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EMPLOYMENT RELATIONSHIPS  
IN IRISH COUNTIES

TERENCE J. BAKER and MICEAL ROSS

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## Employment Relationships in Irish Counties

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*Employment Relationships in Irish Counties*

TERENCE J. BAKER and MICEAL ROSS

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## *General Summary*

ECONOMIC activities in a small but varied area such as the Irish county can be divided into two distinct types. On the one hand, there is the type of activity which is dependent primarily on factors outside that county. Into this category fall those industries, including agriculture, whose products are sold to a national or international market. Also included are those commercial services, such as tourism, which attract the bulk of their clients from beyond the county. Less obviously one can also include the "social" services, such as public administration, education and health. Although these mainly serve the inhabitants of the county, the standards of service to be provided and much of the finance to support these standards, are derived from national, and not local, decisions. All these externally conditioned activities can be classed as *autonomous* from the local viewpoint.

The other type of activity is that which provides goods and services for the local market within the county. These activities thus depend on the population and prosperity of the county itself, and can be classed as locally *induced*.

Given these definitions it is obvious that there should be a relationship between the autonomous and the induced activities in each county. The latter depend on the former to provide them with income and employment. Thus, apart from minor complications such as the situation of towns in relation to county boundaries, and patterns of commuting to work, one might expect the proportions of autonomous and induced activities to be fairly constant from county to county. By and large this is true for economies at an advanced stage of development, as Black and Jefferson demonstrated in their recent paper on Employment Patterns in Northern Ireland.

However, in slightly less developed economies, which still retain a substantial proportion of the population in agriculture, the relationship is not so simple. In such a case, of which the Republic of Ireland is a good example, a high proportion of the population of a county engaged in agriculture indicates, not a prosperous and thriving agricultural sector, but a general lack of economic development. In particular, the agricultural sector in such a county is likely to be relatively backward, with low income per head and a considerable degree of under-employment. At this stage of development, therefore, one would expect that the higher the proportion of agriculture in the autonomous sector, the smaller the resulting induced sector would tend to be. As the county

develops, and non-agricultural autonomous activities become more important relative to agriculture, one would thus expect the induced sector to grow.

A previous paper by one of the authors showed that such a relationship did appear to exist in 1951 and 1961. This paper examines whether it still obtained in 1966 and 1971, and if so, whether its existence could be used in constructing models for predicting future county employment patterns.

Attention is confined solely to employment relationships. Obviously, the actual mechanism linking the sectors involves income and expenditure patterns, but experience in the previous paper suggested that little was to be gained from bringing income variables into the analysis. In the first place, county income estimates must inevitably be subject to a considerable margin of error; in the second place, income variations can be allowed for indirectly in the method of analysis we use, and thirdly, our principal interest lies in induced sector employment, rather than induced sector income.

The data used, therefore, are entirely derived from the Census of Population for the various years examined, ensuring that they are accurate and fully consistent. In order to construct the autonomous and induced sectors it is necessary first to regroup the employment categories used in the Census, and to reclassify certain categories, where, for example, certain local activities of a retail nature are included in the Census as part of manufacturing industry.

The basic tables obtained from this readjustment of the Census material are presented in the Appendix to the paper. For descriptive or analytical use within the body of the paper, the absolute figures are converted into percentages of the total workforce in each county, thus enabling simple comparisons to be made between counties of different size. Even apart from the special case of Dublin, to which the autonomous/induced classification does not properly apply, it can be seen that there are large differences in the employment patterns between counties. Roscommon and Leitrim, at one end of the scale, have large agricultural sectors, very small non-agricultural autonomous, and, in line with our hypothesis, small induced sectors. At the other end of the scale, Louth and Waterford, the most developed counties, have small agricultural sectors and large induced sectors.

Formal examination of the relationship is carried out by means of regression analysis. The share of the induced sector in the total workforce of each county is regressed upon the share of non-agricultural activities in the autonomous sector. Various formulations of the relationship are examined, including some where the non-agricultural autonomous sector is split into smaller sub-sectors.

The results of the regression analysis are very encouraging. In both 1966 and 1971 the relationship between the share of non-agricultural activities in the autonomous sector and the proportion of the workforce engaged in the induced sector is highly significant by all the standard statistical tests. Moreover, the

actual values of the regression coefficients are consistent between each of the four Census years examined.

The actual equations expressing the relationship appear to explain about two-thirds of the variation between counties in the size of the induced sector in 1971, which is slightly less than in the earlier years. However, the explanatory strength of the equations is really much higher than this. As has already been suggested, various local factors are liable to influence the size of a particular county's induced sector. These could include some income effects where, for example, the agricultural sector is significantly richer or poorer than might be expected from the county's development ranking. Most of these local factors, being of a geographical nature, can be expected to be persistent in their effects. The analysis confirms that this is so. Where the size of a county's induced sector diverges from that indicated by the equations, both the direction and the size of the divergence tend to remain remarkably constant from one Census year to the next. Thus, the divergences from one Census year, reflecting local factors for that year, can be fed into the equation for the following Census year as a separate variable. When this is done the regression equations for 1971 explain about 95 per cent of the inter-county variation in the proportionate size of the induced sector.

With such good explanatory equations available for each of the four most recent Census years, it seems highly probable that the analysis can be used to help in predictions for future years. Of course, the method cannot yield a total prediction, being based as it is on current relationships between different types of employment. However, if fairly reliable estimates can be made for future employment in the autonomous sector of the county, then models can be derived to predict the size of the induced sector and thus of total employment. In Irish circumstances, where the decline in the agricultural workforce is fairly steady, and is reported annually, and where planned major developments in industry are closely monitored by the IDA, it is quite reasonable to expect forecasts of autonomous sector employment to be tolerably accurate. Thus a partial model to predict total employment from such estimates could be of considerable use.

In constructing such models it is necessary to project values for the underlying basic relationship of our hypothesis. Fortunately, there has been a tendency over the years observed for the relationship to change slowly in a consistent manner, with the slope tending to become less steep. By projecting this movement forwards for five years from the most recent Census, a forecast equation can be constructed for the next Census. The divergences from the equation based on the most recent Census can then be applied for each county. As we have shown, these divergences tend to remain remarkably stable over time. However, within this general pattern of stability, minor changes do take

place and these changes appear to be systematic. Further regression analysis confirms that there is in fact a relationship between changes in the divergences and the speed of development in a county. The more rapidly a county develops, as measured by the growth in its non-agricultural autonomous sector, the more likely there is to be a negative change in its divergence. This factor is also built into the prediction model, together with a dummy variable for the counties adjacent to Dublin which tend to exhibit some unusual features.

The models, one based on a linear equation and one on a semi-logarithmic equation, are first calculated on the data available after the 1966 Census. They are then applied to 1971, and the results predicted by the models compared with the actual 1971 employment patterns. The results of this test are encouraging, with the predicted outcome very close to the actual for most counties. The models are therefore re-calculated with 1971 data included, and the two equations applicable to 1976 are presented. With the aid of these models we hope that forecasts of autonomous employment in any county or region can be translated, through a few simple calculations, into forecasts of total employment. Equally, the models can be used as consistency checks on any forecasts of regional or county total employment which may have been made.

The derivation of these models itself constitutes the principal conclusion of the paper. However, the analysis does suggest also certain other conclusions. The first of these is the confirmation that the general hypotheses of the paper remain valid in Irish circumstances, and, by extension, could be expected to provide a useful method of analysis in other countries at a similar or slightly lower stage of development. Secondly, there appears to be a limit to the proportionate size of the induced sector. Except where clearly exceptional local factors apply, the share of the induced sector tends to level off at about 35 per cent of the workforce, irrespective of further changes in the composition of the autonomous sector. Most of Northern Ireland, and the five or six most developed counties in the Republic appear to have reached this point, or to be rapidly approaching it.

Thirdly, there is a remarkably strong power of inertia in the regional structure of the economy. Despite the great economic changes which have taken place in the twenty years surveyed in the paper, there has been very little change in the ranking order of counties. Even Clare, with its more than trebling of manufacturing industry, has risen by only four places in the order.

Very rapid increases in non-agricultural autonomous employment do not have an immediate proportionate effect in increasing induced employment. This is probably due mainly to a lag in the adjustment of the induced sector to its improved opportunities, and to this extent it can be expected to correct itself eventually. However, it is possible that part of the shortfall is permanent, with economies of scale being realised in the provision of induced services as

a result of the greater concentration of population and purchasing power so often associated with rapid industrial growth. This suggests, although by no means conclusively, that rapid concentrated growth may have smaller effects in inducing further employment than a more dispersed pattern of growth.

More positively, the analysis demonstrates that growth in the social autonomous sector, in such services as public administration, health and education, has at least as great a power to induce further employment as has manufacturing industry. This finding has obvious implications for regional development policy especially as many such activities are at least as "footloose" with regard to location as is manufacturing, which is currently regarded as the principal vehicle of regional development.

Finally, the analysis of the paper illustrates clearly yet again that a simple division of the country into a more and a less developed region is an inappropriate basis for policy. Although on average the counties North and West of the Shannon are poorer and less developed than those to the South and East, there is no clear dividing line between them. The development index in employment terms, which is confirmed by income estimates, shows that counties are ranked in a continuous spectrum, not in two distinct groups with a break point between them. Unless legislation and policy applications recognise this fact, then there is a danger that past imbalances will be alleviated only at the cost of producing new distortions.

## *Introduction*

THE aim of this paper is to analyse county employment patterns derived from Census data, and to attempt to construct forecasting models for certain types of employment at the county level. Most attention is paid to the two most recent Censuses, those for 1966 (CSO 1966) and 1971 (CSO 1971), but reference is also made to the patterns derived from the two previous Censuses, those for 1951 (CSO 1951) and 1961 (CSO 1961).

The theoretical basis of the analysis is that put forward by one of the authors in a previous paper (Baker 1966) which studied the 1951 and 1961 patterns. However, the methodology employed in applying this theory to the actual analysis of the data has been considerably developed, and the availability of four post-war Census years has enabled further factors of a dynamic nature to be taken into account in the analysis.

The first part of the paper sets out the basic hypothesis on which the analysis is constructed, and describes briefly the adjustments to the Census data which are necessary to allow the hypothesis to be tested. Also in this section some of the conceptual differences between this paper and a recent study of employment patterns in Northern Ireland (Black and Jefferson, 1974) are discussed. Although both papers use methodologies developed from Baker's earlier work (1966), the developments have followed different paths, largely because of the substantial difference in conditions between Northern Ireland and the Republic.

Section Two describes and analyses the pattern of county employment in 1966. A large part of this section is devoted to testing alternative formulations of the hypothesis in an attempt to discover the most appropriate form of equation to fit to the data.

The third section sets out the pattern in 1971, and repeats the more successful formulations of regression analysis found in the previous section.

Section Four combines the findings of the previous sections in an attempt to derive a workable forecasting model for induced employment. This exercise is undertaken in three parts. In the first the data up to and including 1966 is used to obtain models applicable to 1971. In the next the results of these models are compared with the actual out-turn for 1971, while in the final part all the available data are taken into account in calculating revised models applicable to 1976.

The fifth and final section of the paper consists of a set of conclusions drawn from the paper as a whole and from the results of Black and Jefferson's findings in Northern Ireland.

## Section I

### *Theoretical and Data Consideration*

#### *The Basic Hypothesis*

THE hypothesis advanced and tested in the earlier paper, and which forms the basis of this paper also, is that county employment patterns can fruitfully be examined in terms of a systematic relationship between different types of work. Economic activities in any small but heterogeneous area, such as an Irish county, can be divided into those which are autonomous, from a local point of view, and those which are locally induced. The autonomous sector comprises those activities whose product, of either goods or services, is primarily sold or "exported" to the remainder of the country or to the rest of the world. It also includes the social sector, whose services are consumed within the country, but whose standard is determined by national rather than local decisions, and whose financing is at least in part a national responsibility.\*

The induced sector comprises activities whose products are consumed within the county itself and whose level of output is largely determined by the size and prosperity of the autonomous sector.

On these definitions, the greater part of agriculture clearly falls within the autonomous sector, as its output is geared to national or international markets rather than to local consumption. However, there is a strong case for treating agriculture separately from the remainder of the autonomous sector. While a high proportion of the workforce engaged in industry generally implies a well developed industrial sector, a high proportion engaged in agriculture usually reflects a lack of development in the agricultural sector. In these circumstances, both efficiency and income per head in agriculture tend to be relatively low compared with counties with a more developed agricultural sector in which

\*The treatment of the social sector does raise some conceptual difficulties. In a fundamental sense such activities are induced by the presence of population in an area, and according to our hypothesis the size of the working population is in turn dependent mainly on the size of the commercial autonomous sector, including agriculture. On the other hand, the demand for social services, and the finance for their provision in Irish circumstances, is very little dependent on the level of incomes in a locality, or on the structure of the work force. In fact, the demand for the two most important forms of social employment, education and health, is primarily related to the size and composition of the non-working, rather than the working population. Therefore, for purposes of comparative county analysis with a fairly limited time horizon it seems preferable to treat these types of employment as autonomous, while admitting that a case could be made for alternative treatment.

a smaller proportion of the population is engaged. Secondly, there is a tendency in most counties of Ireland, for average agricultural incomes to be lower than average incomes in other autonomous activities (see Attwood and Geary 1963, Ross 1969 and 1972). Thirdly, even if incomes in agriculture are equal to incomes in other sectors, the expenditure patterns of farmers are likely to be different from the expenditure patterns of non-agricultural workers. Not only are farmers likely to save a higher proportion of these incomes (see Kennedy and Dowling 1970) but also it seems probable that a smaller share of what they do spend will be on the purchase of local goods and, especially, services, due to the "do-it-yourself" tradition of farmers in undertaking jobs of household upkeep and in the provision of some food requirements.

Estimates of county incomes from various types of activity have been made by one of the authors for 1960, 1965 and 1969 (Ross 1969 and 1972). The inclusion of some of these estimates as explanatory variables for the size of the induced sector was considered, but on reflection it has been decided to restrict the analyses to employment variables derived from Census data.\* This study does not attempt to offer a comprehensive explanation of county variations in development; such an exercise would involve a multidisciplinary approach with very considerable research resources. As a relatively modest contribution towards understanding regional development, it is felt that this paper is most likely to provide a useful and comprehensible input if it is restricted to a single aspect of the situation, leaving all other factors to contribute to the residual element of the equations. As in the previous paper, considerable attention is given to discussing these residuals, and the possible impact of various factors upon them.

Thus the hypothesis underlying this analysis is that the size of the induced sector in any county, measured as the proportion of the total workforce engaged in induced activities, is dependent on the relative share of agricultural and non-agricultural employment within the autonomous sector. In the previous paper only a linear relationship between these two proportions was tested. In the current paper, it is proposed also to investigate various non-linear forms of relationships, and to present forecasting models based on alternative formulations of the relationships. Some simple disaggregations of the non-agricultural autonomous sector are also studied. The most important of these is the distinction between the "commercial" and the "social" part of the sector, as the two are conceptually different and it is of interest whether this conceptual difference is reflected in empirical results.

\*Income variables were tested in the previous paper (Baker 1966) and were found to add little to the understanding derived from the simple analysis of employment. It is also interesting to note that the results obtained by Black and Jefferson (1974) when they tested the relationships of local sectoral incomes did not differ significantly from their results using employment data.

*The Data*

The data on which this exercise is based are derived from the Industry volumes of the 1966 and 1971 Censuses. However, the industrial classification used in the Census does not correspond with the sectoral definitions postulated in our hypothesis. Thus it has been necessary to reclassify many types of employment. The reclassification adopted is the same as in the earlier paper.

This reclassification is the central feature of the papers, and involves the following major adjustments to the Census presentation:

- (i) The sector of "trading" has been enlarged by transferring to it some items classified in the Census as "Manufacturing Industry" (for example, handicraft tailoring and shoe repairing) or as "Personal Service" (for example, laundries and hairdressing) which appear to be of a primarily retail nature.
- (ii) The Census head "Professions" has been divided into the social service professions in Health, Education and Religion, and the commercial professions, such as Law and Accountancy.
- (iii) The Census group "Building and Construction" has been divided into public authority and private activity.
- (iv) "Transport" has been divided into sea and air transport on the one hand and land transport on the other.
- (v) "Turf Production" has been excluded from mining and transferred to the agricultural sector.

Following these and some other minor adjustments, the four main sectors of our classification are as follows.\*

Agriculture—including forestry, fishing and turf.

Commercial Autonomous—comprising manufacturing industry (minus those items transferred to trade), mining (less turf), sea and air transport, hotels, boarding houses and restaurants, and a few small miscellaneous activities.

Social Autonomous—comprising the social professions, public authority building and construction, and public administration and defence.

Locally Induced—comprising all trading (including those items transferred from manufacturing industry and personal service) and all other activities not included in the other sectors.

\*For full details see Appendix 1.

It is freely acknowledged that the classification is arbitrary, and is not based on any objective criteria, such as the actual degree of geographical dispersion of an activity. Moreover even some of the Census sub-heads used in allocating activities between the different sectors are too large and too heterogeneous to permit real precision in our functional classification. Nevertheless, it is felt that, in spite of obvious flaws, the classification is sufficiently realistic to enable worthwhile analysis to be undertaken and useful conclusions to be drawn.

The other form of amendment to the Census presentation is geographical. The hypothesis we are testing postulated geographical units which are heterogeneous enough to include all the major economic sectors. Thus, the county boroughs are not suitable units for our analysis, and have accordingly been amalgamated with their respective counties in our presentation. Tipperary has, however, been treated as two separate counties, thus providing an additional observation for purposes of regression analysis, and enabling results to be calculated for the IDA Regions. The distinction drawn in the previous paper between the traditional eleven poor counties and the remainder has not been continued in this paper. As the authors have argued elsewhere (Baker and Ross 1970), this simple division of the country has lost most of its relevance in recent years. Counties are, however, grouped into the nine planning regions (excluding Dublin) as these units possess clear administrative relevance.

Dublin has been excluded from the regression analysis, and from the tables based on it. This is because the classification of activities into autonomous and induced sectors cannot be properly sustained in the case of Dublin. Its population is sufficiently large, compact and relatively wealthy as to be able to support substantial manufacturing and other enterprises serving only the local market. Thus a considerable proportion of manufacturing industry, which in other countries is properly regarded as autonomous, should, in the case of Dublin, be classified as induced. Similarly some service industries, such as restaurants, which in other counties are taken to represent the autonomous activity of tourism, in Dublin are largely induced by local demand.

Conversely, many of the service industries which are classified as induced, such as electricity and financial institutions, have a large head office staff in Dublin. While it is reasonable to regard employment in local branches of these organisations as reflecting the locally induced demand for their services, it is clearly inappropriate to regard the employment of their head office staffs in Dublin as being induced solely by Dublin demand.

On the Census data available it is not possible to adjust the classification in the case of Dublin to allow for these factors. Accordingly, there seems no alternative to excluding Dublin, and restricting the analysis to the remaining 26 counties.

*Employment Patterns in Northern Ireland*

In a paper recently published by the ESRI, Black and Jefferson (1974) of The Queen's University, Belfast, studied employment patterns in Northern Ireland. Although heavily influenced by the hypothesis outlined above, their approach differs in several interesting respects from that followed in this paper.

The most obvious difference is the choice of local unit. While in this paper we continue to base our analysis on the county, their basic unit is the "Urban Centre", each consisting of one or more administrative areas, with Rural Districts grouped with the appropriate Urban Districts or County Boroughs. The reasons for this divergence in approach appear to be both theoretical and practical.

On the theoretical level, Black and Jefferson are strongly influenced by the concepts used in spatial analysis by economic geographers, and in particular by Central Place Theory. It is true that the "Urban Centres" distinguished in their analysis approximate more closely to the concept of a unit consisting of town and hinterland than do most of the counties used in this study. On the other hand, the current authors feel that if the results of this study are to have any application in influencing decisions, it is important that the units chosen coincide with administrative areas. This requirement is met in the Republic of Ireland by the county, but would not be met by any smaller, constructed unit, however well the latter may represent a true "geographical" entity.

However, this difference in aim and approach on an essentially abstract level is quite overshadowed by the practical considerations involved. In Northern Ireland the selection of the county as a unit would virtually preclude analysis, through a simple lack of sufficient observations. With Antrim and Down having to be excluded because of their domination by Belfast, Black and Jefferson would be left with only four counties—far too little for any meaningful analysis. Conversely, information is not readily available in the Republic to break down employment on the basis of units smaller than the county. It might be possible, if access were obtained to unpublished Census data, to calculate figures for smaller units, but the benefits to be gained from such an exercise could not be commensurate with the time and energy expended in such a task.

Apart from the choice of unit, there are two other important differences between the Northern Ireland approach and ours. The first of these concerns the classification of industries into autonomous and induced sectors. Mostly this is dictated by consideration of data availability, in that the published Census classification differ to some extent between the North and the South. Partly it is a matter of choice, in that the catering industry, which contains both autonomous and induced elements, has been treated by Black and Jefferson as belonging to the induced sector and by ourselves as belonging to the autonomous.

The final, and perhaps most important difference between the papers concerns the methods of analysis. In this paper we have built on the earlier paper (Baker 1966) by accepting that it demonstrated the applicability to the Republic of the hypothesis that non-agricultural autonomous employment is more effective than agricultural employment in inducing service employment. Thus while we test whether this hypothesis continues to appear valid, our efforts are devoted largely to improving the formulation of the relationship and to investigating whether it can be used as the basis for a partial forecasting model for county employment. In this exercise we consciously restrict ourselves to the single source of Census employment information, feeling that any income data which is, or may become, available could best be used to construct alternative income multiplier models, which could be used in parallel with the pure employment models which are presented in this paper.

Faced with the very different situation of Northern Ireland, with its much more developed employment pattern, Black and Jefferson concentrate on the first part of the basic hypothesis, that autonomous employment as a whole begets induced employment, and pay much less attention to the second part of the hypothesis, that there is a difference in effectiveness between agricultural and other autonomous employment. Thus they are seeking a degree of constancy in the share of induced employment, while we seek the degree of variation, and consequently they have less need to explore alternative formulations in their regression analysis. Finally, this being the first application of this type of analysis to Northern Ireland, they have need to elucidate the method by which the employment multiplier operates, and have accordingly included an analysis in income terms.

These differences between the papers in choice of unit, classification and analysis obviously render it impossible to include simply the Northern Ireland information in our analysis of employment patterns. Nevertheless, in spite of the differences there remains sufficient common ground for Black and Jefferson's results and conclusions to be of great relevance to our own findings. While our analysis will thus be solely in terms of the Republic, the conclusions drawn from it in the final section of this paper will draw also on the results of the Northern paper.

## Section 2

### *Employment Patterns in 1966*

#### *The General Pattern*

TABLE 1 sets out the proportion of the workforce in each county engaged in each of the major sectors discussed in the previous Section.\* This table is directly comparable with Tables 2 and 13 of the previous paper (Baker 1966), which show the patterns for 1961 and 1951 respectively. As will be apparent from Table 2 the sequence of counties is in accordance with the size of the non-agricultural share of the autonomous sector which is explained below.

It can be seen from Table 1 that in 1966 there was still a great range of variation in employment patterns from county to county. At one end of the scale Leitrim has 68½ per cent of its workforce engaged in agricultural occupations and only 5 per cent in the commercial autonomous sector, which includes manufacturing industry. At the other end of the scale, Louth has only 17 per cent in agriculture and 36½ per cent in commercial autonomous occupations.

The range between the highest and lowest counties other than Dublin is very different for the various sectors. Thus for agriculture (column 1) the highest county has roughly four times the proportion engaged compared to the lowest county. For the commercial autonomous sector (column 2) the ratio between the highest and lowest counties is approximately 8:1. In the other two sectors, the ratio is much lower. The share of the social autonomous sector (column 3) is just over twice as high in the highest county as in the lowest, while for the induced sector (column 5) the ratio of highest to lowest is 2.3 to 1.

On a regional basis the pattern of variation is less marked, but, even so, the North-East region has nearly three times the share engaged in commercial autonomous activities than has the West region.

Compared with 1961, the share of the agricultural sector has fallen nationally (excluding Dublin) from 49 per cent to 43½ per cent. The share of the social autonomous sector has risen marginally, that of the commercial autonomous sector has risen by three points from 12½ per cent to 15½ per cent, and that of the induced sector by two points from 27 per cent to 29 per cent. The range of

\*For a more complete tabulation of employment patterns see Appendix 2.

TABLE I: *Employment pattern by county and region in 1966*  
*Percentage of total at work*

County or region†	Agriculture etc.	Locally autonomous			Locally induced
		Commercial	Social	Total	
Leitrim	68.51	4.71	9.03	13.74	17.74
Roscommon	65.95	4.86	10.42	15.28	18.77
Mayo	63.64	6.59	9.16	15.74	20.62
Longford	58.84	4.63	11.46	16.09	25.07
Cavan	59.24	8.99	9.64	18.63	22.14
Galway	55.98	8.52	12.33	21.33	22.69
Sligo	52.44	10.26	11.33	21.59	25.97
Kerry	51.89	11.25	11.01	22.25	25.85
Laois	49.85	11.05	11.51	22.56	27.59
Donegal	50.16	13.54	10.66	24.20	25.64
Monaghan	51.24	13.57	11.27	24.85	23.91
Clare	52.64	14.53	11.77	26.30	21.06
Offaly	48.29	15.91	8.87	24.78	26.93
Wexford	43.76	13.19	10.10	23.29	32.95
Tipperary (North)	46.92	14.27	11.34	25.61	27.47
Kilkenny	44.84	14.10	12.14	26.24	28.91
Tipperary (South)	43.41	14.09	12.35	26.44	30.15
Meath	42.64	16.55	10.09	26.63	30.73
Westmeath	39.84	9.01	19.67	28.68	31.48
Carlow	39.03	17.18	11.46	28.46	32.33
Limerick	30.92	19.92	13.83	33.75	35.34
Wicklow	28.11	20.68	11.07	31.76	40.13
Cork	29.27	22.55	12.80	35.35	35.38
Kildare	30.82	20.83	16.46	37.29	31.89
Waterford	26.88	25.27	13.98	39.26	33.86
Louth	17.11	36.56	11.62	48.18	34.71
North-West	58.69	8.11	10.44	18.54	22.77
West	59.33	7.67	11.21	18.89	21.78
Midlands	52.61	9.29	12.40	21.69	25.70
Donegal	50.16	13.54	10.66	24.20	25.64
South-East	39.44	16.81	12.03	28.83	31.73
Mid-West	40.56	17.18	12.71	29.89	29.55
North-East	39.96	21.42	10.89	32.31	27.72
South-West	34.65	19.86	12.37	32.23	33.11
East (exc. Dublin)	34.13	19.28	12.56	31.85	34.03
Total (exc. Dublin)	43.51	15.58	11.94	27.52	28.98
*Dublin	1.88	31.46	17.51	48.97	49.15
*Grand Total	31.76	20.06	13.51	33.57	34.67

† Sequence determined by Table 2, col. 1.

\* Strictly speaking, the classification cannot be applied to Dublin or to the total including Dublin.

variation between counties (allowing for the changes in the national share of each sector) has not changed much between the two years.

Table 1 also confirms at a glance that there does appear to be a relationship between the shares of the different sectors. The share of the induced sector (column 5) clearly tends to vary directly with the share of the non-agricultural autonomous sector (column 4) and inversely with the share of the agricultural sector (column 1). However, this apparent relationship is partly conditioned by the fact that these three columns are complementary, having to sum to 100 per cent for each county. This would tend to impart a negative bias to any correlations based directly on Table 1, and in order to obtain meaningful correlations it is necessary to remove the condition of strict complementarity.

### *Simple Regression Analysis*

For the purpose of regression analysis, the shares of the agricultural and non-agricultural autonomous sectors are expressed, not as proportions of the total workforce, but as proportions of the total autonomous sector. This method, which was adopted in the previous paper, reduces considerably the problem of complementarity, as both the dependent and independent variable are allowed to vary between 0 to 100. It also accords with the actual form of the hypothesis we are testing. The expression of the induced sector as a proportion of the total workforce implies the assumption central to the hypothesis, that the absolute size of the induced sector in any county depends on the absolute size of the total autonomous sector. The hypothesis further postulates that the composition of the autonomous sector, between agricultural and non-agricultural activities, also affects the size of the induced sector. This is tested directly by expressing the non-agricultural autonomous sector as a proportion of the total autonomous sector.\* The share of agriculture in the autonomous sector is, of course, the simple complement of this, and there is no point in including it in any tables.

The first regression run on the 1966 data is a simple linear regression of the share of the induced sector in the total workforce ( $Y$ ) on the share of non-agricultural activities in the autonomous sector ( $X$ ). The observations are the 26 counties other than Dublin. The result of the equation is as follows, with the results of similar equations on the 1961 and 1951 data shown for comparison.  $T$  values are in parentheses.

\*Geary addressed himself to the problem of assessing the significance of the relationship between two percentages within a system with more than two percentages at the methodological level. He tested the point made in this paper that if  $X$ ,  $Y$  and  $Z$  are independent of one another with  $x = X/(X+Y+Z)$  (and similarly for  $y$  and  $z$ ) then  $z$  is probably independent of  $U$  where  $U = Y/(X+Y)$ . The  $r_{21} = +.15$  obtained using 3 sets of 25 random numbers (based on 25 counties) generated by Monte Carlo was nowhere significant for 23 degrees of freedom and was also + (Geary 1974).

	$R^2$	SEE	F	DW	Tau
1966 $Y_c = 14.95 + 0.353X$ (8.60) (8.03)	.717	3.04	64.4	1.08	6
1961 $Y_c = 12.87 + 0.405X$ (8.93) (9.82)	.792	2.69	96.3	1.98	16
1951 $Y_c = 11.49 + 0.513X$ (8.41) (11.30)	.835	2.67	127.7	2.23	14

As can be seen, the fit is reasonably good and clearly significant, although not as high as in 1951 and 1961. It can also be seen that the slope of the regression appears to be flattening over the years. We shall return to this point later, when we discuss the possible derivation of forecasting models.

In Table 2, the regression results are converted into "expected" values for each county. These are compared with the actual values for the induced sector, and the divergences between actual and expected are shown in column 4. The corresponding divergences for 1961 and 1951 are given in columns 5 and 6.

It was argued in the previous paper (Baker 1966) that these divergences are not strictly random residuals but reflect other factors which influence the level of induced employment in the different counties but which for various reasons have been omitted from the regressions. It was also suggested that most of these factors were of a persistent nature, and that accordingly one could expect the pattern of divergences to alter only little over time. Comparison of columns 4 and 5, and 6 of Table 2 confirms that most of the divergences are in fact of a persistent and reasonably stable nature. This stability of the divergences adds greatly to the explanatory power of the equations, as will be demonstrated in Section 3.

However, there is a sufficient number of changes in the divergences to suggest that in addition to the long-term static factors, there may be a dynamic element present. It is noticeable that there is some relationship between the rate at which a county's non-agricultural share of the autonomous sector has grown and the direction of change in the divergence. The faster the former has grown, the more likely that the divergence has shown a negative movement.

This behaviour suggests, although it does not demonstrate conclusively, that there may be a considerable period of adjustment before the new size of the induced sector appropriate to a changed balance in the autonomous sector (and to the continuing static factors) is reached. This finding, if it is valid, could have important implications for regional development policy, and we return to the point in our discussion of forecasting models and in the concluding discussion.

Before leaving Table 2 it is worth commenting briefly on the lower section of the table, dealing with IDA regions. The "expected" share for the regions is obtained by applying the coefficients derived from the 26 county regression

TABLE 2: *Expected and actual induced sector by county and region linear regressions**Per cent*

	1966				1961	1951
	<i>Non-agric. share of autonomous sector</i>	<i>Induced sector as a percentage of total at work</i>				
		<i>Expected*</i>	<i>Actual</i>	<i>Diver- gence</i>	<i>Diver- gence</i>	<i>Diver- gence</i>
Leitrim	16.71	20.84	17.74	-3.10	-2.45	-2.19
Roscommon	18.82	21.58	18.77	-2.81	-2.90	-2.55
Mayo	19.83	21.94	20.62	-1.32	-0.89	-0.88
Longford	21.47	22.52	25.07	+2.55	+0.58	+1.43
Cavan	23.92	23.38	22.14	-1.24	-0.29	-1.03
Galway	27.59	24.67	22.69	-1.98	-2.37	-0.71
Sligo	29.17	25.23	25.97	+0.74	+0.00	+1.77
Kerry	30.01	25.53	25.85	+0.32	+1.56	+1.57
Laois	31.16	25.93	27.59	+1.66	+0.45	-1.43
Donegal	32.54	26.44	25.64	-0.78	+0.20	+0.09
Monaghan	32.65	26.46	23.91	-2.55	-1.46	-1.16
Clare	33.31	26.69	21.06	-5.63	-2.61	-2.93
Offaly	33.91	26.90	26.93	+0.03	-1.66	-0.93
Wexford	34.74	27.19	32.95	+5.76	+5.57	+8.92
Tipperary (North)	35.31	27.39	27.47	+0.08	+1.13	+1.15
Kilkenny	36.92	27.96	28.91	+0.95	-0.21	-1.65
Tipperary (South)	37.85	28.29	30.15	+1.86	+1.94	+2.09
Meath	38.45	28.50	30.73	+2.23	+0.52	-0.24
Westmeath	41.85	29.70	31.48	+1.78	-0.45	+1.51
Carlow	42.33	29.87	32.33	+2.46	+2.32	+0.78
Limerick	52.19	33.35	35.34	+2.00	+4.74	+3.97
Wicklow	53.04	33.65	40.13	+6.48	+4.71	+5.52
Cork	54.71	34.24	35.38	+1.14	+1.55	+2.27
Kildare	54.75	34.25	31.89	-2.36	-3.91	-5.52
Waterford	59.36	35.87	33.86	-2.01	-0.24	+1.81
Louth	73.80	40.97	34.71	-6.26	-5.84	-5.50
North-West	24.01	23.43	22.77	-0.66	-0.90	+0.19
West	24.15	23.47	21.78	-1.69	-1.70	-0.76
Midlands	29.19	25.25	25.70	+0.45	-0.91	-0.48
Donegal	32.54	26.44	25.64	-0.80	+0.20	+0.09
South-East	42.23	29.66	31.73	+1.87	+2.09	+1.53
Mid-West	42.43	29.93	29.55	-0.38	+2.10	+1.68
North-East	44.71	30.73	27.72	-3.01	-1.90	-1.49
South-West	48.19	31.96	33.11	+1.15	+1.81	+2.46
East (excl. Dublin)	48.27	31.99	34.03	+2.04	+0.45	-0.13
Total (excl. Dublin)	38.74	28.56	28.98	+0.36†	+0.65†	+0.84†

\*From linear equation on page 22.

†The sum of the individual county divergences in the table is zero. However, the application of the equation to the weighted figures for the State shows a positive divergence reflecting the positive divergences in some of the larger counties.

to the autonomous shares of each region. The autonomous share of the regions, although based on an amalgamation of the county figures, do not in themselves form a part of the observations used in calculating the regressions. The results for the regions can thus be regarded as forming a semi-independent test of the cross-section predictive ability of the regression equation. It could be argued that the particular classification of activities adopted as suitable at the county level is conceptually less suited to the regional level, at which the proportion of activities induced rather than autonomous should be rather higher. In practice the difference is likely to be small and the test can be regarded as useful if limited. On the whole it appears that the regression equation can be applied at least as successfully on the regional as on the county level. Both in size and in stability the regional divergences behave in much the same way as the county ones.

#### *Components of the Induced Sector*

Table 3 sets out the share of the total workforce engaged in each of the major components of the induced sector. It is not practicable to include data for 1961 and 1951 on a county level\* but the national totals for those years are shown at the foot of the Table.

It can be seen from the Table that not all types of induced activity show equal degrees of variation between counties. Thus there is relatively little variation between counties in the proportion of the workforce engaged in the first category of retail sales. The average proportion in the three highest counties is only 50 per cent higher than the proportion in the three lowest counties. This is not altogether surprising, as retail sales were divided into categories one and two (as in the previous paper) on the basis that category one includes those types of retailing which could be expected to be widely dispersed geographically, such as grocery stores or petrol filling stations, and that category two includes those types of retailing which could be expected to be more concentrated in major towns such as department stores and furniture shops.†

At the other end of the scale, the degree of variation between counties is greatest in private building and construction. In this case the average proportion engaged in the three highest counties is practically three times the proportion in the three lowest.

Despite these differences between the components in the degree of variation among counties, it can be seen that there is a tendency for all components to be positively related to the level of development in a county. These relationships can be formalised by linear regression analysis into the equations shown

\*Comparable details for 1961 can be found in Table 8 of Baker (1966).

†See Appendix 1 for a detailed classification of retail trade.

TABLE 3: *Locally induced employment, 1966**Percentage of total at work*

	<i>Retail trade (1)</i>	<i>Retail trade (2)</i>	<i>Other trade</i>	<i>Transport</i>	<i>Miscellaneous services</i>	<i>Building and construction</i>	<i>Domestic service</i>	<i>Total induced</i>
Leitrim	5.28	1.91	2.61	2.25	2.21	2.07	1.41	17.74
Roscommon	5.18	2.18	2.69	2.38	2.58	2.52	1.25	18.77
Mayo	5.74	2.82	3.15	2.48	2.36	2.51	1.56	20.62
Longford	6.45	3.12	4.23	2.43	3.24	3.53	2.07	25.07
Cavan	6.92	2.90	3.04	2.11	1.91	3.15	2.10	22.14
Galway	5.43	2.83	3.90	2.66	2.87	3.43	1.58	22.69
Sligo	5.40	3.51	5.22	3.54	3.60	2.97	1.73	25.97
Kerry	6.66	3.61	4.06	2.80	2.84	3.77	2.12	25.85
Laois	7.05	3.41	3.36	3.69	3.37	4.02	2.68	27.59
Donegal	6.54	2.79	4.17	3.13	2.48	3.95	2.59	25.64
Monaghan	6.81	3.63	3.67	2.18	2.29	3.29	2.04	23.91
Clare	4.74	2.25	3.24	2.52	2.47	4.28	1.56	21.06
Offaly	6.63	3.74	3.87	2.29	4.15	4.08	2.17	26.93
Wexford	7.61	4.18	5.22	3.46	3.58	4.84	4.06	32.95
Tipperary (North)	6.35	3.46	3.96	3.50	2.97	4.72	2.49	27.47
Kilkenny	6.84	3.66	4.43	2.94	3.10	4.50	3.44	28.91
Tipperary (South)	7.10	3.92	4.76	3.12	3.39	4.36	3.50	30.15
Meath	6.38	3.59	4.41	2.70	2.99	7.14	3.52	30.73
Westmeath	7.02	4.36	4.53	4.52	4.00	4.35	2.70	32.48
Carlow	7.99	4.20	5.89	2.77	4.02	3.96	3.48	32.33
Limerick	6.33	5.16	6.47	4.51	4.59	5.57	2.71	35.34
Wicklow	7.21	5.22	6.51	3.71	5.43	7.80	4.25	40.13
Cork	6.44	4.87	6.95	3.97	4.51	5.96	2.69	35.38
Kildare	7.47	3.67	4.24	3.12	3.89	5.82	3.67	31.89
Waterford	6.34	5.17	6.33	4.19	4.16	4.69	2.97	33.86
Louth	6.37	5.50	7.43	4.22	4.02	5.39	1.77	34.71
North-West	5.35	2.89	4.20	3.04	3.06	2.62	1.61	22.77
West	5.56	2.82	3.57	2.58	2.65	3.03	1.57	21.78
Midlands	6.40	3.34	3.66	3.07	3.46	3.66	2.13	25.70
Donegal	6.54	2.79	4.17	3.13	2.48	3.95	2.59	25.64
South-East	7.09	4.26	5.30	3.39	3.63	4.55	3.51	31.73
Mid-West	5.87	3.96	5.01	3.72	3.64	5.02	2.33	29.55
North-East	6.67	4.16	4.99	2.99	2.87	4.10	1.95	27.72
South-West	6.50	4.57	6.26	3.69	4.11	5.44	2.55	33.11
East (excl. Dublin)	7.01	4.12	5.00	3.16	4.05	6.89	3.80	34.03
Total (excl. Dublin)	6.39	3.85	4.90	3.27	3.48	4.57	2.52	28.98
Total 1961	6.14	3.48	5.12	3.16	2.87	3.12	3.10	26.99
Total 1951	5.12	3.37	5.20	3.07	2.30	3.20	4.21	26.47

in Table 4, where  $X$  represents the non-agricultural share of the autonomous sector. The 1961 and 1951 relationships are shown for comparison.

It can be seen that there is a significant relationship for all components except retail trade (1) and domestic service, and even these two possess a positive coefficient. Comparison of the 1966 equations with those for 1961 and 1951 shows that the tendency for the slope of the equations to flatten which was

TABLE 4: *Linear equations by category of induced employment*  
*Results as percentage of total at work*

	1966	1961	1951
Retail Sales 1	$Y_c = 5.68 + 0.021X$ $R^2 \cdot 103$ (13.26) (1.97)	$Y_c = 5.15 + 0.032X$ $R^2 \cdot 254$ (14.30) (3.08)	$Y_c = 3.75 + 0.019X$ $R^2 \cdot 641$ (17.22) (6.75)
Retail Sales 2	$Y_c = 1.41 + 0.061X$ $R^2 \cdot 752$ (5.13) (8.75)	$Y_c = 1.28 + 0.063X$ $R^2 \cdot 799$ (5.81) (10.02)	$Y_c = 1.19 + 0.074X$ $R^2 \cdot 720$ (4.31) (8.08)
Total Retail Sales	$Y_c = 7.10 + 0.082X$ $R^2 \cdot 527$ (11.72) (5.37)	$Y_c = 6.45 + 0.095X$ $R^2 \cdot 623$ (12.62) (6.51)	$Y_c = 4.94 + 0.123X$ $R^2 \cdot 758$ (11.90) (8.91)
Other Trade	$Y_c = 1.47 + 0.093X$ $R^2 \cdot 721$ (3.65) (8.11)	$Y_c = 1.47 + 0.100X$ $R^2 \cdot 686$ (3.11) (7.47)	$Y_c = 2.34 + 0.090X$ $R^2 \cdot 578$ (5.12) (5.94)
Transport	$Y_c = 1.66 + 0.039X$ $R^2 \cdot 513$ (5.58) (5.22)	$Y_c = 1.29 + 0.053X$ $R^2 \cdot 656$ (4.89) (6.97)	$Y_c = 1.06 + 0.069X$ $R^2 \cdot 665$ (3.63) (7.12)
Miscellaneous	$Y_c = 1.62 + 0.046X$ $R^2 \cdot 531$ (4.79) (5.41)	$Y_c = 1.10 + 0.050X$ $R^2 \cdot 715$ (4.98) (7.99)	$Y_c = 0.47 + 0.062X$ $R^2 \cdot 691$ (1.89) (7.54)
Building and Construction	$Y_c = 1.63 + 0.073X$ $R^2 \cdot 549$ (3.05) (5.36)	$Y_c = 1.16 + 0.054X$ $R^2 \cdot 633$ (4.12) (6.65)	$Y_c = 0.90 + 0.081X$ $R^2 \cdot 679$ (2.70) (7.34)
Domestic Service	$Y_c = 1.46 + 0.029X$ $R^2 \cdot 188$ (3.30) (2.60)	$Y_c = 1.41 + 0.053X$ $R^2 \cdot 318$ (2.74) (3.56)	$Y_c = 1.78 + 0.088X$ $R^2 \cdot 426$ (2.97) (4.43)
Total Induced	$Y_c = 14.95 + 0.353X$ $R^2 \cdot 717$ (8.60) (8.03)	$Y_c = 12.80 + 0.405X$ $R^2 \cdot 792$ (8.93) (9.82)	$Y_c = 11.49 + 0.513X$ $R^2 \cdot 835$ (8.41) (11.30)
Induced excluding Domestic Service	$Y_c = 13.48 + 0.323X$ $R^2 \cdot 765$ (9.56) (9.08)	$Y_c = 11.39 + 0.352X$ $R^2 \cdot 825$ (10.15) (10.90)	$Y_c = 9.71 + 0.425X$ $R^2 \cdot 854$ (9.23) (12.16)

*N.B.*—Figures in parentheses show *t* values.

noted in the case of the total induced sector, applies also to most components of the sector. Only in the case of building and construction is the slope of the regression line steeper than in 1961, reflecting the marked increase of employment in this activity, especially in the more developed counties. Curiously, the marked serial correlation of residuals which was noted in the case of the induced sector as a whole does not appear to be present in the case of its individual components.

When the equations set out in Table 4 are applied to the non-agricultural proportion of the autonomous sector in each county and region, a set of "expected" employment proportions for each component of the induced sector is obtained. Table 5 shows the divergences between this expected pattern and the actual pattern in 1966.\*

These detailed divergences remained remarkably stable between 1961 and 1966. Of the 156 observations (counting retail trade as a single component), only 29 showed a change in the sign of the divergence between the two years, and in over half of these the actual change in the divergence was less than 0.50 per cent of the workforce. In a further 18 cases the divergence changed by more than 0.50 per cent although retaining the same sign. In the remaining 109 cases both the sign and the order of magnitude of the divergence remained the same in the two years.

The conclusions drawn concerning divergences in the earlier paper (Baker 1966) would therefore appear to remain valid. Domestic service continued to conform to a geographical pattern which largely overrides economic relationships. The influence of large towns and proximity to Dublin continues to be reflected in the patterns of retail trade (2) and other trade. Income factors, particularly where industrial earnings are significantly different from the national average, or where agricultural incomes do not conform with the level to be expected from a county's development ranking, could account for some of the deviations in either direction. Multiple occupation could still account for some negative deviations in the western counties, where a proportion of retail trade is in the hands of part-time shopkeepers whose principal occupation is farming.

Other specific factors, such as the location of railway activities and electricity generation, are reflected in the high positive divergences for transport in Westmeath and miscellaneous services in Offaly. Commuting† probably accounts for some of the large positive divergences in Wicklow. Private sector building and construction tends to reflect geographical location and the rate of change in economic circumstances as well as the actual level of economic

\*See Baker (1966), Tables 9 and 15, for comparable results for 1961 and 1951.

†The Census figures are based on the county of residence of the worker, not on the county in which he works.

TABLE 5: *Divergences from estimate by linear equations, 1966**Percentage of total at work*

	<i>Retail trade</i>	<i>Retail trade</i>	<i>Other trade</i>	<i>Transport</i>	<i>Miscellaneous services</i>	<i>Building and construction</i>	<i>Domestic service</i>	<i>Total induced</i>
	(1)	(2)						
Leitrim	-0.75	-0.52	-0.25	-0.07	-0.19	-0.78	-0.54	-3.10
Roscommon	-0.90	-0.38	-0.34	-0.02	+0.08	-0.48	-0.76	-2.81
Mayo	-0.36	+0.20	+0.03	+0.03	-0.18	-0.56	-0.48	-1.32
Longford	+0.31	+0.40	+0.98	-0.08	+0.62	+0.34	-0.02	+2.55
Cavan	-0.73	+0.03	-0.41	-0.49	-0.82	-0.22	-0.06	-1.24
Galway	-0.84	-0.27	+0.14	-0.09	-0.03	-0.21	-0.68	-1.98
Sligo	-0.90	+0.32	+1.33	+0.73	+0.62	-0.78	-0.58	+0.74
Kerry	+0.28	+0.37	+0.10	-0.04	-0.18	-0.04	-0.21	+0.32
Laois	+0.71	+0.10	-0.69	+0.80	+0.30	+0.12	+0.31	+1.66
Donegal	-0.17	-0.61	+0.00	+0.19	-0.65	-0.05	+0.18	-0.78
Monaghan	-0.44	+0.23	-0.51	-0.77	-0.85	-0.72	-0.37	-2.55
Clare	-1.65	-1.19	-0.99	-0.45	-0.70	+0.23	-0.87	-5.63
Offaly	+0.23	+0.26	-0.41	-0.70	+0.95	-0.02	-0.28	+0.03
Wexford	+1.19	+0.65	+0.87	+0.43	+0.35	+0.68	+1.59	+1.76
Tipperary (North)	-0.08	-0.11	-0.44	+0.45	-0.29	+0.52	+0.00	+0.08
Kilkenny	+0.38	-0.00	-0.10	-0.17	-0.24	+0.18	+0.90	+0.95
Tipperary (South)	+0.62	+0.20	+0.15	-0.03	+0.01	-0.02	+0.94	+1.86
Meath	-0.12	-0.17	-0.24	-0.47	-0.42	+2.71	+0.34	+2.23
Westmeath	+0.45	+0.40	-0.41	+1.21	+0.43	-0.32	+0.02	+1.78
Carlow	+1.41	+0.21	+0.91	-0.56	+0.44	-0.75	+0.79	+2.46
Limerick	+0.46	+0.56	+0.67	+0.80	+0.55	+0.15	-0.27	+2.00
Wicklow	+0.40	+0.57	+0.64	-0.04	+1.34	+2.31	+1.25	+6.48
Cork	-0.40	+0.12	+0.95	+0.16	+0.35	+0.35	-0.36	+1.14
Kildare	+0.63	-1.08	-1.77	-0.69	-0.27	+0.21	+0.62	-2.36
Waterford	-0.60	+0.14	-0.06	+0.20	-0.22	-1.26	-0.22	-2.01
Louth	-0.88	-0.41	-0.15	-0.34	-1.03	-1.61	-1.84	-6.26
North-West	-0.84	+0.02	+0.74	+0.44	+0.33	-0.75	-0.55	-0.66
West	-0.63	-0.06	+0.10	-0.03	-0.09	-0.36	-0.59	-1.69
Midlands	+0.10	+0.15	-0.23	+0.26	+0.47	-0.09	-0.18	+0.45
Donegal	+0.17	-0.50	+0.01	+0.19	-0.65	-0.04	+0.18	-0.80
South-East	+0.51	+0.27	+0.33	+0.07	+0.05	-0.15	+0.82	+1.87
Mid-West	-0.71	-0.04	+0.03	+0.39	+0.05	+0.31	-0.37	-0.38
North-East	+0.04	+0.02	-0.18	-0.43	-0.82	-0.78	-0.81	-3.01
South-West	-0.21	+0.22	+0.80	+0.14	+0.26	+0.31	-0.31	+1.15
East (excl. Dublin)	+0.31	-0.23	-0.47	-0.40	+0.19	+1.75	+0.33	+2.04
Total (excl. Dublin)	-0.10	+0.08	+0.22	+0.09	+0.06	+0.12	-0.07	+0.36

development. Thus Wicklow and Meath exhibit exceptionally large positive divergences, and Clare has a small positive divergence in this sector, in marked contrast to the large negative divergences in all other induced activities. Finally, the tendency noted in Baker (1966) for there to be an apparent cross-induction effect still seems to apply. A marked divergence in one induced

activity has much the same effect as an alteration in the balance of the autonomous sector, and thus tends to be associated with divergences in the same direction in other induced activities.

### *Social and Commercial Autonomous Sectors*

The analysis so far has largely been a repetition of that in the earlier paper (Baker 1966). It seems fair to conclude that the results for 1966 confirm those for 1951 and 1961. The basic hypothesis seems to stand up fairly well under the test of simple regression analysis in each of the three years, and the change over time in the values of the coefficients is itself quite compatible with the hypothesis. The general stability of the divergences between actual and predicted values of the percentage of the workforce engaged in induced activities confirms the impression that these divergences reflect important factors which are known to exist but cannot conveniently be incorporated in regression analysis.

However, as was explained in the introduction to this paper, it is felt that the use of simple linear regression alone may obscure some part of the relationship between the composition of the autonomous sector and the size of the induced sector, and that alternative formulations should be tested.

In describing the hypothesis it was pointed out that the non-agricultural autonomous sector comprised both commercial activities such as manufacturing industry and tourism, and social activities such as education and medicine. We feel that the rather heroic assumption that both types of autonomous activity have similar effects in inducing employment should be tested. Accordingly, a multiple regression has been run for each of the three years with commercial and social activities share in the autonomous sector as separate independent variables.\*

The resulting equation, with  $X_1$  = share of commercial autonomous activities in autonomous sector,  $X_2$  = share of social autonomous activities in autonomous sector, and  $Y$  = proportion of workforce engaged in induced sector, are:

		$\bar{R}^2$	SEE	F	DW	Tau	$\chi^2$
1966	$Y_c = 12.75 + 0.308X_1 + 0.540X_2$ (4.97) (5.30) (3.20)	.721	3.01	33.33	1.28	8	38.02
1961	$Y_c = 10.94 + 0.364X_1 + 0.573X_2$ (4.48) (6.25) (3.24)	.792	2.70	48.57	2.13	16	30.57
1951	$Y_c = 10.12 + 0.463X_1 + 0.645X_2$ (5.43) (7.19) (4.94)	.836	2.66	64.90	2.44	14	40.15

\*Because of the stress so often placed on manufacturing industry in regional analysis and planning, the share of manufacturing alone in the autonomous sector was also tested. However, the results were very similar to, but slightly less significant than those for the wider commercial sector, and do not appear to be worth recording separately.

It can be seen that both the overall fit of the equations and the values of the intercepts and coefficients are very similar to the simple regression. As in the simple regressions also, the fit has slightly deteriorated as the slope has flattened over the years.

With regard to the coefficients it is rather surprising that the coefficient for the social autonomous sector is larger than that for the commercial. This would appear to imply that the social autonomous activities have a more powerful effect in inducing further local employment than the commercial autonomous activities, such as manufacturing industry. In fact the difference between the coefficients is too small, and the definitions too arbitrary, for such a conclusion to be drawn with any confidence, especially as there is some degree of multicollinearity present in the equations. However, the analysis does tend to demonstrate that the employment-inducing effects of the social sector is not obviously weaker than that of the commercial, and this could undoubtedly have relevance to the formulation of regional policy.

As in the case of the simple regressions, the "predicted" percentages of induced employment in each county have been calculated from the equations, and compared with the actual proportions.\* There is very little difference in the results obtained from the multiple and simple regressions. The only major difference is in the case of Westmeath, where the positive 1966 divergence of the simple regression becomes a smaller negative divergence under the multiple regression. This is because an unusually high proportion of Westmeath's non-agricultural autonomous sector is social rather than commercial, so that the higher coefficient of the social autonomous sector results in a higher predicted value of the induced sector.

### *Non-Linear Relationships*

There is no particular reason why the relationship between the composition of the autonomous sector and the induced sector should be linear. In fact the evidence of residual autocorrelation in the 1966 linear equation, and in particular the tendency for counties at either end of the development spectrum to exhibit negative divergences suggests that the true relationship might be curvilinear. Various non-linear relationships have accordingly been tested.

A semi-log formulation, where the proportion of the workforce in the induced sector is regressed on the log of the non-agricultural share of the autonomous sector is encouraging. This yields the equations:

\*The divergences obtained by the multiple regression and by alternative formulations of the simple regression are shown in the appendix to this chapter.

		$\bar{R}^2$	SEE	F	DW	Tau
1966	$Y_c = -20.58 + 31.542 \log_{10} X$ (4.00) (9.51)	.78	2.67	90.4	1.32	10
1961	$Y_c = -21.95 + 32.413 \log_{10} X$ (5.50) (12.09)	.853	2.26	146.3	2.59	15
1951	$Y_c = -22.08 + 33.964 \log_{10} X$ (5.91) (12.91)	.869	2.38	166.7	2.50	17

This has a considerably better  $\bar{R}^2$  than the linear regression equation, as well as a higher  $F$  value and lower  $SEE$ . This better fit is not altogether surprising, as the log-linear relationship implies that as a county becomes more developed, so a given change in the non-agricultural proportion of its autonomous sector has a smaller effect on the size of its locally induced sector. Such a result could well be expected on theoretical grounds due to economies of scale in the induced sector and to competition between the autonomous and induced sectors for the non-agricultural labour force.\*

While the semi-log relationship tends to result generally in smaller divergences between actual and expected levels especially at either end of the range, in only four counties in 1966 is the sign of the divergence different from that produced by the linear equation.† Moreover, there again appears to be considerable stability over time in the direction and size of the divergences. The results of the semi-log analysis thus tend to reinforce the arguments put forward earlier that the divergences can largely be explained in terms of specific local factors.

If semi-log regression analysis is applied to the components of the induced sector, the following equations result for 1966:

		$\bar{R}^2$	SEE	F	DW	Tau
Retail Trade	$Y_c = -1.38 + 7.481 \log X$ (0.74) (6.17)	.597	.976	38.0	2.09	12
Other Trade	$Y_c = -6.19 + 6.963 \log X$ (4.31) (7.52)	.689	.745	56.5	1.86	10
Transport	$Y_c = -2.08 + 3.372 \log X$ (2.07) (5.21)	.511	.521	27.2	2.49	15
Miscellaneous	$Y_c = -2.89 + 4.045 \log X$ (2.58) (5.60)	.548	.581	31.4	1.55	9
Building and Construction	$Y_c = -5.89 + 6.632 \log X$ (3.55) (6.20)	.599	.861	38.4	1.82	12
Domestic Service	$Y_c = -2.13 + 3.033 \log X$ (1.54) (3.39)	.296	.720	11.50	1.62	14

\*There are also purely mathematical grounds for expecting such a result, as complementarity becomes more important as the proportion engaged in agriculture becomes small. Indeed in the extreme case, when there is a very small proportion of the autonomous sector engaged in agriculture, a further rise in the numbers engaged in non-agricultural autonomous activities could not in itself increase the proportion of the workforce in the induced sector, although of course it would be expected to increase the volume of induced employment.

†The divergences obtained by the semi-log equation are shown in the appendix to this Section.

Comparison of these equations with the corresponding linear equations set out in Table 4 indicates that for the components of retail trade, miscellaneous services, building and construction and domestic services, the semi-log equations produce slightly the better fit. When divergences are calculated they tend to be smaller than those derived from the linear equations, but are generally in the same direction and size order as the linear divergences.

Thus it appears that the semi-log formulation is superior to the linear on the standard statistical tests, and may be significantly better at explaining the size and composition of the induced sector in counties at either end of the development spectrum. However for the great majority of counties it appears to make little practical difference whether the semi-log or the linear formulation is adopted.

Another possible formulation is the double log regression, where the log of the induced sector is regressed on the log of the non-agricultural share of the autonomous sector. This yields the equations:

	$\bar{R}^2$	SEE	F	DW	Tau
1966 $\log Y_c = .657 + .507 \log X$ (8.14) (9.73)	.789	.042	94.7	1.31	8
1961 $\log Y_c = .586 + .553 \log X$ (9.10) (12.80)	.867	.037	163.9	2.41	16
1951 $\log Y_c = .574 + .584 \log X$ (10.06) (14.54)	.894	.036	211.3	2.70	16

Once more the divergences\* are similar in pattern to those observed for the other formulations. The divergences tend to be rather smaller than those resulting from the linear or multiple regression equations, but slightly larger than those of the semi-log equations. As in the case of the linear equations there is strong evidence of residual autocorrelation in 1966.

As the double-log formulation appears to offer no advantage over the semi-log on standard statistical tests, and only a marginal advantage over the linear, as it is not entirely acceptable on grounds of economic theory,† and as it is so much more cumbersome to use, there seems little point in using it for an analysis of the separate components of the induced sector.

The final formulation attempted was a quadratic function, but this resulted in a poorer fit than the simple linear equation. As there is no sound theoretical reason to expect a quadratic relationship, this formulation has been rejected.

\*Shown in the Appendix to this Section.

†The fact that the double-log regression line passes through the origin implies that a purely agricultural autonomous sector would induce no further employment at all. This would seem contrary to common sense and observation.

## Appendix to Section 2

TABLE A2.1: *Expected and actual induced sector by county and region multiple regression**Percentage of total at work*

	1966			1961	1951
	<i>Expected*</i>	<i>Actual</i>	<i>Divergence</i>	<i>Divergence</i>	<i>Divergence</i>
Leitrim	20.45	17.74	-2.71	-2.01	-1.76
Roscommon	21.53	18.77	-2.76	-2.78	-2.42
Mayo	21.54	20.62	-0.92	-0.36	-0.28
Longford	22.92	25.07	+2.15	+0.17	+1.02
Cavan	23.00	22.14	-0.86	+0.04	-0.80
Galway	25.10	22.06	-2.41	-2.70	-0.76
Sligo	25.30	25.97	+0.67	-0.03	+1.82
Kerry	25.45	25.85	+0.40	+1.51	+1.60
Laois	26.05	27.59	+1.54	+0.67	-1.46
Donegal	26.11	25.64	-0.47	+0.45	+0.54
Monaghan	26.25	23.91	-2.34	-1.52	-1.16
Clare	26.48	21.06	-5.42	-2.90	-2.99
Offaly	26.02	26.93	+0.91	-1.02	-0.41
Wexford	26.96	32.95	+5.99	+5.66	+2.91
Tipperary (North)	27.27	27.47	+0.21	+1.44	+1.22
Kilkenny	28.10	28.91	+0.81	-0.32	-1.77
Tipperary (South)	28.53	30.15	+1.62	+1.73	+1.37
Meath	27.98	30.73	+2.75	+0.78	-0.27
Westmeath	32.31	31.48	-0.83	-2.32	-0.23
Carlow	29.73	32.83	+2.60	+2.57	+0.68
Limerick	33.80	35.34	+1.54	+4.25	+3.86
Wicklow	33.39	40.13	+6.74	+4.79	+5.19
Cork	34.21	35.38	+1.17	+1.44	+2.47
Kildare	35.24	31.89	-3.35	-4.18	-7.12
Waterford	35.96	33.86	-2.10	-0.59	+1.49
Louth	39.62	34.71	-4.92	-4.74	-3.81
North-West	23.29	22.77	-0.52	-0.75	-0.40
West	23.52	21.78	-1.74	-1.63	-0.49
Midlands	25.63	25.70	+0.07	-1.10	-0.62
Donegal	26.11	25.64	-0.47	+0.45	+0.58
South-East	29.86	31.73	+1.87	+2.01	+1.41
Mid-West	30.02	29.55	-0.47	+1.87	+1.64
North-East	30.03	27.72	-2.31	-1.41	-0.89
South-West	31.90	33.11	+1.21	+1.73	+2.62
East (excl. Dublin)	32.05	34.03	+1.98	+0.21	-0.74
Total (excl. Dublin)	28.59	28.98	+0.39	+0.31	+0.92

\*From multiple equation on page 29.

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TABLE A2.2: *Expected and actual induced sector by county and region semi-log regression*  
*Percentage of total at work*

	1966			1961	1951
	<i>Expected*</i>	<i>Actual</i>	<i>Divergence</i>	<i>Divergence</i>	<i>Divergence</i>
Leitrim	17.99	17.74	-0.25	+0.56	+1.10
Roscommon	19.62	18.77	-0.85	-0.72	-0.66
Mayo	20.34	20.62	+0.28	+1.23	+2.23
Longford	21.43	25.07	+3.64	+1.26	+1.68
Cavan	22.91	22.14	-0.77	+0.56	-0.58
Galway	24.86	22.69	-2.17	-2.52	-0.73
Sligo	25.62	25.97	+0.35	-0.65	+1.32
Kerry	26.01	25.85	-0.16	+1.20	+1.29
Laois	26.53	27.59	+1.06	+0.36	-2.64
Donegal	27.12	25.64	-1.48	-0.47	-0.57
Monaghan	27.17	23.91	-3.26	-2.15	-2.08
Clare	27.44	21.06	-6.38	-2.81	-3.26
Offaly	27.69	26.93	-0.76	-2.65	-2.14
Wexford	28.02	32.95	+4.93	+4.67	+1.71
Tipperary (North)	28.24	27.47	-0.77	+0.34	+0.09
Kilkenny	28.85	28.91	+0.06	-1.25	-2.88
Tipperary (South)	29.19	30.15	+0.96	+0.88	+0.87
Meath	29.41	30.73	+1.32	-0.49	-1.45
Westmeath	30.57	31.48	+0.91	-1.48	+0.35
Carlow	30.72	32.33	+1.61	+1.31	-0.35
Limerick	33.59	35.34	+1.75	+4.00	+3.33
Wicklow	33.81	40.13	+6.32	+4.55	+5.51
Cork	34.24	35.38	+1.14	+1.45	+2.15
Kildare	34.25	31.89	-2.36	-4.13	-5.37
Waterford	35.36	33.86	-1.50	+0.18	+2.23
Louth	38.34	34.71	-3.62	-2.54	-1.15
North-West	22.96	22.77	-0.19	-0.60	+0.89
West	23.04	21.78	-1.26	-1.05	+0.39
Midlands	25.64	25.70	+0.06	-1.46	-1.33
Donegal	27.12	25.64	-1.48	-0.48	-0.56
South-East	30.69	31.73	+1.04	+1.07	+0.41
Mid-West	30.76	29.55	-1.21	+1.06	+0.46
North-East	31.48	27.72	-3.76	-2.86	-2.62
South-West	32.50	33.11	+0.61	+1.07	+1.53
East (excl. Dublin)	32.52	34.03	+1.51	-0.31	-0.82
Total (excl. Dublin)	29.51	28.98	-0.53	-0.39	-0.37

\*From semi-log equation on page 31.

TABLE A2.3: *Expected and actual induced sector by county and region log-log regression*  
*Percentage of total at work*

	1966			1961	1951
	<i>Expected*</i>	<i>Actual</i>	<i>Divergence</i>	<i>Divergence</i>	<i>Divergence</i>
Leitrim	18.93	17.74	-1.19	-0.64	-0.49
Roscommon	20.11	18.77	-1.34	-1.45	-1.39
Mayo	20.62	20.62	-0.03	+0.54	+0.75
Longford	21.50	25.07	+3.57	+1.31	+1.88
Cavan	22.71	22.14	-0.53	+0.53	-0.49
Galway	24.41	22.69	-1.73	-2.10	-0.39
Sligo	25.11	25.97	+0.86	-0.05	+1.87
Kerry	25.48	25.85	+0.37	+1.70	+1.76
Laois	25.97	27.59	+1.62	+0.28	-1.85
Donegal	26.55	25.64	-0.91	+0.13	+0.08
Monaghan	26.59	23.91	-2.68	-1.54	-1.34
Clare	26.86	21.06	-5.80	-2.37	-2.77
Offaly	27.11	26.93	-0.18	-2.00	-1.35
Wexford	27.44	32.95	+5.51	+5.32	+2.50
Tipperary (North)	27.67	27.47	-0.20	+0.97	+0.87
Kilkenny	28.30	28.91	+0.61	-0.63	-2.14
Tipperary (South)	28.66	30.15	+1.49	+1.48	+1.60
Meath	28.89	30.73	+1.84	+0.15	+0.67
Westmeath	30.16	31.48	+1.32	-1.00	+0.99
Carlow	30.33	32.33	+2.00	+1.77	+0.25
Limerick	33.73	35.34	+1.61	+4.16	+3.51
Wicklow	34.01	40.13	+6.12	+4.25	+5.23
Cork	34.55	35.38	+0.83	+1.10	+1.95
Kildare	34.56	31.89	-2.67	-4.39	-5.86
Waterford	36.00	33.86	-2.14	-0.54	+1.65
Louth	40.21	34.71	-5.50	-5.05	-4.12
North-West	22.75	22.77	+0.02	-0.36	+0.85
West	22.82	21.78	-1.04	-0.98	+0.10
Midlands	25.11	25.70	+0.59	-0.88	-0.60
Donegal	26.55	25.65	-0.90	+0.13	+0.08
South-East	30.30	31.73	+1.43	+1.55	+0.99
Mid-West	30.37	29.55	-0.82	+1.68	+1.22
North-East	31.19	27.72	-3.47	-2.46	-2.01
South-West	30.40	33.11	+0.71	+1.24	+1.95
East (excl. Dublin)	32.42	34.03	+1.61	-0.11	-0.60
Total (excl. Dublin)	29.00	28.98	-0.02	+0.21	+0.42

\*From log-log equation on page 32.

### Section 3

#### *Employment Patterns in 1971*

**I**N this section a brief outline of the 1971 patterns is presented. As will become apparent, these are not greatly dissimilar to the 1966 patterns described in the previous Section. Consequently the discussion in this Section is much briefer, as most of the comment relating to 1966 remains valid for 1971.

It can be seen from Table 6 that the continuing decline in agricultural employment has led to a downward shift in the degree of dependence on agriculture in every county. The proportion of the workforce engaged in agriculture now ranges from 12.6 per cent in Louth to just over 60 per cent in Roscommon, which has replaced Leitrim as the county most dependent on agriculture. The same two counties occupy top and bottom positions in the proportion of the workforce in commercial autonomous employment, where there has been a substantial upward movement with every county showing an increased proportion and the national average (excluding Dublin) an increase of almost 3 per cent.

Social autonomous employment has also shown a universal increase in the proportions engaged, although the increase is rather smaller at 1.6 per cent on a national basis. Westmeath continues to have the highest proportion in this category, and Offaly the lowest.

The proportion in induced employment also rose in all counties, with an average rise of 2.1 per cent. Wicklow remains the county with the highest proportion of induced employment, but Roscommon has replaced Leitrim at the bottom end of the scale.

One result of these general movements in employment patterns between 1966 and 1971 has been a fall in the ratio between the top and bottom counties in each form of non-agricultural employment. Thus in 1971, the ratios were 6.2 to 1 for commercial autonomous, 2.0 to 1 for social autonomous and 1.9 to 1 for induced employment. In the case of the autonomous employment categories, this narrowing of the ratios does not appear to be very significant, as the length of the range between the highest and lowest increased for commercial and remained virtually unchanged for social autonomous employment.

However, in the case of induced employment the narrowing of the ratio does appear important. It is accompanied by a significant reduction in the length

TABLE 6: *Employment pattern by county and region, 1971*  
*Percentage of total at work*

	<i>Locally autonomous</i>				<i>Locally induced</i>
	<i>Agriculture, etc.</i>	<i>Commercial</i>	<i>Social</i>	<i>Total</i>	
Leitrim	59.45	7.10	11.35	18.44	22.11
Roscommon	60.32	6.42	11.97	18.39	21.29
Mayo	57.08	8.47	11.42	19.90	23.02
Longford	51.75	8.56	13.38	21.94	26.31
Cavan	51.80	12.92	11.24	24.15	24.05
Galway	48.51	10.63	15.20	25.85	25.66
Sligo	44.59	13.14	13.08	26.22	29.19
Kerry	44.70	15.03	12.56	27.58	27.72
Laois	44.20	13.15	13.17	26.32	29.48
Donegal	42.59	16.56	12.47	29.03	28.38
Monaghan	42.62	19.82	12.81	32.63	24.75
Clare	45.05	18.14	12.98	31.13	23.82
Offaly	43.10	17.04	10.52	27.56	29.34
Wexford	37.10	16.02	11.73	27.39	35.50
Tipperary (North)	40.49	18.21	13.56	31.77	27.75
Kilkenny	38.03	17.84	13.33	31.77	30.80
Tipperary (South)	38.24	16.37	13.76	30.13	31.62
Meath	34.98	19.48	12.52	32.00	33.03
Westmeath	34.85	10.32	21.15	31.47	33.68
Carlow	33.80	20.51	13.15	33.66	32.54
Limerick	26.36	21.29	14.41	35.70	37.93
Wicklow	22.33	24.49	12.09	36.58	41.09
Cork	24.54	23.92	14.64	38.56	36.90
Kildare	25.28	24.53	17.29	41.82	32.90
Waterford	22.05	28.98	14.50	43.47	34.47
Louth	12.58	39.65	13.06	52.70	34.72
North-West	50.17	10.88	12.42	23.30	26.53
West	52.13	9.73	13.60	23.32	24.54
Midlands	46.75	11.18	14.08	25.26	27.99
Donegal	42.59	16.56	12.47	29.03	28.38
South-East	33.53	20.06	13.18	33.24	33.23
Mid-West	34.64	19.76	13.82	33.58	31.79
North-East	32.80	26.05	12.43	38.47	28.73
South-West	29.25	21.85	14.14	36.00	34.76
East (excl. Dublin)	27.74	22.77	14.02	36.79	35.48
Total (excl. Dublin)	36.89	18.44	13.58	32.02	31.08
Dublin*	1.51	30.23	19.24	49.47	49.02
Grand Total*	26.35	21.96	15.26	37.22	36.43

\*See reservations to Table 1.

of the range between highest and lowest, and by a tendency for the counties with the largest induced sectors in 1966 to exhibit the smallest increases in 1971. This provides further evidence in favour of the hypothesis that there may be a ceiling on the proportion of the workforce engaged in the induced sector, and that as this ceiling is approached so further changes in the composition of the autonomous sector have little impact on the induced sector.

As with the 1966 data employment in the non-agricultural autonomous sector was expressed as a percentage of all autonomous employment and the resulting variable used as the independent variable in two simple regression models, one based on a linear relationship, the other on a semi-logarithmic relationship.

Table 7 gives the results for both forms of equation alongside the results obtained from regressions for earlier years.

TABLE 7: Results of linear and semilogarithmic regressions for 1971 compared with other years

	Linear				Semi-log			
	1951	1961	1966	1971	1951	1961	1966	1971
Intercept	11.49	12.87	14.95	16.37	-22.08	-21.95	-20.58	-22.85
„ (t)	(8.41)	(8.93)	(8.60)	(7.85)	(5.91)	(5.50)	(4.00)	(3.30)
Coefficient	0.513	0.405	0.353	0.305	33.96	32.41	31.54	32.42
„ (t)	(11.36)	(9.82)	(8.03)	(6.80)	(12.91)	(12.09)	(9.51)	(7.66)
Adj R <sup>2</sup>	.835	.792	.717	.644	.869	.853	.781	.697
SEE	2.67	2.69	3.04	3.11	2.38	2.26	2.67	2.87
F value	127.7	96.3	64.4	46.2	166.7	146.3	90.4	58.61
DW	2.23	1.98	1.08	1.90	2.50	2.59	1.32	2.18
Tau	14	16	6	10	17	15	10	10

The fit continued to be reasonably good and clearly significant but less so than in 1966 which was itself less good than previous years. The evidence that the slope is tending to flatten, and the relationship to weaken, continued to mount. There seems to be a tendency for induced employment to stabilise around 35 per cent as the county becomes more developed. There was no change in the proportion of induced employment in Louth between 1966 and 1971 and only a marginal increase in Waterford. In Northern Ireland Black and Jefferson reported no instance of induced employment in excess of 36 per cent though incomes are much higher in that part of Ireland and the proportion in agriculture there in 1966 much lower than in the Republic. Nevertheless

for most counties in the Republic, the hypothesis that the proportion of the autonomous sector which is non-agricultural is a major determinant of the size of the induced sector continues to be supported by the 1971 analysis.

While the value of the various parameters convey an impression of a looser fit of the regression line to the data, one favourable aspect of the 1971 results has been the higher values obtained from the Durbin-Watson and Geary Tau tests compared to those obtained for 1966. These are very much in line with the earlier years and suggest that the presence of considerable serial correlation in 1966 was due to some unexplained factor which operated in that year. A possible explanation may be that while certain types of induced employment are subject to long-term trends in social habits and technology, for example, domestic service and employment in the electricity supply industry, others may have been more influenced by cyclical factors, for example, building and, perhaps, specialised retail trading. If this is so, observed changes may reflect the points on the cycle at which the various Censuses have been taken. The Census of 1966 probably reflects the period at which the Republic came closest to full employment in the last two decades. Induced employment in a situation of relatively high employment levels is likely to be different from periods in which the general level of employment was lower and which would tend to promote underemployment in family business. This has been the case in many Continental countries.

### *The Linear Equation*

Table 8 presents the non-agricultural autonomous sector as a proportion of total autonomous employment. These figures are used with the linear equation to forecast the expected proportion in induced employment in each county and the forecasts in turn compared with the actual outturn. As before, the sign of the residuals is of major interest, given the hypothesis that divergences reflect other factors that have inductive power in specific counties and are therefore not strictly random. Between 1966 and 1971 only two counties changed their sign, Kerry and North Tipperary. For the first time both displayed negative divergence but this was not surprising given the trend over the previous fifteen years in which the size of the positive divergence had fallen almost to zero.

Six counties had large divergences in 1971 and four of these were the same as in 1966—Clare, Wexford, Wicklow and Louth. Limerick had a reduced divergence in 1966 but in 1971 was back to the levels of 1951 and 1961. Monaghan's negative divergence had been growing in earlier years but increased sharply in 1971. In general, the stability of the divergence pattern confirms the belief that they are related in the main to long-term geographical and economic factors.

However, if the changes in individual divergences are examined, the first

TABLE 8: *Expected and actual induced sector, 1971 linear equation**Per cent*

	1971				1966
	<i>Non-agricultural share of autonomous sector</i>	<i>Locally induced as a percentage of total at work</i>			<i>Divergence</i>
		<i>Expected</i>	<i>Actual</i>	<i>Divergence</i>	
Roscommon.	23.37	23.49	21.29	-2.20	-2.81
Leitrim	23.68	23.59	22.11	-1.48	-3.10
Mayo	25.85	24.25	23.02	-1.23	-1.32
Longford	29.77	25.44	26.31	+0.87	+2.55
Cavan	31.80	26.06	24.05	-2.01	-1.24
Galway	34.75	26.96	25.66	-1.30	-1.98
Sligo	37.03	27.66	29.19	+1.53	+0.74
Laois	37.32	27.74	29.48	+1.74	+1.66
Kerry	38.16	28.00	27.72	-0.28	+0.32
Offaly	39.00	28.26	29.34	+1.08	+0.03
Donegal	40.54	28.73	28.38	-0.35	-0.78
Clare	40.86	28.82	23.82	-5.00	-5.63
Wexford	42.47	29.31	35.50	+6.19	+5.76
Monaghan	43.36	29.59	24.75	-4.84	-2.55
Tipperary (North)	43.96	29.77	27.75	-2.02	+0.08
Kilkenny	45.04	30.10	30.80	+0.70	+0.95
Tipperary (South)	44.07	29.80	31.62	+1.82	+1.86
Westmeath	47.45	30.83	33.68	+2.85	+1.78
Meath	47.78	30.93	33.03	+2.10	+2.23
Carlow	49.89	31.58	32.54	+0.96	+2.46
Limerick	57.52	33.90	37.93	+4.03	+2.00
Cork	61.11	35.00	36.90	+1.90	+1.14
Wicklow	62.10	35.30	41.09	+5.79	+6.48
Kildare	62.32	35.37	32.90	-2.47	-2.36
Waterford	66.34	36.59	34.47	-2.12	-2.01
Louth	80.73	40.98	34.72	-6.26	-6.26
West	30.91	25.80	24.54	-1.26	-1.69
North-West	31.72	26.04	26.53	+0.49	-0.66
Midlands	35.09	27.07	27.99	+0.92	+0.45
Donegal	40.54	28.73	28.38	-0.35	-0.78
Mid-West	49.22	31.38	31.79	+0.41	-0.38
South-East	49.81	31.56	33.24	+1.68	+1.87
North-East	53.98	32.83	28.73	-4.10	-3.01
South-West	55.18	33.20	34.76	+1.56	+1.15
East (excl. Dublin)	57.03	33.76	35.48	+1.72	+2.04
Total (excl. Dublin)	46.47	30.54	31.08	+0.54	+0.36

regularity to be observed is that in eleven of the fourteen least developed counties the divergence moved in a positive way, whereas in the eleven more developed counties, eight divergences moved in a negative direction. Louth had no change. If these movements are related to changes in the absolute numbers in non-agricultural autonomous employment, it is striking that the three developed counties where the movements were in a positive direction, Limerick (3.7), Westmeath (6.4) and Cork (8.2), had increases in non-agricultural autonomous employment well below the average for the country excluding Dublin (12.6). The only other counties in this group with below average rates of change, South Tipperary (11.1) and Louth (12.3), did not differ greatly from the average. Louth displayed no change and South Tipperary a very small negative movement. In the case of the fourteen less developed counties the three exceptions to the positive trend, Cavan (22.4), Monaghan (30.4) and Kerry (19.7), all showed increases in non-agricultural autonomous employment well in excess of the average. Only two other counties in this group had rates as high as these—Leitrim (19.9) and Longford (28.7) which, while high on a percentage basis, represented in absolute numbers very few employees.

This tendency of the movement in the divergence to be related to the size of the absolute change in the non-agricultural autonomous sector also appears in the regional data, although the North-West (like Leitrim) is a departure from the general tendency. This tends to confirm the hypothesis enunciated in relation to 1966 data that there may be a considerable period of adjustment before the inductive power of increases in non-agricultural autonomous employment brings about a new equilibrium between autonomous and induced employment. It is interesting to note that whereas the Mid-West region had a large negative movement between 1961 and 1966 when investment in Shannon was extremely high and employment rising rapidly, this region had a large positive movement in the late 'sixties when the rate of expansion in non-agricultural autonomous employment there was the lowest in the State. Presumably part of this positive movement was due to a tendency towards equilibrium.

#### *The Semi-log Equation*

The semi-log form of the regression has been presented already and displays the same features as the linear form—a very satisfactory result for the Durbin-Watson test which had been less good in 1966, and a general weakening of the fit which none the less remained good and highly significant. The parameters of the equation however did not continue to change in the same manner as before. The intercepts, which were all negative, had been reducing from 22.08 to 21.95 and 20.58 respectively in the first three years. In 1971 the value was

TABLE 9: *Expected and actual induced sector, 1971 semi-log equation.*

	Percentage of total at work			1966 <i>Divergence</i>	1971 <i>Linear divergence</i>
	<i>Expected</i>	<i>Actual</i>	<i>Divergence</i>		
Roscommon	21.52	21.29	-0.23	-0.85	-2.20
Leitrim	21.70	22.11	+0.41	-0.25	-1.48
Mayo	22.94	23.02	+0.08	+0.28	-1.23
Longford	24.93	26.31	+1.38	+3.64	+0.87
Cavan	25.86	24.05	-1.81	-0.77	-2.01
Galway	27.10	25.66	-1.44	-2.17	-1.30
Sligo	28.00	29.19	+1.19	+0.35	+1.53
Laois	28.11	29.48	+1.37	+1.06	+1.74
Kerry	28.42	27.72	-0.70	-0.16	-0.28
Offaly	28.73	29.34	+0.61	-0.76	+1.08
Donegal	29.27	28.38	-0.89	-1.48	-0.35
Clare	29.38	23.82	-5.56	-6.38	+5.00
Wexford	29.93	35.50	+5.57	+4.93	+6.19
Monaghan	30.22	24.75	-5.47	-2.26	-4.84
Tipperary (North)	30.41	27.75	-2.66	-0.77	-2.02
Kilkenny	30.76	30.80	+0.04	+0.06	+0.70
Tipperary (South)	30.45	31.62	+1.17	+0.96	+1.82
Westmeath	31.49	33.68	+2.19	+0.91	+2.85
Meath	31.59	33.03	+1.44	+1.32	+2.10
Carlow	32.20	32.54	+0.34	+1.61	+0.96
Limerick	34.20	37.93	+3.73	+1.75	+4.03
Cork	35.05	36.90	+1.85	+1.14	+1.90
Wicklow	35.28	41.09	+5.81	+6.32	+5.79
Kildare	35.33	32.90	-2.43	-2.36	-2.47
Waterford	36.21	34.47	-1.74	-1.50	-2.12
Louth	38.97	34.72	-4.25	-3.62	-6.26
West	25.46	24.54	-0.92	-1.26	-1.26
North-West	25.82	26.53	+0.71	-0.19	+0.49
Midlands	27.24	27.99	+0.75	+0.06	+0.92
Donegal	29.27	28.38	-0.89	-1.48	-0.35
Mid-West	32.01	31.79	-0.22	-1.21	+0.41
South-East	32.17	33.24	+1.07	+1.04	+1.68
North-East	33.31	28.73	-4.58	-3.76	-4.10
South-West	33.62	34.76	+1.14	+0.61	+1.56
East (excl. Dublin)	34.08	35.48	+1.40	+1.51	+1.75
Total excl. (Dublin)	31.59	31.08	-0.51	-0.53	+0.54

22.85, i.e. higher than in 1951. Similarly the coefficients had declined progressively from 33.96 to 32.41 and 31.54 but in 1971 reverted to almost exactly the 1961 level: 32.42.

Table 9 gives the predicted and actual values of the proportion in induced employment in each county and region in 1971. The divergences are compared with those in 1966 and with the divergences obtained from the use of the linear model. Eighteen out of twenty-six counties had smaller divergences using this form compared to the linear. Of the eleven counties at the top of the slope, ten had better results, and in the remaining case, Wicklow, the semi-log divergence was only slightly larger (5.81 vs. 5.79). At the lower end of the slope six out of eight counties had better fits from semi-log equation. In the middle only two out of seven were better, but none was very much worse. On average the divergences were smaller and of course the values for  $\bar{R}^2$  and  $F$  were higher.

As in the case of the linear equation the pattern of divergences shows great consistency with the 1966 pattern. Whatever formulation is used, and whichever years are compared, this stability in the pattern of divergences can be observed. This prompts the idea that the divergence pattern can itself be used in the equations, and that a very high degree of fit could then be expected. To test this the 1971 regressions were re-run, with the 1966 divergence patterns ( $X_2$ ) included as a second independent variable. The results were as follows ( $T$  values in parentheses):

		$\bar{R}^2$	$F$	$SEE$	$DW$	$X^2$
Linear	$Y_c = 16.48 + 0.30X_1 + 0.96X_2$ (22.4) (19.13) (13.05)	0.96	271.2	1.10	1.65	205.8
Semi-log	$Y_c = -22.86 + 32.40 \log X_1 + 0.99X_2$ (7.88) (18.00) (10.49)	0.95	217.3	1.22	1.56	323.0

These are highly satisfactory. The intercepts and the coefficients of the main explanatory variable are virtually unchanged from the simple regression, while the coefficients of the 1966 divergences are very close to the expected value of 1. All the variables are highly significant, while the fit of the equations as a whole has improved dramatically. By taking account of the divergences observed at the previous Census, both the linear and the semi-log equations explain about 95 per cent of the variation between counties in the proportion of the workforce engaged in the induced sector.

It will be recalled that, in the analysis of the 1966 results, attention was paid to the individual components of the induced sector, and to a multiple regression equation distinguishing between the commercial and social autonomous sectors. Similar exercises have been carried out on the 1971 data, but the results are so similar to those for 1966 that there seems to be no benefit in

presenting a detailed discussion, which would largely be a mere repetition of the previous Section. The relevant equations are included as an Appendix to this Section for the benefit of the interested reader. For the more general reader, the conclusions reached concerning the 1966 data in Section 2 appear to be supported by the 1971 figures.

Appendix to Section 3

Results of regression analysis on the components of the induced and non-agricultural autonomous sectors, 1971

Name	Coefficient	t	Intercept	t	R <sup>2</sup>	F	SEE	DW
<i>Components of induced employment</i>								
Retail 1	·0038	(0·351)	6·12	(12·23)	-0·04	0·12	0·75	2·14
Retail 2	·0653	(9·14)	1·26	(3·79)	0·77	83·57	0·49	2·03
Retail 1 and 2	·0691	(4·51)	7·38	(10·37)	0·44	20·36	1·06	2·06
Other Trade	·0729	(6·83)	1·46	(2·95)	0·65	46·69	0·74	2·08
Transport	·0307	(3·33)	2·12	(4·94)	0·29	11·07	0·64	2·32
Miscellaneous	·0468	(4·29)	1·80	(3·54)	0·41	18·39	0·76	2·23
Building	·0728	(4·32)	2·58	(3·30)	0·41	18·65	1·17	1·97
Total above	·2922	(7·22)	15·35	(8·15)	0·67	52·11	2·81	1·88
Domestic Service	·0127	(1·98)	1·01	(3·42)	0·11	3·94	0·44	1·80
All Induced	·3049	(6·80)	16·37	(7·85)	0·64	46·22	3·11	1·90
<i>Components of Non-Agricultural Autonomous Employment</i>								
Commercial	·2545	(4·75)	12·58	(4·06)	0·67	25·94	3·02	2·22*
Social	·5680	(3·36)						
Manufacturing	·2112	(3·67)						
Non-Manufacturing	·5935	(4·55)	11·43	(4·00)	0·70	30·09	2·86	2·30†

\*Chi square=48·52.

†Chi square=38·91.

## Section 4

### *Forecasting Models*

THE application of cross-section regression analysis to Census employment data appears from this paper and its predecessor (Baker 1966) to be a reasonably successful method of descriptive analysis. However, the utility of the exercise would be greatly increased if the equations could be adapted for use as partial forecasting models. Clearly the hypothesis itself and the equations derived from it cannot be of any assistance in forecasting the overall employment structure likely to obtain in any county or region in the future. However, it does seem reasonable to hope that the analysis presented in the paper can be used as part of the forecasting procedure. The induced sector is the most difficult area of employment to forecast by direct methods, as most employers in the sector are small, and few changes in induced employment are the result of conscious long-term planning decisions by either the State itself or by State-assisted private companies.

On the other hand, it is not unreasonable to suppose that fairly accurate forecasts can be made of employment in the autonomous sector in particular counties or regions. Such forecasts are likely to be a combination of extrapolations of trends, as in the case of agricultural employment, and direct enquiry, as in the case of grant-aided manufacturing industry. If reasonably accurate forecasts of autonomous sectors of employment can be made by such methods, then the availability of a usable prediction model for the induced sector would be of considerable value for planning purposes, as it would enable the conversion of the forecasts for the autonomous sector into a rough forecast of total employment in an area.

In the earlier paper an attempt was made to derive a forecasting model, based on the parameters of the equations for the most recent Census year. It was found that the equations for one year could not simply be applied to the non-agricultural share of the autonomous sector in some future year, mainly because of the temporal shifts in the relationships already noted.

An attempt was made to overcome this problem by studying the pattern of those changes in induced employment which were not explained by the model itself. It was observed that these unexplained or "exogenous" changes did exhibit some fairly clear national patterns between 1961 and 1966, and a

forecasting method based on predicting national "exogenous" trends in various categories of induced employment was postulated.

Examination of the period from 1961 to 1966 suggests that this approach to the problem has serious drawbacks. In the first place, the patterns were much weaker and less consistent than in the earlier period. Secondly, the trends were very different in the later period than in the earlier, casting doubt on the forecaster's ability to predict the trends for any future period. Thirdly, the method is theoretically unattractive as it rests on no explicit hypothesis of causation. In addition to these basic drawbacks, the method is excessively cumbersome to use, which is a factor of some practical significance although of little theoretical weight.

Fortunately, study of the cross section regression equations for the greater number of Census years now available suggests that there may be a simpler method which proves more effective. This method centres upon forecasting the parameters of the equations for a future year. Inspection of the equations for past Census years reveals a tendency for the intercept of the equations to rise and for the regression coefficients to fall over time. This is illustrated in Chart 1.

The tendency is most marked, most persistent and most formative in the case of the simple linear equations. For the semi-log regressions, 1971 appears to have reversed the previously observed trend, but, nevertheless, over the period as a whole the tendency remains for intercepts to rise and coefficients to fall. The existence of this tendency, and in particular its uniformity in the case of the simple linear equations for the total induced sector, encourages belief that it might be possible to project the parameters of the equations forward.

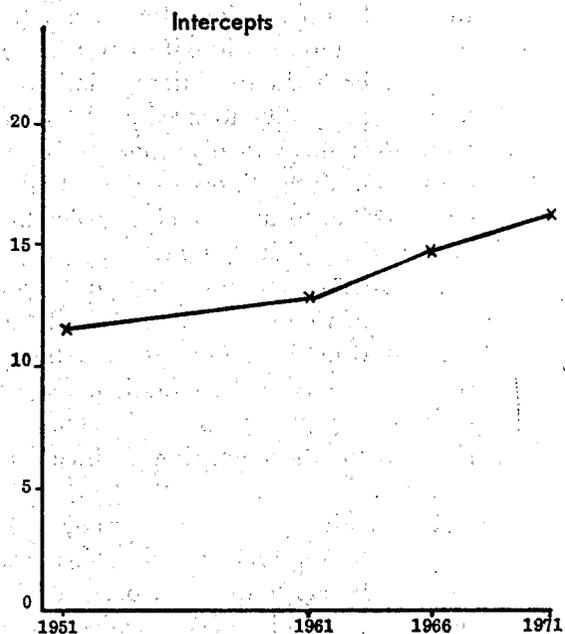
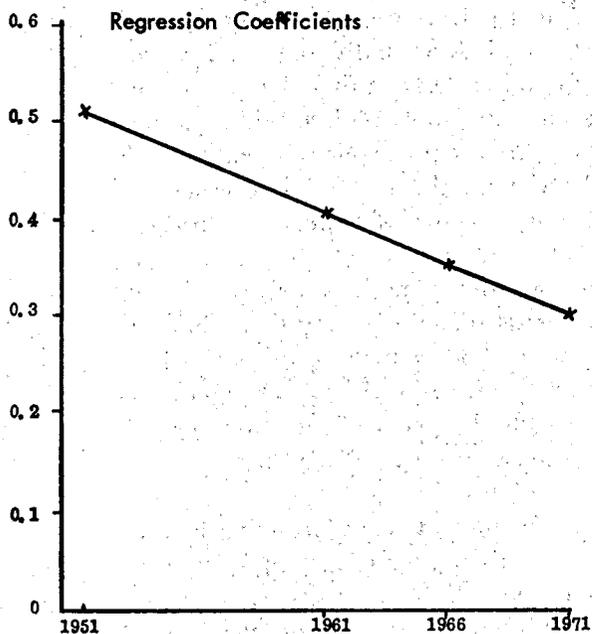
Although the same tendency can be seen in regard to the linear equations for several of the components of the induced sector, it seems that to attempt to project the equations for individual components might be stretching the utility of our employment hypothesis too far. It is, therefore, intended to concentrate on the development of potential prediction models only for the induced sector as a whole.

Given the existence now of cross-section regressions for four Census years, it appears that the most valid procedure for establishing and testing the suggested approach to constructing prediction models is to base such models initially on the three years to 1966, to test the results against 1971, and then, if the tests are satisfactory, to recalculate the models inclusive of 1971 data to apply to 1976.

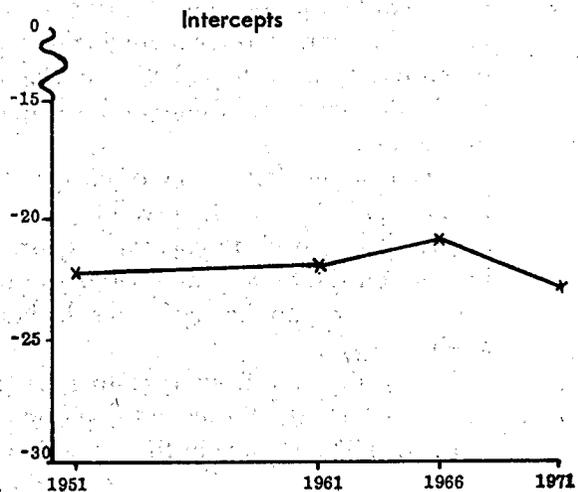
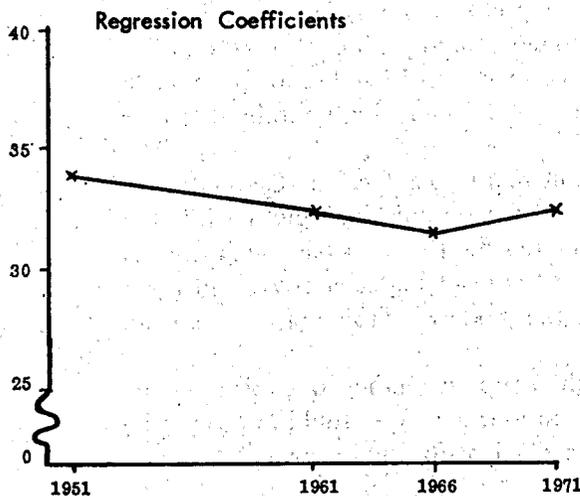
Taking the data from 1951 to 1961, the simplest method of projecting the parameters for the linear and semi-log equations for 1971 would appear to be as follows. The change in the regression coefficients of the linear equation was

CHART 1

A. LINEAR EQUATIONS



B. SEMI-LOG EQUATIONS



a little over 0.05 in each five-year period, while in the case of the semi-log equation the coefficient changed by about 0.8 per five years. Deducting these average changes from the 1966 values, the projected coefficients for 1971 become 0.30 in the linear and 30.74 in the semi-log formulation. With regard to the intercepts the position is less clear cut, as their rise was much greater between 1961 and 1966 than it was in the earlier period. Given that the period from 1966 to 1971 in every way resembled that from 1961 to 1966 more than that from 1951 to 1961, it was decided that the change in the later period was more appropriate as an adjustment in projecting the intercepts to 1971.

Thus the basic equations projected for 1971 emerge as:

$$\begin{aligned}\text{Linear } Y_c &= 17.0 + 0.30X \\ \text{Semi-log } Y_c &= -19.2 + 30.74 \log X_1\end{aligned}$$

However, these basic equations are not on their own sufficient for forecasting induced employment in any particular county. Account must also be taken of that county's likely divergence from the result of the regression equations.

As was shown earlier, the divergences between actual and predicted results tend to follow a fairly stable pattern, so that a tendency towards a positive or negative divergence is likely to persist in any particular county. Thus the insertion of the 1966 divergence for each county is necessary in the model for 1971. However, as could be seen from Tables 3, 6 and 8, there were some fairly substantial changes in the size of some divergences, although not in their signs. These changes, although neither large nor numerous enough to cause concern over the validity of the basic hypothesis, are in some cases large enough to introduce a significant risk of distortion in the application of the equations as prediction models to particular counties or regions.

It was suggested in an earlier section of the paper that the changes in the divergences could be systematic, and that they might be related to dynamic factors, such as the speed of development of an area. This possibility can be tested by regressing the changes in the divergence on some measure of the pace of development.

In the context of this paper, the simplest measure of the pace of development is the change in the non-agricultural share of the autonomous sector. If we express the increase in the share over a period as a percentage of the share in the opening year, we thus obtain our first potential explanatory variable ( $X_1$ ).

However, it is possible, and in the 1951 to 1961 period frequently was so, that an increase in the non-agricultural share of the autonomous sector reflects a fall in agricultural employment rather than a growth in non-agricultural autonomous employment. It is stretching definitions rather far to call such an occurrence development. There is a case therefore for including the simple

percentage increase (or decrease) in the numbers engaged in the non-agricultural autonomous sectors as a second potential explanatory variable ( $X_2$ ).

It has been noted already that employment patterns in counties adjacent to Dublin tend to be distorted in various ways through their proximity to the city. The nature of these distortions tends to change over time. The inclusion of a dummy variable ( $X_3$ ) for Meath, Kildare and Wicklow therefore appears justified.

The test thus involves four dependent variables; the change in the linear and the semi-log divergences for 1961-66 and for 1951-61; and three independent variables ( $X_1$ ,  $X_2$  and  $X_3$  as described) used in various combinations. Cross-section linear regressions on a county basis are carried out for each of these variables.

Most of the results for 1961-66 are set out in Table 10. It can be seen from the Table that the results for the period are highly satisfactory. All the equations are significant overall, and the better equations explain over 70 per cent of the variation in the dependent variables. Thus, in general terms, the results appear consistent with the hypothesis that the change in the divergence is inversely related to the speed of development.

With regard to the use of the results for forecasting purposes there would appear to be a drawback in the extreme instability of the coefficients for  $X_1$  and  $X_2$ . However, this drawback is more apparent than real. The instability of the individual coefficients is an almost classical example of the effects of collinearity in multiple regression analysis. In the 1961-66 period  $X_1$  and  $X_2$  are highly correlated (the coefficient of correlation is .804). However, with the means and standard deviations of  $X_1$  and  $X_2$  being reasonably similar, it can be seen from the coefficients that their combined values are relatively stable, despite the instability of each individually. Thus for predictive purposes, either or both variables can be used without any great difference in the outcome, and the entire performance of the individual coefficients is of limited importance.

The dummy variable for contiguity to Dublin,  $X_3$ , is significant in all the equations in which it appears, possesses a reasonably stable coefficient, and markedly improves the fit of the equations which include it. Thus in any model based on the 1961 to 1966 period, the dummy variable should be included, along with either or both of the other variables.

Similar regression analysis for the period 1951 to 1961 gives rather different results. These are set out in Table 11. It can be seen that, although they are all significant, the general fit of the equations is not so good as those for 1961 to 1966. This is particularly true of the equations dealing with the divergences of the original linear formulation. Nevertheless, the 1951 to 1961 analysis does confirm most of the findings from the 1961 to 1966 regressions. For the earlier period, as for the later, a significant relationship exists between the speed of

TABLE 10: *Divergence change analysis, 1961-1966**A. Variables*

## Dependent

- $Y_1$  Change in linear equation divergences, 1961-1966  
 $Y_2$  Change in semi-log equation divergences, 1961-1966

## Independent

- $X_1$  Change in non-agricultural share of autonomous sector, as percentage of share in 1961  
 $X_2$  Change in numbers engaged in non-agricultural autonomous sector, as percentage of number in 1961  
 $X_3$  Dummy variable; Meath, Kildare, Wicklow = 1, other counties = 0.

*B. Equations*

Equation No.	Equations ( <i>T-values in brackets</i> )	$\bar{R}^2$	<i>F</i>	<i>SEE</i>	<i>DW</i>
1	$Y_{1c} = 2.01 - 0.130X_1$ (3.93) (4.32)	.414	18.69	1.085	2.24
2	$Y_{1c} = 1.09 - 0.109X_2$ (3.51) (4.67)	.455	21.85	1.047	2.01
3	$Y_{1c} = 1.74 - 0.125X_1 + 1.717X_3$ (3.83) (4.77) (2.96)	.557	16.73	.944	1.84
4	$Y_{1c} = 0.93 - 0.120X_2 + 2.345X_3$ (4.32) (7.43) (5.24)	.741	36.71	.722	1.96
5	$Y_{1c} = 0.96 - 0.003X_1 - 0.118X_2 + 2.334X_3$ (2.35) (0.07) (3.95) (4.86)	.729	23.42	.738	1.97
6	$Y_{2c} = 2.27 - 0.147X_1$ (4.16) (4.57)	.443	20.89	11.57	2.01
7	$Y_{2c} = 1.18 - 0.118X_2$ (3.47) (4.62)	.449	21.35	1.151	1.73
8	$Y_{2c} = 1.98 - 0.142X_1 + 1.815X_3$ (4.07) (5.04) (2.92)	.576	18.01	1.009	1.71
9	$Y_{2c} = 1.01 - 0.130X_2 + 2.504X_3$ (4.14) (7.10) (4.93)	.720	33.19	.820	1.76
10	$Y_{2c} = 1.21 - 0.022X_1 - 0.116X_2 + 2.419X_3$ (2.64) (0.51) (3.42) (4.46)	.711	21.51	.833	1.78

The Standard Deviations of the Dependent Variables are:

$$Y_1 \ 1.42, \ Y_2 \ 1.55$$

development of a county and the change in its divergence from the cross-section regression pattern.

It is interesting to note that in the 1951 to 1961 period there is a far weaker correlation between the alternative measures of development. (The correlation coefficient between  $X_1$  and  $X_2$  is .506). This reduction in the degree of multicollinearity has the effect of greatly reducing the instability of the regression coefficients of  $X_1$  and  $X_2$  as compared with Table 10 and in the best equations in Table 11 both variables are significant.

On the other hand, the dummy variable for proximity to Dublin has no significance in the 1951-61 period, in contrast to its high significance in all the 1961-66 equations.

These differences between the results reported in Tables 10 and 11 are by no means surprising when the differences between the periods covered which were outlined in the previous section, are taken into account. In the earlier period the principal factor leading to an increase in the non-agricultural share of the autonomous sector was the decline in agricultural employment. In the later period, not only was the increase in the non-agricultural share of the autonomous sector much more rapid (a mean increase of 15.9 per cent in 5 years compared with a mean increase of 18.4 per cent in ten years) but it was based to a far greater extent on an actual rise in non-agricultural autonomous employment. Thus the higher correlation between  $X_1$  and  $X_2$  in the 1961-66 period reflects the different pattern and greater pace of development in that period.

Similarly, although the working population of County Dublin rose between 1951 and 1961, the rise was neither rapid nor extensive enough to exert a positive influence on induced employment in neighbouring counties. Between 1961 and 1966 on the other hand the vigorous growth of the greater Dublin area spilled over into the adjacent counties, being reflected particularly in the building and construction sector, and to a lesser extent in commuting by other service sector workers. Thus the dummy variable for contiguity to Dublin possesses no significance for the earlier period but a strong significance for the latter.

Turning to the use of the regression analysis of divergence change for prediction purposes, we are faced with the problem of choosing the most appropriate equation from Tables 10 or 11. As the 1966-71 period has much more in common with 1961-66 than with 1951-61, it seems clear that for predictive purposes the selection should be from Table 10. Obviously, given its high significance, the dummy variable  $X_3$  for proximity to Dublin should be included. At first sight it appears to matter little which of the two measures of development is used, as each separately or both together give such similar results for 1961-66. However, the greater ease of use, together with the avoid-

TABLE 11: *Divergence change analysis, 1951-1961*

## A. Variables

## Dependent

 $Y_1$  Change in linear equation divergences, 1951-1961 $Y_2$  Change in semi-log equation divergences, 1951-1961

## Independent

 $X_1$  Change in non-agricultural share of autonomous sector, as percentage of share in 1951 $X_2$  Change in numbers engaged in non-agricultural autonomous sector, as percentage of number in 1951 $X_3$  Dummy variable; Meath, Kildare, Wicklow = 1, other counties = 0.

## B Equations

Equation No.	Equations ( <i>T</i> -values in brackets)	$\bar{R}^2$	<i>F</i>	<i>SEE</i>	<i>DW</i>
1	$Y_{1c} = 1.57 - 0.087X_1$ (2.80) (3.02)	.245	9.11	1.046	2.81
2	$Y_{1c} = -0.26 - 0.102X_2$ (1.38) (4.24)	.405	18.0	0.928	2.43
3	$Y_{1c} = 1.52 - 0.085X_1 + 0.204X_3$ (2.51) (2.83) (0.31)	.215	4.43	1.066	2.73
4	$Y_{1c} = -0.30 - 0.101X_2 + 0.359X_3$ (1.48) (4.11) (0.62)	.389	8.96	.941	2.40
5	$Y_{1c} = 0.46 - 0.039X_1 - 0.082X_2 + 0.227X_3$ (0.71) (1.25) (2.87) (0.39)	.404	6.64	.929	2.82
6	$Y_{2c} = 2.01 - 0.111X_1$ (3.50) (3.76)	.345	14.14	1.069	2.23
7	$Y_{2c} = -0.31 - 0.124X_2$ (1.62) (5.09)	.500	25.96	.934	2.00
8	$Y_{2c} = 2.02 - 0.112X_1 - 0.042X_3$ (3.27) (3.61) (0.06)	.316	6.78	1.092	2.24
9	$Y_{2c} = -0.33 - 0.123X_2 + 0.181X_3$ (1.61) (4.94) (0.31)	.480	12.54	.952	2.00
10	$Y_{2c} = 0.80 - 0.057X_1 - 0.095X_2 - 0.016X_3$ (1.29) (2.92) (3.43) (0.03)	.534	10.55	.901	2.51

The Standard Deviations of the Dependent Variables are:

 $Y_1$  1.20,  $Y_2$  1.32

ance of collinearity, suggests the choice of one variable rather than both. On the grounds that it is a better measure of genuine development over time, and also because it produces rather better results in the equations,  $X_2$  has been chosen.

We are now in a position to obtain two experimental prediction models for county induced employment in 1971, which can be tested against the actual outcome in that year. These are constructed by combining the projected static equations previously shown with the 1966 divergence and the dynamic divergence equations 4 and 9 from Table 10. In view of the errors inevitable in any exercise of this sort, it seems preferable to simplify the equations to two places of decimals for the coefficients and one place for the constants.\*

The combined equations of the models for 1971 are as follows:

$Y$  = numbers in induced employment

$X$  = numbers in non-agricultural autonomous employment

$Z$  = numbers in agricultural employment

$$y = \frac{Y}{Y+X+Z} \times 100$$

$$x = \frac{X}{X+Z} \times 100$$

$d$  = county divergence in 1966 (from Table 2)

$d'$  = county divergence in 1966 (from Table A3.2)

$e$  = dummy variables for contiguity to Dublin.

Subscript indicates year

$$(1) y_{71c} = 17.0 + 0.30x_{71} \pm d_{66} + 0.9 - 0.12 \frac{(X_{71} - X_{66} \times 100)}{X_{66}} + 2.3e.$$

$$(2) y_{71c} = -19.2 + 20.74 \log x_{71} \pm d'_{66} + 1.0 - 0.13 \frac{(X_{71} - X_{66} \times 100)}{X_{66}} + 2.5e.$$

$$(3) Y_{71c} = \frac{(X_{71} + Z_{71} \times 100) - (X_{71} + Z_{71})}{100 - y_{71c}}$$

Equations (1) and (2) provide alternative estimates of the proportion of the workforce in the induced sector of a county. Equation 3 simply converts this proportion to absolute numbers.

\*An attempt to incorporate the independent variables of the "dynamic" equations into the basic cross-section equations so that the model could rest on one rather than two equations, did not prove successful.

To test the operation of these models, it is necessary to apply them to the actual data for employment in the agricultural and non-agricultural autonomous sections in each county in 1971. The results thus obtained can be compared with the actual size of the induced sector, and with the results obtained from a naïve projection of the numbers in the induced sector itself. This comparison is shown in Table 12.

It can be seen from this table that the results of both models are highly

TABLE 12: *Results of prediction models, 1971*

County	Actual induced sector	Predicted induced sector					
		Linear model		Semi-log model		Naïve projection	
		Number	% Error*	Number	% Error*	Number	% Error*
Leitrim	2,390	2,040	-14.6	2,266	-5.2	2,044	-14.5
Roscommon	4,179	4,183	+0.1	4,385	+4.9	4,397	+5.2
Mayo	8,829	8,818	-0.1	9,322	+5.6	9,206	+4.3
Longford	2,617	2,574	-1.6	2,711	+3.6	2,861	+9.3
Cavan	4,756	4,614	-3.0	4,821	+1.4	4,657	-2.1
Galway	13,423	12,758	-5.0	13,173	-1.9	14,005	+4.3
Sligo	5,250	4,930	-6.1	5,053	-3.8	5,052	-3.8
Kerry	10,407	10,139	-2.6	10,397	-0.1	10,168	-2.3
Laois	4,524	4,525	0	4,591	+1.5	4,704	+4.0
Donegal	10,142	10,104	-0.4	10,254	+1.1	10,443	+3.0
Monaghan	4,381	4,392	+0.3	4,416	+0.8	4,331	-1.1
Clare	6,374	6,088	-4.5	6,157	-3.4	6,196	-2.8
Offaly	5,242	5,131	-2.1	5,207	-0.7	5,422	+3.4
Wexford	10,057	9,709	-3.5	9,838	-2.2	10,334	+2.8
Tipperary (North)	5,296	5,606	+5.9	5,633	+6.4	5,832	+10.1
Kilkenny	6,579	6,488	-1.4	6,580	0	6,995	+6.3
Tipperary (South)	7,416	7,443	+0.4	7,512	+1.3	7,461	+0.6
Meath	8,489	8,790	+3.5	8,948	+5.4	9,284	+9.4
Westmeath	6,015	5,860	-2.6	5,940	-1.2	6,456	+7.3
Carlow	3,618	3,830	+5.9	3,847	+6.3	3,935	+8.8
Limerick	17,902	17,056	-4.7	17,351	-3.1	17,926	+0.1
Wicklow	9,460	10,127	+7.3	10,252	+8.6	9,886	+4.7
Cork	45,512	44,351	-2.6	45,318	-0.4	45,982	+1.0
Kildare	8,392	8,974	+6.9	9,133	+8.8	9,162	+9.2
Waterford	9,423	9,309	-1.2	9,560	+1.5	9,165	-2.7
Louth	9,435	9,263	-1.8	9,638	+2.2	9,353	-0.9

\*Expressed as a percentage of the actual numbers in the induced sector in 1971.

satisfactory. In most counties the size of the induced sector predicted from the size of the agricultural and non-agricultural autonomous sections is well within 5 per cent of the true figure. Only in the case of the "linear" projection for Leitrim is the error greater than 10 per cent. As percentages of the total at work, the errors of course would be very small, within 1.5 per cent in most counties.

Comparison with the naïve projections is particularly reassuring. These were obtained by projecting the induced sector for each county at the same rate of change as it had shown in the period from 1961 to 1966. This is a method which cannot seriously be suggested for actual forecasting, as it would give completely misleading results for any period in which there was a major turning point in economic development. For instance, a projection for 1961 to 1966 based on experience from 1951 to 1961 would have indicated a substantial and universal decline in the induced sector, when in fact there was a rise in all counties except Leitrim. However for the 1966-71 period the naïve projection works unusually well, as there was no great change in the rate of economic development.

Nevertheless both models, but particularly that based on the semi-log equation, perform significantly better than the naïve projection. The standard error of the models is 4.6 per cent for the linear and 3.7 per cent for the semi-log, compared with 5.9 per cent for the naïve projection.

Turning to a more detailed examination of the model results, it can be seen that among the larger errors for both models are those relating to the counties adjoining Dublin. These are the counties for which a dummy variable was included in the models, and in each case the result is a substantial overestimate of the size of the induced sector. In fact omission of the dummy greatly improves the results for Wicklow and Kildare, turning the large overestimate into a modest underestimate in each case. For Meath there is a slight deterioration if the dummy is omitted, the resulting underestimate being larger than the overestimate when the dummy is included. The best results for all three counties would be if the dummy were included, but at a considerably smaller value than in the models, say 1 per cent of the workforce rather than 2.3 and 2.5 per cent actually used. In this case the predictions for all three counties on either the linear or the semi-log model would be within  $2\frac{1}{2}$  per cent of the actual numbers engaged in the induced sector.

This behaviour of the dummy variable suggests that the large increase in the divergences between 1961 and 1966 in Meath, Wicklow and Kildare was to a large extent a once-for-all adjustment, resulting in the establishment of a new and fairly stable relationship. This impression is confirmed by a comparison between the models' projected equations for 1971, and the equations based on the actual figures for that year.

So far as the basic static equations are concerned the linear model projection and the actual cross-section equation for 1971 are remarkably similar. The projection is  $17.0 + 0.30X_1$ , while the actual is  $16.37 + 0.305X_1$ . Curiously, in view of the fact that the total model gave better results, the basic static equation of the semi-log model was much further from the actual,  $-19.2 + 30.74X_1$  as against the actual  $-22.85 + 32.42X_1$ .

The resolution of this apparent paradox lies of course in the influence of the divergence change equations. These have been recalculated for the period 1966-71 and the results are set out in Table 13. Comparison with Tables 10 and 11 shows that the fit of most equations is not quite so close as for 1961 to 1966 although better than for 1951 to 1961. It is interesting to note that the equations for the latest period confirm the impression gained earlier that  $X_2$ , the percentage growth in the non-agricultural autonomous sector is the better indicator of development for the purpose of this exercise. It is reassuring to note that the regression coefficient for this variable (adjusted if necessary to allow for the influence of  $X_1$  in multiple regressions) has a similar value in all three periods, and also that it has been consistently significant throughout. The value of the intercept has increased substantially in those equations including  $X_2$ , but the most interesting change is that the dummy variable has lost its significance in most formulations. Moreover, although its sign remains positive in all cases, the value of its coefficient has fallen to less than half that exhibited in the 1961-66 period. This is exactly in line with the performance of the models in predicting induced employment in the affected counties, and confirms the impression that the adjustment in the 1961 to 1966 period was largely, but not entirely, particular to that period.

In sum, it would appear that the tests of the models in 1971 give results that are sufficiently good to justify proceeding with them. The basic equation for the semi-log model differed significantly from the equation based on the actual figures, but any distortion thus created was largely corrected by the operation of the dynamic element of the model. The basic structure of the linear model was more satisfactory, but the results were not quite as good as for the semi-log. There seems a strong case for persisting with both models.

In choosing the precise values to include in the models for 1976 there are two decisions to be made. In the first place, should the dummy variable be included in the dynamic element of the models? Although the inclusion of the dummy does little or nothing to improve the fit of the equations containing it, it is probably better to retain it, and thus maintain the models in the same form as was used for the 1971 tests. The second problem concerns the projected values of the coefficients in the basic static equations. In the linear case this is fairly straightforward, and applying the same procedures as in establishing the projections for 1971, the 1976 projections emerge as  $17.8 + 0.26X_1$ . For the

TABLE 13: *Divergence change analysis, 1966-1971**A. Variables*

## Dependent

 $Y_1$  Change in linear equation divergences, 1966-1971 $Y_2$  Change in semi-log equation divergences, 1966-1971

## Independent

 $X_1$  Change in non-agricultural share of autonomous sector, as percentage of share in 1966 $X_2$  Change in numbers engaged in non-agricultural autonomous sector, as percentage of number in 1966 $X_3$  Dummy variable; Meath, Kildare, Wicklow = 1, other counties = 0.*B. Equations*

Equation No.	Equations ( <i>T</i> -values in brackets)	$R^2$	<i>F</i>	SEE	DW
1	$Y_{1c} = 0.78 - 0.035X_1$ (1.35) (1.45)	.043	2.11	1.04	2.07
2	$Y_{1c} = 1.64 - 0.111X_2$ (4.49) (4.92)	.482	24.23	0.76	1.75
3	$Y_{1c} = 0.91 - 0.384X_1 - 0.515X_2$ (1.51) (1.55) (0.79)	.027	1.35	1.05	1.95
4	$Y_{1c} = 1.69 - 0.117X_2 + 0.437X_3$ (4.54) (4.92) (0.88)	.477	12.39	0.77	1.73
5	$Y_{1c} = 1.12 + 0.063X_1 - 0.179X_2 + 1.126X_3$ (2.82) (2.60) (5.61) (2.17)	.582	12.59	0.69	2.22
6	$Y_{2c} = 1.12 - 0.050X_1$ (2.01) (2.15)	.126	4.62	1.00	1.87
7	$Y_{2c} = 1.81 - 0.122X_2$ (5.44) (5.97)	.581	35.65	0.70	1.56
8	$Y_{2c} = 1.22 - 0.053X_1 - 0.401X_2$ (2.08) (2.20) (0.63)	.104	2.45	1.02	1.78
9	$Y_{2c} = 1.89 - 1.334X_2 + 0.72X_3$ (5.82) (6.39) (1.65)	.609	20.48	0.67	1.49
10	$Y_{2c} = 1.43 + 0.051X_1 - 0.183X_2 + 1.28X_3$ (4.03) (2.35) (6.41) (2.75)	.673	18.16	0.61	1.79

Standard Deviations of the Dependent Variables are:

 $Y_1$  1.06,  $Y_2$  1.08

semi-log formulation the problem is more difficult, as the trend in the movement of the parameters was reversed in 1966 to 1971. In these circumstances the simplest solution would appear to be the retention of the 1971 actual parameters as the projection for 1976, relying on the operation of the dynamic element to correct any distortion.

The prediction models for the size of the induced sector in a county in 1976 are thus as follows (using the same notation as in the models for 1971, with the value of  $d_{71}$  taken from Table 8 and of  $d'_{71}$  from Table 9):

$$y_{76c} = 17.8 + 0.26x_{76} \pm d_{71} + 1.7 - 0.12 \left( \frac{X_{76} - X_{71}}{X_{71}} \times 100 \right) + 0.4e$$

$$y_{76c} = -22.8 + 32.43 \log x_{76} \pm d'_{71} + 1.9 - 0.13 \left( \frac{X_{76} - X_{71}}{X_{71}} \times 100 \right) + 0.7e$$

$$Y_{76c} = \left( \frac{X_{76} + Z_{76}}{100 - y_{76c}} \times 100 \right) - (X_{76} + Z_{76}).$$

A hypothetical example may serve to make the operation of the models clearer. Let us suppose that we had available reliable estimates for autonomous sector employment in County Offaly for 1976, and that these showed the position as follows:

		1971 <i>Actual</i>	1976 <i>Hypothetical</i>
Agriculture, etc.	Z	7,701	6,400
Non-agricultural autonomous	X	4,923	5,300
Induced	Y	5,242	
Total		17,866	

We wish to use the models to obtain predictions of induced and total employment in 1976.

From the Table we can calculate:

$$x_{76} = \frac{5,300}{11,700} \times 100 = 45.7$$

$$\frac{X_{76} - X_{71}}{X_{71}} \times 100 = \frac{5,300 - 4,923}{4,923} \times 100 = 7.7$$

From Table 8 we can see that the 1971 divergence from the linear regression for County Offaly,  $d = 1.1$ . From Table 9 we can see that the 1971 divergence from the semi-log regression for County Offaly,  $d' = 0.6$ .

Offaly not being adjacent to Dublin the dummy variable  $e = 0$ .

Applying the linear model equation (1):

$$Y_{76c} = 17.8 + (0.26 \times 45.7) + 1.1 + 1.7 - (0.12 \times 7.7) + (0.4 \times 0) = 31.6.$$

Applying model equation (3) this converts to absolute figures:

$$Y_{76c} = 5,405 \qquad \text{Total Employment} = 17,105$$

Alternatively, from the semi-log model equation (2):

$$y_{76c} = -22.8 + (32.43 \times \log 45.7) + 0.6 + 1.9 - (0.13 \times 7.7) + (0.7 \times 0) = 32.5$$

and from equation (3):

$$Y_{76c} = 5,633 \qquad \text{Total Employment} = 17,333$$

Taken together, the models indicate that an induced sector about 5,500 in 1976 would be compatible with an agricultural sector of 6,400 and a non-agricultural autonomous sector of 5,300 in County Offaly. Due to the method of deriving the model equations, it is not possible to calculate statistical confidence limits for the models, but, as is common with most prediction models, it must be assumed that they would be very wide.

Nevertheless it appears that the models presented here could be used to give a broad indication of the size of induced sector consistent with forecast levels of agriculture and other autonomous employment in any county or region for 1976. If they perform as successfully for 1976 as they did for 1971 then the consistency predictions they yield could be of genuine assistance to regional planners.

## Section 5

### *Conclusions*

THE analysis presented in this paper, taken in conjunction with the results of the earlier paper (Baker 1966) and of Black and Jefferson's study in Northern Ireland (1974), appears to establish the relevance of a local employment relationship approach to regional analysis in Ireland. For four separate Census years in the Republic, and for 1966 in Northern Ireland, it has been demonstrated that an ordered relationship exists between the induced and autonomous sectors of employment at local level.

The hypothesis tested by Black and Jefferson in Northern Ireland is a simple one. When allowance has been made for special factors, such as the incidence of tourism and certain aspects of geographical location, the induced sector should form a fairly constant proportion of the local workforce, with absolute numbers in induced activity thus reflecting the absolute size of the autonomous sector. The Northern Ireland analysis supports this hypothesis, thereby confirming that the classification of activities into autonomous and induced sectors, which is shared with one or two minor amendments by both the Northern and Republic papers, is basically valid despite its rather arbitrary nature.

The hypothesis tested in the Republic, both in the previous paper (Baker 1966) and in the present study, is a little more complex. Beyond the simple relationship between the size of the autonomous and induced sectors, it is also postulated that the size of the induced sector depends on the composition of the autonomous sector. In particular, the larger the share of agriculture in the autonomous sector, the smaller the size of the induced sector, and conversely, the larger the proportion of non-agricultural activities in the autonomous sector, the larger the induced sector.

It has now been demonstrated for four separate Census years that such a relationship does hold true in the twenty-six counties. The strength of the relationship appears to be diminishing gradually, and the disparity between agricultural and other autonomous activities in inducing further employment seems to be narrowing, but nevertheless the evidence strongly supports the conclusion that the hypothesis still retained its validity in both 1966 and 1971. Counties with relatively large agricultural sectors tend to have fewer people in induced employment than counties where agriculture played a less dominant role.

Of course there are divergences from the pattern suggested by the simple consideration of the relative importance of agriculture. However, these divergences themselves show a remarkable consistency over time, arguing that they reflect such stable factors as the location of towns in relation to county boundaries, established commuting patterns, local deviations from national patterns of average sectoral incomes, major power or transport installations, or contiguity to Dublin. When these are taken into account, together with the basic relationship, about 95 per cent of the variation in the proportional size of the induced sector is explained by the equations based on our hypothesis.

It is the more remarkable that both the underlying relationship and the pattern of divergences from it in the case of individual counties have held so steady over the four Census years, as the twenty-year period thus covered has seen changes in the employment structure that are both dramatic and uneven. Within the context of a total population that declined substantially in the first ten years, and rose modestly in the second, there has been a continuous fall in total employment, although of course the fall was much lower in the 'sixties than in the 'fifties.

Within the workforce itself, agricultural employment has suffered a massive and fairly steady decline. Nationally, the fall in agricultural employment between 1951 and 1971 was 44.6 per cent. Among the individual counties other than Dublin, the declines range from 37.7 per cent in Offaly to 54.6 per cent in Leitrim, tending to be higher in the North and West than in the South and East. In absolute numbers the declines tended to be greater in the 'fifties than in the 'sixties, but as a proportion of agricultural employment at the beginning of the period the declines tended to be greater in the 'sixties.

Changes in non-agricultural autonomous employment have shown much greater variation than in agricultural, both between different time periods and between counties. Excluding Dublin, there was an increase of only 731 jobs in this category in the 'fifties, while in the 'sixties the increase was over 49,000. In the earlier period eleven counties gained in this type of employment, while fifteen lost, but in the 'sixties all counties gained, the increase ranging from 5 per cent in Offaly to 55.4 per cent in Clare.

These variations over time and between counties can be seen in better perspective if the gains in non-agricultural autonomous employment are related to the losses in agriculture. Thus, nationally (including Dublin), there was one new job in the autonomous sector for every 14 given up in agriculture between 1951 and 1961. Between 1961 and 1966 this became one for every 1.35 and between 1966 and 1971 one for every 1.75. If Dublin is excluded, then the ratios are 1 to 159 in the 'fifties and 1 to 2 in the 'sixties. The relative success of decentralisation policies allied to faster growth in the 'sixties is further exemplified by the fact that in the 'fifties there were eleven new jobs

in the non-agricultural autonomous sector in County Dublin for every one in the rest of the country, while since 1961 there have been nearly three new jobs outside Dublin for each one within it.

Taking the twenty years as a whole, Louth and Waterford obtained a non-agricultural autonomous job for each one lost in agriculture. At the other extreme Roscommon obtained only one job for each 99 lost, while Laois had no net gain of non-agricultural jobs at all, so that it is impossible to calculate a ratio. Of the counties between the extremes, as might be expected, it was the more developed counties, and particularly Cork and the Dublin hinterland, which came nearest to replacing their agricultural decline with non-agricultural autonomous employment.

In addition to these temporal and spatial variations in the size of the total population, workforce and composition of the autonomous sector, all of which could be expected to influence the induced sector, there have been structural changes directly affecting some components of the induced sector itself. Domestic service, for instance, declined over the twenty-year period to such an extent that by 1971 such employment was only 30 per cent of its 1951 level. Certain other components also show evidence of such secular changes in response to changing social habits or technology, although none to the same extent as domestic service.

Apart from such secular changes, which are not uniform in their effect between counties, there is an element of instability connected with private building and construction. By its nature this activity is particularly sensitive to the state of the business cycle at any Census date, and also to any variation in the short-term rate of development in a county.

In the light of all these changes affecting both the autonomous and induced sectors, two points need to be stressed. The first is that, in spite of all the changes, the power of inertia in the regional distribution of employment is very strong. Both in a period of general decline, as in the 'fifties, and in a period of expansion, as in the 'sixties, the order of ranking of the counties and the spread in the degree of development between the highest and lowest have shown great stability. Even the extreme case of Clare, with its 244 per cent increase in manufacturing industry, has risen by only four places in the ranking since 1951. Few other counties have moved by more than two places. To alter the regional pattern of development is a long and slow process.

The second point is that the basic hypothesis must possess considerable robustness to give highly significant and mutually compatible results for all four Census years. The nature of this compatibility is itself very interesting, particularly if taken in conjunction with the Northern Ireland results. In the Republic, it will be recalled that the intercept of the linear regressions rose between each of the four years, while the size of the regression coefficient fell.

This resulted in the regression line becoming steadily less steep in each successive Census year.

This flattening of the regression line has been brought about because there has been little or no increase in the induced share of the workforce in the most developed counties, despite a considerable increase in their non-agricultural share of the autonomous sector. In less developed counties on the other hand, the rise in the non-agricultural share of the autonomous sector has been accompanied, throughout the twenty years, by substantial increases in the proportion of the workforce in the induced sector. This would seem to indicate that there is an upper limit to the share of the induced sector, and that as this is approached the rise in the share of the induced sector slackens and finally ceases. Louth and Waterford would appear to have reached this limiting point already and such counties as Cork, Kildare, Wicklow and Limerick to be approaching it. Given the specific local factors which account for the divergences of counties from the regression line, it is impossible to place a definite value on this ceiling. However, in the absence of exceptional circumstances, such as those affecting Wicklow, and to a lesser extent Limerick, it would seem as if the normal limit on the share of the induced sector is about 35 per cent.

This concept of a maximum share of the induced sector is strongly reinforced by Black and Jefferson's results for Northern Ireland. With the exception of two districts, Omagh and Enniskillen, which indeed do show a significantly lower proportion of the workforce in the induced sector, all of the "Urban Centres" studied by Black and Jefferson have a level of development above that of Limerick. Thus the fact that no relationship could be discerned in Northern Ireland between the share of the induced sector and the composition of the autonomous sector supports the evidence from the Republic that there is an upper limit beyond which further changes in the structure of the autonomous sector have little or no impact on the relative size of the induced sector. Moreover, when allowance is made for differences in classification, the Northern results confirm that the ceiling of the induced sector is somewhere around 35 per cent, and that it operates when the non-agricultural share of the autonomous sector reaches the neighbourhood of 55 to 60 per cent.

The implication of this apparent ceiling is that the type of analysis conducted in this paper is relevant to regional studies only during a certain phase of development. Most of the Republic is still in this phase, and consequently the approach is likely to remain useful for about another decade. By the end of that period the further decline in agricultural employment and the concomitant growth of other autonomous activities should have rendered the approach invalid, except for a handful of the least developed counties. For Northern Ireland, the UK and most of Europe the division of the autonomous

sector between agriculture and other activities is almost certainly already redundant as a methodology. A much more complex division of the autonomous sector might yield useful results, but more probably a search for income relationships between the autonomous and induced sectors would prove more fruitful.

However, it seems quite likely that the methodology used in this paper could be useful in regional analysis in the poorer countries of southern Europe, and in much of Latin America. So long as sufficiently detailed and reliable Census data exist, it provides a relatively simple way of measuring regional disparities, of assessing progress in diversifying development, and of predicting possible levels of local employment in induced services.

With regard to this potential predictive ability, the results obtained from the forecasting models developed in Section 4 of the paper were highly encouraging when tested against the 1971 data. It is hoped that the updated versions of these models, applicable to 1976, will prove of utility to Irish regional planners in predicting the future level of total employment within their counties or regions. It must of course be stressed that the models are only partial, or consequential, and depend for their operation on the availability of reasonably accurate forecasts of employment in agriculture and the non-agricultural autonomous sector. However, the assistance offered by the models in converting such estimates of the more readily predictable types of employment into projections of total employment could be of considerable value in a local planning context.

Apart from their direct utility, the models are of interest in that they formalise what was previously no more than a generalised suspicion. This is that where the rate of development of the non-agricultural autonomous sector is particularly rapid, the growth of the induced sector tends not to keep pace with it. This tendency appears to be fairly general, and to have been present in each of the three inter-censal periods studied. To a large extent it would seem to be a temporary problem, caused partly by a slowness in the induced sector to adjust to changed conditions, and in some cases due in part to the effects of competition between the non-agricultural autonomous sector and the induced sector for the available workers in a locality. In either of these cases an eventual correction to the pattern might be expected when the growth in the autonomous sector slackens. However, some part of the tendency might be due to more permanent factors, particularly the realising of economies of scale in service industries as the growth of the workforce is accompanied by a greater concentration of population in medium or large towns. To the extent that this is the case, no subsequent readjustment in the relation between autonomous and induced employment can be expected when the period of rapid expansion comes to an end.

This finding that there is a dynamic relationship between the rate of growth of non-agricultural autonomous activities and changes in the share of the induced sector, as well as the previously observed static relationship between the shares themselves, could have implications for regional location policy. If the principal aim of such policy is to maximise total employment then the findings suggest that extremes of concentration in industrial location should be avoided. A higher total of induced employment is likely to result from a reasonably dispersed pattern of industrial expansion, although in practice the degree of dispersal is bound to be restricted by the requirements of the autonomous industries themselves.

A second point to emerge from the analysis which could be of considerable relevance to regional policy is that employment in the social autonomous sector is at least as effective as employment in manufacturing industry in inducing further local employment. The implications of this are fairly obvious.

Decisions concerning the location of such activities as administration, education or health are more directly under the control of policy makers than are decisions on industrial location. Decentralisation of such services can frequently be achieved at a lower cost in foregone efficiency than decentralisation of manufacturing. There are, of course, difficulties in the way of making decentralisation of social autonomous services a major part of regional policy. The creation of new administrative agencies which can function equally well in alternative locations is a relatively infrequent occurrence. Similarly the provision of such facilities as new hospitals or schools is usually tied to the requirements of the population in a specific place, although some flexibility exists in many cases. Thus it must be conceded that any serious decentralisation plan, even if it were limited to ensuring that the net national increase in jobs in this sector accrued to areas other than Dublin, would involve the actual displacement from Dublin of certain administrative or social units. It seems clear, however, that the benefit to the recipient area of such a policy would outweigh the disadvantages, if any, to Dublin. The political and personal problems inherent in the transfer of the individual workers concerned are beyond the scope of this paper, but it does seem relevant to point out that these problems have been tackled with a fair degree of success in other countries.

The final point relating to regional policy which needs to be made is that the analysis of the 1971 Census confirms the earlier conclusions (see Baker and Ross 1970) that there is no longer any justification for regarding Ireland as divided into a simple two-region economy. It remains true of course that the stage of development of the Western, North-Western and Donegal Regions is lower on average than that of the remainder. However, apart of course from the special case of Dublin, there is no clear-cut discontinuity between the regions or the counties contained in them. Rather there is a fairly smooth

spectrum in the stages of development, and the drawing of any arbitrary lines with areas on one side of it regarded as undeveloped and those on the other as developed, is likely to cause anomalies and distortions. Regional development policy, like regional analysis, must be based on more sophisticated and flexible criteria of development needs and opportunities.

The principal conclusions of this paper can be summarised quite simply. Despite the changes and progress in the previous twenty years, great disparities still existed in 1971 in the stages of economic development as revealed in the employment patterns of different counties and regions. So long as these disparities remain, the analytical approach adopted in this paper is likely to be of relevance and utility. If the paper can contribute towards the situation where the spread of development in Ireland is sufficiently even that its central hypothesis becomes redundant, then the authors will be well satisfied.

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APPENDIX I: Classification of sectors from Census of Population

Sector	Category	Item	Census code number	
			1971 Vol. III	1966 Vol. III
Autonomous Agriculture	Agriculture	Agriculture and Forestry	000-201; 401; 402; 403	001-013
		Fishing	404	014
		Turf Production	406	018
Autonomous Non-agriculture	Commercial Autonomous	Mining and Quarrying	405	015-017
		Manufacturing Industry	407; 409*-424; 426-428; 430; 432*-450	019; 201-042; 044-047 049-052; 054-055-058-077; 079- 909
		Sea and Air Transport	497; 501-502;	150-153
		Tourism	528-530	182-184
	Social Autonomous	Racing	537-538	193-194
		Foreign Government	541*	197
		Public Building etc. Public Administration and Defence Social Professions	451; 453 505-508 509-519; 533	091; 093-094 157-160 162-166; 168-175; 189
	Retail	Retail Trade I	470-472; 485-486; 488*; 490	118-120; 135-136; 139-140
		Retail Trade II	473-484; 487-488*; 494-496	121-134; 137-138; 141-142
	Other Trade	"Manufacturing"	408*; 421; 425-429; 431; 433*	020; 043; 048; 053; 056-057; 078
Trading		460; 464; 468; 469*; 489	102-110	
Wholesale		461-463; 465-467; 469*	111-117	
"Personal Service"		531-532; 534	185-188; 190	
Induced Transport	Land Transport	498-500	146-149	
	Communications and Storage	503-504	154-156	
Miscellaneous	Electricity, Water, Gas	457-459	099-101	
	Insurance, Banks, Finance	491-493	143-145	
	Professions	520-526	161; 167; 176-180	
	Entertainment and Sport Industry not stated	535-536; 539-540 541	191-192; 195-196 198	
Building etc.	Private Building	452; 454-456	092; 095-098	
Domestic Service	Private Domestic Service	527	181	

\*There have been amalgamations in Census classifications between 1961 and 1966 and again between 1966 and 1971. In most cases these have provided no problem but in some cases there may be slight discrepancies between the functional classification of sectors in successive years. The only instance in which an adjustment to the 1966 Census category has had to be made is in the case of category 078, iron and steel forging. (This became 443 "Metal Products" in 1971.) In 1966 this apparently includes "blacksmiths" who formed a separate category (095) in 1961. The numbers engaged in "iron and steel forging" (096) and 1961 have been allocated to manufacturing industry in 1966 and the remainder of 078 has been regarded as representing "blacksmiths" and allocated to the induced sector. In 1971 blacksmiths were assumed to be 20 per cent of the 1961 figure on level and deducted from "metal products" 443.

The 1966 Census categories, Bread and Flour Confectionery (020) and Biscuits (021) became "Bread, Biscuits and Flour confectionery" (408) while "readymade outer clothing" (042) and "Handicraft tailoring and dressmaking" (043) became "Outer clothing" (421). It was assumed that numbers engaged in "biscuits" and "handicraft tailoring" did not differ from the 1966 level and these were deducted from the amalgamated totals and allocated appropriately. Similarly where "motor vehicles and pedal cycles" (138) and "motor garages (including filling stations)" (140) were separate in 1966 they were combined as "motor vehicles, sales and repairs (including filling stations)" (488) in 1971. Again category 198 was assumed to remain constant. This adjustment is of lesser importance as it does not affect the total of the retail sector—only the split between Retail I and Retail II.

	Autonomous sector										Total autonomous	Retail trade			"Manufacturing"
	Agriculture (including forestry, fishing and turf)	Non-agricultural autonomous								Total non-agricultural autonomous		Retail trade (1)	Retail trade (2)	Total retail trade	
		Commercial autonomous				Social autonomous									
		Manufacturing industry	Tourism	Other	Total commercial autonomous	Public building, etc.	Administration and defence	Social professions	Total social autonomous						
Leitrim	6,427	548	117	102	767	227	259	741	1,227	1,994	8,421	627	216	843	142
Roscommon	11,845	842	160	260	1,262	420	537	1,393	2,350	3,612	15,457	1,023	531	1,554	225
Mayo	21,891	2,530	593	128	3,251	637	891	2,851	4,379	7,630	29,531	2,186	1,182	3,368	521
Longford	5,149	653	142	58	853	269	328	733	1,330	2,183	7,332	692	338	1,030	190
Cavan	10,243	2,218	245	93	2,556	433	493	1,294	2,220	4,776	15,019	1,401	608	2,009	274
Galway	25,380	3,737	1,159	673	5,569	1,026	1,430	5,493	7,949	13,518	38,898	2,990	1,767	4,757	748
Sligo	8,022	1,386	356	125	2,367	280	494	1,577	2,351	4,718	12,740	1,001	726	1,727	274
Kerry	16,782	3,869	1,606	175	5,650	615	1,042	3,050	4,707	10,357	27,139	2,433	1,519	3,952	649
Laois	6,816	1,703	226	97	2,026	323	465	1,242	2,030	4,056	10,872	1,038	616	1,654	227
Donegal	15,228	4,766	1,013	142	5,921	720	1,230	2,507	4,457	10,378	25,606	2,198	1,272	3,470	740
Monaghan	7,544	3,050	285	164	3,508	304	502	1,461	2,267	5,775	13,310	1,120	666	1,786	186
Clare	12,058	3,318	798	443	4,859	579	932	1,959	3,470	8,329	20,387	1,239	772	2,011	392
Offaly	7,702	2,739	206	99	3,044	261	395	1,223	1,879	4,923	12,624	1,115	733	1,848	223
Wexford	10,515	3,392	747	403	4,542	417	717	2,084	3,218	7,760	18,275	2,165	1,320	3,485	483
Tipperary (North)	7,730	2,645	269	562	3,476	418	732	1,437	2,587	6,063	13,793	1,213	804	2,017	261
Kilkenny	8,138	3,324	289	199	3,812	357	672	1,818	2,847	6,659	14,797	1,353	842	2,195	340
Tipperary (South)	8,983	2,980	424	435	3,839	399	818	2,011	3,228	7,067	16,050	1,604	1,066	2,670	405
Meath	8,994	4,228	363	419	5,010	722	1,773	3,217	8,227	17,221	1,505	1,065	2,570	409	
Westmeath	6,227	1,444	302	97	1,843	480	1,387	1,910	3,777	5,620	11,847	1,221	894	2,115	299
Carlow	3,759	2,079	145	57	2,281	178	299	986	1,463	3,744	7,503	867	535	1,402	191
Limerick	12,445	8,326	968	757	10,051	708	1,808	4,285	6,801	16,852	29,297	2,976	2,835	5,811	803
Wicklow	5,139	4,168	703	760	5,631	407	697	1,673	2,777	8,408	13,547	1,600	1,241	2,841	512
Cork	30,283	24,603	2,405	2,507	29,515	1,910	5,011	11,128	18,049	47,564	77,852	7,397	6,830	14,227	2,994
Kildare	6,454	5,110	364	786	6,260	423	2,290	1,696	4,409	10,609	17,123	1,755	1,118	2,873	459
Waterford	6,033	6,853	649	422	7,924	442	756	2,762	3,960	11,884	17,917	1,552	1,496	3,048	523
Louth	3,419	9,899	484	393	10,776	300	802	2,446	3,548	14,324	17,743	1,493	1,655	3,148	665
North-West	14,449	2,434	473	227	3,134	507	753	2,318	3,578	6,712	21,161	1,628	942	2,570	416
West	47,271	6,267	1,752	801	8,820	1,663	2,321	8,344	12,328	21,148	68,419	5,176	2,949	8,125	1,269
Midlands	37,739	7,381	1,036	611	9,028	1,753	3,112	6,501	11,366	20,394	58,133	5,089	3,112	8,201	1,164
Donegal	15,228	4,766	1,013	142	5,921	720	1,230	2,507	4,457	10,378	25,606	2,193	1,272	3,470	740
South-East	37,428	18,628	2,254	1,516	22,398	1,793	3,262	9,661	14,716	37,114	74,542	7,541	5,259	12,800	1,942
Mid-West	32,233	14,589	2,035	1,762	18,386	1,705	3,472	7,681	12,858	31,244	63,477	5,428	4,411	9,839	1,459
North-East	21,206	15,176	1,014	650	16,840	1,037	1,797	5,201	8,035	24,875	46,081	4,014	2,929	6,943	1,125
South-West	47,065	28,472	4,011	2,682	35,165	2,525	6,053	14,178	22,756	57,921	104,086	9,890	8,349	18,179	3,643
East (excl. Dublin)	20,587	13,506	1,430	1,965	16,901	1,552	3,709	5,142	10,403	27,304	47,891	4,860	3,424	8,284	1,380
Total (excl. Dublin)	273,206	111,219	15,018	10,356	136,593	13,255	25,709	61,533	100,497	237,090	510,296	45,764	32,647	78,411	13,138
Dublin	4,755	75,746	8,404	10,909	95,059	3,977	23,160	33,347	60,484	155,543	160,298	14,764	22,761	37,525	13,530
Total	277,961	186,965	23,422	21,265	231,652	17,232	48,869	94,880	160,981	392,633	670,594	60,528	55,408	115,936	26,668

Persons at work by county and category

Induced sector													Total at work	
Other trade			Transport including communication and storage	Miscellaneous services					Private building and construction	Domestic service	Total induced sector			
Trading and wholesale	"Personal service"	Total other trade		Electricity, gas and water	Finance, etc.	Professions	Other	Total miscellaneous						
137	51	330	313	119	83	65	55	332	450	132	2,390	10,811	Leitrim	
277	89	591	583	197	158	112	122	583	712	156	4,179	19,636	Roscommon	
563	225	1,309	1,283	273	282	193	170	1,018	1,439	412	8,829	38,350	Mayo	
160	49	399	278	95	97	63	82	337	429	144	2,617	9,949	Longford	
304	102	680	477	104	180	130	109	523	816	251	4,756	19,775	Cavan	
779	525	2,052	1,518	347	530	443	424	1,744	2,785	567	13,423	52,321	Galway	
590	138	1,002	738	195	211	147	117	670	894	219	5,250	17,990	Sligo	
471	302	1,422	1,204	431	366	239	257	1,293	2,079	457	10,407	37,546	Kerry	
247	107	581	637	330	132	91	89	642	789	240	4,543	15,415	Laois	
778	227	1,745	1,264	345	300	192	249	1,086	1,910	667	10,142	35,748	Donegal	
318	139	643	438	75	132	111	99	417	796	301	4,381	17,700	Monaghan	
335	169	896	447	208	229	207	166	810	1,659	251	6,374	26,761	Clare	
405	108	736	465	480	170	102	112	864	1,061	268	5,242	17,867	Offaly	
784	322	1,589	1,015	414	321	412	262	1,409	1,852	709	10,059	28,334	Wexford	
304	144	712	729	106	187	139	135	567	999	272	5,296	19,089	Tipperary (North)	
429	185	954	733	151	243	220	171	785	1,510	405	6,582	21,379	Kilkenny	
516	260	1,181	764	179	264	190	306	939	1,343	519	7,416	23,466	Tipperary (South)	
586	250	1,245	719	181	290	288	194	953	2,478	529	8,494	25,715	Meath	
440	169	908	899	246	210	168	206	830	972	291	6,015	17,862	Westmeath	
339	115	645	344	54	115	163	86	418	586	223	3,618	11,121	Carlow	
1,849	507	3,159	2,436	620	694	650	531	2,495	3,216	786	17,903	47,200	Limerick	
573	380	1,465	836	348	399	347	382	1,476	2,199	625	9,442	22,989	Wicklow	
4,434	1,439	8,917	5,170	1,461	2,173	1,488	1,062	6,184	9,087	1,930	45,515	123,362	Cork	
497	206	1,162	861	411	234	265	217	1,127	1,884	484	8,391	25,514	Kildare	
800	370	1,693	1,262	393	357	334	272	1,356	1,640	425	9,424	27,341	Waterford	
842	337	1,844	1,196	361	314	243	266	1,184	1,765	300	9,437	27,180	Louth	
727	189	1,332	1,051	314	294	212	172	992	1,344	351	7,640	28,801	North-West	
1,342	750	3,361	2,801	620	812	736	594	2,762	4,224	979	22,252	90,671	West	
1,529	522	3,215	2,862	1,342	767	536	611	3,256	3,963	1,099	22,596	80,729	Midlands	
778	227	1,745	1,264	345	300	192	249	1,086	1,910	667	10,142	35,748	Donegal	
2,868	1,252	6,062	4,118	1,191	1,300	1,319	1,097	4,907	6,931	2,281	37,099	111,641	South-East	
2,488	820	4,767	3,912	934	1,110	996	832	3,872	5,874	1,309	29,573	93,050	Mid-West	
1,464	578	3,167	2,111	540	626	484	474	2,124	3,377	852	18,574	64,655	North-East	
4,905	1,791	10,339	6,374	1,892	2,539	1,727	1,319	7,477	11,166	2,387	35,922	160,908	South-West	
1,656	836	3,872	2,416	940	923	900	793	3,556	6,561	1,638	26,327	74,218	East (excl. Dublin)	
17,757	6,965	37,860	26,909	8,118	8,671	7,102	6,141	30,032	45,350	11,563	230,125	740,421	Total (excl. Dublin)	
19,099	6,402	39,031	20,452	6,045	10,815	9,027	5,116	31,003	21,951	4,158	154,120	314,418	Dublin	
36,856	13,367	76,891	47,361	14,163	19,486	16,129	11,257	61,035	67,301	15,721	384,245	1,054,839	Total	

Autonomous sector														
	Non-agricultural autonomous										Total autonomous	Retail trade		
	Agriculture (including forestry, fishing and turf)	Commercial autonomous				Social autonomous				Total non- agricultural autonomous		Retail trade (1)	Retail trade (2)	Total retail trade
		Manufacturing industry	Tourism	Other	Total commercial autonomous	Public building, etc.	Administration and defence	Social professions	Total social autonomous					
Leitrim	8,290	361	107	102	570	197	205	601	1,093	1,663	9,953	639	231	870
Roscommon	14,588	648	163	264	1,075	469	451	1,386	2,306	3,381	17,969	1,145	483	1,628
Mayo	27,637	2,174	571	115	2,860	651	850	2,477	3,978	6,838	34,475	2,493	1,223	3,716
Longford	6,202	327	118	43	488	299	274	635	1,208	1,696	7,898	680	329	1,009
Cavan	12,412	1,520	275	88	1,883	425	427	1,168	2,020	3,903	16,315	1,450	608	2,058
Galway	31,278	3,028	1,198	535	4,761	1,117	1,402	4,637	7,156	11,917	43,195	3,031	1,581	4,612
Sligo	9,971	1,553	295	104	1,952	344	452	1,358	2,154	4,106	14,077	1,027	668	1,695
Kerry	20,165	2,813	1,352	206	4,371	664	989	2,624	4,277	8,648	28,813	2,588	1,403	3,991
Laois	8,049	1,497	145	142	1,784	370	407	1,082	1,859	3,043	11,692	1,139	551	1,690
Donegal	19,810	4,161	1,041	144	5,346	922	950	2,339	4,211	9,557	29,367	2,582	1,103	3,685
Monaghan	9,137	2,063	206	151	2,420	346	386	1,278	2,010	4,430	13,567	1,214	648	1,862
Clare	14,700	3,061	693	303	4,057	677	903	1,705	3,285	7,342	22,042	1,323	629	1,952
Offaly	9,044	2,714	212	54	2,980	256	351	1,054	1,661	4,641	13,685	1,241	701	1,942
Wexford	12,815	2,989	549	324	3,862	466	646	1,847	2,959	6,821	19,636	2,228	1,225	3,453
Tipperary (North)	9,306	2,394	304	133	2,831	399	648	1,201	2,248	5,070	31,189	1,260	686	1,946
Kilkenny	9,926	2,539	175	408	3,122	440	620	1,627	2,687	5,809	15,735	1,513	811	2,324
Tipperary (South)	10,443	2,635	352	402	3,389	471	759	1,742	2,972	6,631	17,074	1,709	942	2,651
Meath	10,637	3,459	340	329	4,128	515	567	1,435	2,517	6,645	17,282	1,591	895	2,486
Westmeath	7,335	1,275	321	63	1,659	727	1,261	1,633	3,621	5,280	12,615	1,292	803	2,095
Carlow	4,511	1,765	123	98	1,986	192	278	855	1,325	3,311	7,822	924	486	1,410
Limerick	14,880	7,900	904	782	9,586	962	1,750	3,943	6,655	16,241	31,121	3,046	2,485	5,531
Wicklow	6,172	3,237	762	542	4,541	352	633	1,445	2,431	6,972	13,144	1,582	1,146	2,728
Cork	36,397	23,449	2,209	2,384	28,042	2,132	4,215	9,572	15,919	43,961	80,358	8,013	6,057	14,070
Kildare	7,478	3,952	347	756	5,055	431	2,283	1,280	3,994	9,049	16,527	1,813	890	2,703
Waterford	7,202	5,677	528	567	6,772	553	735	2,459	3,747	10,519	17,721	1,698	1,386	3,084
Louth	4,528	8,819	476	382	9,677	313	628	2,135	3,076	12,753	17,281	1,686	1,457	3,143
North-West	18,261	1,914	402	206	2,522	541	657	2,049	3,247	5,769	24,030	1,666	899	2,565
West	58,915	5,202	1,769	650	7,621	1,768	2,252	7,114	11,134	13,755	77,670	5,524	2,804	8,328
Midlands	45,218	6,461	959	566	7,986	2,121	2,744	5,790	10,655	18,641	63,859	5,497	2,867	3,364
Donegal	19,810	4,161	1,041	144	5,346	922	950	2,339	4,211	9,557	29,367	2,582	1,103	3,685
South-East	44,897	15,605	1,727	1,799	19,131	2,122	3,038	8,530	13,690	32,821	77,718	8,072	4,850	12,922
Mid-West	38,886	13,355	1,901	1,218	16,474	2,038	3,301	6,849	12,188	28,662	67,548	5,629	3,800	9,429
North-East	26,077	12,402	957	621	13,980	1,084	1,441	4,581	7,106	21,086	47,163	4,350	2,713	7,063
South-East	56,562	26,262	3,561	2,590	32,413	2,796	5,204	12,196	20,196	52,609	109,171	10,601	7,460	18,061
East (excl. Dublin)	24,287	10,648	1,449	1,627	13,724	1,299	3,483	4,160	8,942	22,666	46,953	4,986	2,931	7,917
Total (excl. Dublin)	332,913	96,010	13,766	9,421	119,197	14,691	23,070	53,608	91,369	210,566	543,479	48,907	29,427	73,334
Dublin	5,666	74,343	8,414	11,846	94,603	4,348	20,119	28,206	52,673	147,276	152,942	15,194	21,508	36,702
Total	338,579	170,353	22,180	21,267	213,800	19,039	43,189	81,814	144,042	357,842	696,421	64,101	50,935	110,036

Induced sector														Total at work	
Other trade				Transport including communication and storage	Miscellaneous services					Private building and construction	Domestic service	Total induced sector			
"Manufacturing"	Trading and wholesale	"Personal service"	Total other trade		Electricity, gas and water	Finance, etc.,	Professions	Other	Total miscellaneous						
151	122	43	316	272	65	72	59	72	268	250	171	2,147	12,100	Leitrim	
234	251	109	594	526	180	133	109	149	571	557	276	4,152	22,121	Roscommon	
632	485	252	1,369	1,078	231	231	240	325	1,027	1,089	676	8,955	43,430	Mayo	
220	172	54	446	256	116	84	68	73	341	372	218	2,642	10,540	Longford	
297	225	116	638	442	66	147	110	78	401	659	440	4,638	20,953	Cavan	
792	780	608	2,180	1,484	323	404	373	502	1,602	1,916	880	12,674	55,869	Galway	
302	538	152	992	674	168	177	121	218	684	564	329	4,938	19,015	Sligo	
853	439	284	1,576	1,088	307	296	225	277	1,105	1,464	823	10,047	38,860	Kerry	
235	212	96	543	596	256	103	78	107	544	649	433	4,455	16,147	Laois	
725	696	225	1,646	1,236	277	223	174	305	979	1,559	1,024	10,129	39,496	Donegal	
203	326	125	654	389	65	119	109	115	408	587	363	4,263	17,830	Monaghan	
395	326	183	904	703	169	189	177	155	690	1,195	435	5,879	27,921	Clare	
233	359	133	725	428	416	146	106	110	778	765	406	5,044	18,729	Offaly	
483	624	423	1,529	1,014	215	264	329	239	1,047	1,416	1,190	9,649	29,285	Wexford	
299	343	144	876	695	91	169	164	166	590	937	493	5,447	19,832	Tipperary (North)	
426	339	216	981	651	108	214	160	204	686	997	761	6,400	22,135	Kilkenny	
437	451	258	1,146	751	142	315	180	279	816	1,048	842	7,254	24,058	Tipperary (South)	
399	488	214	1,101	673	134	205	187	221	747	1,782	878	7,667	24,949	Meath	
298	379	157	834	833	215	157	124	240	736	800	497	5,795	18,410	Westmeath	
198	345	138	681	320	59	113	181	113	466	458	402	3,737	11,559	Carlow	
905	1,685	523	3,113	2,171	529	605	512	562	2,208	2,682	1,303	17,008	48,129	Limerick	
508	556	365	1,429	815	224	282	272	415	1,193	1,712	934	8,811	21,955	Wicklow	
3,258	3,901	1,480	8,639	4,935	1,290	1,877	1,323	1,114	5,604	7,410	3,344	44,002	12,360	Cork	
464	366	200	1,030	758	316	167	192	209	944	1,412	891	7,738	24,265	Kildare	
604	804	289	1,697	1,123	278	295	261	282	1,116	1,258	796	9,074	26,795	Waterford	
663	959	344	1,966	1,118	296	255	228	286	1,065	1,428	468	9,188	26,469	Louth	
453	660	195	1,308	946	233	249	180	290	952	814	500	7,085	31,115	North-West	
1,424	1,265	860	3,549	2,562	554	635	613	827	2,629	3,005	1,556	21,629	99,299	West	
1,220	1,373	549	3,142	2,639	1,183	623	485	679	2,970	3,143	1,830	22,088	85,947	Midlands	
725	696	225	1,646	1,236	277	223	174	305	979	1,559	1,024	10,129	39,496	Donegal	
2,147	2,563	1,324	6,034	3,859	802	1,101	1,111	1,117	4,131	5,177	3,991	36,114	113,832	South-East	
1,599	2,354	850	4,803	3,569	789	963	853	883	3,488	4,814	2,231	28,334	95,882	Mid-West	
1,163	1,510	585	3,258	1,949	427	521	447	479	1,874	2,674	1,271	18,089	65,252	North-East	
4,111	4,340	1,764	10,215	6,023	1,597	2,173	1,548	1,391	6,709	8,874	4,167	54,049	163,220	South-West	
1,371	1,410	779	3,560	2,246	674	654	651	905	2,884	4,906	2,703	24,216	71,169	East (excl. Dublin)	
14,213	16,171	7,131	37,515	25,029	6,536	7,142	6,062	6,876	26,616	34,966	19,273	221,733	765,212	Total (excl. Dublin)	
13,811	18,931	7,094	39,836	18,627	5,375	8,864	7,140	4,977	26,356	20,135	6,177	147,833	300,775	Dublin	
28,024	35,102	14,225	77,351	43,656	11,911	16,006	13,202	11,853	52,972	55,101	25,450	369,566	1,065,987	Total	

APPENDIX 4: *Employment pattern by county and region 1971*  
*Percentage of total at work*

County	Agriculture	Non-agricultural autonomous					Locally induced						Total	
		Commercial	Social	Total	Retail (1)	Retail (2)	Total	Other trade	Transport	Miscellaneous	Private building	Domestic service		Total
Leitrim	59.45	7.10	11.35	18.44	5.80	2.00	7.80	3.05	2.90	2.98	4.16	1.22	22.11	100.00
Roscommon	60.32	6.42	11.97	18.39	5.21	2.70	7.92	3.01	2.97	2.97	3.63	0.80	21.29	100.00
Mayo	57.08	8.47	11.42	19.90	5.70	3.08	8.78	3.41	3.35	2.65	3.75	1.07	23.02	100.00
Longford	51.75	8.56	13.38	21.94	6.96	3.40	10.36	4.01	2.80	3.39	4.31	1.45	26.31	100.00
Cavan	51.80	12.92	11.24	24.15	7.08	3.07	10.16	3.44	2.41	2.65	4.13	1.27	24.05	100.00
Galway	48.51	10.63	15.20	25.83	5.72	3.38	9.09	3.92	2.90	3.33	5.32	1.08	25.66	100.00
Sligo	44.59	13.14	13.08	26.22	5.56	4.04	9.60	5.57	4.10	3.72	4.97	1.22	29.19	100.00
Kerry	44.70	15.03	12.56	27.58	6.48	4.05	10.53	3.79	3.21	3.44	5.54	1.22	27.72	100.00
Laois	44.20	13.15	13.17	26.32	6.74	4.00	10.73	3.77	4.13	4.17	5.12	1.55	29.48	100.00
Donegal	42.59	16.56	12.47	29.03	6.15	3.56	9.71	4.88	3.54	3.04	5.34	1.87	28.38	100.00
Monaghan	42.62	19.82	12.81	32.63	6.33	3.76	10.09	3.63	2.48	2.36	4.50	1.70	24.75	100.00
Clare	45.05	18.14	12.98	31.13	4.63	2.89	7.52	3.35	2.79	3.03	6.20	0.94	23.82	100.00
Offaly	43.10	17.04	10.52	27.56	6.24	4.10	10.34	4.12	2.60	4.84	5.94	1.50	29.34	100.00
Wexford	37.10	16.02	11.37	27.39	7.64	4.66	12.30	5.61	3.58	4.97	6.54	2.50	35.50	100.00
Tipperary (North)	40.49	18.21	13.56	31.77	6.36	4.21	10.57	3.73	3.82	2.97	5.23	1.43	27.75	100.00
Kilkenny	38.03	17.84	13.33	31.17	6.33	3.94	10.28	4.47	3.43	3.68	7.07	1.88	30.80	100.00
Tipperary (South)	38.24	16.37	13.76	30.13	6.84	4.55	11.39	5.04	3.26	4.00	5.73	2.21	31.62	100.00
Meath	34.98	19.48	12.52	32.00	5.86	4.14	10.00	4.84	2.80	3.71	9.64	2.04	33.03	100.00
Westmeath	34.85	10.32	21.15	31.47	6.84	5.01	11.84	5.08	5.03	4.65	5.44	1.63	33.68	100.00
Carlow	33.80	20.51	13.15	33.66	7.80	4.81	12.61	5.80	3.09	3.76	5.27	2.01	32.54	100.00
Limerick	26.36	21.29	14.41	35.70	6.31	6.01	12.31	6.69	5.16	5.29	6.81	1.66	37.93	100.00
Wicklow	22.33	24.49	12.09	36.58	6.96	5.40	12.37	6.38	3.64	6.43	9.57	2.71	41.09	100.00
Cork	24.54	23.92	14.64	38.56	6.00	5.54	11.54	7.23	4.19	5.01	7.37	1.56	36.90	100.00
Kildare	25.28	24.53	17.29	41.82	6.88	4.38	11.26	4.56	3.38	4.42	7.39	1.90	32.90	100.00
Waterford	22.05	28.98	14.50	43.47	5.68	5.47	11.15	6.19	4.62	4.96	6.00	1.55	34.47	100.00
Louth	12.58	39.65	13.06	52.70	5.49	6.09	11.58	6.79	4.40	4.36	6.49	1.10	34.72	100.00
North-West	50.17	10.87	12.43	23.30	5.65	3.27	8.92	4.63	3.65	3.44	4.67	1.22	26.53	100.00
West	50.14	9.72	13.61	23.32	5.71	3.25	3.96	3.71	3.09	3.05	4.66	1.08	24.54	100.00
Midlands	46.74	11.18	14.08	25.26	6.31	3.86	10.16	3.98	3.55	4.03	4.91	1.36	27.99	100.00
Donegal	42.59	16.56	12.47	29.03	6.15	3.56	9.71	4.88	3.54	3.04	5.34	1.87	28.38	100.00
South-East	33.51	20.06	13.19	33.26	6.76	4.71	11.47	5.43	3.69	4.40	6.21	2.04	33.24	100.00
Mid-West	34.64	19.75	13.83	33.58	5.83	4.74	10.58	5.12	4.21	4.16	6.31	1.41	31.79	100.00
North-East	32.80	26.04	12.43	38.47	6.21	4.53	10.74	4.90	3.27	3.29	5.22	1.32	28.73	100.00
South-West	29.25	21.85	14.15	36.00	6.11	5.19	11.30	6.43	3.96	4.65	6.94	1.48	34.76	100.00
East (excl. Dublin)	27.73	22.77	14.02	36.79	6.55	4.62	11.17	5.22	3.26	4.30	8.84	2.20	35.48	100.00
Total	36.89	18.44	13.58	32.02	6.18	4.41	10.59	5.11	3.64	4.06	6.13	1.56	31.08	100.00
Dublin	1.51	30.23	19.24	49.47	4.70	7.24	11.93	12.41	6.50	9.86	6.98	1.32	49.02	100.00
Ireland	26.35	21.96	15.26	37.22	5.74	5.25	10.99	7.29	4.49	5.79	6.38	1.49	36.43	100.00

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