LABOUR MIGRATION FROM AGRICULTURE :

A REGIONAL ECONOMETRIC ANALYSIS

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I. INTRODUCTION

One of the most persistent post-war labour movements has been the continuing outmigration of hired labour from the United Kingdom agricultural industry. The consequences of this outmigration may be examined from many angles. It has, for example, far reaching effects on overall farm structure, tending to produce in Britain the family farm set up found in the U.S.A. and many European countries which may in the long run inhibit the necessary flexibility of the industry as the farm families are much less mobile than hired workers. On the industrial side migration from the farm provides a continuous source of labour, designated by Kuzets (11) the "factor contribution" of agriculture. This is explicitly recognized in the National Plan (13) where it is thought agriculture will continue to release substantial manpower resources (over 20,000 per annum) and so help in closing the "manpower gap" expected during the plan period.

The basic aim of this paper is to explain (the year to year) variability in the outflow of labour from agriculture. By this is meant people switching their jobs from agricultural to some other (undefined) sector of the economy. This need not involve migration in the geographical sense in that it may be possible for a farm worker to stay in the same house or area even after changing jobs, for the distinction between rural and urban communities is not so stark as in many other countries where job-transfer does really imply rural exodus. The study is essentially a short run analysis involving predominantly economic variables. Other factors such as housing, irregular hours and lack of promotion prospects, whilst taking on economic importance in the long run will assume only limited variability in this short

run context.[1] Thus the variables used in this study are derived from quantitative data on employment, unemployment, wages, prices, age and education; regional differences in migration patterns remaining unexplained by the quantitative economic variables may reflect regional differences in the socio-economic variables.

It is only justifiable to carry out the analysis at a regional level if the use of national aggregate statistics conceals important regional differences. On this basis it is hardly necessary to look further than regional unemployment rates to justify the regional basis of the study, but examination of the other variables, especially earnings, substantiates this reasoning. Similarly the increasing awareness of regional problems and the beginnings of explicit regional policies which have implications for the labour transfer process also point in favour of a more disaggregated analysis than would be possible using national data. When the factors underlying the large transfer from agriculture are isolated and the parameters of the relationship estimated this will aid in understanding the mechanisms of labour adjustment and the implications of government policies.

The basic unit of study is the Ministry of Labour Region. The time-series is limited by the lack of regional statistics[2] and the bulk of the study concentrates on the period 1960-64. This period is too short for a separate analysis of each region and therefore regional data is pooled using the covariance technique.

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1. The importance of these socio-economic factors has been documented by Cowie and Giles (2).
2. The data used in this study forms part of a Bulletin produced by the authors (4) which is available on request and which will therefore not be presented here.

The analysis is concerned with the migration or job-transfer of hired workers and not farm families, for which little data is available. The magnitude of outflow may be seen from Table 1. Over the period 1960-64 the number of full time hired regular workers in agriculture in the U.K. fell from 504,695 to 414,389, a drop of 17.9 per cent. At the regional level Wales experienced the biggest percentage outmigration, 22.9, and the North, 14.4 per cent., the smallest.

Table 1. Hired Regular Full Time Agricultural Employees by Region 1960-64

Year Region	1960	1961	1962	1963	1964	Percentage decline 1960-64	Actual decline 1960-64
London and South East	66,145	61,952	59,071	56,830	52,608	20.5	13,537
Eastern and Southern	96,207	92,156	89,327	84,261	79,609	17.3	16,598
South West	52,236	49,427	47,268	45,696	42,550	18.5	9,686
Midland	59,977	56,219	55,121	53,905	49,963	16.7	10,014
Yorks and Lincs.	53,306	50,073	48,781	48,132	43,701	18.0	9,605
North West	22,546	21,529	20,936	20,518	19,283	14.5	3,263
Northern	29,820	28,402	27,604	26,941	25,515	14.4	4,305
Scotland	66,988	65,634	62,200	59,600	55,685	16.9	11,303
Wales	26,262	23,875	22,399	21,823	20,244	22.9	6,018
Northern Ireland	32,695	30,091	29,700	27,200	25,580	21.8	7,115
United Kingdom	504,695	478,854	458,909	442,968	414,389	17.9	90,306

II. THE MODEL

In recent years the dynamic adjustment of the demand for and supply of hired labour has consistently produced a lower level of employment in agriculture. The labour transfer from agriculture represents one component of this interaction. The continually declining level of employment may be accounted for by three factors - migration, unemployment and the recruitment-retirement balance.[1] However, it is also possible to define the transfer in terms of the change in employment plus unemployment which is an improvement from the labour supply side but is not so relevant to demand or "push" factors.

The dependent variable to be explained in this study is the variation in outflow of labour from agriculture regionally and over time during the period 1960-65. The variables used in the analysis will be mentioned briefly here and analysed in more depth later to explain why they are relevant and assess past results incorporating these variables. The variables are:

M : percentage change in the agricultural labour force

U : percentage industrial unemployment

$\dot{U}$: percentage change in U

W : ratio of agricultural earnings to industrial earnings

N : a measure of industrialization

A : a measure of the age of agricultural workers

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1. We are not here concerned with the retirement component on which data is limited. Our estimates of migration will reflect variations in both recruitment and retirement policies followed by farmers. Agriculture's failure to recruit labour has similar implications for other sectors as the actual movement of workers who are already engaged in agriculture. The migration estimates will contain some workers who are actually retiring and are not available for alternative employment. Workers not able to find alternative employment will usually register as unemployed.

E : a measure of the education levels of agricultural workers

P : ratio of agricultural earnings to agricultural product prices

T : technology level in agriculture

R : regional variables

The analysis takes the form of a single equation model

$$M = f(U; \dot{U}; W; N; A; E; P; T; R)$$

to be estimated by least squares regression procedures.

It will be noticed that the variables are predominantly supply[1] variables, only P and T being demand or push variables. However, it is possible to regard the migration or job-transfer as entirely a supply or pull phenomenon. For example if T is regarded as reflecting increasing awareness of opportunities on the part of farm workers rather than labour productivity this variable then becomes a supply variable. Similarly it may well be that P should not enter the formulation directly in that if the ratio of agricultural earnings to agricultural product prices rises, whilst this will cause a push of hired workers from agriculture, the push will result firstly in unemployment in agriculture and only later in migration and/or job transfer - the latter step depending on employment and earnings conditions in the industrial sector.

Two basic models will be presented. Firstly, Model 1, where all the regional data are pooled (9 regions over 5 years giving 45 observations). Secondly, Model 2,

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1. For an example of a model estimating supply equations for hired agricultural labour see Tyrchnieywiez and Schuh (17). They formulate a model for nine regions of the United States individually whereas we are forced to pool information because of lack of data. We do, however, estimate the relationship between migration and industrial unemployment for individual regions over the period 1950-63 (Model 3), as an extended series of data is available for industrial unemployment by regions.

where regions are split-up according to their deviation from the base region as indicated by regional dummy variables. In addition Model 3 will present results using extended time-series for individual regions.

The Variables

Dependent Variable

Annual percentage change in the hired agricultural labour force (either defined as (i) employment plus unemployment ($\bar{M}$) or (ii) employment (M)).[1]

It was felt better to use only full-time workers and exclude casuals and part time workers as full time employees are the important ones from a manpower gap viewpoint. Also there are problems of availability of statistics and which weights to use if different categories are to be aggregated, especially as movements in the number of casuals and part-time workers may be seasonal, reflecting random weather conditions. Similarly farmers are excluded because no annual figures are available.[2]

Explanatory Variables

Availability of alternative employment opportunities (U or U-UV).

An historical relationship has been observed between the rate of off farm migration and the business cycle (1), (15). In this analysis percentage regional

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1. Thus $\bar{M}$ is defined as $\frac{(E + U)_t - (E + U)_{t-1}}{(E + U)_{t-1}} \cdot 100$ and M is defined as $\frac{E_t - E_{t-1}}{E_{t-1}} \cdot 100$ where E represents employment and U unemployment. Neither definition is perfect; M represents the change in labour offered to this particular labour market and is therefore better from the viewpoint of supply variables, whereas M represents the change in labour actually demanded. (In fact to be absolutely correct the definition of M should include unfilled vacancies (UV) also but these are not a "hard" statistics and are therefore excluded).

2. The Ministry of Labour uses a constant figure, unchanged since 1957, for farmers when estimating the total labour force in Great Britain.

aggregate unemployment (U) and unemployment minus unfilled vacancies (U-UV) are used to reflect alternative opportunities, and experiments are made with various lags. The expected sign of the relationship is negative. Sjaastad (15) suggests a better reflector of off-farm employment opportunities would be the level of unemployment and vacancies in industries to which migrants move but use of such a series is not possible because virtually no information is available on inter-industry labour movements in the U.K.[1]

Percentage rate of change of alternative opportunities ($\dot{U}$).

This variable may be regarded as an expectations variable. A negative sign is hypothesized between M and $\dot{U}$; thus if unemployment is rising even if the level is low it is hypothesized that this will act as a brake on migration as potential migrants will expect more difficulty in finding alternative employment and postpone or abandon their intention to move. This brake on migration will be heightened if "last hired, first fired" agreements are in operation in those industries such as construction, to which migrants are likely to move.

A measure of industrialization (N).

Whilst the study pools information from all regions and does not fit individual relationships for specific regions it is assumed that the bulk of migrants remain in the same region or are influenced in their decision about moving by conditions in their own specific region. Statistics on geographical migration patterns in

1. Some limited evidence (unpublished) suggests construction and services to be the major recipients of farm labour.

the U.K. are limited but Johnson (10) found that in the U.S.A. over 1935-40 60 per cent. of agricultural migrants remained in the same state and 20 per cent. moved to contiguous states. Similarly a pre-war U.K. study (12) found most migrants only moved short distances. Thus it is thought that the higher the local level of industrialization the greater is the pull exercised. The variable was calculated as the agricultural employees in any one region as a percentage of the total employees in that region averaged over 1960-64. As well as representing the level of industrialization in a specific region it is also a "proximity" variable - the lower the ratio of agricultural industrial employees the greater the "density" of non-farm activities and the less distance potential migrants should have to travel to find a new place of employment. A more accurate proximity variable might define N as the percentage agricultural labour in rural areas (i.e. excluding conurbations); whilst this variable is available from the 1951 Census it is not available for 1961 and therefore is not used. Whether the variable is considered as a proximity or industrialization variable the expected sign of the regationship between M and N is negative.

Ratio of agricultural earnings to industrial earnings (W).

It is this variable which limits the time series to 1960-64, regional industrial earnings only being published since 1960.[1] Whilst previous studies (9), (14) have

1. Agricultural earnings are not published on a regional base but the Ministry of Agriculture provided us with a limited series.

found a significant negative relationship between this variable and migration. Bishop (1) obtained a significant positive relationship for the U.S.A. over 1920-59 and explained this by saying increased agricultural earnings gave the necessary capital for migration. However, lack of capital is not felt to be a major constraint in the U.K. over the period considered as the level of unemployment in the majority of regions has been absolutely low. Therefore because of the proximity of alternatives migrants have not needed a stock of funds which they can dissipate whilst waiting for non-farm employment. Similarly if the hypothesis that no (or small) geographical movement is involved is correct, lack of capital again does not appear to be a barrier to migration, except in outlying regions which have consistently low labour, and it is therefore expected that as the ratio of agricultural earnings to industrial earnings declines the level of migration increases.[1]

Ratio of agricultural earnings to agricultural product prices (P).

It is hypothesized that as unit labour costs rise relative to product prices the farmer has an incentive either to substitute capital for labour (assuming the price of capital does not rise so rapidly as that of labour) or reduce planned output. In either case this will result in a push of hired labour from the land and leads to the more general hypothesis that increases in guaranteed prices of agricultural products hinders migration. This is precisely the result found by Winkelman (18)

1. Again, a better variable might use industrial earnings in industries to which migrants move but this is not constructed because of lack of information on the jobs of migrants.

and Schuh (14) in U.S. studies. Both concluded that those policies which have the effect of raising farm income tend to maintain a larger number of people in agriculture than would otherwise be there. Thus a positive relationship is hypothesized here between P and M.[1]

Age (A).

The age variable is defined as the percentage of occupied farm population who were between the ages of 15 and 34 in 1951. Conceptually a better figure might have been this age group in 1961 but it is likely that most migrants fall into the age group considered (being aged between 24 and 43 in 1960)[2] This is a similar variable to that used in two recent studies of off-farm migration in two regions of the U.S.A. (7), (18). Diehl (7) found that if a region had 10 per cent. more people 10-24 years old than the national average it may be expected to have a migration rate of $3\frac{1}{2}$ times the national average. Similarly we hypothesize the rate of migration will be higher in those regions with a higher than average proportion of occupied farm workers in the younger age groups,[3] (see Table 2 for details).

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1. Regional agricultural product prices are not calculated or published by the Ministry of Agriculture. The method of construction of such an index on a regional base is reported in the Statistical bulletin (4). It is because of the difficulty of construction that the push variable relating regional agricultural earnings to other regional input prices does not appear in the study.
2. It was not possible to use 1961 as the Census Report for that year does not give a regional breakdown of the age structure of the occupied persons by industry group.
3. A conceptual problem arises here as our definition of migration includes retirement as one component and it is likely that the higher the proportion of older age-groups by region the larger will be the retirement and this will boost the "migration" figures. However, it is here assumed that this is outweighed by the positive association between young age groups and migration.

Table 2 : Age Structure and Educational Levels of Hired Agricultural Workers by Region

Region	Age[1]	Education[2]
London and South East	36.9	10.9
Eastern and Southern	38.2	8.7
South West	38.8	10.9
Midlands	42.3	8.7
Yorks, and Lincs	42.9	7.5
North West	43.0	6.9
North	44.9	7.3
Scotland	36.2	6.0
Wales	40.5	9.3
N. Ireland	36.1	n.a.

Education (E).

The variable is defined as the proportion of occupied agricultural workers who had attained a terminal education age of 16 or over in 1951[3] and is set out in Table 2. It is hypothesized that the earnings and employment potential outside agriculture is greater for better educated migrants and a positive relationship is hypothesized between

1. The age variable is defined as the percentage of occupied farm population who were between the ages of 15 and 34 in 1951.
2. The education variable is defined as the proportion of occupied agricultural workers who had attained a terminal education age of 16 or over in 1951.
3. It was not possible to use 1961 for reasons explained when discussing the Age variable.

the rate of migration and level of education.[1] This positive relationship is likely to be enhanced by regarding education levels as reflecting probable awareness of information about alternative employment; the better educated the employee the more aware and concerned he is likely to be about prospects in industry.

An examination of Table 2 shows that in England those regions which have the highest proportion of relatively younger workers (Midlands, Yorkshire and Lincolnshire, North West and North) also have the relatively least well educated agricultural labour forces; similarly those regions which are relatively well endowed with older workers (London and South East, Eastern and Southern, South West and Wales) have a relatively better educated labour force. It may be hypothesized therefore that the net effect of these variables on migration will operate to cancel each other out. Whilst it is surprising that regions with a high proportion of young workers also appear to be regions of less educational attainment it may be partly explained by the fact that the 1944 Education Act had only a limited time in operation by 1951. Therefore if it were possible to calculate these age and education variables using 1961 data it is likely that the situation would be reversed and there would be a positive relationship between a young age structure and educational attainment by region. The 1951 position may also partly result from relatively active labour transfer from some regions leading to an older age structure. If we say that education is partly responsible for this high outflow then we are left with a positive association between educational levels and age.

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1. Gisser (8) points out that better educated workers may be "better off" in agriculture because of this attribute but finds the positive migration aspect outweighs this.

Productivity (T).

This variable is represented by trend with a value 1 in 1960 rising to 5 in 1964 in each region. It is aimed at reflecting the continuous stream of improved technology available to farmers. Thus it is hypothesized that agricultural labour productivity is determined exogenously though it may be influenced by, among other things, the state of the labour market. A major limitation in using this trend variable for each region is that it does not allow for the fact that the rate of increase of labour productivity may be different between regions : for example it is likely that regions specializing in crop production have experienced more rapid rates of productivity growth than livestock producing regions.

We hypothesize a positive relationship between productivity and migration. This may be looked upon as a push or pull variable depending on the causal relationship. It is a "push" variable if, given a constant land stock, as labour productivity rises farmers are induced to push labour from the land. Alternatively it is a "pull" variable if, as labour leaves the land farmers replace this labour by capital so increasing the productivity of those workers remaining. In either instance the a priori sign of the relationship between M and T is positive - in the second case productivity being really a function of migration.

Regional Variables (R_i).

These variables are called dummy variables and allow for shifts in the migration relationship between regions. The variables take the value zero or one according to whether the particular observation is from that specific region. These variables impose the same slopes for the relationship, say between M and U, but allow for

different intercepts. Thus it is expected that for any given level of unemployment the regions will have different levels of migration because of factors peculiar to individual regions which are not quantifiable individually but are reflected in the composite variable for each region (i.e. the regional dummy variables). For example they may reflect a propensity to migrate in response to factors operating outside the particular region. The coefficients of these regional variables will be suggestive of further hypotheses aimed at explaining regional differences in migration.

III. THE RESULTS

The analysis takes the form of single equation, least squares regression applied to observations from the ten Ministry of Labour regions of the U.K. over the period 1960-64.

Model 1

In this model information is pooled from all nine regions of Great Britain, giving 45 observations and regional migration is explained in terms of regional variables. The results of the various formulations of Model 1 are included in table 3. All the equations except (3) being linear relationships U_t performs better than other indicators of alternative employment opportunities (lagged unemployment and measures including unfilled vacancies) and is the only indicator reported here. The coefficient is significant[1] when the variable is used alone or combined with regional dummy variables but loses its significance when incorporated in equations involving W and P. Whilst this may be partly explained by a direct relationship between U and W (in that if unemployment rises industrial earnings increase less rapidly and the W ratio rises) the zero order correlation coefficient between these variables is only 0.32. If equations (1) and (2) are compared it will be seen that in equation (1) the coefficient of U_t is 0.74, indicating a limited response to changing unemployment, and R^2 is only 0.115. The inclusion of the regional dummy variables in equation (2) increases the size of the coefficient of U_t to 2.8

1. A variable is here considered significant if the coefficient is at least twice the standard error. This roughly corresponds to the 5% level with these degrees of freedom.

Table 3. Regression Equations Explaining Regional Transfer of Labour from Agriculture ($\overline{M}$). Model 1

Equation	1	2	3[1]	4	5	6	7
Coefficient of							
Constant	5.9539 (0.6429)*	8.0841 (1.0510)	1.5241 (0.2408)	41.4110 (13.4355)	49.8995 (16.6767)	19.0347 (7.9791)	37.7738 (14.6520)
U_t	-0.7419 (0.3133)	-2.8235 (0.6760)	-1.6681 (0.3569)	-1.3430 (0.8439)	-1.7933 (0.8963)	-0.1123 (0.3261)	-0.7949 (0.8852)
$\dot{U}_t$				-0.0183 (0.0082)	-0.0188 (0.0080)	-0.0246 (0.0072)	-0.0202 (0.0091)
W_t				-0.6706 (0.2042)	-0.5591 (0.1992)	-0.2015 (0.0090)	-0.6080 (0.2104)
P_t				0.1023 (0.0306)		0.0294 (0.0273)	0.0914 (0.0335)
P_{t-1}					-0.0695 (0.1192)		
T_t					1.0246 (0.7326)		
A_t						-0.0789 (0.0884)	
E_t						0.0267 (0.1940)	
r_1 (Eastern & Southern)		-0.8971 (1.1842)	-0.1009 (0.3387)	1.0877 (1.1175)	0.8168 (1.1028)		0.8721 (1.2318)
r_2 (South West)		0.5449 (1.2115)	0.4751 (0.3602)	6.2804 (1.9983)	5.4018 (1.9375)		5.4773 (2.1055)
r_3 (Midlands)		-0.5481 (1.1851)	0.2518 (0.3383)	1.5783 (1.2637)	1.9243 (1.3774)		1.2719 (1.3826)
r_4 (Yorks and Lincs)		-0.2819 (1.1969)	0.0456 (0.3477)	3.6573 (1.5482)	2.9173 (1.4984)		3.0746 (1.6540)
r_5 (North West)		1.7959 (1.3981)	0.9039 (0.4345)	4.8947 (1.5806)	5.6205 (1.8700)		3.8846 (1.7026)
r_6 (North)		4.1284 (1.8278)	1.4847 (0.5303)	4.9843 (1.8074)	4.4459 (1.7136)		3.4923 (1.9513)
r_7 (Scotland)		5.4249 (2.0194)	1.7933 (0.5685)	7.4716 (2.0577)	6.3699 (1.9160)		5.6540 (2.2089)
r_8 (Wales)		4.5508 (1.5500)	1.5092 (0.4796)	3.9114 (1.5186)	3.6521 (1.4703)		2.9289 (1.6523)
r_9 (N. Ireland)							5.8188 (5.8725)
R^2	.115	.392	.446	.652	.669	.428	.538
Von Neumann Ratio	2.37	2.64	2.11	1.52	2.87	2.58	2.99

1. Double log relationship : $\log \overline{M} = f(\log U_t, r_1 \ldots . r_8)$.

* The figures in parenthesis are the standard errors of the estimated parameters.

indicating a much greater response. This may be explained by the fact that variations in U in specific regions cause big changes in outmigration but different regions adjust at different "levels". The high unemployment regions have larger significant positive dummy coefficients (i.e. significantly different intercepts from the base region R_o (London and South East)) indicating migration is much higher than that predicted from the given regional unemployment level. The dummy variable for Wales for example, indicates migration will be 4.5 per cent. higher than the migration predicted from a knowledge of unemployment in Wales, given this particular model. Thus there exists (at least) two different adjustment relationships - one for the high employment and one for the low employment regions. If a double log (non-linear) relationship is substituted for the linear one (equation 3) the unemployment coefficient remains significant at the 1% level and the explanatory power of the equation improves by 6 per cent. with 45 per cent. of the variance in the dependent variable explained. This improvement is, however, not apparent in equations where other variables are added.

The addition of the industrialisation variable (N) does not improve the explanatory power of any model and its coefficient is non-significant. This possibly indicates migrants move further afield than their own region but could also indicate this measure is a poor proxy for the proximity of alternative work in that the distribution of industry may not be even in a region, but rather concentrated in one segment. Lack of evidence arrests further testing of these problems and this variable will not be further considered.

In equation (4) three further variables are added. All the explanatory variables are significant with the correct signs except for U_t which has the right sign but is only one and a half times its standard error the coefficient being smaller than without the additional variables. The coefficients of the explanatory variables are all larger and more significant than in a similar equation without the regional dummy variables. The coefficient of W_t indicates a 10 per cent. fall in the ratio of agricultural earnings to industrial earnings will increase migration by nearly 7 per cent., whereas a 10 per cent. fall in agricultural earnings relative to agricultural product prices only induces a reduction in migration of 1 per cent. Thus it would seem, in the context of the variables so far analysed, that if the Government really wished to provide a spur to migration it could keep agricultural earnings down, either statutorly or, possibly, via the Agricultural Wages Board and the pull element of higher industrial earnings would outweigh the inducement to farmers to retain labour (negative push element) thus giving a net migration movement. Conversley an industrial wage freeze is likely to cause a "backing-up" of labour on the farm and considerably reduce migration and possibly impair future rates of productivity growth. The coefficient of the expectations variable $\dot{U}_t$ indicates a doubling in the level of unemployment (i.e. a value of $\dot{U}$ of 100 per cent.) will induce a change of 2 per cent. in migration which has the obvious policy implication that if unemployment rises sharply this is going to cause a further backing-up of labour in agriculture.

In equation (5) a trend variable is added. This may be considered a proxy variable for productivity but may represent any positive linear growth rate. The coefficient of approximately unity is significant[1] and implies increases in the rate of migration of 1 per cent. per annum. It will be noticed that the addition of T_t causes the price ratio variable to become non-significant (the zero correlation coefficient between T_t and P_t being 0.80).

The result of adding age and education variables is reported in equation (6). These variables add nothing to the formulations already considered, with the respective coefficients non-significant and the variables not improving the explanatory power of the equation. This holds true in other formulations than those reported here. The non-significance is probably a reflection of the poor (but best available) statistical series used[2] and is not a reflection of collinearity between A_t and E_t themselves or with other explanatory variables.

Most previous migration studies have used a dependent vairbble which does not take account of unemployment. When we followed this practice, defining the dependent variable as the rate of change of agricultural employment the significance of the coefficients was little changed and the explanatory power of formulations reduced by around 5 per cent. Thus the dependent variable used in the bulk of the study, which

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1. The Von Neumann ratio does, however, give evidence of autocorrelation and the parameter estimates may therefore not be as significant as at first sight.

2. Whilst there here appears no quantitative relationship between migration and age and education descriptive studies such as that of Thomas (16) did indicate some relationship existed in the U.K. and this supports the need for more detailed current age and education variables by industry on a regional basis to facilitate further quantitative analysis.

includes unemployment, gives a better overall fit although the implications of the results are very similar.

In equation (7) of Table 3 an additional region, Northern Ireland, is added to the nine regions previously analysed. The region was not included in the bulk of the analysis as it was felt that Northern Ireland was more influenced by overall United Kingdom data rather than data pertaining to the particular region. Its addition produced an even smaller and less significant coefficient for the industrial unemployment variable and the Von Neumann ratio gives evidence of autocorrelation. This further suggests that we should allow for more than one relationship between M and U among the regions we are dealing with. It also supports the hypothesis that the transfer of labour out of agriculture in Northern Ireland may be more closely related to labour market conditions in Britain than in Northern Ireland.

Model 2

In this Model the regional observations are split into two groups according to the deviation, shown by the dummy variables, from the base region London and the South East. The groups correspond to high and low unemployment regions. The High Employment Regions consist of (1) London and South East, (2) Eastern and Southern, (3) Midlands and (4) Yorkshire and Lincolnshire giving a total of twenty observations. The Low Employment Regions comprise (1) South West, (2) North West, (3) North, (4) Scotland, (5) Wales giving a total of twenty-five observations. A selection of the more useful results are reported in Table 4.

High Employment Regions: In equation (1) it will be seen that regional unemployment alone explains 56 per cent. of the variation is migration. The coefficient is significant at the 1% level. It is interesting to note the larger size of the coefficient compared with those results in Table 3. In equation (2) the coefficient is - 8.3 indicating a 1 per cent. rise in unemployment in these low unemployment regions would reduce the level of migration by 8.3 per cent. The reason for the sensitivity of migration to unemployment is not hard to seek : unemployment has been low and therefore a 1 per cent. rise would in many cases represent over a doubling of the prevailing level which would cause potential migrants to postpone their move. The addition of other explanatory variables (equation 2) improves the explanatory power of the equation to nearly 90 per cent. The coefficient of W_t is non-significant probably reflecting the larger earnings differential in these regions[1] which will cause migration irrespective of small changes in the ratio. The coefficient of the push variable P_t takes on the wrong sign when the trend variable (productivity) is included whereas this latter variable is significant with a coefficient of 2.7. This probably indicates that increasing productivity is a more important determinant of pushing labour from agriculture than is changes in the price ratio but it could also represent increasing awareness, education or information. However, the high correlation between T_t and P_t (0.94) makes it difficult to separate the effects of these variables. The education variable now assumes a significant coefficient, with

1. The mean ratio of agricultural : industrial earnings is 71 per cent in high employment regions and 74 per cent in low employment regions.

the expected positive sign and indicates that if 10 per cent. more agricultural employees attain a terminal education age of 16 then migration will increase by 6 per cent. This is roughly in agreement with the findings of Gisser (8) who pooled regional and time-series data for the U.S.A and concluded that increasing the level of schooling in rural farm areas by 10 per cent. will induce a 6-7 per cent. farm outmigration.

Table 4. Regression Equations Explaining Changes in Regional Outmigration from Agriculture (M). Model 2

	High Employment Regions[1]		Low Employment Regions[2]	
Coefficients of	1	2	3	4
Constant	9.0674 (0.9277)	15.8545 (13.9335)	27.0048 (8.6574)	29.5186 (7.9334)
U_t	-4.1270 (0.8615)	-8.2948 (1.3563)	-0.7983 (0.3683)	-1.1939 (0.3646)
W_t		-0.2706 (0.1478)	-0.2794 (0.1155)	-0.2170 (0.1121)
P_t		-0.3559 (0.1477)		-0.0853 (0.0521)
T_t		2.6848 (0.8617)		0.8956 (0.3388)
A_t		0.0864 (0.1250)		
E_t		0.6277 (0.3035)		
R^2	.560	.888	.303	.496
Von Neumann Ratio	2.15	2.47	2.54	2.29

1. High Employment Regions consist of London and South East. Eastern and Southern, Midlands and Yorkshire and Lincolnshire.

2. Low Employment Regions consist of South West, North West, North, Scotland and Wales.

Low Employment Regions: Two of the formulations for the high unemployment regions are reported in equations (3) and (4). The pull variables U_t and W_t both appear important determinants of migration. In equation (3) it will be seen that both coefficients are significant and the variables explain 30 per cent. of the variation in the dependent variable. The addition of the push variables P_t and T_t increases the R^2 coefficient to 0.5 (equation (4)). Whilst the trend variable, with a significant coefficient, appears more important than the price variable the two variables are again highly correlated (zero-order correlation coefficient of .73). In equations (3) and (4) the size of the unemployment coefficient is substantially reduced compared with that in the formulations for the High Employment regions. This reflects the general, overall, difficulties of finding alternative employment opportunities in these regions and is indicative of the fact that a 1 per cent. change in the level of unemployment does not reflect so dramatic a change in the labour market as it does in high employment areas. These regions appear to be more dependent on national labour market conditions and much of the outmigration would appear to be true geographical migration into high employment regions. It is probable that the relatively low explanatory power of these equations would be improved by non-linear formulations and by using the British average unemployment level rather than the regional level. The addition of industrialization, age and education variables in other formulations not reported here never improved the R^2 value and the respective coefficients were all non-significant.

Model 3

The lack of regional statistics ranging over the whole post war period limited the bulk of the analysis to the pooling of cross-section and time-series data. However, regional unemployment figures are available from 1950[1] and regional estimates of the relationships between agricultural labour migration (actual numbers) and unemployment over 1950-63 are shown in Table 5. It will be seen that the unemployment coefficient is significant in six[2] of the eleven regions. Experiments were also made with lagged unemployment but this proved an inferior formulation. It will be seen that the clearly significant coefficients belong to the variables of regions which have experienced low unemployment throughout the period (London and South East, Southern, South West[3] and North Midland) and in these High labour Demand areas fluctuations in the level of U_t explain a relatively high percentage of the variation in migration although the explanatory power of variations in regional industrial unemployment is not high in any of the regions over this time period. This supports the findings of Model 2 where it was found that migration is more responsive to changes in the level of unemployment in high employment regions than in low employment regions. In high unemployment regions such as North and Scotland it is likely that potential migrants view off farm employment possibilities in the

1. N.B. The regions are somewhat differently defined here. Eastern and Southern being separate regions and the Midland and Yorkshire and Lincolnshire area being composed of three regions - Midlands, North Midlands and East and West Ridings.
2. These six regions include North West and Wales which have coefficients not quite double their standard errors.
3. The South West only became a relatively high unemployment region after 1960.

context of a longer past time-span and the relationship between M and U in these regions is therefore blunted.

Table 5. Regional Estimates of Relationships between Agricultural Labour Migration (Actual Numbers) and Percentage Unemployment, 1950-63

Coefficient of Region	Constant	U_t	R^2
London and South East	6278	-2769	.412
	(1035)	(945)	
Eastern	3177	-800	.057
	(1190)	(941)	
Southern	2673	-912	.379
	(468)	(337)	
South West	4668	-1763	.313
	(1210)	(754)	
Midland	2017	-494	.151
	(380)	(338)	
North Midland	3238	-1224	.372
	(445)	(459)	
East and West Ridings	1360	-397	.138
	(362)	(286)	
North West	1756	-352	.242
	(373)	(180)	
Northern	1583	-241	.181
	(393)	(148)	
Scotland	1312	+245	.026
	(1409)	(431)	
Wales	2590	-466	.236
	(705)	(242)	
Northern Ireland	2504	-51	.005
	(1560)	(210)	

IV Conclusions and Policy Implications

Covariance analysis of regional migration from agriculture between 1960-64 has shown that migration is related to the business cycle, with variations in industrial unemployment significantly related to outmigration. This substantiates the work of Sjaastad (15) and Bishop (1) who found a similar relationship for the U.S.A. This study has shown that a clear dichotomy exists in regional differences in responsiveness to variations in the local industrial unemployment level. In high labour demand areas outmigration is very sensitive to variations in the level of U; in areas of low labour demand, however, it is less responsive and variations in local unemployment also explain a smaller proportion of the variation in outmigration. Thus it appears that the general ldvel of unemployment may be more relevant to changes in outmigration in these low employment areas. If this is true then an increase in unemployment of 1 per cent., evenly distributed over all regions is likely to have a highly significant effect - reducing migration by up to 8 per cent. in high employment regions and perhaps 2 per cent. in low employment regions.[1]

The ratio of agricultural to industrial earnings appears significant in the general model (model 1) where the estimates indicate a 10 per cent. reduction in the ratio (i.e. increase in industrial earnings relative to agricultural earnings) will result in an increase in migration of 6 per cent. In the "split" model the coefficient

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1. This reduction in percentage migration represents nearly double the mean outflow of the High Employment Regions (4.8 per cent. per annum) and nearly half the mean outflow of the Low Employment Regions (4.5 per cent. per annum).

is only half what it was in the more general model and the significance of the coefficients is also more circumspect. A crucial point concerning implications of this variable is its relationship to U. Previous estimates (5), (6) have shown that if unemployment rises 1 per cent. the rate of wage/earnings inflation is reduced by the order of 3 per cent. It is highly likely therefore that a rise in unemployment will not only induce a reduction of migration by itself, but will also cause an increase in agricultural earnings relative to industrial earnings and thus cause a further decline in percentage migration. In fact the ratio of agricultural earnings to industrial earnings is likely to rise anyway in the next few years because of the simple fact that agricultural workers have composed one of the most poorly paid sections of the economy.

It is difficult to separate the effects of the variable relating agricultural earnings to agricultural product prices from the trend variable -which may represent productivity increase or the information - education - learning process. The evidence does indicate, however, that it is quantitatively less important than W. For example, in the general model the significant coefficients indicate a 10 per cent. rise in the ratio would only increase migration by 1 per cent. In Model 2 the coefficient is either non-significant or assumes the wrong sign. The limited evidence available does support the view that a (minor) inducement to migration can be achieved by a reduction in agricultural product prices via the level of subsidies or alternatively a restructuring of subsidies resulting in a reduction of product prices in the eastern arable sector where the majority of farm workers are employed, which would induce farmers

to push labour from the land. It is possible that the push from the land might result in agricultural unemployment either before or as well as migration and job transfer. From the migration viewpoint this would have the beneficial effect of reducing agricultural earnings[1] and therefore heightening the pull of W.

Of the remaining variables age and industrialization do not appear to be important determinants of outmigration whilst there is some evidence that increasing educational attainment does have a positive impact in the high employment regions. However, all these variables suffer from the fact that they are represented by relatively poor statistical series and it might be that a better formulated series, using possibly 1961 Census data would show these variables to be more important than appears the case here.

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1. For details of the relationship between wage changes and unemployment in agriculture see Cowling and Metcalf (3).

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