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EMPLOYMENT, WAGES, AND UNIONISM IN A MODEL OF THE AGGREGATE LABOR MARKET IN BRITAIN

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ABSTRACT

Two propositions figure prominently in explanations for Britain's comparatively low growth in employment: first, the wage-setting mechanism is insufficiently responsive to the growth of unemployment and, second, there exists a well-defined negative causal relationship from wages to employment with the features of a conventional labor demand function. Using aggregate annual observations from 1953 to 1979, I find the evidence for a conventional labor demand curve to be fragile and I find little support for the notion that trade union objectives are unaffected by unemployment as some versions of the "insider-outsider" hypothesis would maintain. In general, the empirical results in this paper emphasize that confident inferences about Britain's employment record cannot be drawn from aggregate data.

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I. Introduction

Britain's discouraging record on employment during the last 15 years or so has resulted in the revival of the classical explanation for unemployment: wages have been consistently above market-clearing levels and employers have responded by moving back on their labor demand schedules. This explanation in various guises has figured in many accounts of the growth in unemployment including those in government publications and in academic treatises.[1/] The heart of this explanation consists of two propositions: first, the wage-setting mechanism is insufficiently responsive to the growth of unemployment and, second, there exists a well-defined negative causal relationship from wages to employment with the features of a conventional labor demand curve. The purpose of this paper is to present evidence relevant to both of these propositions.

The second proposition is the focus of the research reported in the first part of the paper. There is no doubt that, given the

1/ For example, H.M. Treasury (1985), Bruno and Sachs (1985), and Minford (1983).

resources available to economists, it is feasible to organize the annual movements in wages and employment in postwar Britain in such a way that they conform to something akin to a labor demand function. But not being present at the discovery of this demand function, the reader is normally left uninformed of the trail followed by the researcher in exploring and ultimately locating the function and hence it is difficult to discern whether this employment-wage relationship is readily apparent or its detection requires subtle and sensitive management of the data. Consequently, it is impossible to know how much confidence to place in the concept of an aggregate demand function for labor.

This paper presents an array of empirical results that might be of assistance in evaluating the robustness of the aggregate wage-employment relationship. In fact, quite early in my examination of this issue, I stumbled upon a formulation with the appearance of a conventional labor demand function, but I then found it to be a delicate being, one that was sensitive to small changes in specification. It is not a relationship that the data effortlessly conform to.

Having thus identified a relationship that (though not robust) has claim to be labelled a labor demand function, I build upon this a wage-setting model that affords an opportunity to evaluate the other proposition behind the popular story for the growth in unemployment, the proposition that the mechanism determining wages is unresponsive with respect to unemployment. In fact, given the manner in which I characterize the wage-setting process, this proposition takes the form of examining whether, in pursuing their wage and employment objectives, trade unions take account of the unemployment rate. This is related to the "insider-outsider" hypothesis that has become popular in recent years.[2/] I express this proposition in such a way that it turns on the value assumed by a parameter of the trade union's objective function and I estimate this parameter with aggregate time-series data. Though again unequivocal judgments are not permitted, the point estimates suggest the goals of British unions have been sensitive to the level of unemployment.

Taken as a whole, the empirical work in this paper surely suggests that aggregate British time-series observations do not allow confident inferences to be drawn about two propositions central to the classical unemployment hypothesis. This does not necessarily negate this hypothesis: Britain's wage-setting procedures are decentralized and the characterization of trade union wage pressure impeding the growth of employment might be accurate in many labor markets and yet it is somehow camouflaged in the aggregate data. This is both a plausible and testable proposition. However, disaggregated studies are unusual and most studies (including this one) draw inferences from aggregated data. These data can certainly be organized to provide support for a particular characterization of the workings of the British labor market, but it should be recognized these are primarily exercises in calibration, that is, quantifying the magnitude of presumed relationships. The aggregate data leave ample room for doubt about the existence of these relationships.

[2/] For references to the literature on the "insider-outsider" hypothesis as well as a useful analysis, see Carruth and Oswald (1987).

II. The Determinants of Employment

A. Introduction

The purpose of this section is to report the results of estimating equations that might be interpreted as aggregate employment demand functions. It is appropriate to spell out my procedures here because in some respects they differ from those followed by some other researchers on these issues. First, the emphasis of this section is not one of measuring the magnitude of presumed relationships. Rather, the emphasis is on determining whether an employment equation can be estimated that bears the characteristics of a stylized demand function. In other words, I do not presume the existence of a negative sign on wages in an equation accounting for movements in aggregate employment, but instead I ascertain what has to be done to generate this result. The more convoluted and contorted the specification of the equation ultimately generating the appearance of a conventional labor demand function, the less plausible is such a construct.

Now, of course, given the cost of computing time nowadays and given the availability of observations on more and more variables, there is absolutely no doubt that a diligent researcher will in due course unearth an equation desplaying the features of a labor demand function even if the data have to be skillfully arranged and perhaps misrepresented to do so. The most natural way of achieving this goal is to augment a naive labor demand function (that is, one containing only relative prices and an aggregate demand variable) with variables that do not appear in textbook labor demand functions, but whose presence can be rationalized by an imaginative researcher. For instance, at one time or another, purportedly employment demand functions have been estimated that include as regressors the number of strikes, normal weekly hours of work, a smoothed series on the gross capital stock, the deviation of world trade from a trend, and the adjusted public sector deficit as a percentage of potential gross domestic product.[3/] Usually, quite ingenious explanations are provided for the inclusion of these variables and I am not going to argue that, in some sense, researchers have been ill-advised to augment naive labor demand equations with these variables.

What I would argue is, first, it is often not clear whether the presence of these auxiliary variables is necessary for the rest of the equation to give the appearance of a conventional labor demand function and, second, the usefulness of the pristine labor demand function is compromised if it requires for its application the constancy of a whole string of other variables about which economic analysis has sometimes little to say. In other words, the inclusion of the auxiliary variables is not a matter of truth or falsehood; it is an issue of usefulness for understanding and organizing economic phenomena. If an exogenous increase in real wages depresses employment, but only if strikes, work hours, the capital stock, world trade, and government's budget deficit

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[3/] The strikes and hours of work variables are used by Symons (1982) in his study of British manufacturing industry while the other variables appear in Layard and Nickell (1986). Layard and Nickell's world trade variable is supposed to measure "real demand relative to potential output." Why is the volume of transactions any more a demand than a supply variable and, in any event, how does the volume of exchanges enter a demand function?

are held constant, then perhaps we should be diverting more research resources into understanding the movements of the auxiliary variables and less into real wages.[4/] Consequently, in this study, I shall be investigating the degree to which the aggregate data on employment and other variables conform to a naive, unaugmented, labor demand function.

A word on identification is needed. If employment and real wages do not trace out the negative relationship implied by a naive demand function, the most natural response is to invoke the identification problem: a positive employment-wage association reflecting labor supply decisions has interfered with the negative slope implied by the labor demand function. I believe this is not a persuasive objection in the context of the British labor market. First, standard exclusion restrictions are applied to lend support to the interpretation of the relationship as a demand function.[5/] Second, in a highly unionized economy such as Britain's, I am extremely sceptical of the relevance to most labor markets of a model whereby the wage is set through the intersection of a conventional upward-sloping labor supply function and a conventional downward-sloping demand function. Surely, a more appropriate characterization is a recursive one whereby wages are set by unions, employers, or the representatives of government through collective bargaining procedures and, with wages thus determined, firms make their employment decisions. In this event, the a priori case for

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4/ I maintain that what economists have contributed to an understanding of movements over time in normal hours of work is meagre and that with respect to strikes not much more.

5/ In particular, variables such as the level of unemployment benefits are excluded from the equation determining employment.

the observations on employment and real wages mapping out a labor demand function seems much more compelling. In such an economy, a labor supply relationship may involve the size of the labor force and wages; that is, an increase in real wages may raise the number of people who would like to be employed on these terms and this will be manifested in an expansion of the labor force. This paper also reports the results from some simple specifications of this relationship.

B. Estimates

The specification for aggregate employment from which I start is as follows:

$$e_t = a_0 + \sum_{i=0}^{2} a_{1i}\left(\frac{(1+v)w}{m}\right)_{t-i} + \sum_{i=0}^{2} a_{2i}\left(\frac{r}{m}\right)_{t-i} + \sum_{i=0}^{2} a_{3i}y_{t-i}$$

$$+ \sum_{i=1}^{3} a_{4i}e_{t-i} + a_5T_t + a_6T_t^2 + u_{1t} \quad .$$

All lower case letters denote natural logarithms of the variables. The logarithm of employment is e, money wages w, the payroll tax rate v, the prices of raw materials and fuels m, the user cost of capital r, and real disposable income y. A time trend is given by T_t and u_{1t} repesents a stochastic disturbance. The a's are parameters to be estimated. Descriptive statistics on these and other variables are provided in Table 1.

I have in mind a situation in which firms choose their labor, raw material, energy, and capital inputs to maximize their profits given input prices (including wages set by collective bargaining or some sort

Table 1

Definitions of Variables and Descriptive Statistics, 1953-79

Original Variables	Mean	Standard Deviation
E = employees in employment (millions)	22.19	0.66
Z = total working population (labor force)(millions)	22.74	0.88
W = index of wages	171.2	144.4
M = price index of materials and fuels	145.3	108.7
R = user cost of capital	1256.7	1384.1
Y = real disposable income	211.8	58.5
K = gross capital stock at 1975 replacement cost	356.3	97.0
V = index of payroll tax rate (1975=1)	0.936	0.0425
S = index of indirect tax rate (1975=1)	1.016	0.0161
I = income tax rate	0.169	0.035
C = index of real unemployment benefits	36.81	10.21
(1+S)P = retail price index (inclusive of indirect taxes)	158.7	100.0

Transformed Variables	Mean	Standard Deviation
$U \equiv Z-E$ = number unemployed	0.55	0.36
U/Z = unemployment rate	0.024	0.015
$e = \ln E$	3.099	0.030
$z = \ln Z$	3.123	0.039
$(1+v)w = \ln((1+V)W)$	4.622	0.309
$(1-i)w/(1+s)p = \ln((1-I)W/(1+S)P)$	-0.246	0.201
$r/m = \ln(R/M)$	1.861	0.439
$(1+v)w/m = \ln((1+V)W/M)$	4.622	0.309
$y = \ln Y$	5.319	0.275
$c = \ln C$	3.566	0.296
$k = \ln K$	5.840	0.273

Notes: Observations on personal disposable income, retail prices, employment and the working population are taken from issues of the Annual Abstract of Statistics (Central Statistical Office). The user cost of capital, R, is defined as $(\tilde{R} + 0.05)*\tilde{P}$ where $\tilde{R}$ is the average yield on 2.5 percent Consols and $\tilde{P}$ is the price index of the output of iron and steel industries. Observations on $\tilde{P}$ and $\tilde{R}$ are drawn from the Annual Abstract of Statistics. Real disposable income is nominal disposable income divided by the retail price index. Observations on all the other variables are taken from the data appendix to Nickell and Andrews (1983).

of regulation) and given a downward-sloping demand function for their output. The price of output is thus not exogenous, but variables that shift that demand function (especially consumers' disposable income) may be assumed to be so. The quadratic time trend may be rationalized in terms of the effects of technical progress although, of course, it incorporates the effects of any time-correlated omitted variables. In the absence of a compelling economic model, the case for complicated trends is unconvincing. Indeed, even a quadratic time trend is a little disconcerting and I should be more comfortable with the estimates if they prove to be independent of the presence of this trend.

Equation (1) is estimated with annual data for Britain from 1953 to 1979. The estimation technique is instrumental variables where current and lagged wages and lagged employment are treated as endogenous. Wages are endogenous insofar as wage and employment decisions are made jointly. Treating lagged employment as predetermined would seem most inappropriate given the fact that relevant determinants of employment are almost certainly omitted form equation (1) and these omitted regressors affect employment in earlier years. The empirical application of almost any behavioral model of the dynamic demand for inputs will imply that lagged values of the inputs are jointly determined with the current values. I am well aware a case can be made for treating disposable income as endogenous and, indeed, some equations were fitted allowing for this possibility. The implications from this inquiry were not meaningfully different from those reported. The lag on the regressors in equation (1) are conventionally justified in terms of some (usually unspecified) costs of adjustments. Unfortunately, only under the most restrictive of conditions will adjustment cost models yield explicit expressions in which the lagged values of the regressors with corresponding fixed coefficients accurately embody the effects of such adjustment costs.

The consequences of fitting equation (1) are shown in column 1 of Table 2 and the estimates in the other columns show the consequences of small changes in the specification. Thus the estimates in columns 1 and 2 provide support for restricting the effect of lagged employment to two years. Conventional t-tests allow us to dispense with contemporaneous disposable income and lagged values of the ratio of the prices of capital to raw materials. Columns 3, 4, 5, and 6 present, therefore, more parsimonious versions of equation (1) in which negative and significant (by conventional standards) effects of current and lagged real wages on employment are measured.

These estimates provide empirical support for the notion of a conventional employment demand function as applied to the aggregate British economy. But, unfortunately, this is not a robust relationship, one that survives small alterations in specification. For instance, column 7 of Table 2 simply removes the quadratic time trend from the specification in column 6 and our confidence in the negative effects of real wages on employment is immediately challenged as is our inference about the effect of energy and raw material prices on employment. Or, to provide another indication of the lack of robustness of these results, the estimates in column 8 omit e_{t-2} from the specification in

Table 2: Instrumental Variable Estimates of Equaiton (1)

Equation Number	1	2	3	4	5	6	7	8
Constant	1.804 (3.901)	3.745 (3.568)	3.466* (0.748)	3.141* (0.619)	3.324* (0.611)	3.352* (0.613)	0.185 (0.274)	1.064 (0.564)
$((1+v)w/m)_t$	-0.060 (0.042)	-0.061 (0.039)	-0.076* (0.031)	-0.057* (0.021)	-0.046* (0.019)	-0.048* (0.019)	-0.010 (0.029)	-0.051 (0.032)
$((1+v)w/m)_{t-1}$	-0.122 (0.089)	-0.127 (0.079)	-0.168* (0.037)	-0.152* (0.031)	-0.152* (0.032)	-0.149* (0.032)	-0.025 (0.034)	-0.060 (0.044)
$((1+v)w/m)_{t-2}$	-0.003 (0.121)	-0.028 (0.108)	-0.064* (0.028)	-0.070* (0.027)	-0.070* (0.027)	-0.083* (0.025)	0.010 (0.025)	-0.011 (0.034)
$(r/m)_t$	-0.070 (0.084)	-0.074 (0.075)	-0.109* (0.027)	-0.094* (0.020)	-0.098* (0.020)	-0.089* (0.019)	-0.013 (0.021)	-0.025 (0.023)
$(r/m)_{t-1}$	0.037 (0.040)	0.002 (0.051)	0.031 (0.026)	0.013 (0.014)	0.016 (0.014)			
$(r/m)_{t-2}$	-0.001 (0.025)	0.002 (0.025	-0.016 (0.019)					
y_t	0.064 (0.077)	-0.012 (0.101)	0.075 (0.056)	0.055 (0.050)				
y_{t-1}	0.303* (0.118)	0.335* (0.105)	0.345* (0.069)	0.343* (0.066)	0.383* (0.057)	0.395* (0.056)	0.253* (0.075)	0.357* (0.095)
y_{t-2}	-0.272* (0.099)	-0.309* (0.104)	-0.224* (0.055)	-0.201* (0.046)	-0.208* (0.047)	-0.210* (0.047)	-0.208* (0.075)	-0.289* (0.073)
e_{t-1}	1.089 (0.547)	1.085* (0.495)	0.825* (0.141)	0.842* (0.135)	0.883* (0.133)	0.844* (0.129)	1.058* (0.199)	0.698* (0.213)
e_{t-2}	-0.872* (0.250)	-1.074* (0.288)	-0.918* (0.218)	-0.863* (0.200)	-0.942* (0.192)	-0.927* (0.192)	-0.151 (0.221)	
e_{t-3}	0.265 (0.791)	0.452 (0.795)						
e_{t-4}		-0.460 (0.400)						
T_t	0.023 (0.045)	0.038 (0.040)	0.041* (0.009)	0.036* (0.007)	0.042* (0.009)	0.044* (0.008)		0.013 (0.009)
T_t^2	-0.0005 (0.0010)	-0.0007 (0.0008)	-0.0010* (0.0002)	-0.0009* (0.0002)	-0.0009* (0.0002)	-0.0009* (0.0002)		-0.0003 (0.0002)
BP	2.90	2.98	2.76	4.56	5.58	4.56	3.93	0.72
DW	2.42	2.46	2.05	1.93	1.90	1.70	1.48	1.72
see	0.0055	0.0052	0.0049	0.0047	0.0049	0.0049	0.0086	0.0083

Notes: The estimates in columns 3 through 8 are fitted to data from 1953 to 1979. Those in column 1 use data starting in 1954 and those in column 2 use data starting in 1955. Estimated standard errors are in parentheses. For ease of reading, an asterisk has been attached to coefficients estimated to be at least twice their standard errors. The instrumental variables used to estimate these equations are m_t, m_{t-1}, m_{t-2}, r_t, r_{t-1}, r_{t-2}, $(1+v)_t$, $(1+v)_{t-1}$, $(1+v)_{t-2}$, y_t, y_{t-1}, y_{t-2}, c_t, c_{t-1}, c_{t-2}, $(1+s)_t$, $(1+s)_{t-1}$, $(1+s)_{t-2}$, T_t, and T_t^2. BP stands for the Box-Pierce Chi-Square Statistic computed over two year residual autocorrelations. DW is the Durbin-Watson statistic and see is the equation's standard error of estimate.

column 6. Again, our inferences are immediately surrounded with much greater uncertainty. It is the effects of disposable income that tend to be robust with respect to small changes in equation specification, not the effects of wages.

A common assumption in this literature is that the services from physical capital are predetermined with respect to employment decisions. I find the widespread use of this assumption quite remarkable. Even if the stocks of buildings and machines were fixed, their use is certainly not. However, what difference does it make to our estimated employment equation if the user cost of capital is replaced in equation (1) with a measure of the capital stock (whose logarithm in year t is given by k_t)? This is answered by the estimates in Table 3. A compelling case for a negative wage-elasticity cannot be made from the estimates in Table 3 nor can a strong case be made for employment being significantly affected by physical capital. Henceforth, I maintain the assumption that the relevant regressor is the user cost of capital.

C. Interpretation

There are several ways in which to rationalize the more parsimonious specification in columns 3, 4, 5, and 6 of Table 2. One is the following which starts with a static or desired (indicated by an asterisk) demand for employment

Table 3: The Use of Capital Stock as a Regressor

Equation Number	1	2	3	4	5
Constant	1.155 (2.413)	4.049 (2.414)	0.069 (0.353)	3.603 (1.447)	2.192 (1.279)
$((1+v)w/m)_t$	-0.012 (0.047)	-0.016 (0.053)	-0.037 (0.037)	-0.017 (0.036)	-0.046 (0.040)
$((1+v)w/m)_{t-1}$	-0.059 (0.044)	-0.026 (0.047)	-0.017 (0.042)	-0.032 (0.040)	-0.023 (0.040)
$((1+v)w/m)_{t-2}$	0.014 (0.039)	0.010 (0.043)	0.020 (0.030)	0.006 (0.038)	-0.008 (0.038)
k_t	-0.176 (0.506)	0.266 (0.536)	-0.094 (0.535)	0.215 (0.455)	-0.235 (0.224)
k_{t-1}	-0.648 (0.622)	-0.464 (0.694)	-0.157 (0.746)	-0.679 (0.560)	
k_{t-2}	0.546 (0.816)	-0.394 (0.824)	0.252 (0.566)		
y_t	0.083 (0.085)	0.034 (0.093)	0.082 (0.095)		0.067 (0.085)
y_{t-1}	0.257* (0.106)	0.211 (0.118)	0.172 (0.120)	0.251* (0.090)	0.197 (0.106)
y_{t-2}	-0.155 (0.122)	-0.136 (0.137)	-0.231* (0.094)	-0.173 (0.095)	-0.201* (0.097)
e_{t-1}	0.948* (0.246)	0.733* (0.260)	0.999* (0.246)	0.760* (0.235)	0.839* (0.231)
e_{t-2}	-0.764* (0.321)	-0.176 (0.260)	-0.010 (0.263)	-0.213 (0.227)	-0.159 (0.250)
e_{t-3}	0.705* (0.266)				
T_t	0.008 (0.009)	0.017 (0.009)		0.017 (0.009)	0.014 (0.009)
T_t^2	-0.0001 (0.0003)	0.0001 (0.0004)		-0.0001 (0.0002)	-0.0001 (0.0002)
BP	2.28	2.69	3.89	2.08	2.30
DW	1.43	1.78	1.70	1.60	1.87
see	0.0074	0.0084	0.0093	0.0077	0.0081

Notes: These are instrumental variable estimates where current and lagged values of wages and the capital stock and lagged values of employment are endogenous and where the instruments are those specified in the Notes to Table 2.

$$(2)\qquad e_t^* = \alpha_0 + \alpha_1\left(\frac{(1+v)w}{m}\right)_t + \alpha_2\left(\frac{(1+v)w}{m}\right)_{t-1} + \alpha_3\left(\frac{r}{m}\right)_t + \alpha_4 y_{t-1} + \alpha_5 T_t + \alpha_6 T_t^2 + u_{2t}$$

and combines this with a partial adjustment equation of the form

$$(3)\qquad e_t = \lambda e_t^* + (1-\lambda)e_{t-1} + u_{3t}$$

where u_{3t} is serially correlated $u_{3t} = \rho u_{3t-1} + \tilde{\varepsilon}_{3t}$. The implied structural equation for employment is

$$(4)\qquad e_t = \lambda\alpha_0(1-\rho) + \lambda(\alpha_5-\alpha_6)\rho + \lambda\alpha_1\left(\frac{(1+v)w}{m}\right)_t + \lambda(\alpha_2-\rho\alpha_1)\left(\frac{(1+v)w}{m}\right)_{t-1} - \rho\lambda\alpha_2\left(\frac{(1+v)w}{m}\right)_{t-2} + \lambda\alpha_3\left(\frac{r}{m}\right)_t - \rho\lambda\alpha_3\left(\frac{r}{m}\right)_{t-1} + \lambda\alpha_4 y_{t-1} - \rho\lambda\alpha_4 y_{t-2} + \lambda\left[\alpha_5(1-\rho) + 2\rho\alpha_6\right]T_t + \lambda\alpha_6(1-\rho)T_t^2 + (1-\lambda + \rho)e_{t-1} - \rho(1-\lambda)e_{t-2} + u_{4t}$$

where the stochastic term u_{4t} is a weighted sum of u_{2t} and $\tilde{\varepsilon}_{3t}$.

A different rationalization of the specifications estimated in Table 2 involves characterizing an AR(2) process for the stochastic term in a simple static employment demand function, namely,

$$e_t = \alpha_0 + \alpha_1\left(\frac{(1+v)w}{m}\right)_t + \alpha_3\left(\frac{r}{m}\right)_t + \alpha_4 y_t + \alpha_5 T_t + \alpha_6 T_t^2 + u_{5t}$$

$$u_{5t} = \rho_1 u_{5t-1} + \rho_2 u_{5t-1} + \tilde{\varepsilon}_{4t}\ .$$

This implies the following structural equation for employment:

$$e_t = \alpha_0(1-\rho_1-\rho_2) + (\rho_1+2\rho_2)\alpha_5 - (\rho_1+4\rho_2)\alpha_6 + \alpha_1\left(\frac{(1+v)w}{m}\right)_t - \rho_1\alpha_1\left(\frac{(1+v)w}{m}\right)_{t-1}$$

$$- \rho_2\alpha_1\left(\frac{(1+v)w}{m}\right)_{t-2} + \alpha_3\left(\frac{r}{m}\right)_t - \rho_1\alpha_3\left(\frac{r}{m}\right)_{t-1} - \rho_2\alpha_3\left(\frac{r}{m}\right)_{t-2} + \alpha_4 y_t - \rho_1\alpha_4 y_{t-1}$$

$$- \rho_2\alpha_4 y_{t-2} + [\alpha_5(1-\rho_1-\rho_2) + 2\alpha_6(\rho_1+2\rho_2)]T_t + \alpha_6(1-\rho_1-\rho_2)T_t^2$$

$$+ \rho_1 e_{t-1} + \rho_2 e_{t-2} + u_{6t} \quad ,$$

where again the stochastic term u_{6t} combines u_{5t} and $\bar{\varepsilon}_{4t}$. No doubt, there are other ways to justify the specifications in columns 3 through 6 of Table 2, but these two constitute a most obvious pair.

To determine the empirical performance of equations (4) and (5), I estimated both equations by nonlinear instrumental variables treating all money wage variables and lagged employment variables as endogenous. On the basis of the results in Table 4, there is little to choose between these two rationalizations: the parameters of the employment demand functions are not measured as well as those governing the adjustment or autoregressive processes. With the influence of disposable income coming through quite clearly in equation (4a), there is perhaps a slight preference for these estimates and, indeed, I shall be building on this specification later. However, I do not claim that one specification represents a demonstrably superior description of the data.

Table 4: Nonlinear Instrumental Variables Estimates of Equations (4) and (5)

Parameters \ Equation Number	(4a)	(5a)
$\hat{\alpha}_0$	2.969 (6.948)	3.417* (0.414)
$\hat{\alpha}_1$	-0.006 (0.035)	-0.007 (0.028)
$\hat{\alpha}_2$	-0.043 (0.038)	
$\hat{\alpha}_3$	-0.040 (0.042)	-0.003 (0.025)
$\hat{\alpha}_4$	0.288* (0.109)	-0.074 (0.088)
$\hat{\alpha}_5$	-0.062 (0.288)	0.009 (0.007)
$\hat{\alpha}_6$	0.001 (0.004)	-0.001 (0.002)
$\hat{\lambda}$	0.785* (0.277)	
$\hat{\rho}$	0.920* (0.219)	
$\hat{\rho}_1$		1.297* (0.209)
$\hat{\rho}_2$		-0.629* (0.225)
BP	7.19	5.18
DW	1.62	1.56
see	0.0086	0.0104

III. A Structural Model of the Labor Market

A. Introduction

This section builds on the empirical findings earlier by offering a structural model of wage and employment determination for the British labor market. The purpose of this structural model is not merely to give quantitative expression to a popular account of how wages and employment are set in a highly unionized economy, but also to do so in such a way as to shed light on what has become a fasionable view of the nature of union objectives. This view holds that the objectives of trade unions embrace the welfare of those currently employed, the so-called "insiders," and little or no weight is given to the unemployed who are "outsiders" to the wage determination process. Thus a negative employment shock reduces the size of the union's constituency and they will raise their wage demands to levels that make it unprofitable for the firm subsequently to hire the unemployed.

This "insider-outsider" distinction in union objectives appears to have won a number of adherents although this is not because of frequent or convincing corroboration of its central assumptions or implications with the evidence. Indeed, it runs counter to a long tradition of working class solidarity in British trade unionism where the welfare of the unemployed frequently figures in the stated concerns of both the union leadership and the rank-and-file. Of course, economists are weaned at an early professional age of the fallacy that words necessarily match behavior, but nevertheless most of us would feel more comfortable if our models' postulates were not quite at odds with the way in which the actors thought they were behaving.

The model proposed and estimated here identifies "the" union as the leader in setting wages and "the" employer as the follower in determining employment. The strengths and weaknesses of this approach have been discussed at length elsewhere although evidence of its empirical performance is restricted to a small number of (sometimes atypical) labor markets. It is surely a plausible characterization of British labor markets where unions are often portrayed as having considerable power in setting wages and where employers (or their representatives) are allowed considerable discretion over the level of employment. The attractive feature of this model for empirical researchers is that it allows for a convenient solution to what might be an intractable bargaining problem.

B. Specific Functional Forms

Suppose the union has objectives defined over real wages net of taxes $(1-i)w/(1+s)p$, employment e, and the size of the labor force z, where all these variables are expressed in natural logarithms. In particular, posit the following expression for the goals of the union:

$$(6) \qquad \Gamma(w,e,z) = \left(\left(\frac{(1-i)w}{(1+s)p}\right)_t - \gamma_t + \varepsilon_{1t}\right)^{\theta}\left(e_t - \mu z_t - \delta + \varepsilon_{2t}\right)^{1-\theta}$$

where $$\gamma_t = \gamma_1\left(\left(\frac{(1-i)w}{(1+s)p}\right)_{t-1} + \gamma_2\left(\left(\frac{(1-i)w}{(1+s)p}\right)_{t-2} + \varepsilon_{3t} \;.$$

The ε's are stochastic terms incorporating omitted features of the union's objectives. Of course, a meaningful definition of objectives requires $[(1-i)w/(1+s)p]_t > \gamma_t - \varepsilon_{1t}$ and $e_t - \mu z_t > \delta - \varepsilon_{2t}$. If $\mu = 1$, $e_t - \mu z_t = \ln[1 - (U_t/Z_t)] \approx -(U/Z)_t$ and the unemployment rate figures explicitly in the union's objectives. On the other hand, if $\mu = 0$, the union cares about the employed only, the "insiders," and the size of the employed relative to the labor force (i.e., the unemployment rate) is not of its concern. The value of the parameter μ, therefore, suggests the importance that the "outside" unemployed play in union objectives. Note also that by specifying the reference level of wages, γ_t, to depend upon past values of wages, we permit current wage goals to be molded by experience in the manner of habit persistence models of consumption. This formulation is also consistent with some representations of the role played in wage bargaining by "target" values of real wages.[6/] The parameter θ is closely related to the cyclical variability of employment relative to that of wages: a value of θ close to zero implies greater variability of employment while θ close to unity implies greater variability of wages.

According to the proposed bargaining model, the employer determines employment subject to the wage rate set by the trade union. Suppose the employment demand function is that represented by equation (2) augmented by the partial adjustment equation (3) where the error term in that partial adjustment equation is serially correlated. In

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6/ See, for instance, Sargan (1980). Note that the lagged value of wages is treated as given when current wages are determined implying that the unions are characterized here as not solving an intertemporal problem that recognizes the evolution of their wage objectives.

addition to allowing firms to adjust employment in response to the wage, let us also permit an adjustment from the labor force (whose logarithm in year t is denoted z_t) as given by the following equations:

$$z_t^* = \beta_0 + \beta_1\left(\left(\frac{(1-i)w}{(1+s)p}\right)_t + \beta_2 c_t + u_{7t}\right. \tag{7}$$

where

$$z_t = \xi z_t^* + (1-\xi)z_{t-1} + u_{8t} \quad . \tag{8}$$

One would expect that, other things equal, higher real wages induce an expansion of the labor force so that $\beta_1 > 0$. The variable c_t measures the (logarithm of the) real value of unemployment benefits so that, because z_t includes the unemployed, one might expect fewer of the unemployed would drop out of the labor force when these benefits take on higher real values so β_2 is conjectured to be positive. The partial adjustment equation (8) rationalizes the important role played by one-year lagged values of the labor force in accounting for movements in z_t in instrumental variable regressions. Indeed, this specification was selected in much the same way that the structural employment equation was chosen: instrumental variable regressions were fitted relating z_t to current and lagged values of real wages and of real unemployment benefits and to lagged values of the dependent variable. Some of these regressions are reported in Appendix Table A. An examination of these results will show that, in an equation accounting for movements in the labor force, a powerful case cannot be made for regressors other than contemporaneous values of wages and unemployment benefits and one-year lagged values of the labor force.

Thus this model of the aggregate labor market characterizes wages as being set by a trade union in accordance with the objective function given by equation (6) and with employment and the labor force responding in the manner described by equations (2) and (3) and by equations (7) and (8) respectively. The following equations for real wages, employment, and the labor force are thereby implied:

$$(9) \quad \left(\frac{(1-i)w}{(1+s)p}\right)_t = \Lambda\theta\left[\lambda\rho(\alpha_0+\alpha_6-\alpha_5) + \delta - \lambda\alpha_0 + \mu\xi\beta_0\right] + \Lambda\theta\lambda\ \alpha_1\left(\frac{(1-i)m}{(1+v)(1+s)p}\right)_t$$

$$+ \Lambda\theta\lambda(\alpha_1\rho-\alpha_2)\left(\frac{(1+v)w}{m}\right)_{t-1} + \Lambda\theta\lambda\alpha_2\rho\left(\frac{(1+v)w}{m}\right)_{t-2}$$

$$- \Lambda\theta\lambda\alpha_3\left(\frac{r}{m}\right)_t + \Lambda\theta\lambda\alpha_3\rho\left(\frac{r}{m}\right)_{t-1} - \Lambda\theta\lambda\alpha_4\ y_{t-1}$$

$$+ \Lambda\theta\lambda\alpha_4\rho\ y_{t-2} + \Lambda\theta\lambda\left[(\rho-1)\alpha_5 - 2\alpha_6\rho\right]T_t - \Lambda\theta\lambda\alpha_6(1-\rho)T_t^2$$

$$+ \Lambda\theta\mu\xi\beta_2 c_t + (1-\theta)\gamma_1\left(\left(\frac{(1-i)w}{(1+s)p}\right)_{t-1} + (1-\theta)\gamma_2\left(\left(\frac{(1-i)w}{(1+s)p}\right)_{t-2}\right.\right.$$

$$- \Lambda\theta(1-\lambda+\rho)e_{t-1} + \Lambda\theta\rho(1-\lambda)e_{t-2} + \Lambda\theta\mu(1-\xi)z_{t-1} + \varepsilon_{4t} \quad .$$

$$e_t = \Lambda\theta\lambda\alpha_1\left[\lambda\rho(\alpha_0+\alpha_6-\alpha_5) + \delta - \lambda\alpha_0 + \mu\xi\beta_0\right] + \lambda\alpha_0 - \lambda\rho(\alpha_0+\alpha_6-\alpha_5)$$
$$+ \lambda\alpha_1(\lambda\alpha_1\Lambda\theta-1)\left(\frac{(1-i)m}{(1+v)(1+s)p}\right)_t + \lambda(\alpha_2-\rho\alpha_1)(1-\lambda\alpha_1\Lambda\theta)\left(\frac{(1+v)w}{m}\right)_{t-1}$$
$$- \rho\lambda\alpha_2(1-\lambda\alpha_1\Lambda\theta)\left(\left(\frac{(1+v)w}{m}\right)\right)_{t-2} + \lambda\alpha_3(1-\lambda\alpha_1\Lambda\theta)\left(\frac{r}{m}\right)_t$$
$$- \rho\lambda\alpha_3(1-\lambda\alpha_1\Lambda\theta)\left(\frac{r}{m}\right)_{t-1} + \lambda\alpha_4(1-\lambda\alpha_1\Lambda\theta)\, y_{t-1}$$
$$- \rho\lambda\alpha_4(1-\lambda\alpha_1\Lambda\theta)y_{t-2} + (1-\lambda\alpha_1\Lambda\theta)\lambda\left[\alpha_5(1-\rho)+2\rho\alpha_6\right]T_t$$
$$+ (1-\lambda\alpha_1\Lambda\theta)\lambda\alpha_6(1-\rho)T_t^2 + \lambda\alpha_1\mu\Lambda\theta\xi\beta_2c_t$$
$$+ \lambda\alpha_1(1-\theta)\gamma_1\left(\left(\frac{(1-i)w}{(1+s)p}\right)\right)_{t-1} + \lambda\alpha_1(1-\theta)\gamma_2\left(\left(\frac{(1-i)w}{(1+s)p}\right)\right)_{t-2}$$
$$+ (1-\lambda\alpha_1\Lambda\theta)(1-\lambda+\rho)e_{t-1} - (1-\lambda\alpha_1\Lambda\theta)\rho(1-\lambda)e_{t-2}$$
$$+ \lambda\alpha_1\mu\Lambda\theta(1-\xi)z_{t-1} + \epsilon_{5t} \qquad (10)$$

$$(11) \qquad z_t = \Lambda\theta\xi\beta_1[\lambda\rho(\alpha_0+\alpha_6-\alpha_5) + \delta - \lambda\alpha_0 + \mu\xi\beta_0] + \xi\beta_0$$

$$+ \xi\beta_1\lambda\alpha_1\Lambda\theta\left(\frac{(1-i)m}{(1+v)(1+s)p}\right)_t - \Lambda\theta\xi\beta_1\lambda(\alpha_2-\rho\alpha_1)\left(\frac{(1+v)w}{m}\right)_{t-1}$$

$$+ \Lambda\theta\xi\beta_1\rho\lambda\alpha_2\left(\frac{(1+v)w}{m}\right)_{t-2} - \Lambda\theta\xi\beta_1\lambda\alpha_3\left(\frac{r}{m}\right)_t$$

$$+ \Lambda\theta\xi\beta_1\rho\lambda a_3\left(\frac{r}{m}\right)_{t-1} - \Lambda\theta\xi\beta_1\lambda\alpha_4 y_{t-1} + \Lambda\theta\xi\beta_1\rho\lambda\alpha_4 y_{t-2}$$

$$- \Lambda\theta\xi\beta_1\lambda[\alpha_5(1-\rho) + 2\rho\alpha_6]T_t - \Lambda\theta\xi\beta_1\lambda\alpha_6(1-\rho)T_t^2$$

$$+ \xi\beta_2(1+\xi\beta_1\mu\Lambda\theta)c_t + \xi\beta_1(1-\theta)\left(\left(\frac{(1-i)w}{(1+s)p}\right)_{t-1}\right.$$

$$+ \xi\beta_1(1-\theta)\left(\left(\frac{(1-i)w}{(1+s)p}\right)_{t-2}\right. - \Lambda\theta\xi\beta_1(1-\lambda+\rho)e_{t-1}$$

$$+ \rho\Lambda\theta\xi\beta_1(1-\lambda)e_{t-2} + (1-\xi)(1+\xi\beta_1\mu\Lambda\theta)z_{t-1} + \varepsilon_{6t}$$

where $\Lambda = (\lambda\alpha_1-\mu\xi\beta_1)^{-1}$. In equations (9), (10), and (11), the stochastic terms, ε_{4t}, ε_{5t}, and ε_{6t}, represent linear combinations of the unobserved components ε_{1t}, ε_{2t}, ε_{3t}, u_{2t}, $\bar{\varepsilon}_{3t}$, u_{7t}, and u_{8t}. Note also that, because $e_t - z_t = -(U/Z)_t$, the negative of the unemployment rate, subtracting equation (11) from equation (10) yields an expression for movements in the unemployment rate.

These equations are long and tedious, but (appearances to the contrary) not difficult to comprehend. Though highly nonlinear in parameters, they are linear in the logarithms of the variables. They simplify considerably if the structural parameters assume particular values. Thus the absence of serial correlation in the residuals of the employment adjustment equation (that is, $\rho = 0$) disposes of the lagged values of exogenous variables while, in addition, the immediate adjustment of employment and the labor force (that is, $\lambda = 1$ and $\xi = 1$, respectively) eliminates their lagged values. If the unemployment rate does not figure in the union's objectives (that is, if $\mu = 0$), not merely are wages and employment independent of the exogenous variables in the labor force equation, but also $\Lambda = (\lambda\alpha_1)^{-1}$ and the equations become far less involved.

Throughout a critical role is played by θ, the exponent on real wages in the union's objective function. To illustrate this, consider an exogenous variable in the employment demand function equation (2), say, the lagged value of real disposable income, y_{t-1}. According to equations (9), (10), and (11), lower values of 5 correspond to smaller absolute values of the elasticities of real wages and of the labor force with respect to disposable income while lower values of 5 are associated with a larger absolute value of the elasticity of employment with respect to disposable income. Hence the widely-held belief that wages are less variable over the business cycle than employment would imply a value of θ closer to zero than to unity. For this reason, θ has been labelled the union's relative aversion to variations in employment,[7/] a higher value of 5 corresponding to greater cyclical wage variability and smaller employment variability in response to exogenous shifts in the employment demand function.

[7/] This term was used in Pencavel and Holmlund (1988) and, of course, it alludes to the definition of relative risk aversion because $\theta = -e(\partial^2\Gamma/\partial e^2)/(\partial\Gamma/\partial e)$. This interpretation of θ (though not the term) is offered also by Jackman (1985) and Pencavel (1984).

B. Estimates of the Model

Estimates of the structural parameters of equations (9), (10), and (11) are contained in Table 5. At first, full information maximum likelihood methods were used to calculate the parameters, but these often involved a great deal of programming time which is a hindrance if the researcher is interested in examining the consequences of a number of different specifications. For this reason, I turned to nonlinear three-stage least squares (asymptotically equivalent to full information maximum likelihood) where the estimating equations consisted of the first-order condition of the constrained maximum of the union's objective function and the two constraints, the employment and labor force equations.[8/] It is these system three-stage least squares estimates that are contained in Table 5.

The estimates in column (i) of Table 5 are those corresponding to the form of the model expressed in equations (9), (10), and (11). A number of variations on this specification were also estimated. For instance, the estimates in column (ii) correspond to the omission of

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8/ To be specific, the wage equation takes the following form:

$$\left(\frac{(1-i)w}{(1+s)p}\right)_t = -\Lambda\theta(1-\theta)^{-1}\delta + \sum_{j=1}^{2}\gamma_j\left(\frac{(1-i)w}{(1+s)p}\right)_{t-j}$$

$$-\Lambda\theta(1-\theta)^{-1}e_t + \mu\Lambda\theta(1-\theta)^{-1}z_t + \varepsilon_t^*$$

where ε_t^* is a weighted sum of ε_{1t}, ε_{2t}, and ε_{3t}. The employment equation is given by equation (4) while the labor force equation is that which results from the substitution of (7) into (8).

Table 5: Nonlinear Three-Stage Least Squares Estimates of the Structural Parameters

		Column (i)	Column (ii)	Column (iii)	Column (iv)
Union Objectives	$\hat{\theta}$	-0.060 (0.088)	-0.041 (0.047)	-0.039 (0.045)	-0.013 (0.023)
	$\hat{\mu}$	0.840 (0.541)	0.905* (0.434)	0.945* (0.444)	0.690 (0.786)
	$\hat{\delta}$	0.483 (1.724)	0.275 (1.379)	0.145 (1.409)	0.963 (2.512)
	$\hat{\gamma}_1$	1.462* (0.205)	1.496* (0.202)	1.505* (0.212)	1.480* (0.210)
	$\hat{\gamma}_2$	-0.493* (0.231)	-0.540* (0.228)	-0.555* (0.240)	-0.498* (0.237)
	$\hat{\gamma}_3$			-0.001 (0.007)	
Employment	$\hat{\alpha}_o$	2.766* (1.255)	2.534* (0.420)	2.528* (0.020)	2.263* (0.807)
	$\hat{\alpha}_1$	-0.034* (0.017)	-0.030 (0.019)	-0.028 (0.020)	-0.033 (0.024)
	$\hat{\alpha}_2$	-0.019 (0.021)			-0.054 (0.031)
	$\hat{\alpha}_3$	-0.022 (0.023)	-0.016 (0.022)	-0.020 (0.026)	-0.054 (0.041)
	$\hat{\alpha}_4$	0.183* (0.055)	0.157* (0.052)	0.167* (0.060)	0.279* (0.106)
	$\hat{\alpha}_5$	-0.023 (0.068)	-0.006 (0.021)	-0.009 (0.030)	-0.007 (0.035)
	$\hat{\alpha}_6$	0.0004 (0.0011)	0.0001 (0.0004)	0.0001 (0.0006)	0.0001 (0.0007)
	$\hat{\lambda}$	0.816* (0.196)	0.797* (0.204)	0.735* (0.225)	0.772* (0.257)
	$\hat{\rho}$	0.881* (0.168)	0.826* (0.174)	0.845* (0.187)	0.809* (0.235)
Labor Force	$\hat{\beta}_o$	4.251* (0.889)	3.191* (0.020)	3.193* (0.022)	3.123* (0.007)
	$\hat{\beta}_1$	0.552 (0.325)	0.170* (0.046)	0.171* (0.049)	
	$\hat{\beta}_2$	-0.268 (0.222)			
	$\hat{\xi}$	0.133 (0.069)	0.180* (0.072)	0.169* (0.073)	

Notes: Estimated asymptotic standard errors are in parentheses. An asterisk has been placed next to coefficients whose estimated values are at least twice their standard errors.

lagged wages (that is, $\alpha_2 = 0$) from the employment demand function, equation (2), and to the omission of the real value of unemployment benefits (that is, $\beta_2 = 0$) from the labor force equation (7). In this form, each of the independent variables in the employment demand function appears just once while the labor force equation incorporates the effects of real wages only. The estimates in column (iii) indicate there is no support for extending the lag on real wages to three years[9/] while those in column (iv) correspond to a restricted version of the model whereby the labor force is assumed to be independent of real wages. An examination of Table 5 indicates relatively little variation in the estimates of most parameters across columns and this was also the case for the estimates corresponding to other modifications of the estimating equations. There is good reason, therefore, to concentrate on the estimates given in one of the columns in Table 5 and in what follows I examine those reported in column (ii).

Consider first the estimates of the parameters of the union's objective function. The estimate of \ of 0.91 is close to unity and significantly greater than zero: this is consistent with the notion that, in forming its bargaining strategy, the union takes account of unemployment and it is inconsistent with the "insider-outsider"

9/ To be precise, the estimates in column (iii) conform to the specification of Y_t in equation (6) as

$$Y_t = \sum_{j=1}^{3} \gamma_j \left(\frac{(1-i)w}{(1+s)p}\right)_{t-j} + \varepsilon_{3t} \quad .$$

hypothesis, at least in the manner in which it has been expressed in this paper. The estimates of γ_1 and γ_2 (approximately 1.5 and -0.5 respectively) imply a rising reference level for real wages that ultimately fully erodes the utility enhancing effects of current real wages increases. The estimate of θ of -0.04 is insignificantly different from zero and suggests an extreme aversion to variations in real wages in response to exogenous shocks and a corresponding tolerance of variations in employment. Such an extreme result should clearly be regarded with caution though, in its defence, it should be mentioned it is consistent with a common finding of relatively insensitive real wages in Britain. For instance, in their analysis of wage movements in 19 OECD economies, Grubb, Jackman, and Layard (1983) identify Britain's real wage as the most rigid. A similar result is reported in Klau and Mittelstadt (1986). This is also the message being conveyed by our estimates.

The estimates in Table 5 of the parameters of the employment demand function are broadly similar to those nonlinear least squares results in column (4a) of Table 4. Other than the parameters (λ and ρ) governing the adjustment and autoregressive process, only the influence of disposable income (the coefficient α_4) comes through clearly. The elasticity of employment with respect to real wages is small (-0.03) and not estimated precisely. According to the estimate of β_1 in column (ii) of Table 5, a ten percent increase in real wages is associated with a 1.7 percent expansion in the size of the labor force.

The implications of the estimates of the structural parameters in column (ii) of Table 5 for the reduced-form relations for real wages, employment, the labor force, and the unemployment rate are given in the columns labelled "solved N3SLS" in Table 6. By way of comparison, in the columns labelled "OLSRF," Table 6 also reports the estimates obtained from the simple application of ordinary least squares to these reduced-form equations. In general, the few degrees of freedom render it extremely difficult to make confident inferences about the nature of various relationships: there are 27 observations and 16 parameters computed in the structural model represented in column (ii) of Table 5. The consequence is a relatively large number of imprecisely computed parameters. This is unavoidable if one employs structural estimation at the macroeconomic level: specious statistical significance can be achieved by fitting very parsimonious relationships, the simplicity of which cannot be justified normally on conventional statistical criteria, or the relevance of many different variables can be admitted with the consequence (in a setting of relatively few observations) of imprecise parameter estimates.

The resulting imprecision is clearly in evidence in the real wage equations in Table 6: the only terms of clear significance are lagged real wages in the solved N3SLS equation. The differences in the point estimates in the two columns for real wages are not, in fact, very meaningful, the standard errors accompanying each point estimate usually span the corresponding point estimate in the other column. Given the extraordinary attention given to the role of wages in affecting

Table 6: Reduced Form Equations For Real Wages, Employment, the Labor Force, and the Unemployment Rate

	$(\frac{(1-i)w}{(1+s)p})_t$		e_t		z_t		$(U/Z)_t$	
	OLSRF	Solved N3SLS	OLSRF	Solved N3SLS	OLSRF	Solved N3SLS	OLSRF	Solved N3SLS
Constant	-4.878	0.350	0.246	0.339	0.643	0.585*	0.377	0.948*
	(3.800)	(0.847)	(0.472)	(0.258)	(0.721)	(0.236)	(0.451)	(0.39[illegible])
$(\frac{(1-i)m}{(1+v)(1+s)p})_t$	-0.142	-0.019	0.056*	0.024	0.050	-0.001	-0.006	-0.025
	(0.144)	(0.023)	(0.018)	(0.018)	(0.027)	(0.001)	(0.017)	(0.018)
$(\frac{(1+v)w}{m})_{t-1}$	0.152	-0.016	-0.091*	0.020	-0.074*	-0.001	0.017	-0.021
	(0.177)	(0.020)	(0.022)	(0.017)	(0.034)	(0.001)	(0.021)	(0.017)
$(\frac{F}{m})_t$	0.136	0.010	-0.054*	-0.013	-0.051*	0.000	0.003	0.013
	(0.107)	(0.017)	(0.013)	(0.016)	(0.020)	(0.001)	(0.013)	(0.016)
$(\frac{F}{m})_{t-1}$	0.003	-0.008	0.047*	0.010	0.072*	-0.000	0.025*	-0.011
	(0.097)	(0.013)	(0.012)	(0.012)	(0.018)	(0.000)	(0.011)	(0.012)
y_{t-1}	0.792	-0.099	0.499*	0.127*	0.401*	-0.003	-0.095	-0.130*
	(0.436)	(0.105)	(0.054)	(0.039)	(0.083)	(0.004)	(0.052)	(0.041)
y_{t-2}	-0.048	0.082	-0.043	-0.105*	-0.141	0.003	-0.094*	0.108*
	(0.390)	(0.091)	(0.048)	(0.044)	(0.074)	(0.003)	(0.046)	(0.045)
T_t	-0.014	0.001	0.021*	-0.001	0.014*	0.000	-0.007	0.001
	(0.032)	(0.002)	(0.004)	(0.002)	(0.006)	(0.000)	(0.004)	(0.002)
T_t^2	0.0005	-0.0000	-0.0006*	0.0000	-0.0004*	-0.0000	0.0002*	-0.0001
	(0.0007)	(0.0000)	(0.0001)	(0.0001)	(0.0001)	(0.0000)	(0.0001)	(0.0005)
$(\frac{(1-i)w}{(1+s)p})_{t-1}$	-0.118	1.557*	-0.250*	-0.037	-0.243*	0.048*	0.006	0.085*
	(0.589)	(0.242)	(0.073)	(0.027)	(0.112)	(0.023)	(0.070)	(0.035)
$(\frac{(1-i)w}{(1+s)p})_{t-2}$	-0.426	-0.562*	-0.213*	0.013	-0.045	-0.017	0.161*	-0.031
	(0.520)	(0.250)	(0.065)	(0.011)	(0.099)	(0.011)	(0.062)	(0.018)
e_{t-1}	0.894	-0.819	0.241	1.049*	-0.004	0.025	-0.239	-1.074*
	(1.584)	(0.820)	(0.197)	(0.125)	(0.301)	(0.027)	(0.188)	(0.130)
e_{t-2}	-0.519	0.134	-0.376*	-0.171	-0.232	0.004	0.142	0.175
	(0.769)	(0.166)	(0.096)	(0.144)	(0.145)	(0.006)	(0.091)	(0.147)
Z_{t-1}	-0.701	0.590	0.411*	-0.014	0.703*	0.838*	0.280	0.852*
	(1.619)	(0.709)	(0.201)	(0.019)	(0.307)	(0.071)	(0.192)	(0.080)
R^2	0.993	0.976	0.995	0.933	0.994	0.709	0.982	0.888
BP	5.34	1.15	6.16	4.48	3.72	30.7	1.55	1.95
DW	2.07	2.34	2.86	1.48	2.66	0.21	2.50	1.38
see	0.0235	0.0317	0.0029	0.0080	0.0045	0.0215	0.0028	0.0050

Notes: The R^2 in the Solved N3SLS column is the square of the coefficient of correlation between the actual values of the left-hand side variable and the values predicted by the linear combination of right-hand side variables.

unemployment, it may be worth noting that the solved N3SLS estimates of the coefficients on lagged wages imply that a 10 percent higher level of wages raises the unemployment rate by about three percentage points. However, it is quite evident that this effect is measured quite imprecisely.[10/]

IV. Conclusion

This paper examined the nature and meaning of the association between wages and employment in the aggregate British labor market between 1953 and 1979. My purpose was to determine what had to be done with these and other variables so that they take on the appearance of a conventional labor demand function. In so doing, I imposed relatively little prior structure on the empirical expression of the textbook labor demand curve. Having arrived at a plausible though not a robust relationship between employment and wages, I built upon this a structural model of the determination of wages, employment, and the labor force, and therefore, of the unemployment rate. This model was designed in such a way as to evaluate the empirical relevance of the popular distinction between "insiders" and "outsiders" in the

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10/ The effects of lagged employment, e_{t-1}, and of the lagged labor force, z_{t-1}, on the unemployment rate in the solved N3SLS column should be treated with caution. The implied coefficients on e_{t-1} and z_{t-1} are insignificantly different from unity. But there is an approximate identity involving current values of the unemployment rate, the logarithm of employment, and the logarithm of the labor force, namely $(U/Z)_t \simeq e_t - z_t$. Hence, except for the fact that the lagged values of employment and the labor force appear in the reduced-form unemployment rate equation, these estimates may be simply mapping an identity!

formulation of union objectives. In fact, the point estimates of this model do not lend much support to the insider-outsider distinction although the standard errors surrounding these point estimates render confident inferences unwarranted.

Given the imprecision of these estimates, a consequence of using a relatively short time series and obviously a problem not resolved by exploiting quarterly or monthly data instead of annual observations, a natural response is to forego structural estimation and to fit reduced form equations exclusively. This is an old and complicated issue in applied economics. My major difficulty with this position is that reduced form equations rarely provide information that effectively discriminates among competing hypotheses and imaginative economists can think of several different explanations consistent with the results. Structural estimation is usually necessary (though not always sufficient) to distinguish among these different explanations. And when the data are insufficiently rich, we simply have to confess agnosticism. Indeed, the most salient feature of the empirical work here is the fact that the various relationships computed with aggregate data are sensitive to specification or are estimated imprecisely. In either event, the data are signalling to the researcher that they cannot deliver unambiguous answers to the sort of questions economists ask of them. This calls for scepticism whenever researchers claim unequivocal results from using these data to measure structural relationships.

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Appendix Table A

Equations Accounting for the Annual Movements in the Natural Logarithm of the Working Population (z_t)

Equation Number	1	2	3	4	5
Constant	0.581 (0.555)	0.408 (0.396)	0.474 (0.330)	0.324 (0.294)	0.471* (0.232)
$\left(\frac{(1-i)w}{(1+s)p}\right)_t$	0.118 (0.142)	0.105 (0.137)	0.072 (0.073)	0.133* (0.055)	0.097* (0.035)
$\left(\frac{(1-i)w}{(1+s)p}\right)_{t-1}$	0.025 (0.157)	0.044 (0.149)	0.109 (0.072)		
$\left(\frac{(1-i)w}{(1+s)p}\right)_{t-2}$	0.032 (0.118)	0.021 (0.114)			
c_t	-0.060 (0.077)	-0.039 (0.060)	-0.028 (0.042)	-0.060* (0.025)	-0.060* (0.025)
c_{t-1}	-0.049 (0.064)	-0.056 (0.061)	-0.061 (0.055)		
c_{t-2}	0.027 (0.057)	0.027 (0.056)			
T_t	-0.001 (0.005)	-0.002 (0.003)	-0.001 (0.002)	-0.001 (0.001)	
T_t^2	-0.0001 (0.0007)				
z_{t-1}	1.081* (0.340)	1.079* (0.335)	0.972* (0.110)	0.983* (0.103)	0.927* (0.078)
z_{t-2}	-0.153 (0.417)	-0.108 (0.398)			
BP	3.69	4.06	3.84	0.96	1.19
DW	1.84	1.86	1.84	1.67	1.53
see	0.0096	0.0094	0.0090	0.0084	0.0083

Notes: The instrumental variables used in estimating these equations are m_t, m_{t-1}, m_{t-2}, r_t, r_{t-1}, r_{t-2}, $(1+v)_t$, $(1+v)_{t-1}$, $(1+v)_{t-2}$, y_t, y_{t-1}, y_{t-2}, T_t, and T_t^2. Other information relevant for reading this table is supplied in the Notes to Table 2.