THE EMPIRICAL ECONOMICS OF LABOUR DEMAND AND SUPPLY IN GREAT BRITAIN: A COMMENT

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ABSTRACT

The change in the relationship between unemployment and vacancies in Great Britain has produced different explanations. The difference boils down to whether there has been a shift in labour demand or supply. This paper specifies the "labour supply" hypothesis so that its plausibility can be tested using prediction tests and Chow tests.

The conclusion is that the effect of improved unemployment benefits on median unemployment duration and numbers unemployed was minimal. Any shift in the supply side can best be accounted for by an increase in the demand for leisure arising from increased affluence.

The Empirical Economics of Labour Demand and Supply in Great Britain: A Comment*

The question of explaining the shift in the relationship between the level of unemployment and vacancies has been set in terms of a dichotomy. Some (Gujurati; Maki and Spindler) claim that it was due to a shift in the labour supply function. Others (Taylor, Knight and Wilson) claim it was due to a change in the demand for labour function. The papers by Maki and Spindler, and by Knight and Wilson give some evidence in support of each hypothesis. Both hypotheses have also a measure of theoretical plausibility, based on changes in legislation, notably the Redundancy Payments Act (1965), the National Insurance Act (1966) and the introduction of Selective Employment Tax. These altered the incentives of both suppliers and demanders of labour. This paper puts forward the propostion that both views may contain a part of the truth.

The research was stimulated by dissatisfaction on theoretical grounds with the way Maki and Spindler, and Grubel and Maki had specified their equation. Their equation implies that the unemployment they believe to be induced by the payment of benefits can be simply added on to frictional, structural and cyclical components of unemployment. The latter is approximated by a measure of GNP adjusted for trend, both current and lagged.

There are two objections to this. First it is not clear how the estimating equation, which is presumably a reduced form derived from supply and demand functions, is derived from the theoretical framework laid down by Grubel and Maki. Secondly, a literal reading of their estimated equation is that the more generous unemployment benefits are the greater will GNP be for a given level of unemployment. This seems

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* We would like to thank Mrs. D. Ellwood for her help in data handling.

to imply that generous unemployment benefits make the economy more "efficient" in terms of output per head. Indeed, it might well be read as evidence of the labour-dishoarding hypothesis. It is not totally convincing evidence for the supremacy of the "labour supply" argument.

This leads to the question; suppose the labour supply hypothesis has some truth in it, how would one go about testing it? Grubel and Maki use a "search activity" model to explain the behaviour of workers in unemployment. The volume edited by Phelps presents some detailed analysis of this type of behaviour. The basic idea is as follows. The benefits from remaining unemployed are greater leisure for both direct enjoyment and for increasing the chances of getting a well paid job or one that suits one's individual characteristics better. These benefits must be traded off against the costs which are loss of current income, loss of status, and possibly loss of privacy because of attempts by administrative officials to prevent cheating. It is argued that increased benefits will, via both substitution and income effects, shift the optimum towards more unemployment. Fixed-sum redundancy payments will work in the same direction only via an income effect.

The incentives will be greater for those workers who become unemployed involuntarily since voluntary quitters do not get full benefits immediately or redundancy payments; and with the introduction of earnings related benefits the incentives to increase the period of "voluntary" unemployment should extend higher up the income scale.

These considerations have implications for empirical analysis. First, the average duration of unemployment should be sensitive to unemploy-

ment benefits. Such a relationship has been found in cross sectional work by Mackay and Reid. Second, the set of other variables explaining the duration or level of unemployment should include one which stands as a proxy for "probability of getting a job exceeding the current aspiration level." The obvious candidate is registered vacancies, since the probability of a given type of job is presumably an increasing function of the vacancy rate.

Consequently the function to be estimated becomes a sort of inverse labour supply function.

Duration of unemployment = f(relative price of employment and unemployment, wealth, probability of finding the right job)

"The probability of finding the right job" is possibly not directly proportional to vacancies. For example in periods of heavy unemployment when <u>any</u> job becomes the right job but the probability of finding one approaches zero there may temporarily occur unfilled vacancies in unusual skills or in parts of the country without housing. Furthermore there will be competition for the job from the other unemployed. (This suggests the use of a function of both vacancies and unemployment as possibly being the better proxy for this probability).

The effect on the unemployment rate is indirect. An increase in the duration of employment due to the first argument of f might be interpreted as a shift to the left in the supply surve of labour - resulting in more unemployment. Insofar as wages are determined by the intersection

of a demand and supply curve for labour one would expect an increase in wages to result. (Depending on the underlying model, one might also expect a change in the Phillips curve relationship - but such speculation goes beyond the theoretical and empirical scope of this paper).

The term wealth is included in the above equation because the demand for leisure may have a positive income elasticity. The effect of wealth on the decision to remain unemployed will depend on the form the wealth is held and its liquidity. Assets requiring large complementary inputs of cash (e.g. yachts and cars) will discourage long periods of voluntary unemployment, whereas those requiring small amounts or even generating income (vegetable gardens?) will encourage longer periods. Liquid assets,being the most adaptable form of wealth, should have the largest effect on unemployment. Conversely, large contractural payments such as mortgages, rent, loans and hire purchase, are conducive to hasty search for a new job. Redundancy payments are an obvious major source of liquid assets for the unemployed.

The above equation is, strictly speaking, only one of a simultaneous set. A more ambitious project would be to specify the whole set and estimate jointly those that were identified. This paper is based on the supposition that something useful can be learned by examining individual equations separately.

Statistical considerations

With time series analysis it is often difficult, for various reasons, to separate alternative hypothesis. One of the problems with the paper

by Maki and Spindler is that their equation is not put through any very stringent tests. The furthest they go is to estimate a simultaneous equation model allowing for the possibility that unemployment benefits are increased by the government in times of high unemployment.

Since the unemployment/vacancies relation shifted at the same time as a number of crucial variables were altered, it is possible that a good deal of the explanatory power of the regression is due to spurious correlation arising from this simultaneous shift in the variables. An approach which is a more powerful test of the model is to estimate the equation using data up to the critical period and see if the model can predict the behaviour of the dependent variable in each subsequent period. Using this procedure it is more difficult to get away with spurious or accidental correlation; the higher is R^2 for the estimation period the more stringent is the prediction test. (It also gives an indication of whether the model underpredicts or overpredicts).

A simple prediction test, however, tests the prediction for each period separately. A more powerful test of the adequacy of the labour supply hypothesis in explaining the change in the behaviour of unemployment and vacancies is the Chow test for a change in the structural parameters (see Fisher). The existence of a structural break for an equation suggests that the equation is not fully specified and that some of those aspects which are normally assumed constant have changed. Correcting the specification should therefore normally eliminate the evidence of the structural break. Both types of test are used in the empirical work that follows.*

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* The F statistic for the Chow test was calculated in the following

(footnote over page)

manner

$$F^{k}_{T_1 + T_2 - 2k} = \frac{(SS_{T_1 + T_2} - SS_{T_1} - SS_{T_2}) / k}{(SS_{T_1} + SS_{T_2}) / (T_1 + T_2 - 2k)}$$

SS_{T_1} = Residual sum of squares from regression using set of observations T_1

SS_{T_2} = Residual sum of squares from regression using set of observations T_2

$SS_{T_1 + T_2}$ = Residual sum of squares from regression using the complete set of observations

k = no. of parameters estimated.

The Data

Details and sources are given in the Appendix. Since information on benefits is published by the financial year (April to March) efforts were made to ensure that all the variables conformed to this timing. Since no lags are postulated variables were centred where possible at the end of September/beginning of October.

The "relative price of employment and unemployment" was taken to be total benefits including family allowances and earnings related supplement divided by Average Weekly Earnings plus Family Allowances less tax and National Insurance Contributions for a married person with two children.

This was taken directly from Maki and Spindler (1974).

Results

First it was necessary to decide whether the shift in the relationship between unemployment and vacancies occurred in 1966 or 1967. Regressions of Log_e Unemployment on Log_e Vacancies were performed for i) 1949-65, ii) 1966-72, iii) 1949-66, iv) 1967-72, v) 1949-72 and Chow tests performed using the F statistic defined in footnote (1) above. Similar tests were performed for median duration of unemployment as a function of vacancies. The results (table 1 equations 1 and 5) indicate a possible structural break in either period. Comparison of the F values suggest that if we must restrict ourselves to the notion of one break only the earlier break is more plausible.

If the main reason for these structural breaks were the shift in labour supply caused by the increase in the benefit/income ratio the break should disappear when we allow for this variable in our equations. Initially our work appeared to support the Maki/Spindler hypothesis. The following equations were estimated for 1949-72:-

$$\begin{array}{rcccc} \text{Duration} = & 7.900 & - 0.0126 \text{ Vacancies} & + & 9.11 \text{ Benefit/Income ratio} \\ & (3.74) & (-2.68) & & (4.24) \end{array}$$

$$R^2 = 0.678 \qquad \text{D.W.} = 1.0048$$

$$\begin{array}{rcccc} \text{Ln (Unemployment)} = & 9,543 & - 0.756 \text{ Ln (Vacancies)} & + & 1.42 \text{ Benefit/Income ratio} \\ & (10.13) & (-4.87) & & (5.61) \end{array}$$

$$R^2 = 0.825 \qquad \text{D.W.} = 1.0679$$

Figures in parentheses are t-statistics.

Table 1 - Structural Breaks in Duration/Vacancies and Unemployment/ Vacancies relations

Dependent Variables	Equation	Independent variables and degrees of freedom	Chow F-statistics		Durbin-Watson statistic Oct 49 - Oct 72
			a) Break Oct '65 - Oct '66	b) Break Oct '66 - Oct '67	
Median Duration of unemployment (weeks)	1.	Vacancies* (2, 20)	5.915*	5.708*	0.6405*
	2.	Vacancies*, Benefit/ Income ratio* (3, 18)	2.169	0.075	1.0048*
	3.	Vacancies*, Benefit/ Income ratio, permanent income* (4, 16)	0.471	0.289	1.2904†
	4.	Vacancies*, permanent income* (3, 18)	0.944	0.128	1.2181†
Ln (Unemployment)	5.	Ln (Vacancies)* (2, 20)	9.813*	7.635*	0.535*
	6.	Ln (Vacancies)*, Benefit/ Income ratio* (3, 18)	0.747	0.118	1.0679*
	7.	Ln (Vacancies)*, Benefit/ Income ratio, permanent income* (4, 16)	0.092	0.069	1.3034†
	8.	Ln (Vacancies)*, permanent income* (3, 18)	0.090	0.126	1.3182†

Notes: * indicates significance at 5% level for 1949-72.

† indicates Durbin-Watson statistic falling in indeterminate region

The Chow tests for both of these equations are shown in Table 1, equations 2 and 6. The inclusion of the benefit/income ratio appears to have removed the structural break, whichever date one considers it to have taken place, since the F-statistics are no longer above the critical value.

However, our theory suggests that income effects of income changes will also have been taking place over this period. Furthermore empirical evidence (see, for example Greenberg and Kosters) suggests the presence of income effects as well as substitution effects in labour supply.

Accordingly a measure of permanent income was constructed (see Appendix) and included in our regression equations. The results for the whole period 1949-72 are given below:-

$$\text{Duration} = \underset{(0.52)}{1.098} - \underset{(-2.81)}{0.00961}\ \text{Vacancies} - \underset{(-1.36)}{4.56}\ \text{Benefit/Income ratio}$$

$$+ \underset{(4.60)}{0.034}\ \text{Permanent Income}$$

$$R^2 = 0.843 \quad \text{D.W.} = 1.29$$

$$\text{Ln Unemployment} = \underset{(9.64)}{8.640} - \underset{(-4.91)}{0.685}\ \text{Vacancies} + \underset{(0.55)}{0.269}\ \text{Benefit/Income ratio}$$

$$+ \underset{(2.66)}{0.00289}\ \text{Permanent Income}$$

$$R^2 = 0.870 \quad \text{D.W.} = 1.30$$

The Benefit/Income ratio variable loses significance and is the wrong sign in the first equation. The coefficient of correlation between this variable and permanent income is 0.912, suggesting that multicollinearity may be affecting the coefficient for the former. Comparison of the F-statistics for equations 3 and 4 (table 1) shows that the structural break seems to disappear whether the benefits variable is included or not, provided that permanent income is included.

Multicollinearity, whilst affecting the stability of parameter estimates, does not cause bias in these estimates or in predictions based on them. Accordingly prediction tests based on regressions covering 1947-65, were performed to test the usefulness of the Benefit/Income ratio variable. The results are summarised in Table 2.

The first group of predictions reported are for the simple equation involving no other variable than vacancies. This equation systematically underpredicts duration of employment and numbers unemployed, by an average of 2.56 weeks and 51% respectively.

However, when the Benefit/Income ratio is included as an additional variable the mean error increases to 5.96 weeks and 68% unemployment respectively. These errors are reduced substantially when permanent income is included, but the average error is least when permanent income is included as a variable and the benefit/income ratio is excluded. In fact the mean error in predicting unemployment becomes less than 3%. It would appear, therefore, that awareness of the possible substitution and income effects involved in a rising benefit/income ratio would have contributed little to predictions concerning the relation between vacancies

Table 2 - Predictions of median duration and unemployment levels with different specifications of equations (Based on regressions using data 1949-65)

Equation number (ref. table 1)	Variables included	Year	Duration (weeks)		Ln(Unemployment 000s)	
			Residual	t-statistic	Residual	t-statistic
1, 5	Vacancies or Ln Vacancies	66	0.83	0.47	0.326	1.44
		67	2.00	1.12	0.355	1.56
		68	2.94	1.68	0.440	1.95
		69	2.27	1.29	0.434	1.93
		70	1.90	1.06	0.399	1.74
		71	3.06	1.58	0.377	1.46
		72	4.91	2.69*	0.555	2.37*
		Mean error	2.56		0.412	
2, 6	Vacancies, Benefit/ income ratio	66	-6.94	-2.51*	-0.531	-1.34
		67	-6.59	-2.20*	-0.589	-1.38
		68	-5.69	-1.90	-0.511	-1.20
		69	-5.87	-2.05	-0.464	-1.13
		70	-6.52	-2.31*	-0.526	-1.25
		71	-6.32	-1.93	-0.630	-1.37
		72	-3.67	-1.22	-0.383	-0.90
		Mean error	-5.94		-0.519	
3, 7	Vacancies, Benefit/ income ratio, permanent income	66	-2.63	-0.93	-0.137	-0.30
		67	-1.48	-0.47	-0.124	-0.24
		68	-1.04	-0.34	-0.087	-0.17
		69	-1.94	-0.69	-0.103	-0.22
		70	-2.71	-0.94	-0.178	-0.38
		71	-1.72	-0.53	-0.214	-0.41
		72	-0.64	-0.23	-0.107	-0.24
		Mean error	-1.71		-0.135	
4, 8	Vacancies, permanent income	66	-2.03	-1.61	0.031	0.15
		67	-0.78	-0.62	0.068	0.33
		68	-0.37	-0.28	0.097	0.46
		69	-1.34	-1.00	0.061	0.28
		70	-2.10	-1.50	-0.014	-0.06
		71	-1.02	-0.69	-0.027	-0.11
		72	-0.09	-0.06	-0.043	0.17
		Mean error	-1.10		0.025	

Notes. A positive residual indicates an underprediction
* indicates significance at 5% (two-tailed test)

unemployment levels, and duration. The income effect of income changes appears to be able to account for most of the change in the relationship between income and unemployment.

However, these conclusions are made in the context of a piece of analysis where only the parameters of labour supply are allowed to vary. Demand factors (as in the "shake-out" hypothesis) should be allowed to play their part. It is quite possible that the estimated effects of the supply factors would be reduced in a more complete model.

A slight amount of evidence for this is that even the "best" specification consistently overpredicts duration (although the individual errors are not statistically significant). This would suggest that the amount of short-term unemployment was greater than our predictions allow. This is consistent with a pool of potentially scarce labour,who would easily find re-employment,"released" by employers. So is the tendency to underpredict unemployment levels 1966-69 although again since the prediction errors are not statistically significant not too much should should be made of this.

Conclusion

Our results indicate that the apparent shift in the duration of unemployment/vacancies relationship and unemployment/vacancies relationship can be adequately accounted for by the income effects of income changes in shifting labour supply. There appears to be little scope for the effects arising from the rise in the benefit/income ratio. Why this should be so is not clear. Presumably there are income effects of higher

benefits to people who are unemployed. It is conceivable that these are neutralised by social pressures. Although Mackay and Reid found a positive effect of unemployment benefits it is possible that their results are biased by a failure to include permanent income, which is likely to be correlated with the former.

The implication for policy is that there is no firm evidence for the view a reduction in the ratio of benefits to income would have a significant effect on either the median duration or the level of unemployment.

It may be the case that the relationship between unemployment and vacancies is changing because of increased affluence; but the paramters estimated here need to be checked in a simultaneous system allowing for changes in labour demand relationships before this becomes an accepted fact. By way of corollary, the labour demand school need to revise their estimates to take into account possible shifts in labour supply.

References

Fisher, Franklin M., "Tests of equality between sets of regression coefficients : an expository note." Econometrica, 38, March 1970, 361-366.

Greenberg, David H. and Kosters, Marvin, "Income guarantees and the working poor : the effect of income-maintenance programs on the hours of work of male family heads." in Glen G. Cain and Harold W. Watts, Income Maintenance and Labour Supply. Institute for Poverty Research, University of Wisconsin, 1973.

Grubel, Herbert G. and Maki, Dennis R., "The effect of unemployment benefits on U.S. unemployment rates." Simon Fraser University, mimeo, revised version, December 1974.

Gujurati, Damodar, "The Behaviour of Unemployment and Unfilled Vacancies : Great Britain 1958-71", Economic Journal, 82, March 1972.

Knight, K. G., and Wilson, R. A., "Labour Hoarding, employment and unemployment in British Manufacturing Industry", Applied Economics, 6, 1974, 303-310.

Mackay, D. I. and Reid, G. L., "Redundancy, unemployment, and manpower policy", Economic Journal, 82, December, 1972, 1256-1272.

Maki, D., and Spindler, Z., "The effect of unemployment compensation on the rate of unemployment in Great Britain", Simon Fraser University, Discussion Paper 74-1-3, 1974. Forthcoming, Oxford Economic Papers.

Phelps, E. S. (ed.), Microeconomic Foundations of Employment and Inflation Theory, London : Macmillan, 1971. (Published U.S.A. 1970).

Taylor, J., "The Behaviour of Unemployment and Unfilled Vacancies : Great Britain 1958-71. An alternative view", Economic Journal, 82, December, 1972, 1352-1365.

Appendix

Table A.1. - Data used in calculations

	(1) Median Duration of Unemployment (weeks)	(2) Nos. Unemployed (thousands)	(3) Unfilled Vacancies	(4) Benefit/ Income ratio	(5) "Permanent Income"
(Oct)					
1949	6.50	309.30	386.42	0.383	286.000
1950	6.75	299.02	370.50	0.365	291.986
1951	5.57	269.13	386.17	0.360	296.150
1952	6.35	379.90	263.00	0.415	293.565
1953	6.63	211.45	281.58	0.393	296.594
1954	6.23	210.13	349.75	0.367	302.598
1955	5.55	228.56	410.17	0.394	312.322
1956	5.88	283.76	325.92	0.371	322.414
1957	6.73	323.13	267.58	0.355	330.194
1958	8.50	501.28	184.67	0.440	336.218
1959	10.75	437.13	246.67	0.419	347.447
1960	10.23	346.73	323.33	0.395	362.621
1961	8.48	357.10	301.08	0.443	375.609
1962	9.10	549.80	196.25	0.430	381.205
1963	11.05	489.46	223.75	0.474	390.408
1964	9.95	464.38	335.33	0.446	403.608
1965	8.70	319.39	395.17	0.493	415.423
1966	8.28	423.78	336.75	0.686	424.955
1967	10.60	565.14	249.17	0.732	435.939
1968	11.15	558.70	278.75	0.728	448.346
1969	10.45	551.58	281.08	0.710	457.461
1970	10.58	602.95	243.08	0.727	475.993
1971	12.75	818.44	166.08	0.776	490.547
1972	13.88*	765.70	220.83	0.737	511.290

Sources

(1) Department of Employment Gazette, February 1973 table 2. Arithmetic mean of medians published for June, September, December and March each financial year. (Later data refers to July, October, January and April.) * The January and April 1973 figures required for calculating the 1972 data were estimated from data in the Gazette.

(2) Monthly Digest of Statistics. Twelve month average of total unemployed, Great Britain, April - March.

(3) As for column (2).

(4) Benefit/Income ratio. Social Security Statistics 1972, and Maki and Spindler. October of each year.

Benefit/Income ratio =

$$\frac{\text{Standard rate of unemployment benefit + Earnings Related Supplement + Family Allowances}}{\text{Average weekly earnings + Family Allowances - tax - National Insurance Contributions}}$$

for a married man with two children.

(5) $Y_t^* = (Y_t + 0.5Y_{t-1} + 0.25Y_{t-2}) \div 1.75$

Y_t =

$$\frac{\text{(Income from employment in year t) x 100}}{\text{(Total labour force in year t - numbers unemployed) x (Retail price index (1946=100))}}$$

In words, Y_t^* is a measure of permanent per capita income from employment with arithmetically declining weights and at 1947 prices.