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UNION OBJECTIVES, WAGE BARGAINING
AND THE PHILLIPS CURVE

by

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I. INTRODUCTION

Recent empirical papers on the determination of wages and employment under trade unionism[1] have employed a basic model in which the union attempts to maximise an objective function, usually containing the real wage and employment as positive arguments, subject to a constraint, usually the employers' labour demand function. This theoretical model has a long history[2]. However, the empirical analysis has been conducted on a relatively narrow data set. It has ignored almost wholly the much older and more extensive empirical literature on the Phillips Curve and the determinants of the rate of change of money wages. Since many Phillips Curves have been estimated using (union) minimum wage rate data, there ought to be models of union/firm behaviour consistent with that empirical work. Unfortunately the objective functions and constraints explored recently do not readily yield a role for the unemployment rate *per se* in a money wage change equation.

On the other hand, formal derivations of the relationship between unemployment and the rate of change of money wages, at least those which have remained central to modern macroeconomics, ignore trade unions altogether. The only real concession in these models to monopoly or monopsony elements in the labour market is the assumption

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1. See, for example, Dertouzos and Pencavel (1981) and Pencavel (1984).
2. See, for example, Dunlop (1944), Fellner (1947), Cartter (1959) and McDonald and Solow (1981).

of imperfect information, which allows the real wage rate and unemployment to deviate from their 'natural' values in models which otherwise exhibit no money illusion[3]. This reliance on essentially competitive theories of labour market behaviour sits very uneasily with the role that large, powerful trade unions and employers play in the determination of money wages in most developed countries. It is also in distinct contrast to the earlier literature on the relationship between unemployment and money wage change which emphasised low unemployment as a source of increased trade union bargaining power[4].

These observations suggest the need to generate money wage change relationships from models of union/firm behaviour in which the objectives of each party and the constraints they face are well specified. These objectives and constraints should yield predictions which are consistent with the evidence from previously estimated Phillips Curves. Ideally, such models should also predict parameter values or restrictions on parameters which clearly distinguish them from the class of competitive models.

Hence, the first objective of this paper is to explore a class of wage-bargaining models which readily generate the following, frequently-estimated relationship:

$$\Delta \ln W = a_1 \Delta \ln P + a_2 U + a_3 \Delta \ln U + a_4 \Delta \ln(X/N) + a_5 TUM \qquad (1)$$

3. See, for example, Friedman (1968), Phelps (1967) and Mortensen (1971).
4. See, for example, Robinson (1937).

where $\Delta \ln W$ = the proportionate or percentage rate of change of money wage rates, P = the general price level, U = the unemployment rate, X/N = output per person employed and TUM = some proxy for trade union militancy. The 'concensus' from empirical work would suggest that $a_1 = 1$ (at least at rates of inflations above 3 or 4% p.a.); $a_2, a_3 < 0$ and $a_4, a_5 > 0$. Most controversy surrounds the role of TUM in such equations. Measures of trade union aggressiveness, in particular, the rate of change of union density [Hines (1964) and Ashenfelter, Johnson and Pencavel (1972)] and strike frequency [Godfrey (1971), Taylor (1972) and Phipps (1977)] have had some success in explaining money wage change. The problem with such variables is that they have generally been seen as 'intruders' in the wage equation; ad hoc variables included to capture union militancy in otherwise competitive models. A second objective of this paper is to show that strike frequency should have a legitimate systematic role in explaining money wage change (at least in our class of bargaining models).

Perhaps the major problem of the objective-function approach to union wage determination is that it leaves no clear scope for strike activity. It seems most appropriate for the case of 'weak' firms which cannot or will not face an industrial stoppage. The union sets the wage. The firm responds by hiring or firing labour. We are going to supplement this approach to union wage and employment behaviour with the Ashenfelter and Johnson (1969) modelling of employer resistance. Whereas, most empirical work on strike frequency based on the Ashenfelter and Johnson model[5], has specified the minimum wage increase acceptable to the unions' rank and file in

5. See for example, Pencavel (1970) as well as Ashenfelter and Johnson.

an ad hoc fashion, we propose to use objective function maximisation to determine that wage increase, thereby combining the two models.

Other empirical approaches to the role of unions in wage inflation yield insights into union motivation and objectives which cannot sensibly be ignored. The first is the class of models involving 'wage leadership' [e.g. Levinson (1960), Eckstein and Wilson (1962) and Jackson et al 1972)]. In these models, a well-established pattern of wage relativities provides the mechanism through which a wage increase in a particular occupation, firm or industry generates wage increases across the economy. Although such models have difficulty in identifying the source of wage 'leadership'[6] and additionally have some difficulty in explaining variations in the proportion of 'spillover' from an initial wage increase, the union's concern for relative wages is something that any sensible bargaining model must be capable of incorporating. The second additional type of model requiring some attention is that involving 'target real wage growth' [e.g. Sargan (1971, 1980) and Henry et al (1976)]. Although such models do not explain what determines the target rate of growth of real wages nor indeed why such a target is bounded above at all, their early empirical success in the U.K. does reveal a union concern for real wage growth.

Hence, our objectives are:

(i) to produce a standard Phillips Curve from a model of union behaviour in which the union's objectives and the constraints it faces are made explicit;

6 Is it union power [as suggested by Hines (1968)], rapid productivity growth [as suggested by Jackson et al (1972) and the Scandinavian model of Edgren, Faxen and Odhner (1972)) or localised excess demand [as suggested by Mulvey and Trevithick (1974)]?

(ii) to incorporate the Ashenfelter and Johnson approach as a model of optimum employer resistance to aggressive trade union wage claims derived from (i) and hence

(iii) to show that strike frequency is an integral explanatory variable in such a model of money wage change.

We first of all explore the union's objective function and the constraint imposed by the employers' demand for labour function. This is best done initially in the 'no strike' context. That is, we postulate a 'weak' firm[7] (or group of firms) which accedes to a union's wage demands and responds only by hiring or firing labour.

II. THE 'WEAK' FIRM, NO-STRIKE CASE

1. The Union's Objective Function

The literature on trade unions suggests that rank and file members have three basic economic objectives: to raise their living standards, to protect their jobs and to ensure that their wages are comparable with those of other workers doing similar work. We single out improved living standards and job security as the primary objectives with relative wage protection or improvement as a secondary objective. We further assume that union leaders pursue these objectives partly because they believe in them and partly because their own political survival depends upon rank and file support.

7. In section III we explore the conditions under which a firm is likely to want to avoid a strike, i.e. the conditions for a firm to be 'weak' in its resistance to union wage demands.

The initial problem in specifying a union objective function is the choice of variables to capture the primary objectives. We assume that an improvement in the standard of living may be captured by the proportional rate of increase of real wages[8], $\Delta \ln(W/P)$. This we believe consistent with the modern framework of wage demands and wage bargaining, where the focus is invariably on the rate of change of wages. It is also consistent with the target real wage growth models used in the U.K.

Job security for the rank-and-file member is essentially equivalent to his subjective probability of remaining in employment for the contract period, $P(E) = 1 - P(U)$, where $P(U)$ is the subjective probability of becoming unemployed. We are going to assume that the unemployed in the group of workers covered by the trade union are drawn at random and hence that, for the average member, $P(E) = N/N_s = 1 - u$, where u is the unemployment rate, N_s is the labour supply and N is labour demand or employment.[9] Note that we see job security as a union objective <u>in its own right</u>. Others, including McDonald and Solow (1981), use $P(E)$ as the weight attached to the real wage to approximate the expected wage (from employment). We believe that, just as unemployment imposes greater costs on the individual than simply loss of income, so job security entails more benefits than simply assured income. Hence, any proxy variable for

8. Because wages are adjusted only periodically, we are going to use first differences in wage and price variables.
9. This is obviously over simplistic, but as long as $P(U)$ is an increasing function of u, say $f(u)$, we believe most of our conclusions hold. For simplicity we also assume that the labour force of the firm or industry covered by the trade union is 100% unionised.

job security should enter the union objective function in its own right.

Because union membership is large and because members may have diverse interests and different economic, political and social objectives, representation of union aspirations by an objective function raises the question of whose objectives are being represented. To simplify the analysis, we assume that the union is reasonably democratic and that the rank and file have to decide whether or not to accept an offered wage increase by vote. The objective function ought then to be that of the 'median voting member' when members are ranked by the size of the minimum wage increase acceptable to them. We shall simply refer to him/her as the 'average', rank-and-file member. We are going to assume further that the objectives of the average member are captured by the following objective function:

$$G = (\Delta \ln(W/P) - \bar{w})^{\alpha}(N/N_s - \bar{n})^{\beta}; \qquad \alpha + \beta = 1,\ \bar{n} \geq 0,\ \bar{w} \gtreqless 0 \qquad (2)$$

where W = the money wage rate, P = the general price of goods and services, and N = employment and N_s = the labour supply of the group of workers covered by the trade union. We use the Stone - Geary function because it has a number of desirable properties. The convention of regarding $\bar{w}$ and $\bar{n}$ as 'reference' or 'minimum' or 'necessary' values of wage growth and job security respectively readily permits the introduction of socially and historically established norms. For example, we have already mentioned that a third objective of trade union members is the protection or expansion of relative wages. Hence, $\bar{w}$, may be an increasing function of the rate of wage growth obtained by a particular reference group in the previous period. More generally $\bar{w}$ and $\bar{n}$ may be seen as shift

parameters which reflect rank and file militancy. An increase in rank and file wage-militancy may be represented by a simultaneous increase in $\bar{w}$ and decrease in $\bar{n}$, a greater fundamental concern for real wage growth and a lesser concern for job security. This will become important when we discuss expected strike length and strike frequency. We shall be arguing that, other things equal, strikes will be more likely and more frequent and the resulting wage increases will be larger, the higher is $\bar{w}$ and the lower is $\bar{n}$ i.e. the more wage-militant is the rank and file. Since we do not quite know what variables in what form determine union wage-militancy, we shall be arguing that strike frequency is a reasonable proxy for such variables in a wage equation.

A more tractable form of the objective function, one which highlights the role of unemployment in our analysis, may be determined in the following way. Note that,

$$N/N_s = (1 + \Delta \ln N)N_{-1}/N_s. \qquad (3)$$ [10]

If we assume that the average unionist regards N_s as roughly stable[11], $N_{-1}/N_s = 1 - u_{-1}$ (4)

and

$$N/N_s = 1 - u_{-1} + \Delta \ln N - u_{-1}\Delta \ln N \qquad (5)$$

10. The time subscript t is deleted for convenience.
11. If we are not prepared to make this assumption, expression (7) becomes (after ignoring second-order terms)

$$N/N_s - \bar{n} = \Delta \ln N - (u_{-1} - \bar{u}) - \Delta \ln N_s$$

The extra term, $\Delta \ln N$, will enter the objective function and the consequent wage equation in obvious ways.

We may generally, at least in periods of low unemployment, ignore the term $u_{-1}\Delta lnN$ as it is relatively small. If we do so

$$N/N_s = \Delta lnN - u_{-1} + 1 \tag{6}$$

and

$$N/N_s - \bar{n} = \Delta lnN - (u_{-1} - \bar{u}) \tag{7}$$

where $\bar{u} = 1 - \bar{n}$ is clearly the unemployment rate corresponding to the 'minimum' employment rate in the objective function. Let us call $\bar{u}$ the 'maximum' unemployment rate. Substituting equation (7) into the function (2), yields the form of the objective function with which we are going to work:

$$G = (\Delta ln(W/P) - \bar{w})^{\alpha}(\Delta lnN - u_{-1} + \bar{u})^{\beta} \; ; \; \alpha + \beta = 1 \text{ and } \bar{u} = 1 - \bar{n} \tag{8}$$

Interpreting the objective function in the light of equation (7), the higher is last period's unemployment rate, the more rapid the employment growth required to return the union's average worker (approximately) to the 'minimum' employment rate in the objective function (2). We turn now to the constraint faced by the union. We distinguish two alternatives which we categorise broadly as 'neo-classical' and 'Keynesian'.

2. The Employers' Labour Demand Function: A Neo-Classical Case

We think of the union negotiating with an employer or group of employers whom we term the 'firm'. This firm's labour demand function represents the union's opportunity set. The firm itself we

assume maximises profit subject to a technology constraint represented by a CES production function. The price of the firm's output is assumed to be parametrically given. The labour demand function resulting from these assumptions is well known [see Dhrymes (1969)]. It may be differentiated to yield the following expression for the rate of growth of employment which involves both a scale factor and a substitution factor:

$$\Delta \ln N = \theta \Delta \ln X - \epsilon \Delta \ln(W/P)$$

or

$$\{\Delta \ln N - \theta \Delta \ln X + \epsilon \Delta \ln(W/P)\} = 0 \qquad (9)$$

where X is the firm's output, ϵ is the elasticity of substitution between labour and capital and $0 < \theta \leq 1$ is the elasticity of employment with respect to output. Although profit maximisation subject to a CES technological constraint implies $\theta = 1$, we shall allow the parameter θ to be less than unity, because of the possibility that (some) labour in the firm is 'quasi fixed'. This may result from the costs of adjusting employment or from investment in firm-specific training [Oi (1962), Becker (1964)] or from the nature of production itself in which some 'overhead labour' is divorced from the production process [Kuh (1965)]. We shall simplify matters by assuming temporarily that the price of the firm's output is expected, by the union, to rise in line with the general price level, P. Hence, $\Delta \ln P$ is the same in both equations (8) and (9).

We continue to assume that the firm does not want a work stoppage, accepts the union's wage demand and responds by adjusting output and employment. We further assume that the well-informed

union leader tries to satisfy the rank and file by demanding a money wage increase which maximises the objective function (8) subject to the constraint implied by the employment growth equation (9)[12]. The problem may be approached in the standard way. Form the function

$$F = (\Delta\ln(W/P) - \bar{w})^{\alpha} (\Delta\ln N - u_{-1} + \bar{u})^{\beta} + \lambda\{\Delta\ln N - \theta\Delta\ln X + \epsilon\Delta\ln(W/P)\} \tag{10}$$

where λ is a Lagrange multiplier. Because $\Delta\ln P$ is given, the money wage increase $\Delta\ln W$ and the rate of growth of employment $\Delta\ln N$ are the decision variables. The first-order conditions for F to be at a maximum yield the following equations:

$$-\lambda\epsilon = \alpha(\Delta\ln W - \Delta\ln P - \bar{w})^{\alpha-1} (\Delta\ln N - u_{-1} + \bar{u})^{\beta} \tag{11}$$

$$-\lambda = \beta(\Delta\ln W - \Delta\ln P - \bar{w})^{\alpha} (\Delta\ln N - u_{-1} + \bar{u})^{\beta-1} \tag{12}$$

plus the constraint, equation (9). Dividing (11) by (12) and solving for $\Delta\ln N$ gives

$$\Delta\ln N = -\bar{u} - (\epsilon\beta/\alpha)\bar{w} + u_{-1} + (\epsilon\beta/\alpha)\Delta\ln W - (\epsilon\beta/\alpha)\Delta\ln P \tag{13}$$

Substituting (13) into the constraint (9) and solving for $\Delta\ln W$ yields

$$\Delta\ln W = \Delta\ln P - (\alpha/\epsilon)u_{-1} + (\alpha\theta/\epsilon)\Delta\ln X + \beta\bar{w} + (\alpha/\epsilon)\bar{u} \tag{14}$$

12. Although we treat the problem as though the union leader has perfect foresight, it is actually the leadership's estimate of the constraint (9) and their expectations with regard to the variables which enter it which are relevant

The percentage increase in the money wage demanded by the union will vary:

(i) directly with the rate of increase in the general price level,

(ii) negatively with the rate of unemployment of the previous period,

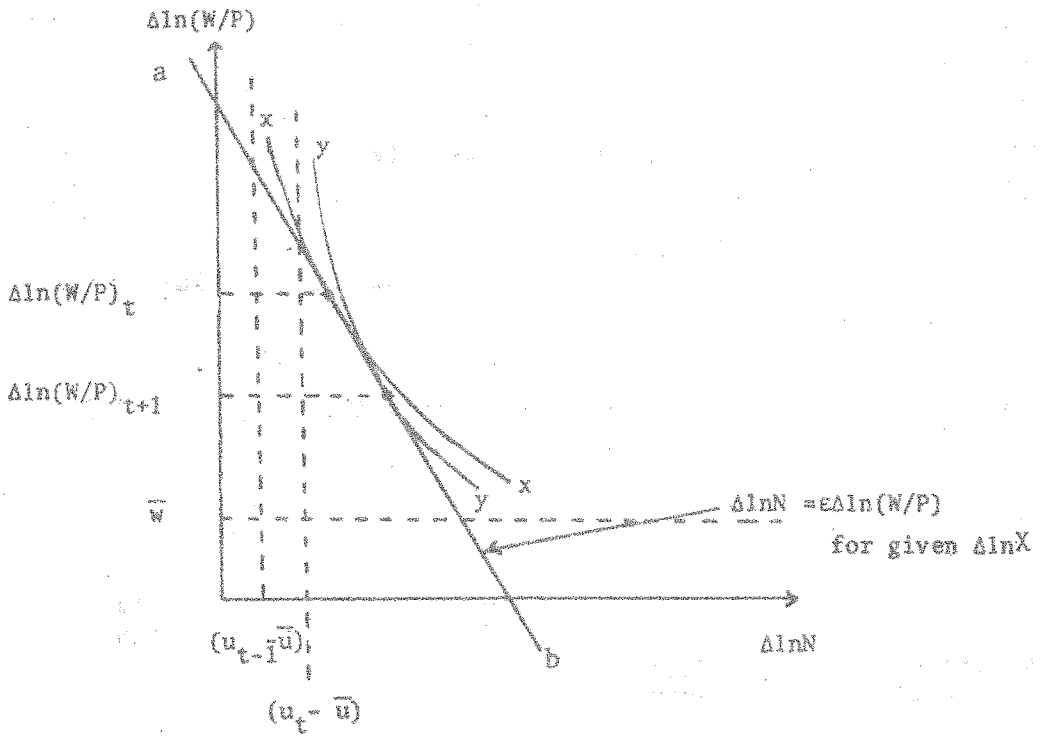
(iii) positively with rate at which the firm's output is increasing,

(iv) positively with $\bar{w}$, the 'minimum' rate of increase in real wages in our representative unionist's objective function,

(v) positively with $\bar{u}$, the 'maximum' level of unemployment in our average unionist's objective function.

Equation (14) has a direct role for the rate of increase of prices and a negative role for unemployment in the determination of money wage change. In that sense, equation (14) is a fairly standard Phillips Curve. The partial relationship between the rate of growth of real wages and unemployment is illustrated in Figure 1.

FIGURE 1



The line ab represents the firms labour demand function for a given $\Delta \ln X$. The dotted lines, $\bar{w}$ and $u_{t-1}-\bar{u}$ represent the initial asymptotes of the objection function. Initial equilibrium occurs at a rate of growth of real wages, $\Delta \ln(W/P)_t$, where a union indifference curve xx is tangential to ab. An <u>increase</u> in unemployment from u_{t-1} to u_t shifts the asymptote on the $\Delta \ln X$ axis rightwards to $u_t-\bar{u}$. The <u>increase</u> in unemployment produces a lower equilibrium rate of increase of real wages $\Delta \ln(W/P)_{t+1}$, where yy is tangential to ab.

The predicted role for the rate of increase of the firm's output is unusual and warrants a few observations. For a given rate of increase of output, the model predicts that the rate of wage increase demanded will be higher:

(i) the higher is α, the exponential weight attached to 'super-numerary' real wage increases in the objective function,

(ii) the higher is θ, the elasticity of employment with respect to output,

(iii) the lower is ϵ, the elasticity of substitution between labour and capital.

A more conventional Phillips Curve may be obtained from (14) by using Okun's Law to derive an expression for the rate of change of output. The identity underlying Okun's Law is

$$X = (X/N)(1 - u)\bar{N}; \qquad \text{where } N = (1 - u)\bar{N} \tag{15}$$

where X = output, N = employment, u = the unemployment rate and $\bar{N}$ = the full-employment labour force.[13] Taking natural logarithms and first differences yields

$$\Delta \ln X = \Delta \ln(X/N) + \Delta \ln(1 - u) + \Delta \ln \bar{N} \tag{16}$$

If, for simplicity, we take the rate of growth of the full-employment labour force as zero, we may substitute (16) into (14) to give

$$\Delta \ln W = \Delta \ln P - (\alpha/\epsilon)u_{-1} + (\alpha\theta/\epsilon)\Delta \ln(1-u) + (\alpha\theta/\epsilon)\Delta \ln(X/N) + \beta\bar{w} + (\alpha/\epsilon)\bar{u} \tag{17}$$

The rate of change of unemployment and the rate of change of labour productivity enter the wage equation (18) with the usual signs; the former being Phillips' counter-clockwise loops.

This model may be made richer by recognizing the fact that the price of the firm's output may grow at a rate different from the general cost of living relevant to the average trade unionist. If we let P_x represent the price of the firm's output and P the cost of living, a retail or consumer price index, then equation (14) becomes, after a similar maximisation procedure.

$$\Delta \ln W = \alpha\Delta \ln P + \beta\Delta \ln P_x - (\alpha/\epsilon)u_{-1} + (\alpha\theta/\epsilon)\Delta \ln X + \beta\bar{w} + (\alpha/\epsilon)\bar{u} \tag{18}$$

Note that the weights on the rates of increase of the cost of living and the firm's output price are α and β respectively, the

13. Note we are avoiding the problem of variations in average hours worked.

exponential weights given to 'supernumerary' real wage and employment increases in the union's objective function. If the average unionist were concerned with 'after-tax', 'take-home' pay, then $\Delta \ln P$ would need to be multiplied by the ratio of his marginal to his average tax rate. Again $\Delta \ln X$ may be replaced by equation (16) to give:

$$\Delta \ln W = \alpha \Delta \ln P + \beta \Delta \ln P_x - (\alpha/\epsilon) u_{-1} + (\alpha\theta/\epsilon)\Delta \ln(1-u) + (\alpha\theta/\epsilon)\Delta \ln(X/N) + \beta\bar{w} + (\alpha/\epsilon)\bar{u} \qquad (19)$$

The fundamental weakness of the model outlined so far, at least in the author's opinion, is in the strict neo-classical interpretation of the labour demand function, equation (9), which defines the union's opportunity set. The derivation of the labour demand function from short-run, profit-maximising behaviour predicts that real wages and output should move (about trend) in opposite directions over the trade cycle; a fall in the real wage producing increases in the profit-maximising levels of both output and employment. The observed tendency for real wages either to vary procyclically or to be unrelated to output over the cycle is a strong argument in favour of a Keynesian, disequilibrium interpretation of the relationship between output and employment. To this we now turn.

3. The Employers' Labour Demand Function: A Keynesian Case

We continue to assume that the average unionist's objectives may be described by the function:

$$G = (\Delta \ln(W/P) - \bar{w})^{\alpha} (\Delta \ln N - u_{-1} + \bar{u})^{\beta} \; ; \; \alpha + \beta = 1, \quad \bar{u} = 1 - \bar{n} \qquad (8)$$

However, we assume that the firm is a price-maker and that it sets its price by a markup over cost. Since this is not an equilibrium, market-clearing price, the demand for labour will be constrained by output. We assume a labour demand function of the very simple form

$$\Delta \ln N = \theta \Delta \ln X; \qquad 0 < \theta \leq 1 \qquad (20)^{14}$$

The union's problem may still be regarded as the choice of increase in money wages, $\Delta \ln W$, which maximises the objective function (8). However, because we no longer assume that the firm is a price-taker, the price increase, $\Delta \ln P_x$, will not be independent of the wage increase, $\Delta \ln W$. If the firm prices output by a constant markup over unit variable costs,

$$P_x = \gamma(WN/X + P_m M/X); \qquad \gamma > 1 \qquad (21)$$

where M = quantity of raw materials and intermediate goods used to produce X and P_M = the price of raw materials and intermediate goods. Assuming material productivity (M/X) to be constant

$$\Delta \ln P_x = c_n(\Delta \ln W - \Delta \ln(X/N)) + c_m \Delta \ln P_m \qquad (22)$$

where c_n = the proportion of labour costs in total variable costs, c_m = the corresponding proportion for material costs and $c_n + c_m = 1$.

14. For simplicity we neglect the problem of long-run, cost-minimising factor substitution in the body of the text. However, the author has shown [Phipps (1983)] that the labour demand function (9) may itself be interpreted as an output-constrained labour demand if the firm's technology is CES, if it prices its output by a fixed markup over cost and if it minimises the cost of producing the consequent level of output.

Furthermore, changes in the firm's output, $\Delta \ln X$, will not be independent of the firm's pricing policy. We assume a demand function for the firm's output of the very simple form

$$\Delta \ln X = -\delta \Delta \ln P_x + \delta \Delta \ln P + \phi \Delta \ln Y \tag{23}$$

where Y = real disposable national income, δ = the price elasticity of demand and ϕ = the income elasticity of demand for output, X. Since the union is interested in the employment consequences of raising wages, it is interested, in this framework, in the impact of the wage increase on the firm's output price and the impact of the price change on demand for the product, output and employment. The appropriate constraint may be obtained by substituting equation (22) into (23) and (23) into (20). Further simplifying by assuming that material prices are expected to increase at the some rate as the general price level (i.e. that $\Delta \ln P_m = \Delta \ln P$) gives a Keynesian-type labour demand function which defines the union's opportunity set

$$\Delta \ln N = \theta \phi \Delta \ln Y - \theta \delta c_n \Delta \ln W + \theta \delta c_n \Delta \ln P + \theta \delta c_n \Delta \ln (X/N) \tag{24}$$

The problem for the union leadership may be seen as maximising the objective function (8) subject to the constraint (24). This yields the following expression for the money wage increase demanded by the union and accepted by the firm

$$\Delta \ln W = \Delta \ln P - \alpha(\theta \delta c_n)^{-1} u_{-1} + \alpha \phi (\delta c_n)^{-1} \Delta \ln Y + \alpha \Delta \ln (X/N) + \beta \bar{w} + \alpha(\theta \delta c_n)^{-1} \bar{u} \tag{25}$$

This version of the Phillips Curve differs from equation (14) in the following ways: The relevant price inflation term is unambiguously the rate of change of the general price level. The rate of change of labour productivity has a positive impact on money wage change because it ameliorates the effect of money wage increases on output prices, demand, output and employment. The rate of increase of real disposable national income has a positive impact again because of its impact on the firm's output and employment. There are also some obvious changes in the parameters. The rate of change of real disposable national income will generate pro-cyclical increases in money wage increases (Phillips' counter-clockwise loops). For a given rate of increase of disposable income the proportional increase in money wages demanded by the union will be larger:

(i) the larger is α, the exponential weight on 'supernumerary' wage increases in the rank and file's objective function,

(ii) the larger is ϕ, the income elasticity of demand for the firm's product,

(iii) the lower is δ, the price elasticity of demand,

(iv) the smaller is c_n, the share of labour costs in the total variable costs of the firm.

So far we have explored the consequences of union maximisation of an objective function subject to a number of different constraints but only where the firm accepts the union's wage demands without a strike. The only form of resistance offered by the firm in our analysis so far is the adjustment of the labour force in the manner implied by the constraint. Frequently, of course, firm resistance will take the form of a wage offer sufficiently less than the union's

wage demand to precipitate a strike. We turn now to the rate of increase of money wages under strike conditions.

III. EMPLOYER RESISTANCE AND STRIKES

The firm's management may be expected to resist a union wage demand as long as such resistance produces a net increase in profits. We are going to model optimum employer resistance along lines suggested by Ashenfelter and Johnson (1969). Their approach is an interesting application of asymmetric information. They postulate three parties to the wage bargain: union rank and file, union leadership and management. The rank and file is assumed to have strong views as to what is an acceptable wage increase but is unaware of what management is prepared to concede. The union leadership, on the other hand, is assumed to be aware of what management will or will not concede. The wage increase acceptable to the union rank and file is assumed to decrease as a strike lengthens. Union leaders continue strike action as long as the firm's wage offers are less than the wage increase acceptable to the rank and file. This ensures their own political survival. Given that the firm's management have a good idea as to how the acceptable wage increase decays with increases in the length of strike, they are assumed to choose that strike length which maximises the firm's net worth. That is, well-informed managers choose the optimum length of strike by weighing off the direct costs of the strike in terms of foregone profits against the benefits of reducing the future wage bill below what it would have been had the rank and file's initial wage demand been accepted.

We are going to use the Ashenfelter and Johnson model partly because it is simple and partly because its predictions concerning strike frequency have stood up reasonably well to empirical scrutiny [c.f. Ashenfelter and Johnson (1969), Pencavel (1970) and Farber (1978)]. A major weakness of this approach to date has been that the wage increase acceptable to the union rank and file in the absence of a strike has been specified in an essentially ad hoc fashion. We are suggesting that a union leadership which wants to do the best by a relatively ill-informed rank and file yet wants to stay in office will demand, at each stage of a strike, a wage increase which maximises the average unionist's objective function.

However, there remains the problem of why and how that acceptable wage demand should decay under strike conditions. In the absence of knowledge about union benefits from a longer strike in terms of any improvement in management wage offers, maximisation of net benefits cannot be used to determine the decay mechanism. One solution is to postulate that rank and file objectives alter in the sense that they become less wage-militant as a direct result of a strike. The rank and file are likely to become increasingly aware that they are imposing financial costs on both themselves and their employers by continuing a strike. Because a longer strike imposes substantial and increasing costs on the firm, the rank and file may believe that their jobs are more at risk the longer a strike continues. They will be aware that the firm's reduced financial resources may make it less able to withstand future, unforeseen contingencies such as reduced demand for its product, breaks in the supply of raw materials or intermediate goods or rises in non-labour costs. A longer strike will also drain the financial resources of

the average unionist. As a result, he/she may be less able and hence less willing to face the possibility of an uncertain duration of unemployment. Both of these lines of argument lead to the conclusion that the average unionist may become increasingly concerned about job security and less concerned about wage increases as a strike lengthens. They will become less wage-militant in the sense discussed in Section II(1). The shifting of the average unionist's objective function, favouring increased job security at the expense of reduced real wage increases as the length of a strike increases may be achieved in a number of ways. The way we propose to do this is to postulate that the 'minimum' wage increase ($\bar{w}$) in the objective function decreases towards zero[15] as the length of the strike (S) increases and that the 'maximum' unemployment rate ($\bar{u}$) similarly decreases. The latter is equivalent to saying that the 'minimum' acceptable employment ratio ($\bar{n}$) approaches unity as the length of strike increases. Additionally, we postulate that the rate of decay is exponential. Thus, we are proposing an objective function of the form:

$$G^* = (\Delta \ln(W/P) - \bar{w}e^{-\gamma S})^{\alpha} (\Delta \ln N - u_{-1} + \bar{u}e^{-\gamma S})^{\beta} \qquad (26)^{16}$$

where S = length of strike in days.

Maximisation of G^* subject to the neo-classical labour demand function (9), assuming similar rates of increase for P_x and P, viz. $\Delta \ln P$, yields a proportionate money wage demand acceptable to the rank and file of

15. For this section at least $\bar{w}$ needs to be positive. This may be deemed a weakness but employer resistance and strikes are most likely, as we shall see, when $\bar{w}$ is high.
16. The assumption of a similar rate of decay (γ) for both $\bar{w}$ and $\bar{u}$ is not necessary but helps keep the algebra simple.

$$\Delta \ln W = \Delta \ln P - (\alpha/\epsilon)u_{-1} + (\alpha\theta/\epsilon)\Delta \ln X + (\beta\bar{w} + (\alpha/\epsilon)\bar{u})e^{-\gamma S} \quad (27)$$

Whilst maximisation of G^* subject to the Keynesian labour demand function (24) yields an acceptable wage increase of the form

$$\Delta \ln W = \Delta \ln P - \alpha(\theta\delta c_n)^{-1}u_{-1} + \alpha\phi(\delta c_n)^{-1}\Delta \ln Y + \alpha\Delta \ln(X/N) + (\beta\bar{w} + \alpha(\theta\delta c_n)^{-1}\bar{u})e^{-\gamma S} \quad (28)$$

By way of illustrating the way in which an Aschenfelter-and-Johnson-like approach may be used to determine both the length of the strike and the resulting wage increase, let us examine the Keynesian case since it is slightly more tractable.[17]

Let us suppose that the firm in deciding whether to resist a union wage demand by provoking a strike, weighs off the direct cost of the strike, foregone profits, against the cost of giving in, the effect of an increased wage bill. The direct cost of a strike increases with the length of a strike but the cost of giving in will decrease with the length of a strike.

1. The Direct Costs of a Strike

Given an assumption in the Keynesian model that the firm prices by a fixed markup over unit costs of production, profits per unit of output are constant. If a strike resulted in an immediate and complete stoppage of production, and if the firm carried no stocks, the direct cost of a strike would simply be profit per day multiplied

17. The neo-classical case is dealt with in the Appendix.

by the number of days for which the strike continues.[18] Thus we may represent the direct costs (C_S) as

$$C_S = \pi X_{-1} S/T \tag{29}$$

where

π = profit per unit of output

S = the duration of the strike in days

T = the total number of days over which X is measured which, for the sake of simplicity, we shall assume to be the length of the contract period or period for which the wage increase is expected to last, so that

$\pi X_{-1}/T$ = profits per day of the strike

2. The Cost of Giving In

The cost of giving in and acceding to the union's wage demand is the loss of potential output and hence profits resulting from the increased wage and output price. The cost may be derived in the following way. The costs resulting from lower output and profits are: $C_{\Delta \ln W} = -\pi \Delta X = -\pi X_{-1} \Delta \ln X$. But from the demand function (23), the rate of change of output, everything other than P_x constant, is $\Delta \ln X = -\delta \Delta \ln P_x$ and from the price equation (21) the rate of increase of P_x, everything other than W constant, is $\Delta \ln P_x = c_n \Delta \ln W$.

18. Most firms carry inventories of finished product and many are able to keep their operations going for a short time during a strike by the use of managerial and supervisory staff. Furthermore, in the event of a very long strike more than just concurrent profits may be lost. Dissatisfied customers may turn permanently to alternative sources of supply, so that future profit may be lost. Increasing marginal costs of a strike to the firm may be more realistic than the constant cost per day assumed here. The only alteration required to our analysis is that the rate of increase of marginal costs will help determine the length of a strike. The more rapidly marginal costs increase the shorter (and less likely) will a strike be.

The accepted wage increase to the union rank and file and hence the union's wage demand, equation (28), may be rewritten as:

$$\Delta \ln W = H_K + (\beta\bar{w} + \alpha(\theta\delta c_n)^{-1}\bar{u})e^{-\gamma S}$$

where

$$H_K = \Delta \ln P - \alpha(\theta\delta c_n)^{-1}u_{-1} + \alpha\phi(\delta c_n)^{-1}\,\Delta \ln Y + \alpha\Delta \ln(X/N)$$

Hence, by substitution

$$C_{\Delta \ln W} = \pi X_{-1}\delta c_n H_K + \pi X_{-1}\delta c_n\,(\beta\bar{w} + \alpha(\theta\delta c_n)^{-1}\bar{u})e^{-\gamma S} \qquad (30)$$

3. Optimum Resistance and the Length of the Strike

We assume that, in determining how long to resist a union wage claim, the firm minimises the total costs of the strike. The total costs of a strike (C) are given by

$$C = C_S + C_{\Delta \ln W} \qquad (31)$$

The first-order condition for C to be at a minimum is

$$dC/dS = \pi X_{-1}/T - \gamma\pi X_{-1}\delta c_n(\beta\bar{w} + \alpha(\theta\delta c_n)^{-1}\bar{u})e^{-\gamma S} = 0 \qquad (32)$$

or

$$\pi X_{-1}/T = \gamma\pi X_{-1}\delta c_n(\beta\bar{w} + \alpha(\theta\delta c_n)^{-1}\bar{u})e^{-\gamma S} \qquad (33)$$

This says that the marginal (= average) cost of the strike to the firm (equal to the profit lost per extra day of the strike) should equal the marginal benefit of the strike (equal to the increase in post-strike profits per extra day of the strike resulting from the

reduction in the negotiated wage increase). If we multiply both sides of (33) by T, divide both sides by πX_{-1}, take natural logarithms and then solve for S we obtain

$$S = \gamma^{-1} \ln[\gamma\delta c_n(\beta\bar{w} + \alpha(\theta\delta c_n)^{-1}\bar{u})T] \qquad (34)$$

A necessary condition for a firm to precipitate a strike is that $\gamma\delta c_n(\beta\bar{w} + \alpha(\theta\delta c_n)^{-1}\bar{u})T > 1$. Hence, a strike and employer resistance is more likely:[19]

(i) the larger is (δ) the price elasticity of demand for the firm's product,

(ii) the larger is (c_n) the share of labour costs in the firm's total costs,

(iii) the larger are $\bar{w}$ the 'minimum real wage increase' and $\bar{u}$ the 'maximum unemployment rate' in the rank and file's objective function in the absence of a strike,

(iv) the more rapidly the latter decline under strike conditions (i.e. the larger is γ) and hence the less resistance shown by the union rank and file,

(v) the longer is (T) the contract period or period over which the wage increase is expected to last.

All these make obvious good sense. The condition for the firm to avoid precipitating a strike (i.e. to be 'weak' in the sense of Section II) is that $\gamma\delta c_n(\beta\bar{w} + \alpha(\theta\delta c_n)^{-1}\bar{u})T < 1$ or that

19. Equation (34) is non-stochastic hence it is not really legitimate to analyse the strike in terms of probability. However, the decision to precipitate a strike or not depends on managements' estimates of the parameters involved in (34). These estimates will introduce stochastic elements into the resulting inequalities.

$(\beta\bar{w} + \alpha(\theta\delta c_n)^{-1}\bar{u}) < (\gamma\delta c_n T)^{-1}$. The reverse of the conditions (i) to (v) listed above increase the likelihood of the firm offering no resistance to the initial union wage demand.

An expression for the wage increase which will result from resolving a strike may be obtained simply by substituting the equation for S (34) into equation (28).

$$\Delta \ln W = H_K + (\gamma\delta c_n T)^{-1} \tag{35}$$

where

$$H_K = \Delta \ln P - \alpha(\theta\delta c_n)^{-1} u_{-1} + \alpha\phi(\delta c_n)^{-1}\Delta \ln Y + \alpha\Delta \ln(X/N)$$

Thus the wage increase is given by

$$\Delta \ln W_{\text{NO STRIKE}} = H_K + (\beta\bar{w} + \alpha(\theta\delta c_n)^{-1}\bar{u}) \text{ for } S = 0$$

and (36)

$$\Delta \ln W_{\text{STRIKE}} = H_K + (\gamma\delta c_n T)^{-1} \text{ for } S > 0$$

It is likely that γ, δ, c_n and T will be stable over time[20] whereas $\bar{w}$ and $\bar{u}$ are more likely to vary. We have already noted that where the firm offers no resistance to a union wage claim and where consequently there is no strike $(\beta\bar{w} + \alpha(\theta\delta c_n)^{-1}\bar{u}) < (\gamma\delta c_n T)^{-1}$ therefore

$$\Delta \ln W_{\text{NO STRIKE}} < \Delta \ln W_{\text{STRIKE}} \tag{37}$$

20. The most likely exception to this generalisation is that γ, the measure of rank and file resistance, will vary over time. Indeed it is likely to be correlated with union militancy. This serves to reduce the probability of a strike. But once a strike does take place, it increases the difference between $\Delta \ln W_{\text{NO STRIKE}}$ and $\Delta \ln W_{\text{STRIKE}}$.

The union militancy component $(\beta\bar{w} + \alpha(\theta\delta c_n)^{-1}\bar{u})$ in the wage increase when there is no strike is replaced by the larger term $(\gamma\delta c_n T)^{-1}$ when there is a strike, all other terms in the wage increase equation remaining the same.

The crux of our story is that increased rank and file wage-militancy, a stronger emphasis on relative wage growth and a reduced concern for job security (indeed anything which might be reflected in increases in $\bar{w}$ and $\bar{u}$ in the union objective function) will, ceteris paribus, result in a larger initial union wage demand. A larger initial union wage demand increases the likelihood of employer resistance and a strike. The wage increase when there is a strike (when rank and file wage-militancy is high) will exceed the wage increase when there is no strike (when rank and file wage-militancy is low), other things equal. Consequently, if we aggregate over a number of firms, we should expect the number of strikes per unit time period (strike frequency) to be an additional explanatory variable in an aggregate wage change equation. A rise in strike frequency reflects increased rank and file militancy and the consequent increase in employer resistance and the negotiated wage rises. The average rate of increase in money wages will be higher, ceteris paribus, the more frequent are strikes.

IV. CONCLUSIONS

This paper has suggested an alternative union objective function, a Stone-Geary function including real wage growth and the employment rate as arguments. Such a function has two advantages: First, it provides a specific framework for incorporating union

militancy and socially established norms into the analysis of union wage and employment determination. Second, maximisation of such a function subject to some simple employer, labour-demand constraints produces standard Phillips' Curves.

Using the Ashenfelter and Johnson model to determine optimum employer resistance, we have demonstrated that, under certain plausible conditions, increased union wage-militancy and consequently larger wage demands will, other things equal, provoke increased employer resistance and a strike. The wage increase negotiated after a strike will exceed that which would have been negotiated had union militancy not been high enough to provoke a strike, all other things equal. This goes some way to explaining the statistically significant impact of strike frequency on the rate of change of money wages that many researchers have established.

BIBLIOGRAPHY

Ashenfelter, O.C. and Johnson, G.E. (1969) "Bargaining Theory, Trade Unions and Industrial Strike Activity," American Economic Review, 59, March, 35-49.

Ashenfelter, O.C. Johnson, G.E. and Pencavel, J.H. (1972) "Trade Unions and the Rate of Change of Money Wages in United States Manufacturing Industry," Review of Economic Studies, 39, January, 27-54.

Becker, G.S. (1964) Human Capital (NBER, Columbia University Press).

Cartter, A.M. (1959) Theory of Wages and Employment (Irwin, Homewood, Il.).

Dertouzos, J.N. and Pencavel, J.H. (1981) "Wage and Employment Determination under Trade Unionism: The International Typographical Union," Journal of Political Economy, 89, December, 1162-81.

Dhrymes, P. (1969) "A Model of Short-Run Labor Adjustments," in J. Duesenberry, G. From et.al, eds (The Brookings Model: Some further results) (North Holland).

Dunlop, J.T. (1944) Wage Determination under Trade Unions (Macmillan, New York).

Eckstein, O. and Wilson, T.A. (1962) "The Determination of Money Wages in American Industry," Quarterly Journal of Economics, 76, August, 379-414.

Edgren, G. Faxen, K.O. and Odhner, C.E. (1973) Wage Formation and the Economy (Allen and Unwin, London).

Farber, H.S. (1978) "Bargaining Theory, Wage Outcomes and the Occurrence of Strikes," American Economic Review, 68, June, 262-71.

Fellner, W.J. (1947) "Prices and Wages under Bilateral Monopoly," Quarterly Journal of Economics, 61, August, 503-532.

Friedman, M. (1968) "The Role of Monetary Policy," American Economic Review, 58, March, 1-17.

Godfrey, L.G. (1971) "The Phillips Curve: Incomes Policy and Trade Union Effects," in H.G.Johnson and A.R.Noboy, eds. The Current Inflation (Macmillan, London).

Goldstein, M. (1975) "Wage Indexation, Inflation and the Labour Market," IMF Staff Papers,

Henry, S.G.B., Sawyer, M.C. and Smith, P. (1976) "Models of Inflation in the United Kingdom: An Evaluation," National Institute Economic Review, 77, August, 60-71.

Hines, A.G.(1964) "Trade Unions and Wage Inflation in the United Kingdom: 1893-1961," Review of Economic Studies,31, October, 221-52.

Jackson, D., Turner, H.A. and Wilkinson, F. (1972) Do Trade Unions Cause Inflation? University of Cambridge Department of Applied Economics, Occasional Paper No. 36, Cambridge University Press.

Johnston, J. (1972) "A Model of Wage Determination under Bilateral Monopoly," Economic Journal, 82, September, 837-52.

Kuh, E. (1965) "Cyclical and Secular Labor Productivity in U.S. Manufacturing," Review of Economics and Statistics, 45, February, 1-12.

Levinson, H.M. (1960) "Pattern Bargaining: A Case Study of the Automobile Workers," Quarterly Journal of Economics, 74, May, 296-317.

McDonald, I.M. and Solow, R.M. (1981) "Wage Bargaining and Employment," American Economic Review, 71, December, 896-908.

Mortensen, D.(1971) "A Theory of Wage and Employment Dynamics," in E.S. Phelps, ed., Microeconomic Foundations of Employment and Inflation Theory (Macmillan, London).

Mulvey, C. and Trevithick, J.A. (1974) " Some Evidence on the Wage Leadership Hypothesis," Scottish Journal of Political Economy, 21, February, 1-11.

Oi, W. (1962) "Labor as a Quasi-Fixed Factor of Production," Journal of Political Economy, 70, October, 538-55.

Pencavel, J.H. (1970) "An Investigation into Industrial Strike Activity in Great Britain," Economica, 37, August, 239-56.

Pencavel, J.H. (1984) "The Trade off between Wages and Employment in Trade Union Objectives," Quarterly Journal of Economics, 99, May, 215-32.

Phelps, E.S. (1967) "Phillips Curves, Expectations of Inflation and Optimal Unemployment over Time," Economica, 34, August, 254-81.

Phipps, A.J. (1977) "Strike Activity and Inflation in Australia," Economic Record, 53, September, 297-319.

Phipps, A.J. (1983) "Australian Unemployment: Some Evidence from Industry Labour Demand Functions," Australian Economic Papers, December, 333-344.

Robinson, J. (1937) Essays in the Theory of Employment (Macmillan. London) pp.7-9.

Ross, A.M. (1948) Trade Union Wage Policy, (California University Press, Berkeley).

Sargan, J.D. (1971) "A Study of Wages and Prices in the U.K. 1949-68," in H.G. Johnson and A.R.Nobay op.cit.

Taylor, J. (1972) "Incomes Policy, the Structure of Unemployment and the Phillips Curve," in J.M. Parkin and M.T. Sumner, eds. Incomes Policy and Inflation (Manchester University Press).

APPENDIX

Optimum Employer Resistance: A Neo Classical Case

We proceed along lines similar to those pursued in the Keynesian case.

1. The Direct Costs of a Strike

If we assume that total profits (π) are earned evenly throughout the contract period, then the direct costs of a strike to the firm may be represented by

$$C_S = \pi_{-1} S/T \tag{1}$$

2 The Cost of Giving In

In our simple neo-classical model with given (CES) technology, equilibrium profits (π) are an increasing function of price and a decreasing function of the wage rate. Thus

$$\pi = f(P,W); \qquad \partial\pi/\partial P > 0, \ \partial\pi/\partial W < 0. \tag{2}$$

Totally differentiating (2)

$$d\pi = (\partial\pi/\partial P)dP + (\partial\pi/\partial W)dW \tag{3}$$

The cost to the firm of giving in to the union's wage demand is the loss of potential profit resulting from the wage increase <u>given</u> the <u>expected</u> price P. If we define $f_W = -\partial\pi/\partial W$ the costs resulting from lost potential profit are:

$$C_{\Delta \ln W} = f_W \, W_{-1} \, \Delta \ln W \tag{4}$$

The wage increase acceptable to the average rank and file unionist and demanded by the union leadership is, from main text equation (27)

$$\Delta \ln W = H_{NC} + (\beta\bar{w} + (\alpha/\epsilon)\bar{u})e^{-\gamma S} \tag{5}$$

where

$$H_{NC} = \Delta \ln P - (\alpha/\epsilon)u_{-1} + (\alpha\theta/\epsilon)\Delta \ln X$$

Substituting (6) into (5) gives

$$C_{\Delta \ln W} = f_W W_{-1} H_{NC} + f_W W_{-1}(\beta\bar{w} + (\alpha/\epsilon)\bar{u})e^{-\gamma S} \tag{6}$$

3. Optimum Resistance

The problem from the firm's view point may be seen as minimising:

$$C = C_S + C_{\Delta \ln W} \tag{7}$$

with respect to S. The first-order condition for C to be at a minimum is

$$dC/dS = \pi_{-1}/T - \gamma f_W W_{-1} \ (\beta\bar{w} + (\alpha/\epsilon)\bar{u})e^{-\gamma S} = 0 \tag{8}$$

or

$$\pi_{-1}/T = \gamma f_W W_{-1} \ (\beta\bar{w} + (\alpha/\epsilon)\bar{u})e^{-\gamma S}$$

Taking natural logarithms and solving for S gives

$$S = \gamma^{-1} \ln[\gamma(W_{-1}/\pi_{-1})f_W(\beta\bar{w} + (\alpha/\epsilon)\bar{u})T] \tag{9}$$

A necessary condition for the firm to precipitate a strike is

$$\gamma(W_{-1}/\pi_{-1})f_W(\beta\bar{w} + (\alpha/\epsilon)\bar{u})T > 1$$

or

$$(\beta\bar{w} + (\alpha/\epsilon)\bar{u}) > \pi_{-1}(W_{-1}\gamma f_W)^{-1} \qquad (10)$$

Hence, a strike is more likely

(i) the larger are $\bar{w}$ and $\bar{u}$ and γ as in the Keynesian case,

(ii) the smaller are π_{-1}/T, profits per day lost,

(iii) the larger is W_{-1} (since we have been dealing with percentage wage increases, W_{-1} determines the money cost of a given percentage rise in wages),

(iv) the larger is $f_W = -\partial\pi/\partial W$, the more responsive are profits in equilibrium to changes in the wage rate.

The wage increase after a strike (substituting (9) into main text (27)) is

$$\Delta \ln W_{STRIKE} = H_{NC} + \pi_{-1}(W_{-1}\gamma f_W)^{-1} \qquad (11)$$

which compares with

$$\Delta \ln W_{NO\ STRIKE} = H_{NC} + (\beta\bar{w} + (\alpha/\epsilon)\bar{u}) \qquad (12)$$

so that $\Delta \ln W_{STRIKE} > \Delta \ln W_{NO\ STRIKE}$

The substantive conclusions reached in the Keynesian case about the effect of rank and file wage-militancy on both strike frequency and final negotiated wage increases hold in this neo-classical case.

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