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DISEQUILIBRIUM LABOUR MARKET MODELS: A DIAGRAMMATIC APPROACH

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INTRODUCTION

In this paper, a simple disequilibrium aggregate labour market model will be proposed. As in the case of most market models, more than one relationship is involved, since in a market, at least three variables, namely demand, supply and own price, may be assumed to be simultaneously determined.

The presentation is intended for readers with little or no knowledge of econometrics, and for this reason, a diagrammatic approach is used. Mathematical formulations are kept to the barest minimum in the main text.

In a diagrammatic representation of a model, a given relationship is usually restricted to include two variables, generally with the dependent variable on the vertical axis and one explanatory variable on the horizontal axis. Such an exposition implicitly assumes that other explanatory variables involved in the relationship remain constant. Thus, for example, the traditional price/demand diagram, assumes amongst other things, that the income of the buyers, the price of substitutes and consumer tastes remain constant. This *ceteris paribus* assumption may be relaxed by allowing for outward or inward shifts of the schedule.

In econometric estimation, on the other hand, the researcher proposes a model, generally in mathematical form, with all the variables involved in the relationship, and utilises data on the dependent and the explanatory variables to test certain hypotheses. Very often the Least Squares Method of Regression is used, and this permits the researcher to produce estimates of the extent to which every explanatory variable included in the model effects the dependent variable.

Very often diagrammatic expositions are used to propose theoretical relationships, which are then empirically investigated by some econometric method. As stated, the method used in the present paper is diamgrammatic, and is theoretical in nature. A formal mathematical derivation of the model however appears in the appendix, and it is intended to explain how the relationships shown in the diagrams can be estimated by the Least Squares method of regression.

A LABOUR MARKET MODEL

The labour market to be discussed in this paper consists of five relationships explaining (1) labour demand, (2) labour supply, (3) wage rate changes (4) observed unemployment and (5) observed employment.

Labour demand (by firms), measured by employment, is assumed to be influenced by wage rates, on the grounds that employers may decide to employ fewer labour services as the cost of employment increases.[1] Labour supply (by households), is also assumed to be influenced by wage rates, which may be considered as the opportunity cost of performing non-market work (such as housework).[2]

Wage rates are assumed to increase with excess labour demand and to decrease with excess labour supply. The most important difference between an equilibrium and a disequilibrium labour market model is that in the case of the former model, wage adjustment is assumed to be fast enough to ensure that disequilibrium does not persist, whereas in the latter model wage adjustment is assumed to be sluggish.

As is well known, unemployment may be caused by various factors. For the moment it is assumed that unemployment is due to shortage of labour demand in relation to labour supply. At a later stage, frictional unemployment, due for example to skill mismatches, will also be allowed for.

To start with, we shall assume equilibrium conditions, implying that actual employment[3] is equal to labour supply and labour demand, and that unemployment is equal to zero. This assumption, which will be abandoned at a later stage, is useful only in so far as it permits us to explain the main difference between the equilibrium and disequilibrium versions of the model.

In very simple terms, an equilibrium labour market model may be expressed as follows:

Labour Demand:	L^d is influenced by W and X^d	(1)
Labour Supply:	L^s is influenced by W and X^s	(2)
Wage Rate Adjustment:	ΔW is influenced by $[L^d - L^s]$	(3)
Unemployment:	$U = L^s - L^d = 0$ (assuming equilibrium	(4)
Employment:	$L = L^s = L^d$ (assuming equilibrium)	(5)

where L^d and L^s represent labour demand and labour supply respectively. X^d represents non-wage variables influencing labour demand, such as output and technology, whereas X^s represents non-wage variables influencing labour supply, such as population size and short-run economic conditions. W is the wage rate, and ΔW refers to changes in the wage rate.

In diagrammatic form, these relationships may be expressed as shown in figure 1. Figure 1a shows the demand and supply relationships,

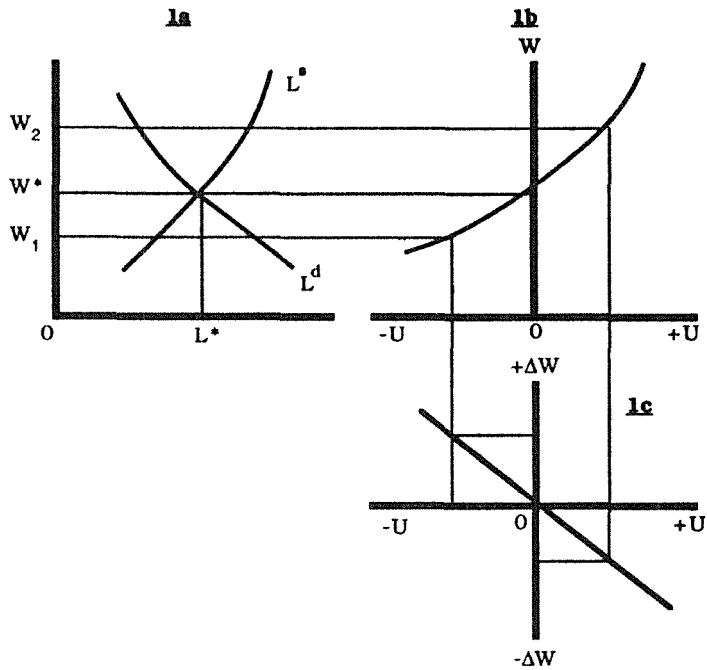
where equilibrium occurs at wage rate W* and employment L*. This equilibrium position may be disturbed at any time with shifts in the supply and/or demand schedules, caused by changes in X^s and/or X^d.

Figure 1b shows the rate of unemployment at different wage rates. It is zero at W*, assuming equilibrium. At wage rate W_2, unemployment is positive, since at this relatively high wage rate, labour demand is lower than labour supply. It is notionally negative at wage rate W_1, since at this wage rate, labour demand is higher than labour supply.

Figure 1c shows the wage adjustment function. The south-east quadrant of figure 1c shows that when unemployment is positive, wage rates decrease. Higher rates of unemployment would bring about faster wage rate decreases. The north-west quadrant of figure 1c shows that when labour demand is excessive in relation to labour supply, wage rates will rise. Wage rates are stable when unemployment is zero.

In this equilibrium scheme, wage inflation and unemployment can exist but cannot persist, since wage rates are assumed to change quickly in response to market disequilibrium, so as to eliminate excess supply or demand.

Figure 1. A Labour Market Model.



Although *involuntary* unemployment is to many of us an observed reality, some authors prefer to work with the assumption that the wage rate clears the market in all periods, and propose labour market models based on the equilibrium assumption. Such models impose the constraint that supply and demand for labour services are equal, so that the observed quantities are those shown by the intersection of the demand and supply schedules, as in equation (5) above.

This assumption may be justified on the grounds that the observed unemployment is the result of voluntary choice by the persons concerned to stay out of work. This choice can be rationalised in terms of labour supply theory, regarding the allocation of time to alternative uses. For example, among the unemployed persons, there may be those who refuse immediate offers of employment to improve the chances of finding a better job at some later date. In a way, this is similar to a person's voluntary decision to invest in his human capital through full time study, rather than by taking a job.[4]

This type of non-employment may occur even if job vacancies exist, and if the wage rate is at its equilibrium level. It may be considered as forming part of what Friedman (1968) called *The Natural Rate of Unemployment*, and is associated with searching for jobs. Therefore, irrespective of whether or not the persons concerned are registered as unemployed, such non-participation in market work is voluntary, and does not violate the assumption of equilibrium.

Such an interpretation of observed unemployment has been used to support the formulation of equilibrium labour market models. For example, Lucas and Rapping (1970), whose model postulates that the wage rate clears the market in all periods, suggest that even during the 1930's depression, there was no involuntary unemployment.[5]

Although it cannot be denied that measured unemployment contains a voluntary component, the implication that it contains nothing else is, to say the least, questionable.[6] In the real world, there may be persons who would be willing to take employment at the current or even lower wage rates, but who remain involuntarily unemployed because the current wage rate fails to adjust to its equilibrium level.

It is reasonable to assume, or at least to test the assumption, that the labour market may not clear, in which case it would not be correct to impose the condition shown as relation (5) above, which states that the transacted quantity of labour is equal to both labour supply and labour demand.

MODELS OF MARKETS IN DISEQUILIBRIUM

To allow for the possibility of market disequilibrium, the unemployment relation could be specified so as to include a term for

observed employment as follows:

$$L = \text{minimum of } L^d \text{ or } L^s \qquad (5')$$

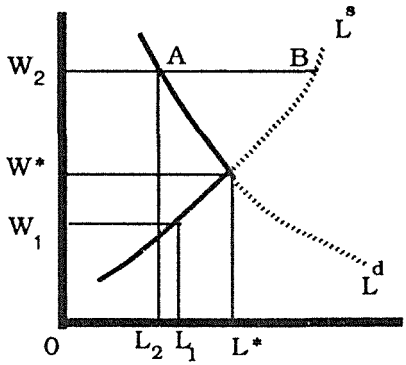
which states that the observed quantity of labour employed is equal to the quantity demanded or the quantity supplied, depending on which of the two is the lower.

This can be explained with respect to figure 2, which shows a hypothetical labour demand (L^d) and labour supply (L^s) schedules. In figure 2, W* and L* represent the equilibrium wage rate and the equilibrium amount of labour services respectively. At a wage rate higher than W*, say at W_2 the transacted quantity of labour, L_2, is determined by the amount that firms are willing to take at this relatively high wage rate. In this case, excess labour supply (involuntary unemployment) would be equal to AB.

At a wage rate lower than W*, say at W_1, the transacted quantity of labour (L_1) is determined by the amount that households are willing to offer at this relatively low wage rate.

Thus the quantity of labour transacted cannot be on the dotted line sections of the labour demand and labour supply schedules, but on the solid line sections, which is known as 'the short side of the market'.

Figure 2. The Short Side of the Labour Market



Relation (5') therefore expresses all possible points on the short side of the market.

It should be noted with respect to figure 2 that observed employment would be on the demand schedule, when $W > W^*$ and excess supply is implied, and on the supply schedule, when $W < W^*$ and excess demand is implied. It is on both schedules when $W = W^*$ and equilibrium is implied.[7]

In a disequilibrium market model, it is not assumed that the wage rate adjusts completely to clear the market, and it cannot therefore be taken for granted that $L = L^d = L^s$ at all times, so that, before assigning employment observations to labour demand or labour supply, one has to partition the sample into excess supply or excess demand regimes.

ESTIMATING DISEQUILIBRIUM MARKETS MODEL

The question of whether or not wage rates adjust to the equilibrium rates is an empirical one, and cannot be settled on *a priori* grounds.[8] To some, the presence of institutional factors such as minimum wage legislation is sufficient evidence that the wage rate does not necessarily adjust to clear the market.

The speed of wage adjustment can be investigated empirically through econometric methods developed for this purpose. Econometric methods of estimating the coefficients of markets in disequilibrium is of fairly recent origin. In their seminal paper on the subject, Fair and Jaffee (1972) suggested several procedures of specifying and estimating demand and supply schedules in uncleared markets. This problem was subsequently considered by others[9] who introduced variants of the models suggested by Fair and Jaffee. Basically, these methods can be grouped into three categories, namely:

1. methods which are not based on wage-changes information, and the sample of observatios is separated into excess supply and excess demand regimes on the basis of some other criteria. As a general rule, econometric criteria are not sufficient for this purpose, and the researcher has to rely on partition rules chosen by himself, such as for example, the assumption that periods characterised by large layoff rates or low capacity utilisation belong to the excess supply regime.[10]

The Least Squares method of regression is then applied to estimate the labour demand coefficients, (such as the demand/wage elasticity) utilising data for the periods assigned to the excess supply regime, since as noted with respect to figure 2, during periods of excess supply, only labour demand is observed. The coefficients of the labour supply equation are estimated utilising data for periods assigned to the excess demand regime.

2. methods where information about the direction, but not the magnitude, of wage changes is available and used as an indicator of the presence of excess supply or excess demand. This procedure is sometimes referred to as the *Directional Method.*

It is assumed that when the wage rate is higher than its equilibrium level, excess supply exists, in which case market forces will exert downward pressures on the wage rate. If on the other hand, the wage

rate is lower than its equilibrium level, excess demand is implied, in which case the wage rate would tend to increase.

Following this assumption, it is postulated that if the current period wage rate is observed to increase relative to that of the previous period, the current period is characterised by excess demand. In this case the transacted quantity of labour in the current period is assumed to belong to the supply schedule, as shown in figure 2.

On the other hand, when the current period wage rate is observed to decrease, current period observations are assigned to the excess supply regime, in which case the transacted quantity would represent labour demand, as shown in figure 2.

The labour demand (or labour supply) relation can then be estimated separately, utilising data for periods when the transacted quantity of labour is assumed to belong to the demand (or supply) schedule.

One problem with this and the previous procedure method is that the number of observations, which may already be limited, would have to be divided into two regimes, and therefore degrees of freedom are lost in the estimation procedure. Another problem is that it may be difficult to allow for the presence of non-market forces in wage adjustment. In particular, there is the possibility that in the presence of excess supply, wage rates increase due to union activity, in which case, the transacted quantity would be mistakingly assigned to the excess demand regime.

3. methods utilising information about the magnitude of price changes to estimate the amount of excess supply, or excess demand. This procedure is sometimes referred to as the *Quantitative Method* . Unlike the other methods just described, the Quantitative Method is not based on the *a priori* assumption that disequilibrium exists and persists, but it can be used to derive an expression to estimate the speed with which the wage rate adjust to clear the market. The basic assumption made for estimation purposes is that the difference between current period and previous period wage rate is related, in terms of magnitude, to the extent of excess labour demand. This third method therefore involves estimating the magnitude of the slope in figure (1c).

A finding of slow or sluggish adjustment is interpreted as evidence that disequilibrium exists and persists. The procedure is somewhat too lengthy and technical to present here. It is explained in Briguglio (1984), and presented in summary form in the appendix to the present study.

The Quantitative Method has several advantages over the other two described earlier. Apart from the fact that it does not take disequilibrium for granted, it permits the researcher to use all the observations in the

sample to estimate the coefficients of the model, and allows for the effects of non-market forces on wage rate changes.

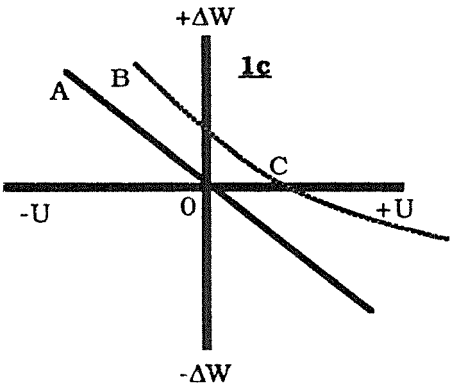
NON-MARKET FORCES

The method just described can be used to test for the effects of non-competitive elements on wage rate changes. An important consideration in this respect is union activity.[11] If the non-competitive elements are denoted by N, the wage adjustment equation can be modified as follows:

$$\Delta W \text{ is influenced by } [L^d - L^s] \text{ and } N \qquad (3')$$

the difference between relations (3') and (3) can be shown in diagrammatic form as in figure 3.

Figure 3. Non-Market Forces



Line A of figure 3 shows the wage adjustment in the absence of non-competitive forces. In this case, wage changes occur as a result of excess labour demand or excess labour supply. Thus, when excess demand is zero, wage rate changes are also zero. Curve B, on the other hand, indicates that as a result of upward pushes on wage rates by non-competitive forces, wage rates changes are positive even when there is no excess labour demand. In this hypothetical case, non-competitive forces work against market forces, and it takes an excess supply larger than OC to bring about a decrease in wage rates.

Notice also that wage adjustment is assumed to be slower in the downward direction. This is shown by the non-linear section of curve B, and reflects amonst other things, institutional factors which tend to work against flexible downward wage adjustment.

This inclusion of variables representing non-competitive forces in the wage adjustment relation means that the partitioning of the sample into excess supply and excess demand regimes no longer depends on

whether wage rate changes are positive or negative, since positive wage rate changes may no longer signify excess demand. The mathematically minded reader would find in the Appendix a more rigorous explanation of how non-competitive elements enter the model.

MARKET FRICTIONS

The relationships described so far are based on the assumption that unemployment is equal to excess labour supply in relation to labour demand. In reality, unemployment may be caused by what are known as market frictions, which result in unfilled job vacancies. In other words, there may be an amount of jobs demanded by firms which cannot be filled due to such factors as skill mismatches, lack of information about market conditions, and lack of labour mobility.

Under these circumstances, observed unemployment would have to be redifined as follows:

$$U = (L^s - L^d) + V \qquad (4')$$

Relation (4') states that observed unemployment is excess labour supply plus unfilled vacancies. In other words, the number of labour force members without a job includes those who do not have one due to the fact that the going wage rate is higher than its equilibrium level, and those who would have had a job in the absence of market frictions.

Also, with the presence of market frictions, labour demand and employment cannot be assumed to be equal, since a fraction of demand remains unsatisfied.

As a result, relation (5) would also have to be modified to allow for a respectification of the short side of the market, as follows:

$$L = \text{minimum of } (L^d - V) \text{ or } L^s \qquad (5'')$$

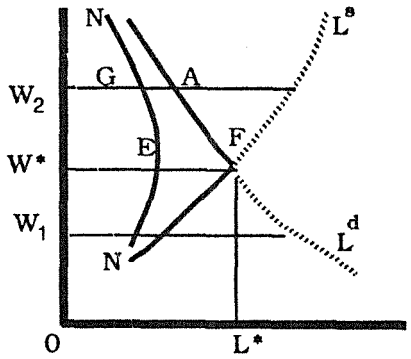
Relation (5") states that the observed employment is labour demand less job vacancies, or labour supply, whichever is the smaller.

Relation (4') and (5") can be explained in terms of figure 4.

In figure 4, L^d and L^s are drawn as before. This time however, employment and labour demand are not assumed to be synonymous. For example at wage rate W_2 labour demand is denoted by W_2A. This measures the number of jobs available. The number of unfilled vacancies is AG. Employment is therefore W_2G. At wage rate W^*, labour demand is W^*F, unfilled vacancies is FE, so that employment is W^*E. In other words, in an equilibrium situation, unemployment exists due to market frictions.

It should be noted that in figure 4, the number of unfilled vacancies increases as labour demand increases. This implies that frictional

Figure 4. The Short side of the Market with Job-Vacancies



unemployment increases as excess supply increases. One reason for this is that as unemployment increases, job search for the existing vacancies becomes more efficient.[12]

In figure 4, the curve NN shows observed employment at each level of W. It is drawn to the left of both the L^s and L^d curves, suggesting that actual employment is always lower than labour demand or labour supply.

An important implication of figure 4 is that W*, which is the equilibrium wage rate, is compatible with a certain amount of frictional unemployment, equal to EF.

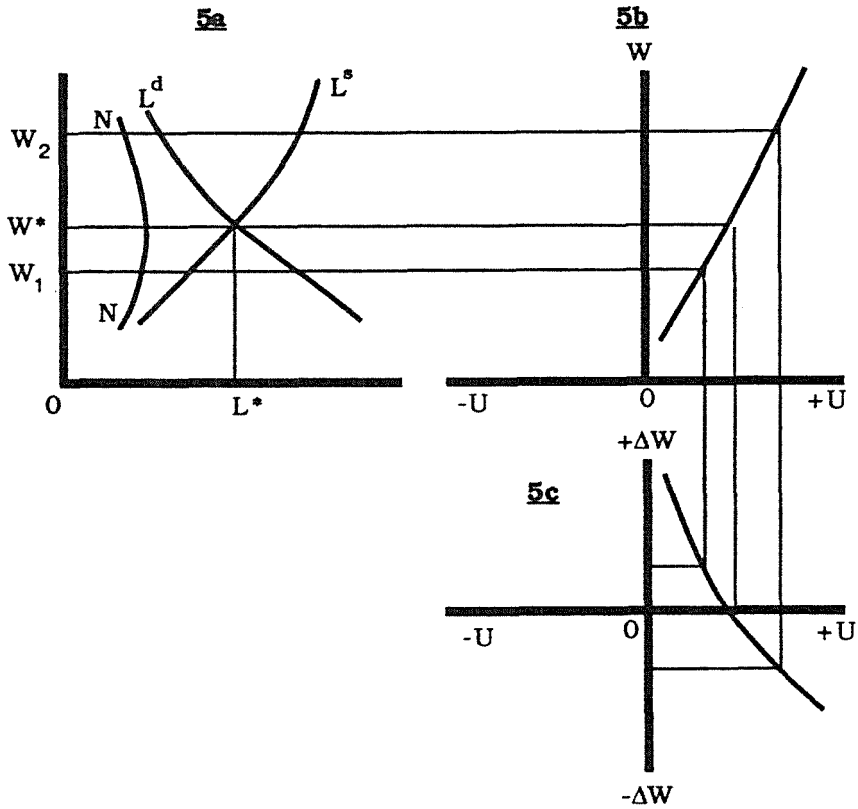
INCORPORATING MARKET IMPERFECTIONS

Diagrams (3) and (4) can be combined into a single diagram depicting a disequilibrium labour market model as shown in figure 5.

Figure 5a shows the labour demand, labour supply and observed employment schedules. As explained with reference to figure 4, the observed quantity of employment is shown by the curve NN. Figure 5b shows the extent to which unemployment rates change with the wage rate. Unlike figure 1b, at the equilibrium wage rate, unemployment exists. It should be noted that unemployment in figure 5 covers excess supply and frictional unemployment.

Figure 5c shows the wage adjustment equation. The wage adjustment equation does not pass from the origin due to the imperfections described above. Firstly, due to the possibility of non-competitive forces, pushing up wage rates even in the presence of unemployment, we may have positive wage changes compatible with excess labour supply. Secondly, due to the presence of market frictions, we may have positive wage changes compatible with a degree of frictional unemployment.

Figure 5. A Disequilibrium Model



It should be noted that union pushfulness and frictional unemployment do not in themselves explain wage inflexibility. It is possible, for example, that following a wage increase demanded by a union during periods of excess supply, market forces operate to bring back the real wage rate to an equilibrium level again. Similarly, the presence of market frictions implies that unemployment may exist at an equilibrium wage rates, but not necessarily that wage rates are inflexible.

DISEQUILIBRIUM AND THE PHILLIPS CURVE

Figure (5c) may be compared to the Phillips curve relation which also starts from the premise that wage rate changes and excess demand for labour are related. Literature on the Phillips curve abounds[13], and has been reviewed elsewhere. Most of the empirical attempts to estimate the Phillips relation followed Lipsey's (1960) lead in that they were based

on the explicit or implicit assumption that there exists a transformation between excess labour demand and the rate of (observed) unemployment. The validity of this assumption has been questioned.[14]

Figure (5c) is not based on this assumption, and since it directly uses the determinants of labour demand and labour supply. The problem of whether or not the observed unemployment is a good proxy for excess labour demand or supply is therefore avoided.[15]

In some studies on wage adjustment, additional explanatory variables, besides the rate of unemployment have been included. Among these one finds price changes[16], profit rate or its rate of change[17], and productivity.[18] These variables may influence wage rate changes directly, and indirectly through their effects on labour demand and supply. The indirect effects would therefore be already represented by the unemployment rate, if the latter is considered to be an index of excess labour demand (or supply). The meaning attached to the coefficients in the wage setting equation have therefore to be interpreted in this light, and care must be taken not to include variables which are already represented by the rate of unemployment, and which may therefore be redundant.[19]

CONCLUSION

Models that impose the *a priori* condition that the labour market is always characterised by equilibrium may not represent reality in the presence of slow wage adjustment. It was shown in this study that it is possible to specify a labour market model which, while not excluding the possibility of equilibrium, allows for the existance of excess supply or demand.

It was shown that the incorporation of a wage adjustment relation in the model permits the researcher to explain and possibly estimate the degree of sluggishness in market clearing, and even to assess the impact of non-market forces on wage rate changes.

The explanation of disequilibrium models is somewhat more complicated than the more convenient explanation of equilibrium models. The improvement in relevance, however, particularly with respect to the labour market, where non-market clearing is a distinct possibility, would seem to warrant the extra effort involved.

A MATHEMATICAL FORMULATION OF A DISEQUILIBRIUM LABOUR MARKET MODEL

A. The Equations

Labour Demand:	$LD = aW + bX$	(1)
Labour Supply:	$LD = cW + dY$	(2)
Wage Adjustment:	$W - W_{-1} = e(LD - LS) + fN$	(3)
Unemployment:	$U = LS - LD$	(3)
Observed Employment:	$L =$ minimum LS, LD	(5)

where: LD = labour demand
LS = labour supply
W = current period wage rate
W_{-1} = previous period wage rate
U = unemployment
L = observed employment
X = non-wage variable affecting LD (other variables may be added)
Y = non-wage variable affecting LS (other variables may be added)
N = non-excess demand variables affecting wage adjustment.

All variables are current period observations, unless otherwise stated. The lower case coefficients would represent elasticities if the variables are measured in logs.

B. Deriving an Expression with the Demand Relation Coefficients.

Since market equilibrium is not imposed, observed labour cannot be assumed to belong to the demand schedule during all periods.

According to equation (5) labour demand (and not labour supply) would be observed, i.e. L = LD, in periods when excess supply exists, i.e. when the current wage rate (W) exceeds the equilibrium wage rate (W*). Thus we can write:

$$L = aW + bX \qquad \text{if } W > W^* \tag{6}$$

During periods of excess demand, labour supply is observed i.e. L = LS. An expression for labour supply may be obtained by rearranging equation (3) as follows:

$$LS = LD - 1/e\ (W - W_{-1} - fN)$$

Substituting for LD and given that in periods of excess demand, L = LS, the above can be written as:

$$L = aW + bX - 1/e\ (W - W_{-1} - fN) \qquad \text{if } W < W^* \tag{7}$$

Combining equations (6) and (7):

$$L = aW + bX - 1/eG \tag{8}$$

where:

$$G = (W - W_{-1} - fN) \text{ if } W < W^*$$
$$\text{and } G = 0 \text{ otherwise.}$$

The term [1/eG] is therefore introduced as an implicit adjustment for excess demand. There still remains the problem, however, of establishing when $W < W^*$ in order to compute the value of G.

C. Deriving an Expression with the Supply Relation Coefficients

According to equation (5) labour supply (and not labour demand) would be observed, i.e. $L = LS$, when excess demand exists, i.e. when the current wage rate (W) is lower than the equilibrium wage rate (W*). thus we can write:

$$L = cW + dY \qquad \text{if } W < W^* \tag{6'}$$

During periods of excess supply, labour demand is observed i.e. $L = LD$. An expression for labour demand may be obtained by rearranging equation (3) as follows:

$$LD = LS + 1/e\ (W - W_{-1} - fN)$$

substituting for LS and given that in periods of excess supply $L = LD$, the above can be written as follows:

$$L = cW + dX + 1/e\ (W - W_{-1} - fN) \qquad \text{if } W > W^* \tag{7'}$$

Combining equations (6') and (7'):

$$L = cW + dX + 1/eH \tag{8'}$$

where:

$$H = (W - W_{-1} - fN) \qquad \text{if } W > W^*$$
$$\text{and } H = 0 \text{ otherwise.}$$

The term [1/eH] is introduced as an implicit adjustment for excess supply. As before, there still remains the problem of establishing when $W < W^*$ in order to compute the value of H.

D. Establishing when $W < W^*$ *from Observed Data*

Substitute (1) and (2) into (3):

$$W - W_{-1} = e(aW + bX) - (cW + dY) + fN$$

which when rearranged yields:

$$\{1-[e(c-a)]\}W = W_{-1} + e(bX - dY) - fN \quad (9)$$

In a situation of equilibrium LS = LD and $W = W^*$ so that

$$aW^* + bX = cW^* + eY$$

which when rearranged gives

$$(c-a)W^* = bX - dY \quad (10)$$

Now substitute equation (10) into (9) to obtain the following:

$$\{1-[e(c-a)]\}W = W_{-1} + e(c-a)W^* - fN \quad (11)$$

so that:

$$W = iW_{-1}(1-i)W^* - (if)N \quad (12)$$

where:

$$i = 1/\{1+[e(c-a)]\} \quad (13)$$

which when rearranged gives:

$$W^* - W = [i/(1-i)]\ [W - W_{-1} - fN] \quad (14)$$

the coefficient i takes a value of between zero and unity given that e and (c − a) are both positive, (as is reasonable to assume). Therefore equation (14) states that:

i. if $W - W_{-1} - fN > 0$ then $W^* < W$ and excess supply is implied.
ii. if $W - W_{-1} - fN < 0$ then $W^* > W$ and excess demand is implied.
iii. if $W - W_{-1} - fN = 0$ then $W^* = W$ and equilibrium is implied.

The sign of the expression $(W - W_{-1} - fN)$ therefore is an indicator of excess supply or excess demand. All the terms in the expression, with the exception of the coeficient f are observable variables. The next step is to produce an expression for the coefficient f utilising observable variables.

This can be done by rearranging equation (9) and substituting equation (14) into it as follows:

$$W = iW_{-1} + \{[1-h)/(c-a)]b\}X - \{[1-h)/(c-a)]a\}Y + (if)N \quad (15)$$

Equation (15) can be estimated by the method of least squares, from which the estimate of i is obtained, and by substitution, an estimate of f.

Once i and f are estimated the researcher would be in a position to compute the right hand side of equation (14) and to assign observations to the excess supply and excess demand regime. This would then enable the researcher to compute G of equation (B), and H of equation (B'). In

turn this would permit the estimation of equation (B) and (B') and therefore of the coefficients of the demand and supply relations.

The parameter i is of interest with respect to the state of the market. It can be seen from equation (13), that if e takes a value of zero [implying infinitely slow wage adjustment in equation (3)], then i would take a value of unity. If on the other hand e takes a value of infinity, implying instantaneous wage adjustment, then i takes a value of zero.

The estimated value of i from equation (15) would therefore indicate whether the equilibrium assumption is valid. If i is found to differ significantly from zero, then it would not be correct to assume equilibrium, since such a value of i implies sluggish wage adjustment.

E. Some Comments

The model just described can be estimated by the method of Least Squares, given data on the variables listed in section A of this appendix. The two-stage Least Squares may be appropriate to allow for the endogeneity of wage rates, labour demand and labour supply. The procedure would involve estimating equation (15) first, and then using the predicted values of W and the estimated values of i and f, to estimate equations (8) and (8').

It should be noted that the above model does not allow for unfilled job vacancies in equations (4) and (5). The introduction of unfilled vacancies would complicate the exposition, since the criteria for partitioning the sample into excess supply and excess demand regimes would have to allow for the assumption that a component of labour demand is not actually observed as employment.

Another point to notice is that equation (3) assumes the same speed of upward and downward wage adjustment. The model can be formulated in such a way as to assume slower downward adjustment, and this assumption can then be tested econometrically.

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Notes

[1] The relationship between Labour demand and wage rates can be explained in terms of the law of diminishing marginal productivity, which in turn could be formally derived from an assumed underlying production function. See Briguglio (1985).

[2] For a discussion on the variables, including wage rates, which are thought to affect labour supply on macro-economic level see Bowen and Finegan (1969).

[3] In this discussion, the transacted quantity of labour is assumed to be that observed, which in the text of this paper is sometimes referred to as *employment*. For a discussion on the various concepts associated with market quantities see Grossman (1974).

[4] The 'New Microeconomics' approach [see for example phelps et al (1970] allows for search unemployment, which is frictional and voluntary in nature. One implication of this approach is that unemployment may be an investment in better utilisation of employed persons at some future date (op. cit. p. 17).

[5] In their study, which covered the period 1929 – 1965, Lucas and Rapping consider observed unemployment as 'consisting of persons who regard the wage rate at which they could be currently employed as temporary low and who therefore choose to wait, or search, for improved conditions . . .' (p. 285).

[6] The work of Lucas and Rapping (1970) was heavily criticised for this underlying assumption by Rees (1970) who has this to say about the equilibrium assumption contained in the Lucas and Rapping model: 'It is of great convenience in fitting simultaneous equation models to be able to assume that quantity supplied is equal to quantity demanded, but where the world is not obliging enough to satisfy this condition, econometricians may be forced, to go through the trouble of making more realistic assumptions'. (p. 309).

[7] This suggests that single equation models of labour demand would be misspecified, if in the presence of excess demand, observations of the quantity of labour are assigned to the demand schedule.

[8] Wage rigidity may be due to institutional factors, such as minimum wage legislation, union resistance to wage cuts, and wage contracts which bind the employers to retain a certain wage rate, irrespective of market conditions.

It should be noted that the wage adjustment relation is specified in discrete units, compatible with observable wage and labour quantities, the data for which is usually published in discrete time intervals (monthly, quaterly or annually). The numerical value of the coefficient c_1, therefore depends on the length of the time interval between one period and another. For a discussion on the relation between discrete and continuous-time versions of the wage adjustment mechanism see Bowden (1978b), pp. 84 – 88.

[9] See for example Bowden (1978), Fair and Kelejian (1974), Godfield and Quandt (1975), Laffont and Garcia (1977), Maddala and Nelson (1974) Rosan and Quandt (1978), Quandt (1983), and Briguglio (1984).

[10] One method that may be used for this purpose is a maximum likelihood procedure, suggested by Quandt (1958). Reece (1976) utilised a version of this model together with *a priori* information to assign observations to the demand or supply schedules.

[11] Union activity is sometimes measured by the rate of change of union density [see Hines (1969)] or by an index of strike action [see for example Johnston and Timbrell (1974)].

[12] On the relation between job vacancies and unemployment see Hansen (1970). A number of empirical studies on this relation conclude that there is a negative relation between job vacancies and unemployment. See for example Dow and Dicks-Mireau (1958).

[13] See for example, Santomero and Seater (1978) and Laidler and Parkin (1977).

[14] See for example, Corry and Laidler (1967).

[15] A similar approach was utilised by McCallum (1974).

[16] See for example Eckstein and Wilson (1962).

[17] See for example Perry (1966).

[18] See for example Kuh (1967).

[19] See Archibald (1969) for a discussion on what he calls 'intruders' in the Phillips relation.

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