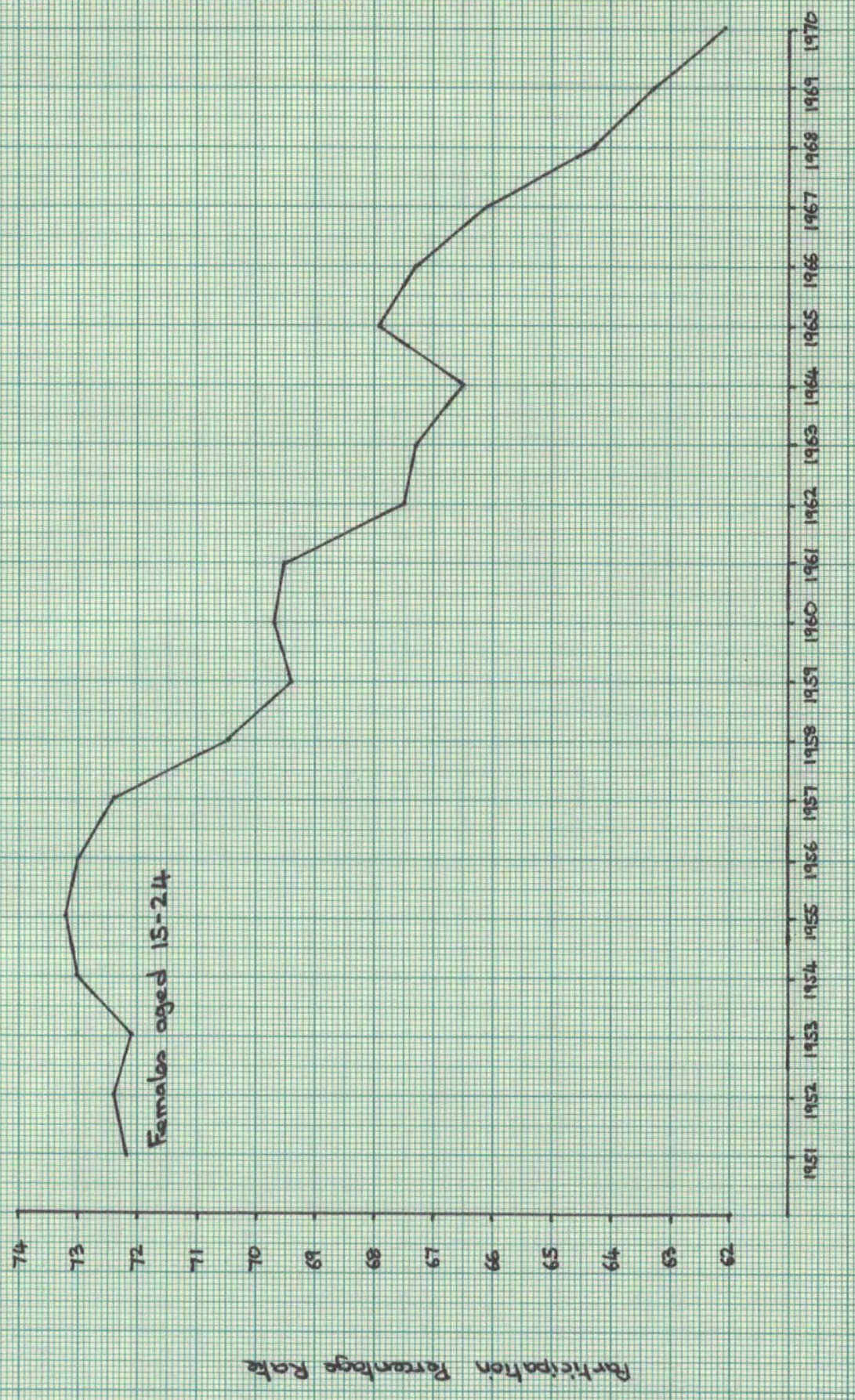
TIME

4.



DATA SOURCE: Appendix, columns 28 and 32

5.



DATA SOURCE: Appendix, column 29

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