

Regional Growth and Income Patterns, 1960-65

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THIS study owes its origins to the earlier research of Ross [8] and Baker [1] into regional income and employment patterns in Ireland and to the appearance of the Buchanan Report in 1969. These works have laid much of the groundwork for future regional studies, but they have one basic methodological feature which may have outlived its usefulness for regional analysis in Ireland. This is the choice of the Irish county as the basic regional unit for analysis. This approach has had the merit of focussing attention on the economic problems of particular areas, such as the Western counties; yet it may have obscured the wider study of the relative economic performance and interrelationships of the economic regions in this country. It is the author's view that it is now necessary to adopt the "economic regions" approach in analysing Irish regional development; and it is his purpose to examine the spatial patterns of income growth in 1960-65. Certain techniques of regional analysis will be applied to the data to see whether they have anything to contribute to regional development policy. This paper examines the growth patterns of regional income per head. A second paper will undertake a detailed analysis of the changing structure of regional employment. A test will be applied to measure the extent to which regional growth has been "balanced"—in the sense in which the concept of "balanced growth" is defined in this study. Allied to this it is hoped to support Ross and Baker's hypothesis [10] that the simple classification of the country into developed and undeveloped regions no longer fits the Irish experience. If this is so, a more flexible development framework is needed, and in a second article some suggestions for a possible alternative classification can then be made.

I. ECONOMIC REGIONS

The theoretical problems connected with the definition of an economic region are well set out in Meyer's [5] review article, and need not detain us here. Given

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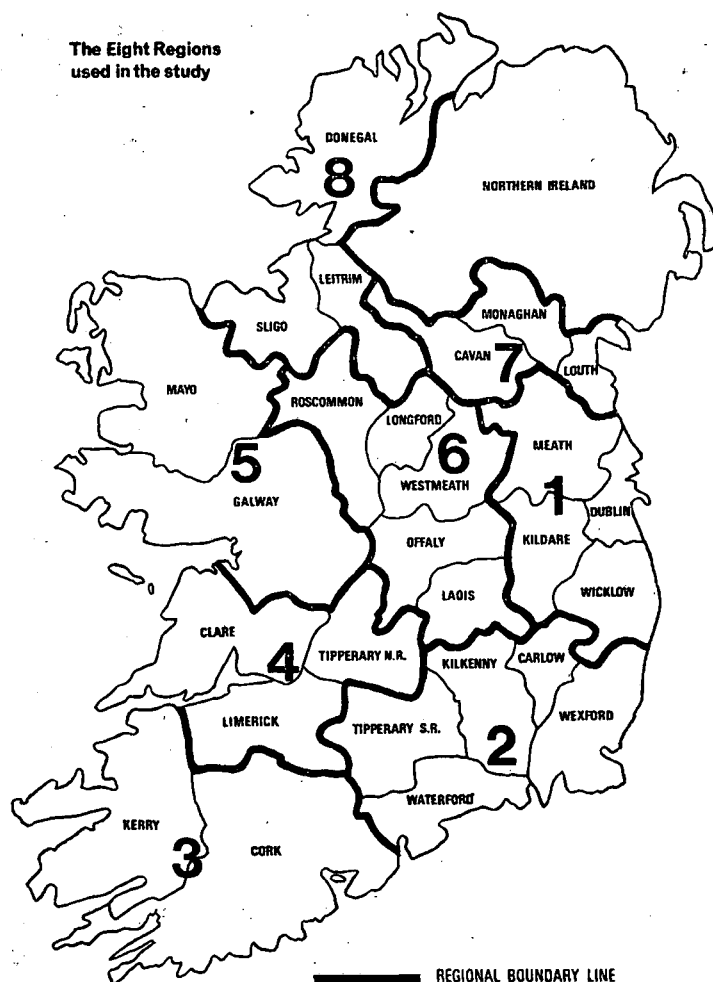
that regional economics is orientated to the practical solution of problems, Fisher puts forward the view [3] that:

"the most helpful region in many instances is what might be called the economic development region . . . (where) . . . the emphasis is on the development of policies, programmes and actions to move the region from where it is economically toward pre-determined economic objectives."

The economic regions are generally built up on the existing political and administrative boundaries. Data availability is also important because this usually dictates what the basic analytic unit will be. In Ireland the county unit is the lowest common denominator for which data is generally available, and thus has been the regional unit in most studies. In fairness to previous researchers it should be pointed out that all the evidence up to now suggests that the simple division of the country into "developed" and "undeveloped" counties was adequate until recently. A further point is that no clearly defined and practical set of "economic regions" was available for physical and economic planning purposes until 1970. The Department of Local Government issued nine provisional planning regions in 1965; but as they did not follow county boundaries problems of data collection prevented researchers from using these regions. The Buchanan Report [2] proposed eight planning areas based on major urban focal points. Finally the Department drew up nine regions whose borders follow county boundaries in all cases, except that Tipperary is divided into its two administrative ridings, the South Riding being part of the South-East region, and the North Riding part of the Mid-West region (see regions 2 and 4 in the accompanying map).

However, the choice of the Irish county as a basic regional unit is open to a number of objections. There are great divergences between counties in land area and population (e.g., Leitrim and Kildare occupy approximately the same land area, but the population of Kildare in 1966 was more than twice that of Leitrim). Neither are the counties homogeneous with respect to natural resources or situation; nor does the arbitrariness of county boundaries take into account the linkages between various towns and enterprises. The county employment figures in the Census of Population are an example of this: they relate to the county of residence of the person at work rather than to the county in which his work-place is situated. Thus the official county employment figures overstate and understate the "true" employment situation to the degree that people journey to work across county boundaries.¹ The sheer number of counties in a country of Ireland's size makes it almost impossible to plan regional development coherently. A national regional policy requires that each regional plan be integrated into the overall plan, this being essential if a choice between regional priorities and goals

1. Lucey and Kaldor [4] encountered this in their study on rural industrialisation: out of the 151 employees in the Scariff (Co. Clare) plant who were interviewed, about 10 per cent were residents of Co. Tipperary.



is to be closely outlined. Twenty-six small and diverse regional units make this approach unworkable.

One solution to these problems is to use a smaller number of more homogeneous regions. Ideally, "economic regions" would not follow county boundaries, but the statistical convenience of the county unit outweighs the theoretical case for rejecting it. It was decided to use the physical planning regions outlined by the Department, with one exception. Donegal is an anomaly from the viewpoint of regional planning in that, as a result of partition, it is cut off from its natural hinterland. County Donegal, treated as a separate region by the Department, in this study is included in the North-West region, with Counties Sligo and Leitrim. It seemed desirable to combine the three counties into one region to reduce the degree of heterogeneity in population size among the regions. Also the three

counties concerned have some economic and social problems in common, such as an overdependence on agriculture and high emigration rates, which mean that the grouping makes some sense from a planning viewpoint. Thus this study uses only eight regions instead of the nine drafted by the Department.

"Balanced Growth" Criteria

A major aim of regional policy is frequently stated to be balanced regional development; yet, as O'Farrell [7] points out, this concept can have a wide variety of meanings. The objective being seldom specified in quantitative terms, actual regional growth patterns can rarely be analysed to check the degree to which growth has been balanced or unbalanced. For this a set of indicators of regional development must be chosen. Opinions differ as to the most meaningful indicator, which may be personal income per head, the level of emigration, unemployment etc. In this study personal income *per capita* levels are taken as *realistic* indicators of regional prosperity.

A simple test of the "balanced growth" hypothesis would be to compare the regional growth rates with the national average growth rate. If a region preserved its position relative to the whole country (i.e., the twenty-six counties) in the period 1960-65, then it could be stated that regional income growth had been "balanced". This might be regarded as too stringent a test because the inclusion of Dublin county may unduly bias² the national average growth rate upwards. Thus a second, more realistic, test would postulate that regional income growth was "balanced" if the region preserved its relative position *vis-à-vis* the whole country excluding Dublin (hereafter referred to as the 25-county area). This is the main test adopted in this study.

Methodology

The methodology of the study is as follows. The personal income figures by county for 1960 and 1965 are converted to regional income *per capita* figures (as in Ross's paper, the 1960 and 1965 regional populations are assumed to be the same as the 1961 and 1966 levels from the census.) The regional income figures are then analysed, and a number of techniques applied to them to check whether the trends were uniform in all regions. A measure is used to test whether there was a tendency towards convergence or divergence in regional incomes *per capita* relative to the national figures. Econometric analysis is applied to the cross-section income data for 1960 and 1965 to test a series of hypotheses about the relationship between employment patterns and the level of regional income per head.

A number of problems arose, in connection with the interpretation of the results, which should be mentioned. First, a major difficulty is that the time-period under review in the study, i.e., 1960-65, is too short for any long-term trend to be isolated. This means that too much significance should not be read

2. T. J. Baker [1] holds that, due to the immense disparity in terms of population density between Dublin and the other counties, it should be excluded from the analysis.

into the figures; yet if the trends all point in one direction it seems possible to make inferences from them. Second, using the 25-county area for comparison purposes to allow for the influence of Dublin is not wholly satisfactory. Dublin's sphere of influence spills over into the three remaining counties in the Dublin region; yet it is not possible to allow for this effect, except by dropping these counties from the analysis. It seemed more desirable to accept this fact rather than reduce any further the number of regions.

2. REGIONAL INCOME PER CAPITA LEVELS

A very real problem with regional economics is the possibility of conflicting objectives. Connected with this is the difficulty of formulating goals and objectives in a meaningful fashion, i.e., by quantifying certain variables. However, income *per capita* could be considered a reasonable proxy for the level of development in a region. Maximisation of regional *per capita* income, or minimisation of regional income disparities, could also be considered reasonable goals of regional policy. Classical economic theory postulates that persistent differences in regional incomes over time will be equalised by the free movement of the factors of production, apart from the constraint of transport costs. The classical assumptions are usually not realised in a spatial economy characterised by many imperfections in competition. There are economic and social barriers to hinder factor mobility, so that market forces do not inevitably lead to equality of regional *per capita* incomes. Indeed, in certain circumstances they may even have a disequilibrating effect. A significant test of whether "balanced growth" occurred or not would be an examination of the trends in income *per capita* at the regional level.

The growth rate of income *per capita* is only one facet of the regional income problem in Ireland. The relationship between income levels in the various sectors of the economy is equally important. A frequently-stated aim of Government policy [11] is to ensure that "a reasonable relationship is maintained between farm incomes and incomes in other occupations". A subsidiary indicator of regional development could thus be the ratio of income *per capita* in the agricultural sector, at the beginning and end of a period. A value of the ratio close to unity would be an indication that the region had solved the problem of sectoral imbalance in the levels of income *per capita*. If, however, the value of the ratio was equal to or greater than unity, this would not necessarily indicate that the region has no income problem because the sectoral equality could be at a low level of income *per capita*. In this case the problem would be solely one of slow growth in regional income *per capita* relative to the national average growth rate. Thus it is a further check to examine the absolute regional income figures, as well as the trend in growth rates.

The regional income *per capita* figures,³ calculated from Ross's revised county

3. An implicit assumption, made in deriving the regional income *per capita* figures, is that there were no significant differences in inter-regional price levels.

income estimates [9], are presented in Table 1. The only problem arose with regard to the two ridings of Tipperary, which are in separate regions. Ross⁴ does not give separate income figures for the two parts of Tipperary, so it was necessary to make some estimates of them. A set of population, employment and agricultural output distributors were evolved to break down the global income figures for Tipperary into separate estimates for each riding. This method yielded estimates of personal income *per capita* in Tipperary (N.R.) and Tipperary (S.R.) of £192 and £188 in 1960, and £280 and £269 in 1965, respectively. These estimates seem realistic when compared with Ross's figures of £190 in 1960, and £274 in 1965, for income *per capita* in Co. Tipperary. Before examining the figures in Table 1, a number of points as regards interpretation should be made.

The Interpretation of the Results

First, agricultural income is subject to yearly fluctuation due to the influence of exogenous factors, such as weather, market conditions and cyclical changes. Ross [8] specifically mentions the poor performance of tillage in 1960-65, giving this as a reason why the province of Leinster fared less well than might have been expected. He points out that the growth in tillage since 1965 is an indication that the income pattern in 1969 might be different from that in 1965. The growth in certain Munster counties reflects the continued expansion of dairying in this period; and as this enterprise is heavily subsidised, the regional distribution of agricultural subsidies is biased in favour of Munster. In 1966, approximately 50 per cent of certain agricultural subsidies, totalling about £39 million, went to Munster, which contained only 32 per cent of the farmers in the country. Leinster farmers, who made up about 23 per cent of the total farmers, received 25 per cent of the subsidies. [6] Second, the great variations between counties in terms of size and population partly accounts for the difference in county income levels: the greater density of population in certain areas leads to significant economies of scale associated with large urban concentrations. Standardisation techniques, such as adjusting for population size, are generally unable to deal with this factor.

The Regional Income Per Capita Figures

If we examine the absolute levels, in 1960 and 1965 only one region—the Dublin region—had a personal income *per capita* figure greater than the 26-county average. This appears to be due to the influence of Co. Dublin. When this county is dropped from the analysis, and the 25-county average taken as the yardstick, a more even regional pattern emerges. In 1960, four of the regions had absolute levels of *per capita* income greater than the 25-county average. In 1965, five regions had income *per capita* levels above the 25-county average: the same four regions, plus the North-West region. The main difference between 1960 and 1965 lies in the ranking of the regions by absolute income levels. The "adjusted

4. The author would like to express his gratitude to Miceal Ross for supplying him with a more detailed breakdown of the income figures for Tipperary.

TABLE 1: *Certain Aspects of Regional Income Per Capita, 1960 and 1965*

Region	Personal Income £ Per head of population		% Change in Income per Capita 1960-65	Income ³ per capita in the Agricultural Sector as a proportion of Income in the Non-Agricultural Sector.	
	1960	1965 ²		1960	1965
1. (A) The Dublin region	246	359	45.9	0.95	0.87
(B) Adjusted "Dublin Region" ¹	193	266(278)	37.8	1.10	1.04
2. South-East region	188	270(271)	43.6	1.01	0.95
3. South-West region	195	286(281)	46.7	0.93	0.97
4. Mid-West region	188	277(271)	47.3	0.87	0.90
5. Western region	156	223(225)	42.9	0.53	0.51
6. Midlands region	166	230(239)	38.6	0.77	0.67
7. North-East region	176	259(253)	47.2	0.65	0.75
8. North-West region	152	217(219)	42.8	0.59	0.59
25-County Average	179	258	44.0	0.79	0.78
26-County Average	199	292	46.3	0.74	0.72

Notes:

1. Adjusted "Dublin" region comprises Counties Kildare, Meath and Wicklow.
2. Figures in brackets are "expected" regional income per head figures for 1965 if each region's income had grown at the 25-County average rate.
3. Income defined as "Remuneration of Employees and Income of self-employed" in both sectors.

Dublin region", which in 1960 ranked second after the South-West region, had by 1965 dropped to fourth place. The Mid-West region, which in 1960 was joint third with the South-East region, in 1965 was second, after the South-West region. The regions with the lowest income levels in both years were the North-West and Western regions, which have always been regarded as problem areas. On the other hand, the gap between the Midlands and the Western region, £10 in 1960, had narrowed to £7 in 1965.

The absolute income levels are only one aspect of the development process. While a narrowing of the absolute gap may be politically meaningful, a more realistic aim of regional policy is probably the narrowing of the gap between the relative income levels in various regions. The degree of success of this policy can be analysed by looking at the regional income *per capita* growth rates. Interestingly, the growth rate in the Dublin region was slightly below the 26-county average; but this was due to a poor growth rate in the "adjusted Dublin

region". The fastest rates of growth were recorded in the Mid-West and North-West regions; the lowest in the Midlands and the "adjusted Dublin region", respectively. The major contribution to growth in the Mid-West came from non-agricultural wage income. Clare and Limerick recorded the fastest growth in non-agricultural employment in the country, a factor closely linked to the Shannon-Limerick complex. The growth rate in the North-East is mainly attributable to the performance of the agricultural sector in Cavan and Monaghan. Ross [8] points out that "non-employee income in agriculture grew 75 per cent faster in Cavan than in the country generally and almost as fast in Monaghan." The slow growth rates in the "adjusted Dublin region" and the Midlands had much to do with the structural importance of agriculture in these regions. The growth rate of agricultural income in the Midlands was 30 per cent compared with a 25-county average of 42 per cent.

The 25-county average growth rate shows that regional growth was unbalanced in seven of the eight regions. The South-East region's growth rate alone was about equal to the 25-county rate. The relative positions of the Mid-West, North-East and South-West regions improved relative to the 25-county average as their growth rates were above the average. The Western and North-West regions showed a small decline in their relative position, while the decline was sharpest in the Midlands and the "adjusted Dublin region". A further test standardises the regional income levels by applying the 25-county area growth rates. This gives an "expected" regional income *per capita* figure for 1965, i.e., what the region's income *per capita* would have been had regional growth been balanced. The "expected" figures, presented in brackets in Table 1, show that in the "adjusted Dublin region" the actual slower growth rate cost it £12 a head. The slower growth in the Midlands meant that actual income level was £9 a head less than it would have been if growth had been at the 25-county average. The above-average growth rates in the Mid-West and North-East regions were "worth" an extra £6 a head to both regions. Such figures are only illustrative, but they do indicate the regional losses and gains due to unbalanced growth.

Finally, the income balance in the agricultural and non-agricultural sectors can be examined at the regional level. The 1960 values for the ratio show that only two regions had solved this facet of the income problem with values greater than unity. In 1965 the "adjusted Dublin region" was the only region to meet this test. However, an increase in the ratio between 1960-65 could be regarded as progress towards solving this problem. The national trends show slight declines in the value of the ratio; in the 25-county area four regions showed an increase in the ratio while four showed a decline. The largest increase, occurring in the North-East, and the largest decrease, occurring in the Midlands region, reflect the differing performances of agricultural income in the two areas. The low value of the ratio in the Western and North-West regions exemplifies the income problem in these areas. One slight encouragement is that the decline in the ratio was very small in the Western region (though this is due to the movements in agricultural employment, as well as to the growth of overall agricultural income).

Convergence and Divergence in Regional Income Levels

What are the implications of these trends in income *per capita*? In the period 1960-65, was there a tendency towards convergence or divergence in regional income *per capita* levels relative to the national averages? Such information is useful in that it enables us to formulate the "balanced growth" test in an alternative way, i.e., there should be no tendency towards increasing divergence in regional income *per capita* levels. The more stringent test of reducing regional income differentials would require convergence in regional income *per capita* relative to the national figure. In an article on regional development, Williamson [12] defines a measure of regional income inequality, Vw , which may be derived for the national areas from the following formula:

$$Vw = \sqrt{\frac{\sum_{i=1}^x (Y_i - \bar{Y})^2 \frac{n_i}{N}}{\bar{Y}}}$$

Where:

- Y_i = Personal Income *per capita* in the region ($i = 1, 2, \dots, x$).
- $\bar{Y}$ = Personal Income *per capita* in the aggregate national area.
- n_i = population in the i th region.
- N = population in the aggregate national area.
- x = number of regions under examination.

The measure is a weighted coefficient of variation which gauges the dispersion of regional income *per capita* relative to the national average, with each regional deviation weighted by its share in total population. The greater the value of Vw , the larger the size of regional income differentials. Vw may also be calculated for individual regions using the above formula and dropping the summation sign. Williamson used this measure of regional inequality to test a number of hypotheses about the pattern of regional development over time. Since we have only two sets of observations, his approach is denied us: yet the measure can test whether there was any tendency towards convergence or divergence in this period.

Interpreting Changes in Vw

Where $Vw_t \neq Vw_{t+1}$ (subscripts refer to successive time periods) then,

- (A) if $Vw_{t+1} < Vw_t$, convergence has occurred;
- (B) if $Vw_{t+1} > Vw_t$, divergence has occurred; and
- (C) if $Vw_t = 0$ there is no difference between regional and national income per head levels. As an indicator of regional prosperity, Vw needs to be carefully analysed. Cases (A) and (B) above have different meanings for regions depending on the relationship between income per head in the region and the national averages. For example, an increase in Vw over time (Case B) for a region with

above average income per head (relative to either the 26- or 25-county average) implies relative enrichment for that region. The opposite is true for a below average region. Case (A) implies that regional prosperity is more evenly balanced as income increases relatively fastest in the below-average income regions. A final point to remember is that the analysis is only concerned with relative income differentials and not absolute differentials. A decline in percentage regional deviations from either of the national averages could be equally consistent with increasing or decreasing absolute divergence, e.g., income growth in Dublin ranked sixth on the national scale in 1960-65, although the absolute margin between Dublin and its nearest rival widened from £54 to £77 per head.

Values of Vw were calculated for 1960 and 1965. The results are presented in Table 2. The measure⁵ is calculated both for the 26- and 25-county areas, and also for eight regions. Thus the last row in Table 2 gives us two yardsticks against which we can measure the size of geographic income differentials in 1960 and 1965. At the same time, a separate value of Vw is given for each region, which enables us to check whether the dispersion between regional income *per capita* and the national average has narrowed in the period between the two years.

The last row in Table 2 shows that the two national areas experienced divergence in this period; but the increase in regional income differentials was greater in the 25-county area. In the 26-county area in both years, the regions with the second and third highest absolute values of Vw were the Western and North-West regions. The population declines in these regions during the period would tend to reduce the absolute value of Vw , but the low absolute level of income *per capita* in the regions outweighed this convergent factor. In the 26-county area, case (A) applied to only two regions—the Mid-West and North-East regions. This is due to the high growth rates of income *per capita*, mentioned earlier. The South-West had a value of Vw close to zero in both years, which means that the region showed little dispersion from the national average due to the prosperity of Munster agriculture and the Cork urban complex. The largest percentage increases in Vw came in the South-East and Midlands region. The South-East region has an income *per capita* lower than the 26-county average; and a below-average growth in income gives it an increased value of Vw . In 1965, the absolute value of Vw in the Midlands region had declined sharply almost to the North-West figure.

The calculated values for Vw , using 25-county area weights, need to be interpreted a little differently. The exclusion of Dublin means a drop in the average income *per capita*, and the South-West region now has the highest absolute value of Vw . The adjusted "Dublin region" now shows a convergent trend over this period, while the South-East region shows the same pattern. Average income *per capita* in these regions is above the 25-county average. Thus a decline in the value

5. Calculation of the measure involves the squaring of the *per capita* income differentials, and it is possible that the index may be unduly sensitive to a few extreme deviations in regional income *per capita*. On this criterion Dublin could be regarded as an extreme observation.

TABLE 2. *Calculated Values of Vw for 1960 and 1965 using 26- and 25- County Area Weights and the Percentage in Vw Change for the Period*

Region	Vw—using 26- county weights		% change in Vw 1960-1965	Vw—using 25- county weights		% change in Vw 1960-1965
	1960	1965		1960	1965	
1. Dublin ^a Region	0.1338	0.1344	+ 0.45	0.0234	0.0095	-59.4
2. The South-East	0.0187	0.0251	+34.22	0.0196	0.0182	- 7.14
3. The South-West	0.0080	0.0081	+ 1.25	0.0412	0.0505	+22.57
4. The Mid-West	0.0169	0.0158	- 7.69	0.0177	0.0262	+48.02
5. The Western Region	0.0673	0.0713	+ 5.94	0.0463	0.0482	+ 4.10
6. The Midlands Region	0.0483	0.0604	+25.05	0.0245	0.0364	+48.57
7. The North-East	0.0285	0.0275	- 3.51	0.0048	0.0011	-77.08
8. The North-West	0.0629	0.066	+ 4.93	0.0467	0.048	+ 2.78
National Area	0.174	0.181	+ 4.02	0.0889	0.098	+10.24

Notes:

(a) Using 25-County area weights, region one is comprised of Counties Meath, Kildare and Wicklow.

of *Vw* for both implies a relatively slower growth in regional "prosperity" (as measured by income *per capita*). The large increase in *Vw* in the Mid-West implies that this region enriched itself relative to the 25-county average income *per capita*. As the growth rates in income *per capita* in the Western and North-West regions were so close to the 25-county average, the percentage increase in *Vw* was very small in both areas. The Midlands recorded a very large increase in *Vw*, implying that the region became poorer relative to the 25-county area average.

The results so far suggest that, if "balanced income growth" in a region is defined as a growth rate at least equal to the 25-county area average, only three regions passed this test—the South-West, the Mid-West and the North-East regions. The next step is to try to establish the determinants of regional income *per capita*.

3. THE DETERMINANTS OF REGIONAL INCOME PER CAPITA

This section attempts to explain what determined the level of regional income *per capita* in 1960 and 1965. More specifically, multiple regression was applied to the cross-section regional data for both years to test the hypothesis that the variations in the regional income *per capita* figures could be explained by the varying employment ratios in different sectors of the regional economies. A serious difficulty with this approach arises from the small size of the sample; but,

while accepting this point, it was decided nevertheless to carry out the analysis to test the hypothesis.

Dependent and Independent Variables

Two dependent variables were specified. The first was regional income *per capita* in the 26-county area (Y_d). The second was regional income *per capita* in the 25-county area (Y_{ed}). As it was hoped to test the stability of the coefficients in the two years, the 1965 income *per capita* estimates for both areas were deflated by the rise in the Consumer Price Index from 1960-65, to obtain 1965 regional income estimates at constant 1960 prices.

Six independent variables were selected, five being employment variables, and the remaining variable a figure for net output per persons engaged in Transportable Goods Industry.⁶ The main source of the employment data was the Census of Population. The assumption was made that the employment proportions in 1960 and 1965 were approximated by the 1961 and 1966 figures. Further data were supplied by Baker and Ross, which gave the census data for 1961 and 1966 revised in accordance with Baker's modified classification of economic activity into the autonomous and induced sector.

The first explanatory variable is the share of the agricultural sector in total employment. Previous research [10] indicates that there should be a significant negative relationship between regional income *per capita* and the proportion of the labour force engaged in agriculture. The second explanatory variable selected was the share of Manufacturing Industry in non-agricultural employment. The period 1960-65 witnessed a rapid expansion in manufacturing employment and it would be desirable to test whether it had any significant impact on the level of regional income *per capita* in either year. Economic development studies abound with references to the manufacturing sector, and the conventional view would postulate a positive relationship between the level of regional income *per capita* and the size of the manufacturing sector. However, Baker believes that the relationship is over-simplified.

He re-classifies employment into the autonomous and induced sectors. The autonomous sector is that whose output depends on "export" markets outside the region. This includes the social services sector whose size depends on the application of national standards. The induced sector is determined locally, partly by the size of the autonomous sector,⁷ and partly by the division, within the autonomous sector itself, between agricultural and non-agricultural activities. Thus the next two explanatory variables are the proportion of non-agricultural employment in the autonomous sector and the induced sector as a proportion of total employment. On *a priori* grounds one would expect a positive relationship between these variables and the dependent variable. The fifth explanatory variable

6. This figure was obtained from Table 107 of the Statistical Abstract. The 1965 figures were deflated by the rise in the Wholesale Price Index for the Output of All Industry from 1960-65.

7. For a fuller definition of this modified classification see Baker [1].

selected is the share of "Government and Social" employment in the total autonomous non-agricultural sector. This variable is specifically distinguished from the remainder of the autonomous non-agricultural sector because Baker's research [1] indicates, in the 25-county area, a large regional uniformity in the size of this sector and that in the poorer regions:

"it is this sector rather than manufacturing industry which is primarily responsible for maintaining induced activities above the level which would obtain in a purely agricultural environment."

The final explanatory variable is the net output per employee, which allows for the fact that industry is not uniform in terms of output and employment provided. Thus the greater the level of net output per employee in a region, *ceteris paribus*, the greater should be the level of regional income *per capita*.

TABLE 3A: Parameter Estimates for Regional Income per capita Regressions for the 26-County Area, 1965 (*t*-ratios in parentheses)

Equation	Intercept	X ₁	X ₈	X ₆	X ₇	X ₉	X ₁₁	R	s.e.e.	F
1	311.29	-2.360 (-13.19)						.983	7.380	173.87
2	123.83		3.674 (1.85)					.602	32.256	3.42
3	133.63			1.904 (11.41)				.978	8.484	130.11
4	69.92				4.856 (12.07)			.980	8.036	145.69
5	76.11					0.157 (2.08)		.648	30.769	4.35
6	282.10	-1.974 (-1.30)		0.315 (0.26)				.983	8.032	73.41
7	284.75	-2.221 (-10.07)				0.023 (1.06)		.986	7.310	89.16
8	194.47	-1.119 (-0.51)		0.334 (0.25)	1.738 (0.59)			.985	8.614	42.67
9	207.83	-2.446 (-12.61)				0.066 (2.60)	1.075 (2.22)	.994	5.475	107.58
10	0.78				4.594 (10.65)	0.061 (2.04)	0.503 (0.921)	.991	6.452	77.10
11	47.85				4.414 (11.65)	0.040 (2.14)		.990	6.353	118.82

Terminology:

- X₁ = Proportionate share of the Agricultural Sector in Total Employment in the 26-county area in 1966.
- X₈ = Share of Manufacturing Employment in Total Non-Agricultural Employment in the 26-county area.
- X₆ = Autonomous Non-Agricultural Employment as a proportion of Total Autonomous Sector Employment, 26-county area.
- X₇ = Induced Sector Employment as a proportion of Total Employment.
- X₉ = Regional Net Output per employee in Transportable Goods Industry at 1960 prices.
- X₁₁ = Government and Social Sector Employment as a proportion of Total Autonomous Non-Agricultural Employment.
- R = Multiple Correlation Coefficient.
- s.e.e. = Standard error of estimate.
- F = F-ratio.

TABLE 3B: Parameter Estimates for the 25-County Area, 1965 (*t*-ratio in parentheses)

Equation	Intercept	X_2	X_4	X_5	X_8	X_{10}	X_{12}	R	s.e.e.	F
12	297.49	-2.093 (-5.25)						.906	9.857	27.55
13	144.85		2.505 (2.30)					.685	16.975	5.31
14	124.94			2.119 (6.20)				.930	8.564	38.45
15	80.86				4.399 (4.75)			.889	10.690	22.52
16	89.78					0.132 (6.67)		.939	8.037	44.46
17	286.20	0.154 (0.09)		2.268 (1.28)				.930	9.375	16.04
18	175.99	-0.996 (-2.53)				0.024 (3.49)		.974	5.826	45.52
19	-129.46	2.621 (0.81)		3.140 (1.55)	3.543 (0.93)			.943	9.507	10.69
20	132.10	-1.477 (-4.97)				0.108 (6.26)	0.962 (2.93)	.992	3.672	79.27
21	7.63				2.558 (5.42)	0.110 (6.96)	0.634 (2.31)	.993	3.402	92.54
22	68.23				2.139 (3.60)	0.087 (5.17)		.983	4.646	72.99

Terminology:

X_2, X_4, X_8 , etc. = X_1, X_3, X_5 , etc. calculated for the 25-county area.

Format of the Equations

Regression analysis was applied using single equation, least squares to the two sets of cross-section data for the 26- and 25-county areas. As the same equations were run for both years, the number tested was over 70. It was decided to present only the 1965 results. A selected number of the equations are presented in Tables 3A and 3B. The validity of the results is not lessened because the 1960 equations are not presented: the same equations were significant in both years. Table 3A gives the regression results for the 26-county area, and Table 3B the results for the same equations run for the 25-county area.

Results for 26-County Area

The first five equations in Table 3A present the results of the simple regression of regional income *per capita* in the 26-county area (Y_d) on each of the first five explanatory variables. Equation 1 supports the hypothesis of a negative relationship between regional income *per capita* and the proportion of the labour force in agriculture (X_1); the resulting fit is reasonably satisfactory with a high R value, though the standard error is quite high. Equation 2 presents the result of the simple regression of Y_d on the share of Manufacturing employment in non-agricultural employment, (X_3). Although the sign of the coefficient is positive, the equation gives a poor fit by all statistical tests. There is no necessity for high regional income per head to be associated with a large manufacturing sector; only if it could be held that incomes *per capita* in the manufacturing sector were always

higher than incomes in other sectors of the economy, or had a greater inducement effect on higher income sectors, would this view be correct. The net output variable (X_9) takes account of the fact that the level of output varies with location. It could also be regarded as a more satisfactory variable than X_3 in that the Transportable Goods sector comprises Building, Construction, Electricity, Gas and Water, as well as the Manufacturing sector. However, the fit of equation 5 is only slightly better than that of equation 2. An explanation for this result may be that the inclusion of Dublin lessens the significance of this variable. Baker's work on the autonomous and induced sectors is given further support by the results of equations 3 and 4, which are only slightly less satisfactory, in terms of fit, than equation 1.

A major difficulty in using employment proportions as explanatory variables is that there are significant cross-correlations between the independent variables, i.e., the statistical problem of multi-collinearity. The results of equations 6 and 8 confirm this. The significance of the individual coefficients is destroyed, while the overall fit of the equations, as measured by the R value and the standard error, remains very good.⁸ The choice of the best explanatory equation from the eleven presented lies between the last three equations. Equation 9 is marginally the best by the statistical criteria because all the independent variables are significant, the R value extremely high, and the standard error low. It is obvious from equations 1 and 4 that X_1 and X_7 are almost equally satisfactory substitutes for one another. In equation 10, the coefficient of X_{11} is insignificant, and equation 11 shows that the result of dropping it only affects the fit slightly. Thus the most satisfactory explanatory equations for the 26-county area in 1965 are equations 9 and 11. The explanatory power of X_1 may be overstated, due to the inclusion of Dublin, because this is an extreme observation, in the sense that it has by far the lowest figure for X_1 , and the highest value of income per head, in the 26-county area. The results for the 25-county area in Table 3B may test this hypothesis.

Results for 25-county Area

The table gives the general impression that the exclusion of County Dublin tends to lower slightly the fit of the equations. This can be seen by contrasting equation 1 in Table 3A with equation 12 in Table 3B. The significant reduction in the R-value tends to confirm the hypothesis that the inclusion of Dublin overstates the negative relationship between the dependent variable and the proportion engaged in agriculture. Once again the results of equation 13 shows that using manufacturing employment as the explanatory variable gives an unsatisfactory fit.⁹ Equations 14 and 15 supports the view that the autonomous

8. This is partly due to the formulation of the independent variables as proportions. There is the danger that the sum of the proportions may add to unity. Also Baker points to the existence of a significant negative relationship between the size of the agricultural sector and the induced sector, i.e., between X_1 and X_5 and between X_1 and X_7 and a positive relationship between X_5 and X_7 .

9. Whenever X_3 and X_4 were included with other variables in equations not presented in Tables 3A and 3B, the individual co-efficients of X_3 and X_4 were never significant and occasionally the coefficient sign was negative.

non-agricultural sector and the induced sector are more satisfactory indicators of regional development than the size of the manufacturing sector. The result of equation 16 suggests that, for the 25-county area, the best single predictor of the level of regional income *per capita* is the net output variable. This result is somewhat surprising; but it could be argued that the level of net output *per capita* in the Transportable Goods sector has an inducement effect on income *per capita* in other sectors. Contrasting this result with the poor fit of the same equation for the 26-county area (see equation 5, Table 3A), confirms the hypothesis that the inclusion of Dublin county lessens the significance of this variable. The autonomous sector variable, X_6 , is only slightly less satisfactory as a determinant of regional income *per capita* levels. The combination of X_2 and X_{10} in equation 18 gives a satisfactory fit, though the net output variable tends to be more significant than the proportion engaged in agriculture (X_2). Contrasting the results of equations 21 and 22 shows that the effect of adding X_{12} as an explanatory variable increases the goodness of fit of the equation, while the coefficient of X_{12} is itself significant. Thus the final choice of a best explanatory equation lies between equations 20 and 21, with the final choice falling on equation 21 because of the lower standard error of the equation.

If the hypothesis is accepted that the most meaningful index of regional growth in Ireland is the 25-county average, then the most satisfactory equation to explain the level of regional income *per capita* in 1965 is:

$$Yed_{1965} = 7.6275 + 2.5576X_8 + 0.1101X_{10} + 0.6338X_{12} \quad (A)$$

(5.425) (6.963) (2.308)

$$r = .993, \text{ s. e. e.} = 3.402, F = 92.539 \text{ and } \bar{Y}ed = 206.25.$$

The goodness of fit of equation (A) is confirmed by examining the results of the same equations run with 1960 data. The full results are not presented, but the "best" equation for the 25-county area was of the same form as equation (A):

$$Yed_{1960} = -22.6396 + 3.2166X_8 + 0.0858X_{10} + 1.1393X_{12} \quad (B)$$

(7.099) (3.898) (4.408)

$$r = .993, \text{ s. e. e.} = 2.562, F = 100.694, \text{ and } \bar{Y}ed = 176.75$$

An examination of equations (A) and (B) suggests that between 1960 and 1965 the slope of the regression flattened out. It was decided to test whether the observed differences in the coefficients were significant.¹⁰ The results indicated that the change in the coefficients of X_8 and X_{10} was not significant. The hypothesis of stability in the coefficients was rejected in the case of X_{12} . This may reflect the growth in the other sectors of the economy from 1960-1965. An increasing proportion of employment in the "Government and Social" sector would lead to an increase in *per capita* income only to the extent that average income *per capita*

10. The test adopted was that for the differences between two means using the *t*-distribution [13].

in that sector was greater than in the other sectors of the economy, or the inducement effect was positive on the remainder of the economy. As the size of the agricultural sector diminishes, and the remainder of the autonomous and induced sectors grow, this relationship is less likely to hold, and the explanatory power of X_{12} on Y_{ed} will be correspondingly reduced.

Actual and "Expected" Income Estimates

The utility of the cross-section regressions for prediction purposes could not be tested due to the lack of observations outside the regression set. However, applying cross-section analysis over time may give poor results because there are often broad temporal movements in the independent variables which a "snap-shot" cross-section regression may fail to catch. Time may reveal that the assumption of linearity in the relationship is an inadequate specification.

As a further test of the goodness of fit of the "best" equations, the value of each independent variable for each region was substituted into equations (A) and (B). This gives "expected" income *per capita* estimates for each region for 1960 and 1965. These "expected" figures are then compared with the actual income *per capita* figures in Table 4. It is clear from the small size of the residuals in both years that the equations explain the level of regional income *per capita* very well. A test of this is to express the residual, i.e., the difference between the actual and expected values, as a proportion of the actual value. The proportion ranges from an error of 2.7 per cent for the Midlands in 1960, to zero error for the adjusted Dublin region in 1960. In 1965 the range of the residual lies between 1.7 per cent for the North-West region, to 0.16 per cent for the Midlands.

TABLE 4: *Actual Regional Income per capita in the 25-county area compared with "Expected" income estimates derived from equations (A) and (B)*

Region	Income per Head (£)					
	1960			1965		
	Actual	Expected	Residual	Actual	Expected	Residual
1. The Dublin Region	193	193.0	+0.0	216	215.6	0.4
2. The South-East	188	189.5	-1.5	220	222.6	-2.6
3. The South-West	195	195.6	-0.6	233	229.4	3.6
4. The Mid-West	188	187.0	1.0	225	227.5	-2.5
5. The Western Region	156	157.8	-1.8	181	178.0	3.0
6. The Midlands Region	166	162.2	3.8	188	188.3	-0.3
7. The North-East	176	174.9	1.1	211	209.6	-1.4
8. The North-West	152	153.9	-1.9	176	179.0	-3.0

Thus the results of the econometric work reveal that the level of regional income *per capita* in the 25-county area can be satisfactorily explained by a combination of Baker's revised classification of employment sectors and a variable representing the level of net output per employee in transportable goods industry. A comparison of the results of the equations for the 26- and 25-county areas indicates that the exclusion of Dublin county from the analysis makes a significant difference to the results.

Conclusions

The thesis has been put forward that "economic regions" analysis is now more meaningful for regional development purposes than the county by county approach. From a study made of the patterns of regional income growth in 1960-65 the conclusion was drawn that regional growth was unbalanced in this period. The Mid-West, North-East and South-West regions all improved relative to the 25-county average; while the Midlands showed a decline towards the position of the Western region. Finally, econometric analysis indicated that a combination of sectoral employment proportions and a net output per employee variable satisfactorily explained the level of regional income *per capita* in 1960 and 1965.

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