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DISCUSSION PAPER

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The Urban-Rural Income Gradient and the Pressure of Demand for Labour

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1. Introduction

The attempted introduction of a more comprehensive planning system, the rising level of concern with environmental questions and renewed concern about poverty and deprivation have all lead to a greater interest in the welfare, broadly defined, of rural people in the last decade or so. The system of planning, involving structure plans, preceded by detailed surveys, which was formally introduced in the Town and Country Planning Acts of 1968 and 1971, has raised the analytical level of the planning activity substantially. Analysis now replaces judgement in a range of issues.

This new orientation also brings out some of the measurement problems which confront the planner, both in plan preparation and evaluation. In both phases some measure of welfare is needed, either to compare options in a technical sense or to assess the relative strength of "needs" for various subsidised services. The notion of need is implicit in the Scottish Consumers Council (Makay and Laing, 1982) analysis of the problem of rural consumers. It is explicit in the EEC's Less Favoured Areas Directive (75/268) where one of the criteria for designation of LFA's is that the relevant economic indicator (in this case Net Farm Income) shall be less than 80 per cent of the national average. For evaluation purposes, it may also be necessary to examine the distributional aspects of a proposal in which case comparisons of the welfare of different groups will be necessary. Two measures of welfare have received attention: social indicators and income.

To economists income is a natural starting point in measuring welfare. However, in the U.K. particularly (compared with the U.S.) income data are scarce and are only slowly becoming generally accessible. Furthermore, income only provides a precise measure of welfare under restrictive assumptions (e.g. the absence of externalities) which do not universally apply.

Social indicators offer an alternative measure of welfare, but they bring problems too. In particular they seek to combine physical variables into an aggregate which may be completely unrelated to each other, or may partially reflect the same entity which is being measured. It is also difficult to produce a continuous index of welfare from variables some of which are discreet. For example, Moseley's (1979) proposal to use "accessibility" as a measure of the welfare implications of "a wide range of policy alternatives" is questionable on these grounds. Also, as Kuz (1978) shows, indicators produce results which are highly sensitive to the types of variables they embody. A residual role for such indicators may remain in accounting for the non-traded public goods provided by the environment, although even this role will only be appropriate where, as Wingo (1973) points out, inferences relating to value cannot be drawn from quasi-market processes.

An individual's command of resources is determined mainly by the income at his disposal plus any "free" goods and services to which he is entitled. Disposable income is usually defined as gross income from all sources, minus taxes plus subsidies and transfers. Ideally a measure of the individual's welfare would therefore include disposable income plus the value of free goods and services he receives. In practice such a measure is rarely available and compromises are inevitable. For this study the starting point was the Inland Revenue data on incomes from employment, at the county level. The data also contain estimates of the wife's income from employment and this has been included to give an average income from employment. The average used is gross of tax and net of all other possible additions, such as investment income, pensions and family allowances. In most counties the additions would have exceeded the tax paid by a small margin so that the gross employment income used here does not differ greatly from aggregate income, from all sources, net of tax.

Income, then, remains the appropriate starting point to begin an examination of rural welfare. In this paper we week to explain variation in county average incomes in terms of the structural characteristics of the regional economy. First, an hypothesis is developed, then available data are described and finally the hypothesis is tested.

2. Hypothesis

As in most regional studies the spatial unit of analysis is determined by the available data. In the case of incomes, these relate, in the present study, to counties in England and Wales. We therefore need to establish hypotheses as to the determinants of income at the county level. *A priori* these might include:

- the county industrial structure;
- the level of income transfers, both into and out of the county;
- the earnings of county residents who commute to work outside the county;
- the earnings of non-residents employed within the county;
- the income from assets owned by county residents;
- the income from county assets to non-residents of the county:
- the volume of resources unemployed in the county;
- the age structure of the county population.

A simple hypothesis, tested from such data, might be that average county income (Y) is explained by the value of some set of the above variables for that county.

This type of model will be examined with the available data. Clearly the above list of factors which might affect the level of county income is neither exhaustive, nor are the variables independent of each other. More problematic for this investigation is that many of the variables cannot be seperately measured at the county level, so that proxies must be found for them. Cloke (1977) has published an "index of rurality" for 1971 which combines

several of these factors. At the district level his index is derived from population census data and the variables he included are:

Population Change 1961-71
Household Amenities 1961-71
Population of Women aged 15-45
Commuting Out Pattern
In-migration Over Five Years
Population Density
Population over 65
Distance from 50,000 Urban Node
Occupational Structure.

It may be possible, therefore, to use this index of rurality as an explanatory variable in our model. However, before doing this we must assess how well the index would reflect inter-county variations in the determinants of income, as listed above. The first variable in the list, *industrial structure*, seems to be covered by Cloke's "occupational structure". However, the coverage is partial because Cloke's variable measures only the proportion of the population occupied in agriculture. This is only one aspect of industrial structure and will only be the most important one in a limited number of counties. *Income transfers* consist of pensions, unemployment benefits, subsidies and taxes. Pensions will be reflected roughly in the proportion of "population over 65". Some subsidies (to farming) will be reflected by the "occupational structure" measure, but others, particularly those paid to manufacturers, will not influence the size of Cloke's index. A particularly important determinant of the transfer flow, which does not feature in Cloke's list, is the level of unemployment. We return to this problem below.

The next two variables relate to the *earnings of commuters*. The size of the income inflow might be reflected in Cloke's "commuting out pattern", but he does not incorporate any measures of the

contrary flow of income leaving the county as earnings of non-residents. The next two variables relate to the *income to assets* flowing across the county boundaries. These are particularly difficult to measure at the county level because of the lack of information on the residence of asset owners in relation to the location of their holdings. Even in the case of agricultural landlords, some of whose existence is documented through the agricultural census, it is not possible to specify any credible assumption as to whether they are "absentees" or not. Some (particularly institutional landlords) will own land in several counties, whereas others will probably reside on or near their estates, and no particular pattern can be extracted from the published data. This lack of detailed information on income from assets suggests that the dependent variable in our model be modified so as to relate only to income from employment.

The *volume of resources unemployed* is important for two reasons. First, the existence of unemployment means that some workers will obtain low incomes, relative to their earnings when in work. But secondly, the presence of unemployment would suggest that there is an excess supply of labour in the county and that this would lead to some general depression in regional rates of pay. Further to this point, because of the possibility that labour will migrate from areas of high unemployment, in search of work, it should be recognised that out-migration and unemployment may be measuring the same phenomenon, and therefore as a measure of the pressure of demand for labour, unemployment may need to be combined with net migratory movements out of countries.

Although omitting a measure of unemployment, Cloke's index is a highly aggregated measure of rurality, condensing nine variables into a single value through his principle component equation. And as well as the problem of aggregation there is the question as to what the index is actually measuring. Is "rurality" adequately represented by the nine included variables? In the first part of

this article we overlook the highly aggregate nature of Cloke's index and accept it as being a reasonable measure of rurality. It is not necessary to dwell on the problems of aggregation and definition since at a later stage we drop Cloke's index as an explanatory variable in our model in favour of just one of its components - industrial structure.

However, as a starting point we assume that an adequate explanation of county income from employment might be obtained from Cloke's index of rurality together with a measure of county unemployment or unemployment plus net migration.

3. Tests of Hypothesis

Cloke evaluated his index for all districts in England and Wales, but for the purposes of this study, which is concerned with post-reorganisation counties, it was necessary to obtain a county index of rurality. This was achieved by selecting the median district index in each county. In using Cloke's index we are thus flirting with the ecological fallacy (Robinson, 1980) in using an index based on districts to represent events at the county level.

The estimating equation of the model is thus:

$$(2) \qquad Y_j = \alpha + \beta_1 R_j + \beta_2 U_j + e$$

where Y_j is mean per capita income from employment in county j.

R_j is the median district score of Cloke's rurality index to county j.

U_j is either the percentage of unemployment plus net out-migration or the rate of unemployment in county j.

e is an error term, and $\beta_1 > 0 > \beta_2$.

The coefficient, β_1, is expected to be positive because R declines with increasing rurality. The coefficient, β_2, is expected to be negative *a priori*.

Data for the dependent variable, mean per capita income from employment, are available from two possible sources. The Department of Inland Revenue publishes annual income data at the county level, and the Department of Employment publish average county earnings data. Each set of data is tested as a measure of the dependent variable in our model. The county data used in testing the model are thus:

E Average gross weekly earnings of full-time men, aged 21 and over, whose pay was not affected by absence, April 1976. (Department of Employment)

Y Mean annual per capita gross income from employment 1975/76. (Inland Revenue)

U Percentage rate of unemployment March 1976. (Department of Employment).

UM Percentage rate of unemployment plus net civilian out-migration for 1975/76. (Regional Statistics)

R Cloke's index of rurality for 1971 as published, the county index being taken as the county median district score for post-reorganisation counties in England and Wales. The medians range from greater than 5.0 for Berkshire, Oxfordshire and Staffordshire to -8.166 for Powys.

These data relate to 39 non-metropolitan counties in England and Wales,[1] except the earnings data which pertain only to 33 non-metropolitan counties in England.[2] The data are for 1976 except Cloke's index of rurality which, being calculated from the census data, is available only for 1971. We have therefore to assume that Cloke's index remained stable from 1971 to 1976, which is consistent with his findings that the index was fairly stable from 1961 to 1971. The correlation matrix for the data is shown in Appendix 1. The correlation between rurality and unemployment

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1. There are 35 non-metropolitan counties in England and 5 in Wales, but a rate of unemployment for the county of Warwickshire is unavailable.

2. The gross weekly earnings recorded by the Department of Employment for Northamptonshire has a particularly large sampling error and so has been omitted from the data.

of -0.68 confirms that the more rural the area (i.e. the smaller is R) the higher the level of unemployment. This coefficient is large enough to raise doubts about collinearity but not high enough to preclude further analysis. Further doubts as to the meaning of the unemployment data arise from McCallum and Adams (1981) note, indicating that the presence of relatively larger numbers of self-employed persons (farmers and other small businessmen) in rural areas would reduce the denominator of the percentage unemployed, thus biassing it upwards in rural areas. To the extent that this is important the correlation between unemployment and rurality will be somewhat spurious.

The mean values of Y and E are £2,705 and £68.26 respectively. The latter is equivalent to an annual figure of around £3,500. The discrepancy between the income and earnings data arises for two main reasons. First, the weekly earnings data are for full-time males, over 21 years of age, whose pay was not affected by absence. Thus, part-time employment, female employment, the employment of males under 21 years of age and absenteeism would, if accounted for, all lower the level of average earnings. These categories will, of course, be recorded in the Inland Revenue income data. Secondly, the Inland Revenue data will also include the income of those people who were unemployed for part of the year. This element of unemployment will tend to lower the level of average county income.

The regression results, shown in Table 1, have signs as expected on all coefficients and "reasonable" explanatory power. The rurality coefficients are significant in all four equations and indicate that a unit increase in Cloke's index (i.e. a decrease in rurality) was accompanied by a rise of £30-35 in county average annual income/earnings. Over the range from most rural to most urban, the change in the index would predict a total increase of £400-450 per annum. The unemployment coefficients in equations

3 and 4 were not significant, but those in the first two county equations indicate that a one percentage point increase in county unemployment (plus migration) would be accompanied by a drop in county average income of around £60. There is thus a clearly established gradient along which income declines as areas become more rural and as unemployment rises.

TABLE 1 - Regression Results

Equation	Dependent Variable		Independent Variables			Constant	R^{-2}
	Y	E	R	U	UM		
	(£'000)	(£)	(Index)	(%)	(%)		
Means	2.705	68.26	0.546	5.6	5.1		
1.	Y		0.031	-0.061		3.02	0.62
			(3.00)	(-3.07)			
2.	Y		0.034		-0.057	2.97	0.61
			(3.38)		(-2.99)	(28.76)	
3.		E	0.64	-0.50		70.12	0.52
			(3.31)	(-1.38)		(33.77)	
4.		E	0.72		0.35	69.08	0.51
			(3.96)		(-1.00)	(37.97)	

NOTES : 1. t values are given in parentheses below the estimates to which they refer.

2. Data sources are indicated in text.

It is not evident to what extent this urban rural gradient measures the propensity of rural employers to pay low wages, or reflects the dominance of low pay industries in rural areas. From the first two equations in Table 1 it would seem that the local pressure of demand for labour, as reflected in the unemployment variable, may well affect pay rates since the unemployment variable is significant. However, in the latter two equations, where the earnings of those *with jobs*, rather than the income data from tax

returns are used as the dependent variable, unemployment loses its significance. This would perhaps support our earlier suggestion that unemployment benefit, being quantitatively less than income from actual employment, lowers the level of average county income in much the same way as would the presence of low pay industries.

To test whether the dominance of low pay industries is the determining factor in rural areas, a measure of county industrial structure was substituted for Cloke's rurality index in the regression runs. It will be recalled that Cloke's index did itself contain an element of "occupational structure", in that it recorded the proportion of the working population engaged in agriculture. To focus on the industrial structure at the county level, the percentage employment in six broad industrial categories[3] were used as explanatory variables in place of the rurality index. The cross correlations of these variables are shown in Appendix 1 where it can be seen that the correlation coefficients between industrial structure and unemployment are smaller than that between rurality and unemployment, thus reducing the likelihood of collinearity affecting the estimates.

Of the six industrial categories, we would expect agriculture, being the obvious example of a low pay industry, to exhibit a negative coefficient in the model. Services, another low pay sector, may also be expected to show a negative sign. Conversely, we would expect positive coefficients for engineering and manufacturing. The six variables along with unemployment were tested using step-wise regression, and the results of this are shown in Table 2.

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3. The six categories being:

i) agriculture, fishing and forestry;
ii) engineering and allied industries;
iii) other manufacturing
iv) construction
v) mining, quarrying, gas, electricity and water;
vi) services.

TABLE 2 - Regression Results

Equation	Dependent Variable	Independent variables				Constant	R^{-2}
			Percentage employed in:				
		U	Agriculture	Engineering	Other manufacturing		
5.	Y	-0.099	-0.035		-0.013	3.58	0.67
		(-6.54)	(-3.61)		(-2.56)	(25.93)	
6.	E	-0.811	-0.584	0.205		71.26	0.60
		(-2.96)	(-2.91)	(2.10)		(28.72)	

NOTES : 1. t values are given in parentheses below the estimate to which they refer.

2. Data sources are indicated in text.

Both equations produce higher R^{-2} than those of equations 1 and 3. The signs of the coefficients on the unemployment variable are again negative and are significant in the two equations. As for the industrial structure, both equations demonstrate a negative relationship between agriculture's share of employment and county incomes. The other categories of industrial structure that were significant were other manufacturing in equation 5 and engineering in equation 6. The sign on the latter is as expected but that on other manufacturing is negative, although neither variable has a large coefficient. The value of the coefficient on agricultural employment in both equations indicates that a rise of one percentage point in agricultural employment would cause a drop in average annual county income earnings of £30-35. However, the largest coefficient values in the equations are those attached to unemployment. They indicate that a rise of one percentage point would lead to a £100 decrease in annual average income and a £40 drop in annual average earnings. The latter figure could be taken to represent the effect of the pressure of demand for labour on local rates of pay, since the earnings data in equation 6 relate only to persons

actually in employment. The difference between the coefficient values in the two equations could therefore be an indication of the extent to which unemployment lowers average income through unemployment benefit being quantitatively less than income from employment.

4. Conclusions

The results of the simple model tested here provide a useful explanation of the data and may have potential for predictive purposes. Average county per capita income and earnings were shown to decline the more rural the county and the higher the level of unemployment. An urban-rural gradient was thus established. Further analysis then suggested industrial structure to be the single most important element in the rurality index in explaining inter-county variations in average income levels, and that industrial structure and unemployment are themselves important factors in determining the level of county income.

It can be concluded that rural counties suffer from low incomes as a consequence of their heavy reliance on agriculture, and because unemployment acts as a 'low pay sector' in the industrial mix and also has the effect of depressing local rates of pay.

APPENDIX 1 - Correlation Matrix

Variable	E	Y	U	UM	R	I_1	I_2	I_3	I_4	I_5	I_6
Means	68.26	2.705	5.60	5.10	0.546	3.80	15.90	15.40	5.90	3.50	55.60
Earnings (E)	1.00										
Income (Y)	0.81	1.00									
Unemployment (U) + Unemployment	-0.59	-0.72	1.00								
Migration (UM)	-0.57	-0.70	0.98	1.00							
Rurality (R)	0.70	0.72	-0.68	-0.64	1.00						
Employment in:											
Agriculture (I_1)	-0.62	-0.51	0.32	-	-0.75	1.00					
Engineering (I_2)	0.54	0.42	-0.28	-	0.54	-0.48	1.00				
Other Manufacturing (I_3)	0.05	0.13	-0.38	-	0.36	-0.35	0.09	1.00			
Construction (I_4)	-0.47	-0.58	0.68	-	-0.71	0.49	-0.46	-0.42	1.00		
Mining & Power (I_5)	-0.15	-0.36	0.29	-	-0.22	-0.03	-0.15	0.09	0.37	1.00	
Services (I_6)	-0.06	0.05	0.16	-	-0.15	0.14	-0.44	-0.71	0.16	-0.44	1.00

NOTE : The number of observations is 39, except where earnings (E) are involved, when it is reduced to 33 (see text).

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