ECONOMIC ANALYSIS AND WORKERS'
MANAGEMENT, 3, XXII (1988), 177—196

EQUILIBRIUM AND DISEQUILIBRIUM LABOUR MARKET MODELS

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Summary

This paper discusses two versions of an aggregate labour market model, the first of which is based on the assumption of market equilibrium, whereas the second is not. It is argued that the equilibrium version imposes what may be regarded as an unrealistic constraint, namely that the wage rate clears the market in all periods. The disequilibrium version does not rule out the possibility of equilibrium, but allows for the existence of excess labour supply or demand. The paper also describes some procedures suitable for estimating coefficients of disequilibrium labour market models. It is shown that a particular specification of these types of models permits the researcher to investigate whether or not the assumption of equilibrium is valid.

INTRODUCTION

Although unemployment is 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 transacted quantities are those shown by the demand and supply schedules.

In contrast, other authors allow for the possibility of inequality between labour supply and labour demand, implying that the transacted quantity need not be at its equilibrium level.

In this paper, these two versions of labour market models will be compared. It will be argued that the disequilibrium version has the advantage that it is more general, in that, while not ruling out the possibility of market equilibrium, it allows the researcher to test whether or not the equilibrium assumption is valid.

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THE EQUILIBRIUM VERSION

A very simple model of an equilibrium labour market model consists of three equations, the first and second of which explain how labour demand and labour supply are determined, while the third expresses an identity, equating labour demand and labour supply with the transacted quantity of labour.[1]

The model can be specified as follows:

$$L^d_t = a_o + a_1W^*_t + a_2X^d_t + U^d_t \tag{1a}$$

$$L^s_t = b_o + b_1W^*_t + b_2X^s_t + U^s_t \tag{1b}$$

$$L^*_t = L^d_t = L^s_t \tag{1c}$$

where L^d and L^s are the quantity of labour services demanded and supplied, X^d and X^s are different exogenous variables influencing labour supply and U^d and U^s are random factors affecting labour demand and labour supply. W^* is the equilibrium wage rate. L^* refers to the transacted quantity. The supply and demand relations can of course be extended to include any number of exogenous variables, some of which, but not all, may be common to both equations.[2]

Given the simultaneous determination of wage rates, labour demand and labour supply, and given that the system is identified, the structural equations can be estimated by some appropriate econometric technique, such as the Two Stage Least Squares.

The reduced-form equations of the equilibrium model can be obtained by substituting the structural equations into each other as follows:

$$W^*_t = \frac{a_o - b_o}{b_1 - a_1} + \frac{a_2}{b_1 - a_1} X^d_t - \frac{b_2}{b_1 - a_1} X^s_t + \frac{U^d_t - U^s_t}{b_1 - a_1}$$

$$L^*_t = \frac{a_ob_1 - a_1b_o}{b_1 - a_1} + \frac{a_2b_1}{b_1 - a_1} X^d_t - \frac{a_1b_2}{b_1 - a_1} X^s_t + \frac{U^d_tb_1 - U^s_ta_1}{b_1 - a_1}$$

These reduced form equations will later on be compared with those obtained from a disequilibrium model. It should be noted that the equation for L^* applies to both the demand and supply of labour.

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[1] In this discussion, the transacted quantity of labour is assumed to be that observed. For a discussion on the various concepts associated with market quantities see Grossman (1974).

[2] For a discussion on the variables which affect labour supply on macro-economic level see Bowen and Fenegan (1969). A discussion on the market labour demand relation is given in Briguglio (1985).

INVOLUNTARY UNEMPLOYMENT AND EQUILIBRIUM

The equilibrium model of the labour market imposes the constraint that the amount of labour services that firms are willing to hire is equal to the amount that households are willing to supply, and involuntary unemployment is ruled out by assumption.

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 by taking a full-time university course, rather than take a job.[3]

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 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.[4]

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.[5]

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[3] 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 even be productive, in the sense that today's unemployment may be an investment in better utilisation of employed persons at some future date (op. cit. p. 17).

[4] 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).

[5] The work of Lucas and Rapping (1970) was heavily criticised for this underlying assumption by Rees (1970) who had 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).

In the real world, there may be persons who would be willing to take employment at the current or even lower age rates, but who remain involuntarily unemployed because the current wage rate fails to adjust to its equilibrium level. Theoretically one would expect that, given wage rate flexibility, market forces would cancel out excess supply through a fall in wage rates. This adjustment may however not take place due to wage rigidity or stickiness.[6]

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 equation (1c) above, which states that the transacted quantity of labour is equal to both labour supply and labour demand.

MODELS OF MARKETS IN DISEQUILIBRIUM

An equation which allows for the possibility of market disequilibrium is the following:

$$L_t = min\ (L^d_t,\ L^s_t) \tag{2c}$$

which states that the transacted quantity of labour is equal to the quantity demand or the quantity supplied, depending on which of the two is the minimum.

This can be explained with respect to figure 1, which shows hypothetical labour demand (L^d) and labour supply (L^s) schedules. In figure 1, 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«.

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[6] Wage rigidity may be due to imperfections within the labour market itself. For example, workers enter into contracts which bind the employers to retain a certain wage rate, irrespective of market conditions. This type of wage stickiness is more likely to occur in the downward direction.

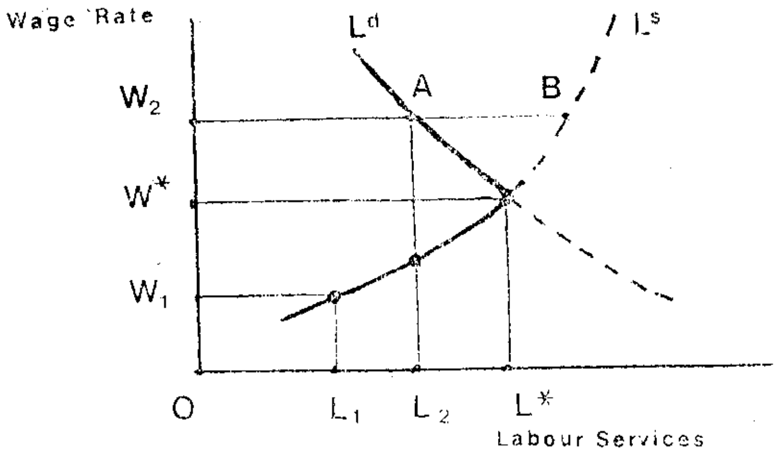

Figure 1. The Short Side of the Labour Market

Equation (2c) therefore expresses all possible points on the short side of the market.[7]

ESTIMATION DISEQUILIBRIUM MARKETS

The development of 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 for specifying and estimating demand and supply schedules in uncleared markets. This problem was subsequently considered by others[8] 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 price setting information, and the sample of observations is separated into supply and demand regimes on the basis of some econometric criteria. An example of this method, based on a Maximum Likelihood procedure, will be described here.

2. methods where information about the direction of price changes is available and used as an indicator of the presence of excess supply or excess demand. This method will be referred to as the Directional Method.

3. methods where information about the magnitude of price changes is available and used as an indicator of the amount of excess supply, or excess demand. This method will be referred to as the Quantitative Method.

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

These three categories of estimation methods will be explained with respect to the following four equations:

$$L^d_t = a_o + a_1 W_t + a_2 X^d_t + U^d_t \tag{2a}$$

$$L^s_t = b_o + b_1 W_t + b_2 X^s_t + U^s_t \tag{2b}$$

$$L_t = min\ (L^d_t, L^s_t) \tag{2c}$$

$$W_t - W_{t-1} = f\ (L^d_t - L^s_t) \tag{2d}$$

Equations (2a) and (2b) are similar to equations (1a) and (1b) with the exception that W is no longer assumed to be at its equilibrium level. Equation (2c) has already been explained.

Equation (2d) states that the wage rate increases between any two periods as some function of excess labour demand, and decreases as some function of excess labour supply.

ABSENCE OF WAGE SETTING INFORMATION

This method utilises equations (2a), (2b) and (2c), but not equation (2d). The basic difficulty associated with this method is that the researcher cannot resort to the direction or the magnitude of wage rate changes as a guide for assigning observations either to the supply schedule or to the demand schedule.

An estimation technique that has been sugested for models of this type is the maximum likelihood method. Fair and Jaffee (1972) suggest a relatively simple procedure, based on the assumption that the observed quantity belongs to either the demand schedule or the supply schedule, but not to both. The method involves the generalisation of Quandt's (1958) Maximum Likelihood technique for identifying switching points, in the case of the above model, from equation (2a) to equation (2b).

Equations (2a) and (2b) can be combined as follows:

$$L_t = k_t\ (a_o + a_1 W_t + a_2 X^d_t + U^d_t) +$$

$$+\ (1 - k_t)\ (b_o + b_1 W_t + X^s_t + U^s_t)$$

where $k_t = 0$ if $L_t = L^s_t$ and $k_t = 1$ if $L_t = L^d_t$.

The object of the exercise is to separate the sample into periods where $k = 0$, in which case demand is observed, and others periods where $k = 1$, in which case supply is observed.

Assuming that U^d and U^s are normally distributed with mean zero, and constant variances and that U^d and U^s are independent from each other and from their own lagged values, the likelihood of the demand and supply observations can be combined in one likelihood function for the entire sample as follows:

$$L = (2\pi\sigma^2_d)^{-T^d/_2}\, 2\, (\pi\sigma^2)^{T^s/_2}\ \ \text{EXP}\left[-\frac{1}{2\sigma^2_d} \sum^{T^d} (L^d_t - a_o - a_1 W_t - a_2 X^d_t)^2 \right.$$

$$\left. - \frac{1}{2\sigma^2_s} \sum^{T^s} (L^s_t - b_o - b_1 W_t - b_2 X^s_t)^2 \right]$$

where σ_d and σ_s are the standard deviations of U^d and U^s respectively. T^d is the number of observations for which $L = L^d$, (when $k = 1$) whereas T^s is the number of observations for which $L = L^s$ (when $k = 0$), so that $T^d + T^s = T$, the total number of observations.[9]

Assuming for the moment that T^s and T^d are known, the normal least squares estimates of the coefficients of equations (2a) and (2b) can be found by maximizing the log likelihood function with respect to the these coefficients.

The estimates of the variances of U^d and U^s can also be found by maximizing the log likelihood function with respect to σ_d and σ_s to obtain the following expressions:

$$\hat{\sigma}^2_d = \sum^{T^d} (L^d_t - \hat{a}_o - \hat{a}_1 W^d_t - a_2 X^d_t) \,/\, T^d$$

and

$$\hat{\sigma}^2_s = \sum^{T^s} (L^s_t - b_o - b_1 W_t - b_2 X^s_t) \,/\, T^s$$

which can be substituted back into the likelihood function. The resulting equation, transformed into logs, would then be:

$$Log\, L = -(T^d + T^s)\, log \sqrt{2\pi} - T^d\, log\, \hat{\sigma}_d -$$

$$- T^s\, log\, \hat{\sigma}_s - \frac{T^d + T^s}{2} \qquad (3)$$

The method involves the use of an iterative procedure to choose sample separations of size T^d and T^s, which after substituting in equation (3) give the maximum maximorum of Log L. In practice this amounts to performing OLS regressions to obtain the coefficients of equations (2a) and (2b) for all possible sample separations, and use these estimates to compute σ^d and σ^s, which together with T^d and T^s

[9] When multiplied by each other, the likelihood of the supply and demand observations produce the likelihood for the entire sample, since it is assumed that no observations belong to both regimes, and that the error terms of both relations are independent of each other.

are substituted into equation (3), after which this equation is maximized. The estimates that correspond to the sample separation which yields the highest maximum of equation (3) are taken to belong to the demand or supply regimes.

One problem with this method is that the number of iterations required to take account of all possible separations in order to compute the highest possible maximum of equation (3) may be too large, and not feasible in practice. To avoid this problem, some of the observations may be assigned to the demand or supply schedules on *a priori* grounds. Reece (1975) for example, utilised prior information regarding quit rates, layoffs, unemployment and capacity utilisation, to assign certain observations to one regime or the other, and thereby reduced the possible number of sample separations to a manageable proportion.

THE DIRECTIONAL METHOD

Unlike the previous method, the Directional Method makes use of information regarding wage rate changes in order to assign observations to the demand and supply regimes. Specifically it is postulated that equation (2d) has the following form:

$$W_t - W_{t-1} \gtreqless 0 \quad \text{as} \quad L^d_t \gtreqless L^s_t \tag{2d'}$$

According to equation (2d'), if the current period wage rate is observed to increase relative to that of the previous period, it is assumed that the current period wage rate is lower than its equilibrium level, in which case the current period observations are assigned to the excess demand regime. In this case, the transacted quantity would represent labour supply, as shown in figure 1. 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.

When the current wage rate is observed not to change, it is assumed that the current period observations belong to both regimes, and equilibrium is therefore implied.[10]

An alternative method of assigning the sample of observations to the excess demand and excess supply regime is by respecifying equation (2d') as:

$$W_t - W^*_t \gtreqless 0 \quad \text{as} \quad L^d_t \gtreqless L^s_t$$

[10] The wage adjustment equation (2d') is a general one, and more specific formulations may be proposed. The wage adjustment for example may be assumed to operate within or outside the current period [see Laffont and Garcia (1977), p. 1191]. It is possible to make allowance for price expectations by including expected (as distinguished from current) price changes. [see for example, Peel and Walker (1978)].

This equation states that a wage rate higher (lower) than its equilibrium level implies excess supply (excess demand). Since it cannot be assumed that the observed wage rate is the equilibrium wage rate, some method has to be devised to estimate W^*. Dawson (1979), for example, used a variety of time-series regressions in order to compute values of W^* from observed wage rate values.

There are at least two problems which are common to this and the previous methods. The first is that the number of observations have to be divided into two regimes, and therefore degrees of freedom are lost in the estimation procedure. The second is related to serial correlation. If one postulates first order serial correlation for example, the error term lagged one period may not belong to the same regime as the previous period. Fair and Jaffee suggest that as a practical matter, it is better to assume that the previous observation belongs to the current regime, than to ignore serial correlation altogether.[11]

THE QUANTITATIVE METHOD

This method utilises a more specific assumption regarding the wage setting process, in that the magnitude, and not' just the direction, of wage rate changes is taken to be an indicator of excess demand and excess supply.

This method respecifies equation (2d) as follows:

$$W_t - W_{t-1} = c\,(L^d_t - L^s_t), \qquad c \geqslant 0 \qquad \text{(2d'')}$$

Equation (2d'') states that the difference of current period wage rate relative to the previous period wage rate is proportional to excess labour demand. The equation implies that the coefficient c is related to the speed with which the wage rate adjusts to its equilibrium level. Thus if c takes a value of zero, the implication is that wage rates do not respond to excess demand, and market clearing therefore does not ocur. If on the other hand c takes a value of infinity, the implication is that wage rate adjustment is instantaneous.[12]

It is recalled that, with respect to the short side of the market shown in figure 1, in periods of rising wage rates, labour demand exceeds labour supply, and the transacted and observed quantity would therefore belong to supply. Symbolically, this means that:

$$L_t = L^s_t = b_0 + b_1 W_t + b_2 X^s_t + U^s_t; \qquad \text{if } (W_t - W_{t-1}) > 0 \qquad \text{(4a)}$$

[11] Op. cit. p. 510.

[12] It should be noted that equation (2d'') is specified in discrete time units, compatible with observable wage and labour quantities, the data for which is usually published in discrete time intervals (monthly, quarterly or annually). The numerical value of the coefficient c_2, 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.

On the other hand, in periods of falling wage rates, labour demand would be observed. Again, symbolically this means that:

$$L_t = L^d_t = a_o + a_1W_t + a_2X^d_t + U^d_t; \qquad \text{if } (W_t - W_{t-1}) < 0 \qquad (4b)$$

Noting also that equation (2d") can be rearranged as follows

$$L^d_t = L^s_t + \frac{1}{c}(W_t - W_{t-1})$$

and substituting (4a) into it, the following expression is obtained:

$$L_t = b_o + b_1W_t + b_2X^s_t + U^s_t + \frac{1}{c}(W_t - W_{t-1});$$

$$\text{if } (W_t - W_{t-1}) < 0 \qquad (5a)$$

Similarly rearranging equation (2d") as follows

$$L^s_t = L^d_t - \frac{1}{c}(W_t - W_{t-1})$$

and substituting equation (4a) into it, the following expression is obtained:

$$L_t = a_o + a_1W_t + a_2X^d_t + U^d_t - \frac{1}{c}(W_t - W_{t-1});$$

$$\text{if } (W_t - W_{t-1}) > 0 \qquad (5b)$$

Equations (4b) and (5b) can be combined to produce a single equation for the entire period as follows:

$$L_t = a_o + a_1W_t + a_2X^d_t - \frac{1}{c}G_t + U^d_t \qquad (6a)$$

where:

$$G_t = \begin{cases} (W_t - {}_{t\ 1}) & \text{if } (W_t - W_{t-1}) > 0 \\ \text{zero otherwise.} & \end{cases}$$

similarly, equations (4a) and (5a) can be combined to cover the entire period as follows:

$$L_t = b_o + b_1W_t + b_2X^s_t + \frac{1}{c}H_t + U^s_t \qquad (6b)$$

where:

$$H_t = \begin{cases} (W_t - W_{t-1}) & \text{if} \quad (W_t - W_{t-1}) < 0 \\ \text{zero otherwise.} \end{cases}$$

The variable G_t and H_t are thus included in equations (6a) and (6b) as adjustments for excess supply and demand.

TESTING FOR THE VALIDITY OF THE EQUILIBRIUM ASSUMPTION

As noted, the coefficient c of equation (2d") can take any possible value between zero and infinity, so that its magnitude is not of much use as an indicator of the speed of adjustment. However, a more meaningful speed of adjustment parameter, to be denoted by d, may be derived from equation (2d") as explained below.

If equations (2a) and (2b) are substituted into equation (2d") the following expression is obtained:

$$W_t - W_{t-1} = c\,[(a_o + a_1 W_t + a_2 X^d_t + U^d_t) - (b_o + b_1 W_t + b_2 X^s_t + U^s_t)]$$

Therefore:

$$[1 + c\,(b_1 - a_1)]\; W_t = W_{t-1} + c\,[(a_o + a_2 X^d_t + U^d_t) - (b_o + b_2 X^s_t + U^s_t)] \tag{7}$$

The unobservable variable W^*_t is now defined as the market clearing (equilibrium) wage rate. Thus in an equilibrium situation the following equation holds:

$$L^d_t = L^s_t = a_o + a_1 W^*_t + a_2 X^d_t + U^d_t = b_o + b_1 W^*_t + b_1 X^s_t + U^s_t$$

which when rearranged yields:

$$(b_1 - a_1)\, W^*_t = (a_o + a_2 X^d_t + U^d_t) - (b_o + b_2 X^s_t + U^s_t) \tag{8}$$

Substituting equation (7) into equation (8) we obtain:

$$[1 + c\,(b_1 - a_1)]\; W_t = W_{t-1} + c\,(b_1 - a_1)\, W^*_t$$

so that

$$W_t = dW_{t-1} + (1 - d)\, W^*_t \tag{9}$$

where

$$d = \frac{1}{1 + c\,(b_1 - a_1)} \tag{10}$$

The parameter d of equation (9) is therefore related to c in equation (2d'') and to the wage rate coefficients of equations (2a) and (2b).

Thus, if b_1 is greater than a_1, as seems reasonable to assume, it can be concluded that if wage rate adjustment is infinitely slow, implying that $c = 0$, d takes a value of one. If on the other hand, wage rate adjustment is infinitely fast, implying that $c = \infty$, d takes a value of zero. In this latter case, equilibrium is implied.

Equation (9) has interesting implications regarding the divergence of actual wage rates from their equilibrium levels. This equations can be re-arranged so as to show that $(W^*_t - W_t)$ has the same sign as $(W_t - W_{t-1})$ as follows:

$$W^*_t = \frac{1}{1-d} W_t - \frac{d}{1-d} W_{t-1}$$

which yields

$$W^*_t - W_t = \frac{d}{1-d} (W_t - W_{t-1})$$

This confirms that when wage rates are rising, actual wage rates are lower than their equilibrium level, implying excess demand, and vice-versa for excess supply.

The procedure just explained with respect to the derivation of equations (6a) and (6b) can be repeated, but this time the parameter $1/c$ can be replaced by solving it into equation (10) as follows:

$$\frac{1}{c} = (b_1 - a_1) \quad (\frac{d}{1-d})$$

Equations (6a) and (6b) can therefore be expressed as follows:

$$L_t = a_o + a_1 W_t + a_2 X^d_t - \quad [(d/1-d) \quad (b_1 - a_1)] \; G_t + U^d_t \qquad (6a')$$

$$L_t = b_o + b_1 W_t + b_2 X^s_t + \quad [(d/1-d) \quad (b_1 - a_1)] \; H_t + U^s_t \qquad (6b')$$

Also from equation (8), the following equation can be derived:

$$W^*_t = \frac{a_o - b_o}{b_1 - a_1} - \frac{b_2}{b_1 - a_1} X^s_t + \frac{a_2}{b_1 - a_1} X^d_t + \frac{U^d_t - U^s_t}{b_1 - a_1}$$

which after substituting into equation (9) to eliminate the unobservable W^*, yields:

$$W_t = dW_{t-1} + (\frac{1-d}{b_1 - a_1}) \quad (a_o - b_o) - (\frac{1-d}{b_1 - a_1}) \; b_2 X^s_t +$$

$$+ \left(\frac{1-d}{b_1 - a_1}\right) a_2 X^d{}_t + \left(\frac{1-d}{b_1 - a_1}\right) U^d{}_t - U^s{}_t \qquad (11')$$

The introduction of the parameter d in equation (ba'), (6b') and (11') is of interest, since it can be used to test whether the equilibrium assumption is valid. If the estimation of equation (11') indicates that d has a value of zero, the wage equation becomes identical to the reduced from equation for $W^*{}_t$ discussed with respect to the equilibrium model. Likewise, if $d = 0$, equations (6a') and (6b') become identical to equations (1a) and (1b), applicable to the equilibrium assumption.

DISEQUILIBRIUM AND THE PHILLIPS CURVE

Equation (11') 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, and has been reviewed elsewhere.[13] 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]

Equation (11') is not based on this assumption, 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]

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[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 the calls »intruders« in the Phillips relation.

NON-MARKET FORCES

Equation (2d") can be augmented to allow for the effect of non-competitive elements on wage rate changes. An important consideration in this respect is union activity.[20] If the non-competitive elements are denoted by V_t, the wage adjustment equation can be modified as follows:

$$W_t - W_{t-1} = c_1 (L^d_t - L^s_t) + c_2 V_t \qquad (2d''')$$

The difference between equations (2d') and (2d''') can be shown in diagramatic form as in figure 2.

Line A of figure 2 shows wage adjustment in the absence of non-competitive forces. In this case, wage changes occur as a result of excess demand or supply. Thus when excess demand is zero, wage rate changes are also zero. Line 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 excess labour demand is zero. In this hypothetical case, non-competitive elements work against market forces, and an excess supply smaller than OC would still result in wage rate increases.

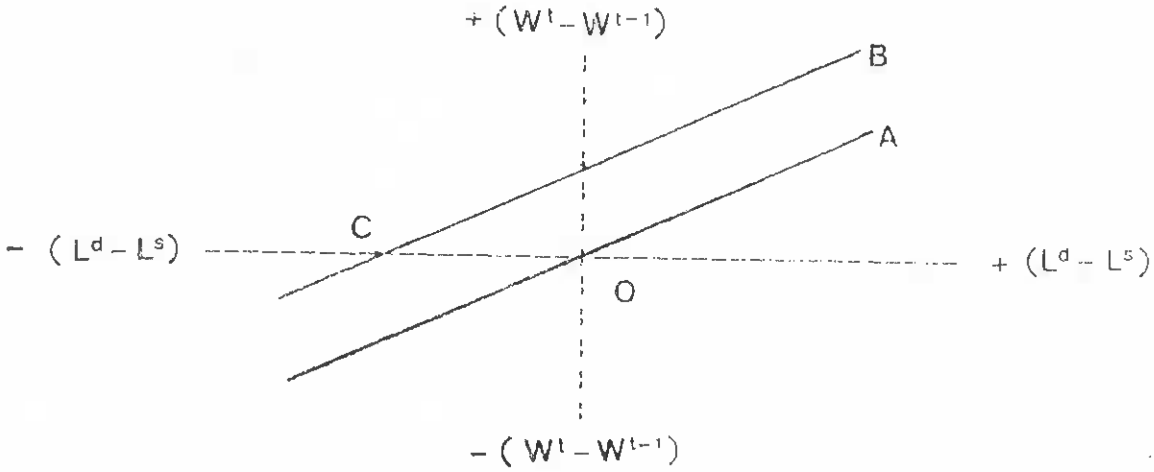

Figure 2. The Wage Adjustment Diagram

The inclusion of variables representing non-competitive forces in the wage adjustment equation means that the partitioning of the sample into excess supply and excess demand regime no longer depends on whether the wage rate changes are positive or negative, since positive wage rate changes may no longer signify excess labour demand.

With respect to the Quantitative Method, the procedure for sample partitioning in the presence of non-market forces involves the modification of the variable G_t and H_t of equations (6a') and (6b').

[20] 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)].

Repeating the steps for deriving equations (9) from equation (2d''') the following equation is derived:

$$W_t = dW_{t-1} + (1-d)\ W^*_t + dc_2V_t \tag{9'}$$

from which the following is obtained:

$$W^*_t - W_t = \frac{d}{1-d}(W_t - W_{t-1} - c_2V_t)$$

which states that negative wage rate changes are associated with a wage rate higher than the equilibrium wage rate, and therefore indicate the presence of excess supply. However, positive wage rate changes are not necessarily associated with a wage rate lower than the equilibrium wage rate, and need not therefore indicate the presence of excess demand.

The expression $(W_t - W_{t-1} - c_2V_t)$ and therefore of $(W^*_t - W_t)$ may be negative even when $(W_t - W_{t-1})$ is positive, depending of course on the magnitude of c_2V_t.

Repeating the steps for deriving equations (6a') and (6b') and (11'), but incorporating the term c_2V_t, the following equations are obtained:

$$W_t = dW_{t-1} + \frac{1-d}{b_1-a_1}(a_o - b_o) - \frac{1-d}{b_1-a_1}b_2X^s_t +$$

$$+ \frac{1-d}{b_1-a_1}a_2X^d_t + dc_2V_t + \frac{1-d}{b_1-a_1}(U^d_t - U^s_t) \tag{11''}$$

$$L_t = a_o + a_1W_t + a_2X^d_t - \frac{1}{c}G_t + U^d_t \tag{6a''}$$

where: $G_t = \begin{cases}(W_t - W_{t-1} - c_2V_t) & \text{if } (W_t - W_{t-1} - c_2V_t) > 0\\ \text{zero otherwise}\end{cases}$

$$L_t = b_o + b_1W_t + b_2XS_t + \frac{1}{c}H_t + US_t \tag{6b''}$$

where: $H_t = \begin{cases}(W_t - W_{t-1} - c_2V_t) & \text{if } (W_t - W_{t-1} - c_2V_t) < 0\\ \text{zero otherwise}\end{cases}$

Of interest is that the variables G_t and H_t contain in them the term c_2V_t. The coefficient c_2 can be estimated from equation (11''). Again here, if d is found to have a value of zero, equilibrium would be implied, and the reduced form equations for labour and wage rates would be identical to those obtained from the equilibrium model. This can be verified by setting $d = 0$ in equations (6a''), (6b'') and (11'').

ESTIMATION PROCEDURE FOR THE QUANTITATIVE METHOD

In general the wage equations (11') and (11") derived for the disequilibrium Quantitative Method pose no special problems of estimation.

The labour equations however contain the variables G_t and H_t, which have to be computed first. If the current wage rate is assumed to be determined exogenously then the actual values of W_t are used to compute G_t and H_t. In the labour demand equations, G_t takes its actual value when it is positive and is assigned a value of zero when it is negative. Similarly, in the supply equations, H_t takes its own value when this value is negative, and is assigned a value of zero when its value is positive.

If the current wage rate is endogenously determined, the Two Stage Least Squares method could be used... The predicted values of W_t, is computed first, by applying the Ordinary Least Squares method to equations (11') or (11").

The expressions for G_t and H_t are then computed, by replacing W_t by its predicted value. As before, G_t takes its actual value when it is positive, and is assigned a value of zero when its value is negative, whereas H_t takes its own zero when its value is positive.

The labour equations can then be estimated by the Ordinary Least Squares method, using the variables G_t and H_t computed as just explained, and replacing W_t by its predicted value.[21]

Briguglio (1984) applied this technique, and the results indicated that the estimates of d and c_2 were significantly larger than zero, indicating that the labour market was not in equilibrium at all times and that non-market forces had an impact on wage rates.[22]

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[21] It should be noted here that the variables G_t and H_t contain the endogenous variable W_t, but unlike W_t, G_t and H_t are not linear functions of the exogenous variables X^d_t and X^s_t. Bowden (1978b) suggested an instrumental variable technique which utilises an expression derived from estimates of the reduced-form equation for wage rates as an instrument for the non-linear terms G_t and H_t [(op. cit. pp. 182—183)]. However, on the basis of simulation experiments, Bowden concluded that the method of Two-Stage Least Squares, as outlined above, produced more acceptable results in terms of the Mean Square Error. This method deserves attention also on grounds of simplicity.

[22] It should be noted that the methods just described for estimating the coefficient c_1 on G_t and H_t do not impose any restrictions on the value of this coefficient, and the Least Squares method can produce different values of c_1 in the two labour equations. However, values of c_1 derived from the model itself — since $c_1 = (1 — d) / [d (b_1 — a_1)]$ can be imposed on the equations as follows. The estimate of d can be obtained from equation (11). Initial estimates of b_1 and a_1 can be obtained from the unrestricted labour equations (6a) and (6b). Equations (6a) and (6b) are then rearranged, so that their dependent variables are redefined as $L_t + [(1/c_2G_t]$ and $L_t — [1/c_2)H_t]$ respectively. An iterative procedure can than be applied until the value of b_1 and a_1 produced by the Least Squares method converge with those used to compute $c_2 = (1 — d) / [d (b_1 — a_1)]$. See Briguglio (1984) p. 549.

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 wage rigidity and the existance of non-competitive forces. 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 existence of excess supply or demand.

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

The procedure for estimating disequilibrium models is somewhat more complicated than the more convenient procedure for estimating 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.

Received: 14. 03. 1988.
Revised: 02. 06. 1988.

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MODELI RANOTEŽNIH I NERAVNOTEŽNIH TRŽIŠTA RADA

Lino BRIGUGLIO

Rezime

U ovome članku razmatraju se dve varijante modela agregatnog tržišta rada. Prva varijanta se oslanja na pretpostavku o tržišnoj ravnoteži a druga se ne zasniva na ovoj pretpostavci. Pokazuje se da varijanta modela koja se temelji na pretpostavci o tržišnoj ravnoteži nameće ograničenje koje se može smatrati nerealističkim, a koje se

sastoji u tome da stopa najamnina uravnotežava tržište u svim periodima. Varijanta modela koja se ne oslanja na pretpostavku o tržišnoj ravnoteži ne isključuje mogućnost ravnoteže, ali dozvoljava i postojanje viška ponude rada odnosno viška potražnje za radom. U članku se, također, opisuju i postupci ocenjivanja koeficijenata modela neravnotežnog tržišta rada. Pokazuje se da određena specifikacija ovih potonjih modela omogućava ispitivanje valjanosti pretpostavke o ravnoteži.