THE
ECONOMIC & SOCIAL
RESEARCH INSTITUTE

Regional Employment Patterns in Northern Ireland

WILLIAM BLACK and CLIFFORD W. JEFFERSON

January, 1974

PAPER No. 73

THE ECONOMIC AND SOCIAL RESEARCH INSTITUTE
COUNCIL 1972-73

*T. K. WHITAKER, M.SC. (ECON.), D.ECON.SC., *President of the Institute.*

T. J. BARRINGTON, *Director, Institute of Public Administration.*

J. P. BEDDY, D.ECON.SC., LL.D. (H.C.).

R. D. C. BLACK, PH.D., *Professor, Department of Economics, The Queen's University, Belfast.*

*F. B. CHUBB, M.A., D.PHIL., *Professor, Department of Political Science, Trinity College, Dublin.*

VERY REV. D. CREGAN, C.M., *President, St. Patrick's Training College, Drumcondra, Dublin.*

G. DEAN, M.D., F.R.C.P., *Director, Medico-Social Research Board.*

REV. PETER DEMPSEY, O.F.M.CAP., M.A., PH.D., *Professor, Department of Applied Psychology, University College, Cork.*

N. J. GIBSON, B.SC. (ECON.), PH.D., *Professor, Department of Economics, The New University of Ulster, Coleraine.*

*W. A. HONOHAN, M.A., F.I.A.,

*THE MOST REV. JAMES KAVANAGH, M.A., S.T.L., *Bishop of Zerta.*

*KIERAN A. KENNEDY, M.ECON.SC., B.PHIL., PH.D., *Director of the Institute.*

IVOR KENNY, M.A., *Director, Irish Management Institute.*

T. P. LINEHAN, B.E., B.SC., *Director, Central Statistics Office.*

P. LYNCH, M.A., *Associate Professor of Political Economy, University College, Dublin.*

CHARLES McCARTHY, B.L., *Chairman, Human Sciences Committee.*

*M. D. McCARTHY, M.A., PH.D., D.SC., *President, University College, Cork.*

J. J. McELLIGOTT, M.A., LL.D., *Past President of the Institute.*

G. A. MEAGHER, B.COMM., D.P.A., *Deputy Secretary, Department of Local Government.*

*J. F. MEENAN, M.A., B.L., *Professor of Political Economy, University College, Dublin.*

*C. H. MURRAY, *Secretary, Department of Finance.*

J. C. NAGLE, M.COMM.

D. NEVIN, *Assistant General Secretary, Irish Congress of Trade Unions.*

RIGHT REV. MONSIGNOR J. NEWMAN, M.A., D.PH., *President, St. Patrick's College, Maynooth.*

TADHG Ó CEARBHAILL, *Secretary, Department of Labour.*

REV. E. F. O'DOHERTY, M.A., B.D., PH.D., *Professor, Department of Logic and Psychology, University College, Dublin.*

D. P. O'MAHONY, M.A., PH.D., B.L., *Professor, Department of Economics, University College, Cork.*

LABHRAS Ó NUALLAIN, D.ECON.SC., *Professor of Economics, University College, Galway.*

*W. J. L. RYAN, M.A., PH.D., *Professor of Political Economy, Trinity College, Dublin.*

P. G. SHERRY, M.SC., PH.D., *Confederation of Irish Industry.*

T. WALSH, D.SC., *Director, An Foras Taluntais.*

*Members of Executive Committee.

Regional Employment Patterns in Northern Ireland

WILLIAM BLACK and CLIFFORD W. JEFFERSON

Regional Employment Patterns in Northern Ireland

Copies of this paper may be obtained from The Economic and Social Research Institute (Limited Company No. 18269), *Registered Office:* 4 *Burlington Road, Dublin* 4, *Ireland.*

Price £1.00

(*Special rate for students,* £0·50)

The authors are on the staff of The Queen's University, Belfast. The paper has been accepted for publication by the Institute, which is not responsible for either the content or the views expressed therein.

CONTENTS

Regional Employment Patterns in Northern Ireland

WHILE much regional development policy is still concerned with the promotion of manufacturing industry there has been an increasing awareness during the past decade of the contribution to employment opportunities which can be made by the development of service industries. The important role to be played by the growth of service employment has been clearly recognised in the Northern Ireland Development Programmes: the programme for 1964–69[1] predicted a growth of some 30,000 service jobs; the programme for 1970–75[2] more conservatively suggested an expansion of the order of 15,000. Such estimates as have been made of longer term employment growth in the province also emphasise the importance of services. Recent estimates suggest that as much as 60 per cent of the employment growth that could reasonably be expected during the next two decades will probably be in the services sector.[3]

As yet, however, the forces determining the growth of service employment are not very clearly understood. This is so at a national level: it is even more so at regional and local levels. Yet the extent to which autonomously established industry can generate service employment is of critical concern for economic and physical planning. The importance of the multiplier process in the generation of service industry is obvious, but the validity of the multiplier approach to the analysis of employment patterns at the intra-regional area level depends upon the establishment of a stable relationship between autonomous and induced industry in existing centres of population. It is not necessary that the relationship should be identical for all centres for, as the economic geographers have told us[4], different towns play different roles in the life of the community and one would not expect wholesale distribution, for example, to bear the same relationship to total employment in a small village and a large town. But if the relationship is to be of use for prediction then it must be a reasonably stable function of a small enough number of variables.

The identification of this relationship is, in a sense, a cross-section approach to the service-manufacturing, or more generally the induced-autonomous multiplier. It is an approach which has been pioneered in Ireland by the work

[1] *Economic Development in Northern Ireland*, Cmd. 479, Belfast HMSO, 1965.
[2] *Northern Ireland Development Programme* 1970–75, Belfast, HMSO, 1970.
[3] *The Northern Ireland Economy*, N. Cuthbert, Inaugural Lecture, The Queen's University, Belfast, 1970.
[4] See for example, B. J. L. Berry and W. L. Garrison, "The Functional Basis of Central Place Hierarchy", *Economic Geography*, Vol. 34, pp. 145–154.

of Baker[5] at The Economic and Social Research Institute in Dublin, and what follows owes a great debt to that work. Baker was mainly interested in testing the hypothesis that agriculture is less efficient in inducing secondary employment than other types of autonomous activity. In this paper that possibility is considered, along with others, in an attempt to establish a stable relationship between autonomous and induced employment.

The broad hypothesis which is tested is that within centres of population, appropriately defined, there is a stable relationship between employment in industrial sectors which may, from the point of view of the centre concerned, be regarded as autonomous, and employment in other industrial sectors, which following accepted usage, may be described as induced. The basis on which a sector is defined as induced is that the demand for its output arises within the centre concerned: all other sectors are regarded as autonomous. It will be readily apparent that the dichotomy involved here is similar to the distinction between export and domestic industry in export base models.

Although the analysis was initially carried out in terms of employment the underlying mechanism by which employment is induced operates through income. Factor receipts in autonomous industry, arising from expenditure which originates outside the centre under consideration, provide the income which is the basis of the demand for the output of induced industry. Employment is thus being used as a proxy for factor incomes in the industries concerned; employment in autonomous industry is a proxy for income resulting from expenditure arising outside the centre and employment in induced industry as a proxy for income arising from local expenditure on local industry.

It must be recognised, however, that factor income per head varies substantially from one industry to another, and that in consequence employment can be only an approximate indicator of the expenditure flows. A difference in income per head between autonomous and induced industry would not be a critical obstacle if it were uniform between centres[6]. Difficulties arise because there are differences in income per head between the constituent elements of the sectors and differences in the weighting of the elements in the various centres. Thus autonomous industry in one centre may be dominated by a high-

[5] T. J. Baker, *Regional Employment Patterns in the Republic of Ireland*, Paper No. 32, The Economic and Social Research Institute, Dublin: 1966.

[6] In income terms the basic multiplier relationship can be written $Y_t = \frac{Y_a}{1-k}$ or $\frac{Y_t}{Y_a} = k$ where Y_a is autonomous income, Y_t total income and induced income $Y_i = KY_t$. On the assumption that average income per head in the autonomous sector, $\frac{Y_a}{E_a}$ is β_a and average income per head in the induced sector $\frac{Y_i}{E_i}$ is β_i the corresponding employment relationship can be written $\frac{E_i}{E_i + E_a} = \frac{k\beta_a}{(1-k)\beta_i + k\beta_a}$ i.e. provided that output per head in each sector is the same for all centres the relationship between induced and total employment depends only on the values of the expenditure and output per head coefficients.

earning industry with a correspondingly high leverage power per employee to induce local industry while another centre with the same number engaged in low-income autonomous industry may have a smaller induced sector.

The ideal answer to this problem would be to calculate the induced-autonomous ratio in terms of income rather than employment. Unfortunately, only fragmentary information on incomes is available for the centres concerned, whereas very detailed information on the geographical distribution of employment is available from the Census of Population. The main body of the investigation was therefore carried out in terms of employment but in the last section of the paper an attempt was made to recast the analysis in terms of income indicators.

The analysis fell into two main stages. In the first, attention was directed to the problems of distinguishing between induced and autonomous employment and to the problems of identifying meaningful economic regions. The second stage recognised the possibility that the proportion may be influenced by factors other than those which have been taken into account in the classifications of industries and regions. Regression analysis was used to test the responsiveness of the proportion to a number of independent variables.

The Data: Employment Classifications and Economic Regions

THE basic data used for the analysis were the numbers of persons in full-time employment classified by trade groups and recorded for each local authority area in the Northern Ireland Census of Population for 1966.

As a first step in the investigation this data had to be arranged to fit the conceptual framework implied by the model; the employment groups had to be classified as either autonomous or induced and the geographical areas within which the multiplier process could be expected to operate had to be defined. The two classifications are not independent: for very small areas the proportion of induced to total employment is likely to be low since a large proportion of total demand will originate outside the area. It seems probable that up to some limit the size of the area and the proportion of induced employment in the total will be positively correlated. It was important therefore to choose areas which were sufficiently large to permit the existence of every type of induced activity.

The main conceptual problems in the distinction between autonomous and induced industry had already been explored in considerable detail by Baker.[7] As has been noted the essential characteristic of autonomous industry is that its factor receipts originate outside the centre concerned. It was not much of an approximation, therefore, to proceed on the basis that all manufacturing industry is autonomous. Indeed, even from the point of view of Northern Ireland as a whole most manufacturing industry could be regarded as autonomous. A larger proportion of agricultural than of manufacturing output is consumed at home but for any population centre significantly smaller than the Province as a whole, agricultural employment can also be treated as autonomous. This view is reinforced by the fact that wherever the output is sold a large proportion of factor incomes in agriculture originate in the public sector, that is, as far as the expenditure decision is concerned, originate outside the centre, in the form of guarantee payments and subsidies.

The main service trades which must be treated as autonomous are those provided by the public sector, public administration, medical and dental services and educational services. To distinguish them from the Commercially Autonomous groups, Agriculture and Manufacture, these trades are described as Socially Autonomous. There is an obvious sense in which in the long run the numbers employed in the provision of medical and educational services is determined by the *population* of the centre concerned and might therefore be

[7] *Op. cit.*

said to be a response to demand within the centre. But, viewed in the short run context of the income multiplier, *expenditure* on these services arises outside the centre, and that expenditure, and the corresponding employment which it generates must therefore be considered as autonomous.

Amongst the industries which can, with reasonable confidence, be classified as being mainly dependent on local demand are Distribution, Professional activities such as Legal and Accounting Services and certain Miscellaneous Services such as laundries, garages, betting shops, etc. These reasonably clear-cut assignments, together with the industries which have already been identified as autonomous, accounted for more than 80 per cent of all employment in 1966.

This left a number of industrial groups, Gas, Electricity and Water, Transport and Communications, Construction and Catering which resisted precise classification on the basis of the origin of demand. Employment in a town gas works, for example, is almost certainly best treated as induced, but employment in an electricity generating station or on the maintenance staff of a reservoir is likely to be autonomous. In the absence of detailed information Baker's lead was followed and the Gas, Electricity and Water Order was assigned to the induced sector. Similarly Transport and Communications probably includes both autonomous and induced elements but on balance it was thought best to assign the whole Order to the induced sector.

Baker was able to disaggregate Construction, distinguishing between public building, which he assigned to the autonomous sector and private building which he treated as induced. No similar breakdown was available for Northern Ireland: construction in total had to be assigned to one sector or the other. The decision was finally made on the basis of the figures for gross fixed capital formation: 64 per cent of construction output in Northern Ireland was financed by public funds in 1966.[8] On the basis of this evidence, and recognising the approximation involved, construction was assigned to the autonomous sector.

In the catering trade employment in hotels and boarding houses which can be attributed to the provision of overnight accommodation might reasonably be treated as autonomous on the presumption that anyone living within a centre is unlikely to stay in a hotel there. Employment in restaurants and bars, however, is probably largely induced. Moreover, the relative importance of the two classifications is likely to vary substantially from centre to centre; where tourism is important as, for example in a seaside resort, the catering trade is likely to be largely autonomous, elsewhere it is likely to be largely induced. The census data did not distinguish between the various sub-groups in the Catering total but since it was apparent from alternative evidence[9] that

[8] *Northern Ireland Digest of Statistics*, No. 38, Sept. 1972, Table 110.

[9] A survey of employment for the Catering Industry Training Board, carried out by the Ministry of Health and Social Services, showed that in 1966, Hotels, Guest Houses and Boarding Houses accounted for 18·3 per cent of all catering employment.

hotels and boarding houses accounted for a relatively small proportion of employment in the total the whole industry was assigned to the induced sector.

The details of the classifications of activities as autonomous or induced are shown in Appendix 1.

The limitations imposed by the data on the accuracy of the division between autonomous and induced activities obviously have to be taken into account in the statistical testing of the model. Two types of check have been employed. First, where it seemed likely to be an important consideration the effect on the results of reallocating the marginal industrial groups between the autonomous and induced classifications has been investigated. The results are reported at appropriate places in the text. Secondly, the possibility that certain activities such as Catering might have a greater tendency to be autonomous in tourist areas than elsewhere was investigated in the regression analysis.

The requirement that Baker used in his specification of economic regions is twofold: a region should be large enough to give the opportunity for every type of economic activity to be represented in it but not so large as to represent a significant proportion of national demand. A third consideration is that, as far as possible, a region should be an economic unit. County data, such as those used in the Baker study, do not meet this consideration. This is not simply a matter of size: a county will normally be large enough to meet the first two requirements, but county boundaries may well cut across natural economic units dividing towns from their hinterlands and thereby producing heterogeneous groupings of parts of economic units. In the context of the analysis presented here the characteristic of an economic unit is that autonomous activity and the consequential induced activity, as defined for the purposes of the analysis, should be located in the same area.

The concepts of Central Place Theory in which settlements are regarded as central places providing services for the population of a surrounding area are relevant to the definition of the spatial characteristics of such an economic unit. This approach has been much used by economic geographers as a starting point in the analysis of settlement systems.[10] At the same time the notion of a town and its hinterland as an entity provides the ideal economic unit for the analysis of the autonomous-induced employment. In practice this involves defining the basic areas for analysis in such a way that there is a settlement of significant size in each and that the settlement occupies a reasonably central position in so far as the provision of services is concerned.

The geographical breakdown of the 1966 Census provides detailed employment classifications for 67 administrative areas (36 County Boroughs and Urban Districts and 31 Rural Districts). It was clear from the outset that these

[10]B. J. L. Berry and A. Pred, Central Place Studies, *Regional Science Research Institute Bibliography*. Series I.

units would not meet the specifications required for the model: the economic regions had to be produced by amalgamating administrative areas. A preliminary arrangement in which Rural Districts were grouped around towns resulted in 23 regions which, for the purposes of the analysis, will be described as Urban Centres. In a number of cases where towns were close together, e.g. Portadown and Lurgan or Coleraine, Portrush and Portstewart, they were treated jointly as the nucleus of one Urban Centre.

The existence in the 1966 Census of an analysis of labour mobility[11] in which place of residence was cross-classified by place of employment at the level of administrative areas provided an opportunity for a further test on the suitability of the defined Urban Centres. In Table 1 the administrative area data were amalgamated for Urban Centres and the table shows the proportion of the engaged labour force resident in each centre which is also employed in the

TABLE 1: *Working Population: Place of Work and Place of Residence*

Urban Centre		*Percentage of resident labour force working in Urban Centre*	
Belfast	Greater Belfast	90·5	94·1
Lisburn		44·3	
North Down		65·7	
Londonderry	Greater Londonderry	94·8	93·2
Limavady		69·8	
Craigavon	Greater Craigavon	85·7	86·2
Tandragee		53·8	
Ballymena		85·5	
Cookstown		83·4	
Newry		84·5	
Omagh		92·2	
Enniskillen		95·9	
Larne		71·7	
Antrim		71·6	
Coleraine		88·7	
Armagh		88·6	
Downpatrick		76·0	
Dungannon		89·1	
Banbridge		73·8	
Ballymoney		70·2	
Strabane		84·4	
Newcastle		70·7	
Ballycastle		77·0	

Source: Northern Ireland Census of Population 1966, General Report. Table 19.

[11] *Northern Ireland Census of Population*, 1966, General Report. Table 19.

centre. Four urban Centres, Lisburn, North Down, Limavady and Tandragee have less than 70 per cent correspondence between place of residence and place of employment: the first two are dominated by Belfast, the third by Londonderry and the fourth by Craigavon. Clearly, these centres do not meet the required specifications for an economic region and they have, accordingly, been combined with their dominant centres. This left a number of Centres with residence-employment correspondence of less than 80 per cent. Some of these, e.g. Larne and Antrim, are strongly influenced by commuting to Belfast: the others, Banbridge, Newcastle, Downpatrick, Ballymoney and Ballycastle have more diverse outside connections. Nevertheless, it was felt that the areas possessed sufficient identity to treat them as individual Urban Centres. The details of the administrative areas comprising the resulting 19 Centres are set out in Appendix 2 and their geographical location shown on the map in Appendix 3.

Finally, it was recognised that Greater Belfast, which accounted for more than 50·6 per cent of total employment in the Province, did not meet the criterion that no region should be so large as to represent a significant proportion of national demand. Moreover, there is a sense in which Belfast might best be regarded as a centre of higher order than the others, providing not only those services which are induced within its area but services for the country as a whole. For this reason most of the statistical analysis was concentrated on the remaining 18 Urban Centres.

Urban Centre Employment Patterns

PROPORTIONS of total employment in each Urban Centre classified by type of economic activity are shown in Table 2. The details of employment in each trade group from which the table was constructed are shown in Appendix 4. The central hypothesis of the analysis is that the proportion of induced to total employment is stable, or at least is a stable function of a relatively small number of independent variables. The definitions of centres and of types of employment did in fact achieve some degree of stability: leaving aside Belfast the proportion varied from 23·0 per cent in Antrim to 35·7 per cent in Coleraine; the mean proportion was 27·9 per cent, the standard

TABLE 2: *Employment Patterns in Urban Centres, 1966*
(Percentage of total employment in each Centre)

	Autonomous				*Induced*
	Agriculture	*Other Commercial*	*Social*	*Total*	
Belfast	1·9	46·8	14·7	63·4	36·6
Londonderry	8·2	41·3	20·4	69·9	30·1
Craigavon	7·9	56·5	9·6	74·0	26·0
Ballymena	15·2	44·1	12·6	71·9	28·1
Cookstown	26·7	38·4	10·5	75·6	24·4
Newry	19·5	35·4	12·0	66·9	33·1
Omagh	34·6	21·0	17·0	72·6	27·4
Enniskillen	38·6	20·6	15·7	74·9	25·1
Larne	8·9	46·4	10·7	66·0	34·0
Antrim	12·6	47·7	16·8	77·1	22·9
Coleraine	15·0	35·8	13·5	64·3	35·7
Armagh	23·6	32·8	17·9	74·3	25·7
Downpatrick	16·4	34·6	23·5	74·5	25·5
Dungannon	20·5	41·6	11·8	73·9	26·1
Banbridge	19·4	47·7	8·9	76·0	24·0
Ballymoney	24·8	35·6	11·2	71·6	28·4
Strabane	22·3	43·2	9·9	75·4	24·6
Newcastle	21·1	32·8	13·3	67·2	32·8
Ballycastle	31·8	25·7	13·6	71·1	28·9
Mean of 18 centres (excl. Belfast)	20·4	37·8	13·8	72·1	27·9
Northern Ireland	10·10	43·07	14·50	67·67	32·33

deviation 3·8 per cent and the co-efficient of variation 13·6 per cent. This showed a considerable improvement over the amount of variation when the analysis was conducted in ungrouped administrative areas: the coefficient of variation for the administrative areas other than Belfast County Borough was 29·2 per cent. It is also worth noting that the dispersion of the induced proportion in Northern Ireland Urban Centres was much lower than the dispersion of the 1961 Irish County data used by Baker, which had a coefficient of variation of 23 per cent.[12]

The main divergences from the mean of the 18 Centres were apparent in Coleraine, Larne, Newry and Newcastle all of which had induced proportions in excess of 30 per cent and in Antrim, Cookstown, Strabane and Banbridge which had proportions under 25 per cent. The common characteristic of the first four is that they are, to a greater or lesser extent, tourist resorts. In these areas the proportions of the labour force engaged in Catering, Retail Distribution, and Miscellaneous Services were very much higher than the average for the country as a whole. But this does not invalidate the hypothesis; it simply reflects the fact that much service employment in tourist centres is autonomous rather than induced. Unfortunately, it is not possible to deal with this problem by reclassifying that part of Catering employment which exists to meet tourist demands, for there is no way of identifying it. Treating Catering as autonomous in all Urban Centres gave a marginal reduction in the coefficient of variation of the induced proportion to 12·48 per cent but this was at the obvious cost of incorrectly classifying much of Catering employment in non-tourist centres. The problem is, however, too important to ignore and an attempt was made to deal with it in the regression analysis which is reported below.

The induced proportions which were distinctively lower than average seem more likely to reflect problems in the spatial definition of centres than problems of industrial classification. A low-induced ratio may reflect the fact that the Urban Centre concerned falls within the service orbit of a nearby major Urban centre and it is noticeable that three of the four centres with the lowest induced proportion, Antrim, Banbridge and Strabane are very close respectively to Belfast, Craigavon and Londonderry.

As expected Belfast has the largest proportion of induced to total employment with 36·6 per cent. This is due to the size and what might be described as the "head office" effect of the capital city. The city provides specialised services for the Province as a whole and the proportion employed in agriculture is minute. Clearly Belfast must be regarded as a centre of higher order and different character to the other 18 centres.

Because the sum of the induced and autonomous proportions is 100, the dispersion of the induced proportion about its mean mirrors the dispersion of

[12] *Op. cit.* Calculations based on Table 2, page 7.

the autonomous proportion about its mean. The various sub-groups of autonomous activity are, however, free to vary and the coefficients of variation for the sub-group proportions, 40·0 per cent for Agriculture, 26·0 per cent for Non-agriculture Commercially Autonomous and 28·0 per cent for Socially Autonomous were all higher than that for the induced proportion. The economy of an Urban Centre may be based mainly on agriculture, as in Omagh or Enniskillen, on manufacturing, as in Craigavon or Larne or on socially autonomous activities as in Downpatrick which is a county administrative centre and the site of a major hospital. Whether or not there are significant variations in the inductive powers of differing autonomous activities will be discussed below.

Little change in the general picture resulted from a reclassification of construction as an induced rather than an autonomous activity. The coefficient of variation of the induced proportion was reduced to 12·8 but to a large extent this reflected the increase in the mean value of the revised induced series, 40·8 per cent.

While the results of this first stage of the analysis might be regarded as being consistent with the broad hypothesis under consideration, and while explanations can be offered for some of the dispersion of the induced employment proportions about their mean, the amount of variation in the cross-section of proportions was still large. The purpose of the next section is to explore the extent to which this variation can be explained by the introduction of independent variables not yet taken into account.

The Regression Analysis

BEFORE proceeding to the regression results it may be helpful to direct attention to the underlying logic of this section of the investigation. The variations in the induced proportions of employment in the cross-section of urban centres can be ascribed to three main types of influence, (*a*) those which arise because the multiplier model does not specify adequately all the causal forces operating, (*b*) those which arise systematically because it is not possible to fit the data perfectly to the requirements of the model and (*c*) those which arise because of random factors.

Amongst the possibilities which were candidates for investigation in group (*a*) was the hypothesis that is central to Baker's work, that some sectors of autonomous industry, notably agriculture, are less effective than others in the induction of secondary employment. Baker found that for the Republic of Ireland the proportion of autonomous employment in Agriculture exerted a significant influence on the proportion of total employment that is induced, an influence which he explained partly in terms of the relatively low level of agricultural incomes and partly in terms of the propensity of farmers to spend a smaller proportion of income than the rest of the community on locally induced services. It seemed desirable to investigate whether similar influences operate in Northern Ireland.

To the extent that it is the level of income that explains the differential inductive power of agriculture a more general hypothesis can be developed: the proportion of employment that is induced is a positive function of the average level of income in the autonomous sector, or, since induced activities also act to induce employment, of the average level of income in the urban centre as a whole. Preliminary tests of this hypothesis were unsatisfactory, however, and reflection suggested that the hypothesis was inadequately specified. For, while the level of income per head may effect the division between autonomous and induced activities it will also be the result of that division. Clearly a more systematic formulation of the income hypothesis is required: this is attempted in the final section of the paper.

Analysis by further specification of the urban centres also falls into type (*a*). There were two obvious hypotheses to be tested here. The first is that the proportion of employment that is induced is a function of the size, i.e. the total population, of the urban centre. In a sense this is merely an extension of the line of argument that led to the decision to exclude Belfast from the statistical analysis: the larger the centre the greater the range of specialised services

provided. But the argument must be treated with caution, for some of the specialised services, such as those in Education or Medicine might just as easily be autonomous in a large centre as induced. There was, however, a wide range of urban centre sizes, even excluding Belfast, ranging from Londonderry with a population of 104,500 to Ballycastle with population 11,000, and the simple hypothesis that the induced proportion increases with size seemed worth testing.

The second hypothesis is closely related to the first: it is that the proportion of total employment that is induced is affected by the distance of the urban centre from Belfast. The closer a centre is to Belfast the more likely it is that its residents will use Belfast for some of the specialised services which the large centre provides. In consequence it is to be expected that the induced proportion will be positively correlated with distance from the capital city.

Under type (*b*), variations in the induced proportion arising from the nature of the data, there were two further areas worth exploring. In the previous section the possibility was suggested that a number of employment groups which have been classified as induced might be mainly autonomous in tourist areas. An attempt was made to ascertain the importance of this influence by assigning a dummy variable to specified tourist centres in the regressions.

Similarly, the problems arising from uncertainty about the sectoral classification of Construction have already been mentioned. There is no obvious way of dealing with this problem by specifying independent variables in the regression analysis which will distinguish between centres where Construction is mainly autonomous and those where it is mainly induced. In view of the fact, however, that the coefficient of variation of the induced proportion was slightly reduced by shifting all construction from the autonomous Sector to the induced Sector it seemed desirable to examine the effects on the regressions of treating all construction employment as induced.

Tests of the various hypotheses involved regressions of the induced proportion of employment on the following independent variables for each urban centre; the proportion of total employment in agriculture, total population, distance from Belfast and a dummy variable indicating the specification of a centre as a tourist area. Each test was carried out on two alternative bases, one with construction treated as an autonomous activity designated as Series A, the other with construction treated as induced, Series B.

The values of the independent variables for the eighteen urban centres are set out in Table 3. Distance is measured in terms of the distance between the largest town within each Urban Centre and Belfast. Newcastle, Ballycastle, Larne, Coleraine and Newry all include major seaside resorts and have been specified as tourist areas. Employment in agriculture is expressed as a proportion of total employment. Population is simply the sum of the Census figures for the administrative areas constituting each urban centre.

TABLE 3: *Population, Distance from Belfast, and Proportion Employed in Agricultural, (18 Urban Centres)*

	Distance from Belfast (miles)	*Tourist Area Dummy*	*Total Population ('000)*	*Proportion of Agricultural to Total Employment (per cent)*
Londonderry	75	0	104·5	8·2
Craigavon	24	0	66·3	7·9
Ballymena	28	0	48·0	15·2
Cookstown	45	0	53·5	26·7
Newry	38	1	57·9	19·5
Omagh	73	0	56·9	34·6
Enniskillen	86	0	49·9	38·6
Larne	21	1	41·2	8·9
Antrim	17	0	37·2	12·6
Coleraine	55	1	41·0	15·0
Armagh	37	0	39·9	23·6
Downpatrick	22	0	36·9	16·4
Dungannon	43	0	33·4	20·5
Banbridge	24	0	28·1	19·4
Ballymoney	47	0	25·6	24·8
Strabane	81	0	25·7	22·3
Newcastle	44	1	20·4	21·1
Ballycastle	55	1	11·0	31·8

The results of the simple regressions for the 18 urban centres are shown in Table 4. For any particular dependent variable series the usual statistical criterion for choosing the best regression set is the coefficient of correlation, R, where R^2 is a measure of the proportion of the variation about the regression plane that is "explained" by the regression equation. It is also useful in the present context to have, for comparative purposes, a measure of absolute unexplained variation in each series relative to the mean of the series. The measure chosen for this purpose was the standard error of the estimate divided by the mean of the series under consideration: the resulting statistic has been defined as the coefficient of unexplained variation. The coefficient of variation is a standardised proportionate measure of dispersion about the mean; the coefficient of unexplained variation is a similarly standardised measure of dispersion about the regression plane.

TABLE 4: *Regression Results: Ratio of Induced to Total Employment as the Dependent Variable (18 Urban Centres)*

Independent Variables	*Coefficient of Correlation*		*Coefficient of Unexplained Variation*	
	Series A	*Series B*	*Series A*	*Series B*
Population (Pop)	·084	—·191	13·95	13·13
Tourist Area Dummy (Dum)	·837	·853	7·67	6·98
Proportion in Agriculture (Farm)	—·252	—·133	13·55	13·26
Distance from Belfast (Dis)	·045	—·075	13·98	13·34
Pop Dum	·897	·784	6·40	8·54
Pop Dum Farm	·899	·855	6·56	7·41
Pop Dum Dis	·898	·854	6·58	7·44
Pop Dum Farm Dis	·909	·856	6·46	7·67

Of the independent variables taken singly in the regressions only the Dummy variable, identifying a tourist area, added anything to the explanation. For Series A each of the other single variable regressions gave a coefficient of unexplained variation not very different from the simple coefficient of variation about the mean of the Series, which, it will be recalled, was 13·6 per cent. The same broad results were obtained for Series B. The tourist area variable, with a coefficient of correlation of 0·837 for Series A, was significant at the 0·01 per cent level; the coefficient of unexplained variation was 7·67 per cent. With Series B the improvement was even more pronounced, the coefficient of unexplained variation was 6·98 per cent.

The obvious next step was to test the effects of combinations of the independent variables in a multiple regression analysis. Experiments were carried out with various combinations using stepwise and *ad hoc* procedures; the results shown in Table 4 are those which gave best fit judged either by the coefficient of multiple correlation R, or by the coefficient of unexplained variation. The stepwise procedure at the 0·05 level of significance admitted only the Tourist Area Dummy (Dum) and Population (Pop). The equation (with the t ratios in parentheses) was

$$\underset{\text{(per cent)}}{\text{Induced Employment Proportion}} = 23{\cdot}2 + \underset{(7{\cdot}8)}{7{\cdot}6\ \text{Dum}} + \underset{(2{\cdot}82)}{0{\cdot}06\ \text{Pop}}$$

With a correlation coefficient of 0·897 this equation was successful in explaining the major part of the variation about the mean of the series. The signs of the coefficients were as expected from the hypotheses tested: a centre identified as a tourist area could be expected to have an induced proportion 7·6 percentage

points higher than a non-tourist centre; each thousand of population added 0·06 percentage points to the proportion. A comparison of actual induced proportions with those estimated on the basis of the two-variable equation is shown in Table 5.

TABLE 5: *Induced Employment as a Proportion of Total Employment*

Urban Centres	*Induced Employment*		
	Estimated Proportion	*Actual Proportion*	*Difference*
Londonderry	29·5	30·1	−0·6
Craigavon	27·2	26·0	1·2
Ballymena	26·1	28·1	−2·0
Cookstown	26·4	26·4	2·0
Newry	34·3	33·1	1·2
Omagh	26·6	27·4	−0·8
Enniskillen	26·2	25·1	1·1
Larne	33·3	34·0	−0·7
Antrim	25·4	22·9	2·5
Coleraine	33·3	35·7	−2·4
Armagh	25·6	25·7	−0·1
Downpatrick	25·4	25·5	−0·1
Dungannon	25·2	26·1	−0·9
Banbridge	24·9	24·0	0·9
Ballymoney	24·7	28·4	−3·7
Strabane	24·7	24·6	0·1
Newcastle	32·1	32·8	−0·7
Ballycastle	31·5	28·9	2·6

The addition of the Proportion Employed in Agriculture (Farm) as an independent variable improved the fit marginally but as can be seen from the regression equation while the coefficient of Farm was negative as expected but it was not statistically significant.

$$\underset{\text{(per cent)}}{\text{Induced Employment}} = 24{\cdot}1 + \underset{(7{\cdot}37)}{7{\cdot}52}\ \text{Dum} + \underset{(2{\cdot}33)}{0{\cdot}06}\ \text{Pop} - \underset{(0{\cdot}56)}{0{\cdot}03}\ \text{Farm}$$

It will be apparent from the results shown in Table 4 that the addition of Distance from Belfast to the combination of Tourist Dummy and Population as independent variables gave a regression fit only slightly poorer than the combination, Dum, Pop, Farm. Combining all four independent variables in the multiple regression did produce marginal improvement in the correlation

coefficient but as the regression equation shows none of the independent variables other than Dum was statistically significant.

$$\underset{\text{(per cent)}}{\text{Induced Proportion}} = 24{\cdot}6 + \underset{(7{\cdot}20)}{7{\cdot}33\ \text{Dum}} + \underset{(1{\cdot}36)}{0{\cdot}04\ \text{Pop}} - \underset{(1{\cdot}24)}{0{\cdot}09\ \text{Farm}} + \underset{(1{\cdot}19)}{0{\cdot}03\ \text{Dis.}}$$

Part of the reason for this result may have been that there was some correlation between the independent variables, Farm and Dis: the proportion of total employment in agriculture increases with distance from Belfast. The coefficient of simple correlation between the two series was 0·571.

Finally, it is clear from Table 4 that Series B, with Construction treated as induced rather than autonomous, gave poorer results in all of the multiple regressions than Series A. Even in the simple regression involving the Tourist Area Dummy the apparently lower value for the coefficient of Unexplained Variation for Series B is mainly a reflection of the higher value of the Mean of the Series. The Standard Error of Estimate for B was 2·2 compared with 2·1 for Series A. It can be concluded therefore that there is nothing to be gained from reclassifying construction as an induced activity: given the deficiencies of the data classification of construction as autonomous is the least unsatisfactory procedure.

Gross Domestic Product Patterns in Urban Centres

ALTHOUGH the analysis to this point was carried out in terms of employment it was recognised at the outset of the paper that the underlying mechanism by which industry is induced operates through income. As in many multiplier analyses employment was used as a proxy for income. A systematic investigation of the possibility that the relationship between induced and autonomous activities may be affected by the relative levels of income in each involves a direct approach to the underlying mechanism by carrying out the analysis in terms of income, that is, by testing the general hypothesis that there is a stable relationship between income generated in induced activities and total income generated in appropriately defined urban centres.

The reason this approach was not adopted at the outset was the absence of reliable income data on a regional basis in Northern Ireland. What must be explored here is whether proxy indicators of income add to the explanation in terms of employment. The bases of the indicators are the estimates of gross domestic product by industrial sector which are published annually for Northern Ireland as a whole.[13] On the assumption that the average product per person employed in each sector is the same for all urban centres estimates of gross domestic product generated by autonomous and induced activities can be produced for each centre.

Differences in average gross domestic product per head between centres can be decomposed into two elements, one, the result of differences in product per head in the same industry in different centres, the other the result of differences in industrial composition in different centres. The procedure adopted here ignores differences due to the first element and takes into account only differences arising from the second. For this reason the estimates must be regarded as very approximate indicators of income. But the fact that the estimates take into account differences in industrial weighting between centres should render them a more efficient measure of autonomous and induced activities than employment. For the assumptions involved in using employment are not only that there is the same average product per head in similar industries across the country but that there is the same average product per head in different industries in the same centre. In the analysis of the autonomous-

[13]The sectoral breakdown of the published estimates does not correspond to the industrial groupings used in the analysis. Unpublished estimates at a more detailed level of classification were made available by the Economic Section of the Northern Ireland Ministry of Finance. These are shown in Appendix 1.

induced multiplier relationship the efficiency of the proxy income estimates are clearly poorer than accurate urban centre income data but probably somewhat better than employment. From this point of view it seemed desirable to investigate the effects of recasting the analysis in terms of the income estimates.

The results of classifying income generated by type of activity for the specified urban centres are set out in Table 6. To facilitate comparison with the employment data the proportion of induced activity calculated on the basis of employment is shown beside the corresponding measure calculated on the basis of income. In every case the income proportion was higher than the employment proportion, reflecting the general tendency for average incomes in the induced sectors to be higher than those in the autonomous sectors. The average income proportion for the eighteen centres other than Belfast was 29·7 per cent compared with an average employment proportion of 27·9 per cent. But the difference varied substantially from one centre to another, from 0·4 percentage points in the case of Craigavon to 3·5 per cent points in Ballycastle.

The main reasons for the differences stem from two industrial sectors, Agriculture and Miscellaneous Services. Because gross domestic product per person employed is low in Agriculture relative to other sectors the induced proportion in those Urban Centres where there is heavy concentration on Agriculture, such as Omagh or Enniskillen was raised substantially by recalculating in terms of income. Similarly, because GDP per head in Miscellaneous Services is high relative to average incomes earned in the autonomous sector the induced proportion in centres where there is heavy concentration on Miscellaneous Services such as the tourist areas or Londonderry was raised substantially by recalculating in terms of income. To the extent that the income proxy estimates are accurate these changes should reflect a reduction in the bias introduced by using the employment data.

But the reformulation of the analysis in terms of income did not, at this stage, produce any improvement in fit of the data to the general model. The dispersion of the induced income proportion about its mean was slightly greater than the dispersion of the induced employment proportion: the coefficient of variation for the income series was 14·0 per cent compared with 13·6 per cent for the employment series.

The regression analysis did, however, produce an improvement in results. The stepwise regression procedure at the 0·05 level again admitted only the Tourist Area Dummy and Population, but the fit was improved with a correlation coefficient of 0·922. The equation was

$$\underset{\text{(per cent)}}{\text{Induced income proportion}} = 24{\cdot}97 + \underset{(2{\cdot}56)}{0{\cdot}05\ \text{Pop}} + \underset{(9{\cdot}20)}{8{\cdot}65\ \text{Dum}}$$

Inclusion of the proportion employed in agriculture with the independent variables produced virtually no improvement in fit with the coefficient of correlation again rounded to 0·922. The equation was

$$\underset{\text{(per cent)}}{\text{Induced Income Proportion}} = 24{\cdot}90 + 8{\cdot}66\ \underset{(8{\cdot}73)}{\text{Dum}} + 0{\cdot}05\ \underset{(2{\cdot}30)}{\text{Pop}} - 0{\cdot}002\ \underset{(0{\cdot}05)}{\text{Farm}}$$

TABLE 6: *Autonomous and Induced Income generated in Urban Centres (percentage of total income generated in each Centre)*

	Autonomous Income Proportion	*Induced Income Proportion*	*Induced Employment Proportion*	*Differences in Income and Employment Induced Proportions*
Belfast	62·2	37·8	36·6	1·2
Derry	68·4	31·6	30·1	1·5
Craigavon	73·3	26·7	26·3	0·4
Ballymena	71·1	28·9	28·1	0·8
Cookstown	74·1	25·9	24·4	1·5
Newry	65·2	34·8	33·1	1·7
Omagh	70·8	29·2	27·4	1·8
Enniskillen	72·5	27·5	25·2	2·3
Larne	63·5	36·5	34·0	2·5
Antrim	75·7	24·3	22·9	1·4
Coleraine	62·2	37·8	35·7	2·1
Armagh	73·0	27·0	25·7	1·3
Downpatrick	72·8	27·2	25·5	1·7
Dungannon	73·1	26·9	26·1	0·8
Banbridge	74·3	25·7	24·0	1·7
Ballymoney	70·1	29·9	28·4	0·5
Strabane	74·1	25·9	24·6	1·3
Newcastle	64·3	35·7	32·8	2·9
Ballycastle	67·6	32·4	28·9	3·5
Mean of 18 Centres (excl. Belfast)	70·3	29·7	27·9	1·8
Northern Ireland	66·1	33·9	32·3	1·6

The coefficient of the agricultural proportion was considerably lower than the corresponding coefficient in the employment equation, −0·002 compared with −0·031 and the extremely low value of the *t* statistic suggests that the differential agricultural induction effect is virtually non-existent in the Northern Ireland income series. Presumably a substantial part of whatever influence

agriculture exerted on the employment series was picked up in the transformation to income. There is no evidence that the other factor affecting the employment generating power of agriculture which Baker noted in the Republic, the tendency for farmers to spend a smaller than average proportion of their incomes on induced activities, is present in Northern Ireland.

In general the classification of autonomous and induced activities on the basis of income generated, reinforced the cross section multiplier hypothesis despite the inadequacy of the income data. Further validation using improved income data must await the production of accurate area income estimates for Northern Ireland. In present circumstances it may well be better to rely for practical purposes on the classification of activities based on employment.

Conclusions

1. It is possible to define regions within Northern Ireland which are economic units in the sense that there is, within each one, a predictable relationship between autonomous and induced activities. The regions or, as they are called here, Urban Centres, can be obtained by aggregating the administrative areas for which data are available in the Census of Population.

2. The classification of activities as autonomous or induced can be made on the basis of the details of employment which are available for the appropriately defined Urban Centres. The proportion of employment which is induced shows some variation between centres but much of the variation can be explained by introducing independent variables, particularly the population of the centre and a dummy variable indicating a tourist area.

3. There is very little evidence that the inductive power of agricultural employment is significantly lower than the inductive power of non-agricultural employment in Northern Ireland. There is no evidence that farmers spend a lower proportion of income on induced activities than the rest of the community.

4. Activities can also be classified as autonomous or induced on the basis of income generated but, possibly because only approximate income indicators are available for Urban Centres, the resulting statistical estimates are only slightly better than those for employment data.

5. The estimates produced here are of the average relationship between autonomous and induced employment. For planning purposes it is desirable to have an estimate of the relationships between a given increase in autonomous employment and the corresponding increase in induced employment, i.e. it is desirable to know the marginal or incremental relationship. It may be possible to estimate this from the changes in autonomous and induced employment in Urban Centres through time and the authors propose to attempt this for the period 1966–71 as soon as the detailed results of the 1971 Census of Population are available.

Appendix 1
Industrial Sectors classified as Induced or Autonomous[1]

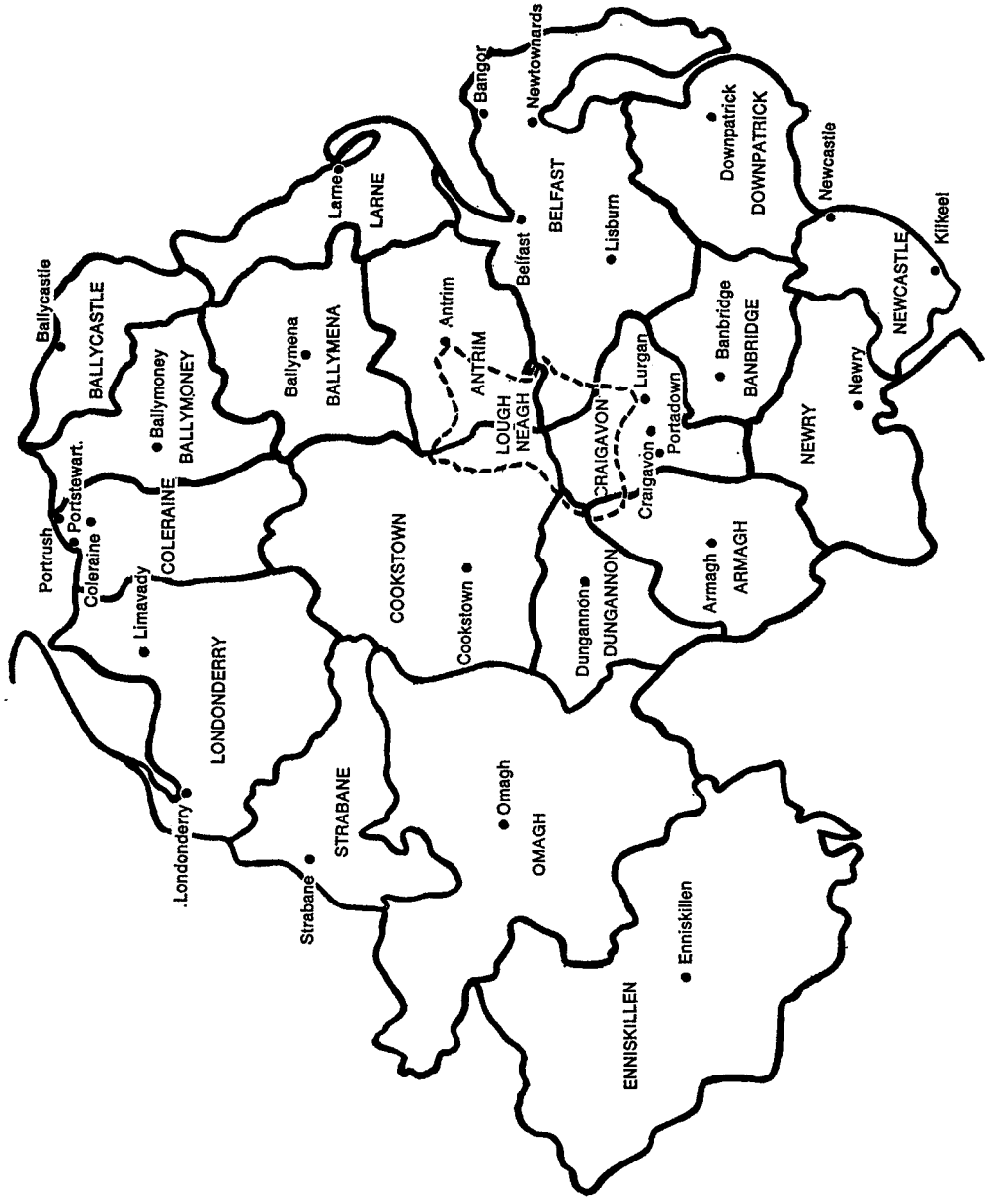
	Order	*Minimum List Heading*	*Gross Domestic Product per person employed* £
Autonomous Sector:			
Agriculture, Forestry, Fishing	I		878
Mining and Quarrying	II		500
All Manufacturing Industry	III–XVI		1,103
Construction	XVII		761
Educational Services		872	1,348
Medical and Dental Services		874	1,111
Public Administration and Defence	XXIV		1,000
Induced Sector:			
Gas, Electricity and Water	XVIII		2,105
Transport and Communication	XIX		1,226
Distributive Trades	XX		869
Insurance, Banking and Finance	XXI		1,146
Accountancy Services		871	1,150
Legal Services		873	
Religious Organisations		875	
Other Professional and Scientific Services		879	
Miscellaneous Services	XXIII		

[1]Standard Industrial Classification, 1958.

Appendix 2

Urban Centres	*Constituent Administrative Areas*	
	County Boroughs and Urban Districts	*Rural Districts*
Antrim	Ballyclare	Antrim
Armagh	Armagh, Keady	Armagh
Ballycastle	Ballycastle	Ballycastle
Ballymena	Ballymena	Ballymena
Ballymoney	Ballymoney	Ballymoney
Banbridge	Banbridge, Dromore	Banbridge
Belfast	Belfast, Carrickfergus, Holywood, Newtownabbey	Castlereagh
Coleraine	Coleraine, Portstewart, Portrush	Coleraine
Cookstown	Cookstown	Cookstown, Magherafelt
Craigavon	Lurgan, Portadown, Tandragee	Lurgan, Moira, Tandragee
Downpatrick	Downpatrick	East Down
Dungannon	Dungannon	Dungannon
Enniskillen	Enniskillen	Enniskillen, Irvinestown, Lisnaskea
Larne	Larne, Whitehead	Larne
Limavady	Limavady	Limavady
Lisburn	Lisburn	Hillsborough, Lisburn
Londonderry	Londonderry, Strabane	Londonderry, Strabane
Newcastle	Kilkeel, Newcastle	South Down
Newry	Newry, Warrenpoint	Newry No. 1, Newry No. 2
North Down	Bangor, Donaghadee and Newtownards	North Down
Omagh	Omagh	Castlederg, Clogher, Omagh

Appendix 3


Bangor
Newtownards
Downpatrick
DOWNPATRICK
Newcastle
Kilkeel
NEWCASTLE
Larne
LARNE
Belfast
BELFAST
Lisburn
Ballycastle
BALLYCASTLE
Ballymena
BALLYMENA
Antrim
ANTRIM
LOUGH NEAGH
Lurgan
Banbridge
BANBRIDGE
Ballymoney
BALLYMONEY
Portstewart.
Portrush
Coleraine
COLERAINE
Limavady
Portadown
Craigavon
CRAIGAVON
NEWRY
Newry
COOKSTOWN
Cookstown
Dungannon
DUNGANNON
Armagh
ARMAGH
LONDONDERRY
Londonderry
STRABANE
Strabane
Omagh
OMAGH
ENNISKILLEN
Enniskillen

Appendix 4: Proportions of Employment in Industrial Sectors for Urban Centres in Northern Ireland, 1966 (percentage of total employed)

Urban Centre	*Total Employment*	*Induced Proportion*	*Agriculture, Fishing, Forestry*	*Mining and Quarrying*	*Manufacturing Industry*	*Construction*	*Public Administration and Defence*	*Education Services*	*Medical and Dental Services*	*Gas, Electricity and Water*	*Transport and Communication*	*Distributive Trades*	*Retail Distribution*	*Wholesale Distribution*	*Insurance, Banking and Finance*	*Accountancy Services*	*Legal Services*	*Religious Organisations*	*Other Professional and Scientific Services*	*Miscellaneous Services*	*Catering, Hotels, Etc.*
Belfast	266,403	36·6	1·9	0·2	38·2	8·4	6·4	3·7	4·6	2·0	6·4	15·1	9·2	3·8	2·5	0·4	0·4	0·6	0·7	8·3	2·2
Londonderry	33,590	30·1	8·2	0·0	31·6	9·7	11·8	3·4	5·2	1·6	4·7	12·4	8·8	1·9	1·3	0·2	0·3	0·6	0·4	8·7	2·4
Craigavon	25,903	26·0	7·9	0·3	44·6	11·6	4·1	2·9	2·6	1·0	3·5	12·1	7·6	2·8	1·4	0·3	0·2	0·6	0·4	6·5	1·8
Ballymena	18,800	28·1	15·2	0·3	33·0	10·7	6·3	3·1	3·2	1·0	3·1	14·9	9·6	3·7	0·9	0·2	0·4	0·6	0·4	6·5	1·3
Cookstown	17,682	24·4	26·7	0·8	23·4	14·3	4·0	3·8	2·7	0·7	2·4	12·6	8·9	1·5	0·6	0·2	0·3	0·6	0·2	6·7	1·5
Newry	17,000	33·1	19·5	0·4	22·3	12·6	4·7	4·1	3·2	1·0	3·5	17·0	10·7	1·5	1·0	0·2	0·4	1·5	0·3	9·4	2·8
Omagh	16,912	27·4	34·6	0·6	10·2	10·1	6·2	4·5	6·3	0·8	2·7	12·6	9·5	1·5	1·0	0·1	0·3	0·7	0·3	8·8	2·6
Enniskillen	15,226	25·2	38·6	0·9	10·7	9·0	6·9	5·0	3·8	0·8	2·7	10·9	8·9	1·4	0·9	0·1	0·3	0·8	0·3	8·4	2·6
Larne	14,757	34·0	8·9	0·3	36·2	9·8	4·0	3·4	3·3	2·2	10·0	11·2	6·9	1·6	1·6	0·2	0·4	0·5	0·6	7·6	2·9
Antrim	13,938	22·9	12·6	0·9	36·7	10·1	6·9	2·6	7·3	1·0	4·4	9·0	5·8	1·3	1·0	0·2	0·2	0·4	0·4	6·3	1·8
Coleraine	13,308	35·7	15·0	0·5	21·4	13·9	5·8	4·7	3·0	1·3	3·9	15·2	11·4	1·7	1·4	0·4	0·4	0·6	1·4	11·2	4·6
Armagh	13,059	25·7	23·6	0·6	22·3	10·0	7·1	4·1	6·7	1·3	2·3	13·4	9·1	2·8	0·8	0·2	0·3	0·8	0·4	6·3	2·0
Downpatrick	12,834	25·5	16·4	0·7	19·1	14·7	12·1	2·9	8·5	0·8	3·2	11·0	7·8	1·4	1·3	0·3	0·4	0·7	0·3	7·5	2·2
Dungannon	10,885	26·1	20·6	0·2	30·9	10·5	3·3	4·1	4·4	0·7	2·6	13·2	8·7	2·3	0·8	0·2	0·3	0·9	0·2	7·0	2·0
Banbridge	10,670	24·0	19·4	0·5	33·3	13·8	3·4	2·2	3·3	1·3	2·9	11·4	6·0	1·1	1·1	0·2	0·3	0·5	0·3	6·1	1·5
Ballymoney	8,490	28·4	24·8	0·7	20·9	14·1	4·9	3·3	3·0	0·7	2·9	15·1	10·7	3·3	0·4	0·0	0·1	0·5	0·2	4·2	1·9
Strabane	7,564	24·6	22·3	0·5	32·6	10·1	4·0	3·6	2·3	1·1	2·1	11·6	9·2	1·3	1·0	0·0	0·3	0·8	0·2	7·3	2·6
Newcastle	5,865	32·8	21·1	0·6	13·5	18·7	5·0	5·0	3·3	1·4	3·8	14·5	10·6	1·5	1·3	0·1	0·3	1·4	0·2	10·9	4·4
Ballycastle	3,176	28·9	31·8	0·7	8·9	16·0	4·5	5·0	4·1	1·1	3·4	10·0	7·7	0·8	1·0	0·1	0·3	1·3	0·5	11·3	4·6

Source: Northern Ireland Census of Population, 1966.

THE ECONOMIC AND SOCIAL RESEARCH INSTITUTE

Broadsheet Series:

1. *Dental Services in Ireland* — P. R. Kaim-Caudle
2. *We Can Stop Rising Prices* — M. P. Fogarty
3. *Pharmaceutical Services in Ireland* — P. R. Kaim-Caudle assisted by Annette O'Toole and Kathleen O'Donoghue
4. *Ophthalmic Services in Ireland* — P. R. Kaim-Caudle assisted by Kathleen O'Donoghue and Annette O'Toole
5. *Irish Pensions Schemes*, 1969 — P. R. Kaim-Caudle and J. G. Byrne assisted by Annette O'Toole
6. *The Social Science Percentage Nuisance* — R. C. Geary
7. *Poverty in Ireland: Research Priorities* — Brendan M. Walsh
8. *Irish Entrepreneurs Speak for Themselves.* — M. P. Fogarty

Publication Series:

1. *The Ownership of Personal Property in Ireland* — Edward Nevin
2. *Short Term Economic Forecasting and its Application in Ireland* — Alfred Kuehn
3. *The Irish Tariff and The E.E.C.: A Factual Survey* — Edward Nevin
4. *Demand Relationships for Ireland* — C. E. V. Leser
5. *Local Government Finance in Ireland: A Preliminary Survey* — David Walker
6. *Prospects of the Irish Economy in* 1962 — Alfred Kuehn
7. *The Irish Woollen and Worsted Industry*, 1946–59: *A Study in Statistical Method* — R. C. Geary
8. *The Allocation of Public Funds for Social Development* — David Walker
9. *The Irish Price Level: A Comparative Study* — Edward Nevin
10. *Inland Transport in Ireland: A Factual Survey* — D. J. Reynolds
11. *Public Debt and Economic Development* — Edward Nevin
12. *Wages in Ireland*, 1946–62 — Edward Nevin
13. *Road Transport: The Problems and Prospects in Ireland* — D. J. Reynolds
14. *Imports and Economic Growth in Ireland*, 1947–61 — C. E. V. Leser
15. *The Irish Economy in* 1962 *and* 1963 — C. E. V. Leser
16. *Irish County Incomes in* 1960 — E. A. Attwood and R. C. Geary
17. *The Capital Stock of Irish Industry* — Edward Nevin
18. *Local Government Finance and County Incomes* — David Walker
19. *Industrial Relations in Ireland: The Background* — David O'Mahony
20. *Social Security in Ireland and Western Europe* — P. R. Kaim-Caudle
21. *The Irish Economy in* 1963 *and* 1964 — C. E. V. Leser
22. *The Cost of Irish Industry*, 1950–60 — Edward Nevin
23. *A Further Analysis of Irish Household Budget Data*, 1951–1952 — C. E. V. Leser
24. *Economic Aspects of Industrial Relations* — David O'Mahony
25. *Psychological Barriers to Economic Achievement* — P. Pentony
26. *Seasonality in Irish Economic Statistics* — C. E. V. Leser
27. *The Irish Economy in* 1964 *and* 1965 — C. E. V. Leser
28. *Housing in Ireland: Some Economic Aspects* — P. R. Kaim-Caudle
29. *A Statistical Study of Wages, Prices and Employment in the Irish Manufacturing Sector* — C. St. J. O'Herlihy
30. *Fuel and Power in Ireland: Part I. Energy Consumption in* 1970 — J. L. Booth
31. *Determinants of Wage Inflation in Ireland* — Keith Cowling
32. *Regional Employment Patterns in the Republic of Ireland* — T. J. Baker
33. *The Irish Economy in* 1966 — The Staff of The Economic and Social Research Institute
34. *Fuel and Power in Ireland: Part II. Electricity and Turf* — J. L. Booth
35. *Fuel and Power in Ireland: Part III, International and Temporal Aspects of Energy Consumption* — J. L. Booth
36. *Institutional Aspects of Commercial and Central Banking in Ireland* — John Hein
37. *Fuel and Power in Ireland; Part IV, Sources and Uses of Energy* — J. L. Booth
38. *A Study of Imports* — C. E. V. Leser
39. *The Irish Economy in* 1967 — The Staff of The Economic and Social Research Institute
40. *Some Aspects of Price Inflation in Ireland* — R. C. Geary and J. L. Pratschke
41. *A Medium Term Planning Model for Ireland* — David Simpson

THE ECONOMIC AND SOCIAL RESEARCH INSTITUTE

Publication Series:—*continued.*

42. *Some Irish Population Problems Reconsidered* — Brendan M. Walsh
43. *The Irish Brain Drain* — Richard Lynn
44. *A Method of Estimating the Stock of Capital in Northern Ireland Industry; Limitations and Applications* — C. W. Jefferson
45. *An Input-Output Analysis of the Agricultural Sector of the Irish Economy in* 1964 — R. O'Connor with M. Breslin
46. *The Implications for Cattle Producers of Seasonal Price Fluctuations* — R. O'Connor
47. *Transport in the Developing Economy of Ireland* — John Blackwell
48. *Social Status and Inter-Generational Social Mobility in Dublin* — Bertram Hutchinson
49. *Personal Incomes by County,* 1965 — Miceal Ross
50. *Income Expenditure Relations in Ireland,* 1965–1966 — John L. Pratschke
51. *Costs and Prices in Transportable Goods Industries* — W. Black, J. V. Simpson, D. G. Slattery
52. *Certain Aspects of Non-Agricultural Unemployment in Ireland* — R. C. Geary and J. G. Hughes
53. *A Study of Demand Elasticities for Irish Imports* — Dermot McAleese
54. *Internal Migration in Ireland with Appendix* — R. C. Geary and J. G. Hughes; C. J. Gillman
55. *Religion and Demographic Behaviour in Ireland* — B. M. Walsh
56. *Views on Pay Increases, Fringe Benefits and Low Pay* — H. Behrend, A. Knowles and J. Davies
57. *Views on Income Differentials and the Economic Situation* — H. Behrend, A. Knowles and J. Davies
58. *Computers in Ireland* — F. G. Foster
59. *National Differences in Anxiety* — Richard Lynn
60. *Capital Statistics for Irish Manufacturing Industry* — C. W. Jefferson
61. *Rural Household Budget—Feasibility Study* — Sile Sheehy and R. O'Connor
62. *Effective Tariffs and the Structure of Industrial Protection in Ireland* — Dermot McAleese
63. *Methodology of Personal Income Estimation by County* — Miceal Ross
64. *Further Data on County Incomes in the Sixties* — Miceal Ross
65. *The Functional Distribution of Income in Ireland,* 1938–70 — J. G. Hughes
66. *Irish Input-Output Structures,* 1964 *and* 1968 — E. W. Henry
67. *Social Status in Dublin: Marriage, Mobility and First Employment* — Bertram Hutchinson
68. *An Economic Evaluation of Irish Salmon Fishing;* 1: *The Visiting Anglers* — R. O'Connor and B. J. Whelan
69. *Women and Employment in Ireland: Results of a National Survey* — Brendan M. Walsh assisted by Annette O'Toole
70. *Irish Manufactured Imports from the UK in the Sixties: The Effects of AIFTA.* — Dermot McAleese and John Martin
71. *Alphabetical Voting: A Study of the* 1973 *General Election in the Republic of Ireland* — Christopher Robson and Brendan M. Walsh
72. *A Study of the Irish Cattle and Beef Industries:* — Terence J. Baker, Robert O'Connor and Rory Dunne
73. *Regional Employment Patterns in Northern Ireland* — William Black and Clifford W. Jefferson

Cahill & Co. Limited, Dublin