Deprivation and its Spatial Articulation in the Republic of Ireland

New Measures of Deprivation based on the Census of Population, 1991, 1996 and 2002

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Foreword

ADM funded programmes have made a significant contribution to promoting social inclusion, reconciliation and equality through social and economic development within communities over the past decade. The identification of these communities has been greatly facilitated through the development of the Haase Index of Relative Affluence and Deprivation which is constructed using census data. In 1993, 1995 and 1998, ADM commissioned local area reports based on the 1986, 1991 and 1996 Censuses, respectively. The Haase Index was one of the factors used to identify designated areas of disadvantage in the preparation for the Operational Programme for Local, Urban and Rural Development (1994-1999) and the establishment of Area-Based Partnership companies.

The 1998 Haase Index examined the population figures and deprivation scores of designated disadvantaged areas and identified the relative level of deprivation in communities based on the 1996 Census information. The geographical unit used was the District Electoral Division, which broke counties down into manageable and coherent areas. The Haase Index deliberately included variables beyond measures of material deprivation which endeavoured to capture the structural weaknesses which contributed to the disadvantaged status of the areas in question.

In 2003, ADM commissioned Trutz Haase and Jonathan Pratschke to develop a new Deprivation Index based on the 2002 Census. This new index builds on the 1998 Haase Index and draws on international best practice in the construction of deprivation indices. Local area reports were prepared and circulated to all Area-Based and Community Partnerships, County/City Childcare Committees and made available to all County/City Development Boards in 2004. The construction of the 2002 Index introduces a number of developments, the most important of which is the stronger emphasis placed on conceptualising the underlying dimensions of deprivation and the causal paths that lead to persistent deprivation. This facilitates the comparison of scores across successive census periods and the Index compares 1991, 1996 and 2002 Censuses, resulting in the identification of Relative Affluence and Deprivation over this period.

The authors identify the underlying dimensions of social disadvantage (Social Class Disadvantage, Demographic Decline and Labour Market Deprivation) and estimate scores for these variables. The dimensions are then combined to form a measure of Overall Affluence and Deprivation. This approach allows the same set of dimensions to be measured using successive waves of census data, establishing a common structure and measurement scale.

While the census provides a unique snapshot of social and economic characteristics at a particular point in time and facilitates comparisons over time, there are a number of inherent limitations to a census-based deprivation index that the authors identified and are outlined below:

- The nature of census data imposes limits on the measurement of disadvantage because census tracts represent a relatively arbitrary sub-division of space that often does not always coincide with the boundaries of local communities. Like other researchers, they are forced to adopt a definition of “community” or “local area” that is the same as the census tract.
- There is a degree of uncertainty that surrounds the interpretation of spatial estimates. The authors give the example that an unemployment rate of 10% in a particular area might result from a uniform distribution of unemployed people *or* from a single “unemployment black-spot” within an otherwise affluent area.
- The issue of population size. Some previous indices of disadvantage have incorporated the size of an area’s population into its deprivation score, on the basis of assuming that a larger area would suffer much greater problems than a smaller area even if both had the same deprivation score. Haase and Pratschke argue that by building in population size in this way, the index would be biased towards more populous, urban areas and would overlook pockets of disadvantage elsewhere. They have sought to maintain an index that “is like a thermometer, yielding comparable measurements in all areas”, and argue that the measurements can then be weighted by population size if this is required for the purposes of allocating resources.

While it is important to be aware of these issues, they do not detract from the 2002 Deprivation Index's three key functions. In the first instance, it provides a reliable tool for targeting resources at the objectively most disadvantaged areas. Secondly, it assists in creating the political consensus necessary to allow resources to be distributed in this way. Thirdly, it facilitates the monitoring and quantification of change over time in the level of disadvantage observed within specific areas and across the country as a whole.

This report articulates the key concepts associated with developing a deprivation index. It also outlines the main methodological considerations that underpin the construction of the 2002 Deprivation Index. The authors examine the substantive findings from their research and compare the overall scores for affluence and disadvantage at Electoral Division level, in Local Authority Areas and make comparisons on a Regional basis.

ADM would like to thank Trutz Haase and Jonathan Pratschke for their work in researching and constructing the 2002 Deprivation Index, which has a significant contribution to make in planning interventions aimed at addressing the uneven spatial outcomes of economic development.

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Executive Summary

This study is based on a powerful and innovative approach to the construction of deprivation indices. The approach builds on the best elements of existing approaches, whilst simultaneously pushing out the boundaries in favour of greater conceptual clarity and precision.

The role of deprivation indices

In response to the persistent failure of certain urban and rural areas to benefit from economic growth at national level, successive Irish Governments have developed a plethora of area-based initiatives with a wide and complex agenda, addressing the needs of individuals and communities. The primary aim of these initiatives is to complement existing statutory interventions by addressing the underlying structural weaknesses which contribute to the disadvantaged status of the areas in question. Deprivation indices should therefore identify the *underlying* dimensions which contribute to uneven spatial development rather than simply providing an estimate of the number of individuals or households living in poverty.

Measurement scale

Very few areas experience substantial changes from one census wave to the next in their relative affluence/deprivation vis-à-vis other areas. For this reason, the indices presented in this report pay greater attention to the actual level of disadvantage experienced, using finely-differentiated deprivation scores to track changes over time.

The underlying dimensions of deprivation

Most deprivation indices make use of factor analytical techniques. This approach is taken a step further in the indices presented in this study. Based on experience with census data from various countries and utilising new estimation techniques, the authors identify the underlying dimensions of social disadvantage (**Social Class Disadvantage**, **Demographic Decline** and **Labour Market Deprivation**), and estimate scores for these. The dimensions are then combined to form a measure of **Overall Affluence and Deprivation**. This new approach allows the same set of dimensions to be measured using successive waves of census data, establishing a common structure and measurement scale.

Comparison over time

None of the deprivation indices that have been developed to date in European or OECD countries permit true comparisons to be made between two census periods. This is clearly a major shortcoming, as it means that they cannot be used to evaluate change over time or to monitor the effects of intervention programmes. Due to the new method of index construction presented in this report, it is no longer a problem to produce directly comparable indices for successive census periods, facilitating the measurement of change over time.

Substantive Findings

Ireland 1991-2002, a period of sustained growth

The first set of maps presented in this report show the actual level of overall affluence and deprivation in 1991, 1996 and 2002, using identical intervals for all three maps. The scores range, in broad terms, from -50 to +50, with higher values indicating greater affluence and lower values indicating greater deprivation. The scores are not de-trended; i.e. the mean for 1991 is zero, but the means for 1996 and 2002 are approximately 7 and 15 respectively, reflecting the considerable growth in the Irish economy over this 11-year period.

The maps provide fascinating insights into the spatial distribution of this growth, most importantly its nodal character and the overriding importance of Ireland's urban centres. The most affluent areas of the country are distributed in concentric rings around the main population centres, mainly demarcating the urban commuter belts. The maps show how rapidly these rings of affluence expanded during the 1990s as large-scale private housing development took place in the outer urban periphery, leading to high concentrations of relatively affluent young couples. Furthermore, after many decades of relative deprivation in Dublin's Inner City, for the first time there is evidence of substantial gentrification, particularly along the Liffey Quays.

The spatial distribution of deprivation over time

The second set of maps shows the limited degree to which the *relative* position of local areas changed during the 1990s. The worst-affected areas in 1991 were generally the worst-affected ones in 2002. As is increasingly clear from analyses carried out in different countries, the spatial distribution of relative deprivation is highly stable over time. Indeed, as a recent study of England and Wales shows, the distribution of relative deprivation in these two countries has not changed dramatically over the course of a century. Because of this stability in the spatial distribution of deprivation over time, the limited changes that have occurred – particularly in Dublin City – are of great interest, and these alterations may be quantified thanks to the new approach employed in this study.

The transformation of Dublin's Inner City

There has been a rapid and massive gentrification of Dublin's Inner City, and of the Liffey Quays in particular. This is clearly visible from the maps included in this report, reflecting the impact of intensive redevelopment in the areas concerned. Indeed, the population of the Inner City increased by nearly one third between 1991 and 2002 and in some areas the number of residents increased by a multiple of two or three. This has led to a significant influx of dual-earner couples and young families, a relatively income-rich and affluent population which has produced a significant change in the social composition of the centre of Dublin. For example, the percentage of adults with no more than a Primary School education roughly halved between 1991 and 2002, whilst the percentage with a Third Level education almost quadrupled (individual EDs show even greater changes). The transformation of Dublin's Inner City is all the more dramatic given the overall stability of the spatial pattern of relative affluence and disadvantage.

1 Introduction

One of the fundamental aims of the European Union is to achieve greater social and economic cohesion between its member states. As part of this overall aim, the EU has also committed considerable resources in recent years to the achievement of greater regional cohesion *within* member states. This has encouraged European governments to develop a plethora of area-based initiatives with a wide and complex agenda, ranging from economic development to the co-ordination of existing policies, from the identification of unmet needs to the mobilisation of local resources.

Deprivation indices are one of the principal tools for measuring and tackling the uneven spatial outcome of economic development and have a long history in the Anglo-Saxon countries. These indices are frequently used by governments to identify localities where social need is particularly accentuated and to target additional resources at these areas.

The first *Index of Relative Affluence and Deprivation* in Ireland was constructed by Trutz Haase using the 1986 Census of Population, in the context of the Government's decision to extend the original pilot projects to combat long-term unemployment under the *Programme for Economic and Social Progress* (PESP) to the worst-affected areas throughout Ireland. The index was subsequently updated using the 1991 and 1996 Censuses. It has achieved considerable popularity with the individuals and organisations directly involved in local development and has been utilised by a wide cross-section of government departments and local development agencies.

The construction of the 2002 Index builds on the success of the previous Irish deprivation indices, whilst also introducing some significant innovations. The most important of these is the stronger emphasis placed on conceptualising the underlying dimensions of deprivation and the causal paths that lead to persistent deprivation. This opens the way to the comparison of scores across successive census periods. Thus, the present study not only offers a consistent and comparable Irish Deprivation Index for the 1991, 1996 and 2002 Censuses, but also makes a considerable contribution to international debates about index construction.[1]

[1] A version of this index, using the 1986, 1991 and 1996 Censuses, was presented by the authors at the Fifth International Conference on Logic and Methodology, organised by the International Sociology Association (Cologne, October 2000).

2 Methodological Considerations

In this chapter, we will outline the main methodological considerations that underpin the construction of the 2002 Index (and the estimation of comparable indices for the 1991 and 1996 Censuses). The chapter is divided into six sub-sections, each of which constitutes a critical element in the analysis:

i. a detailed discussion of the role of space in the social organisation of society
ii. identifying the strengths and weaknesses of existing deprivation indices
iii. taking into account the multidimensional nature of social disadvantage
iv. identifying powerful indicators
v. the appropriate estimation of overall deprivation
vi. the measurement of change over time

We will outline the methodology used to construct the new index in broad terms, describing the key decisions that were taken, from the initial conceptualisation of the index to the final completion of the maps. The technical details of the analysis, which may not be of interest to all readers, are included in Appendix B.

2.1 Social Disadvantage and its Spatial Articulation

Social stratification cannot be divorced from its spatial articulation, and the importance of space in contemporary Ireland appears, if anything, to be increasing. Due to political pressures, the Government has withdrawn the requirement that each new housing estate should reserve twenty per cent of units for social or affordable housing, a powerful reminder of the political pressures which can obstruct attempts to reduce the pervasiveness of spatial segregation. Those who can afford it are willing to pay an escalating premium in order to live in 'exclusive' or desirable areas. Middle-class parents are willing to incur considerable expenses in order to send their children to fee-paying schools, and many parents give considerable weight to the reputation of local schools when choosing where to live. The rationale underlying this consideration is that scholastic achievement is highly influenced by contextual factors, and parents are well aware of this.

Indeed, there is a rich international literature dealing with what are commonly referred to as *neighbourhood effects*. Neighbourhood effects derive from factors that affect the life chances of individuals over and above what might be predicted from their individual socio-economic circumstances. Two examples will suffice to highlight both their existence and great importance. The first involves rural communities that have experienced prolonged labour market disadvantage in the form of a simultaneous decline in demand for agricultural labour and an absence of alternative job opportunities. As a consequence, many people who grew up in marginal farming households have emigrated. Clearly, we can no longer measure the degree of deprivation in areas such as these on the basis of their unemployment level. Nevertheless, few would disagree that they are highly deprived, even though there may not be large concentrations of deprived people within them.

The second example comes from the educational sector, and applies mainly to deprived urban areas. Children from disadvantaged backgrounds tend to have lower educational achievements than children from more privileged families. However, children from disadvantaged backgrounds who share their school environment with other poor children have a much greater risk (up to one-and-a-half times greater) of becoming an 'educational failure' than those who study alongside children from more affluent homes. This is an example of a 'neighbourhood effect', and sophisticated statistical techniques have been developed in recent years that enable one to quantify the impact of the wider social context on individual educational outcomes. Although the study of neighbourhood effects represents

an important advance in social science methodology, it is striking that few such studies have been undertaken in Ireland.[2]

These examples reveal the potentially misleading results obtained when aggregate measures of social disadvantage rely on an individualistic conception of poverty, rather than applying a wider, social concept of disadvantage which takes into account the structural limitations that curtail people's life chances and opportunities, including their shared environment.

2.2 Review of Existing Deprivation Indices

Over the past two decades, a number of multivariate indices have been developed in Anglo-Saxon countries, with the aim of providing an objective measure of the relative affluence or deprivation of local areas. Well-known British indices include the Carstairs Index[3], the Townsend Index[4], the DoE 1981 Index of Deprivation[5], and the UK Index of Local Conditions.[6] Less well-known are the 'Breadline Britain' Index[7] and the 'People and Places' Index.[8] Indices for Northern Ireland include the Index of Relative Deprivation[9] and the Noble Index.[10] A general deprivation index for the Republic of Ireland was developed by Haase[11], and an Index for Health and Health Services has been put forward by SAHRU.[12] Indices have also been developed in other Anglo-Saxon countries, including New Zealand[13] and the US.[14]

All of the above indices (with the exception of the Noble Index) rely exclusively or almost exclusively upon variables derived from the Census of Population in order to construct a multivariate scale and to provide a ranking of areas. The reason for this is that the census provides a unique 'snapshot' of social and economic conditions, in all areas, at a high level of spatial disaggregation. Furthermore, the phrasing of the questions included in the census form tends to remain relatively stable over time, thus facilitating comparison.

There is also considerable agreement amongst academics and policy-makers in relation to the domains that must be considered when developing a deprivation index. Table 2.1 below shows the domains and variables used in the most well-known indices from Britain, Northern Ireland and the Republic of Ireland.

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2 The only two Irish studies that have thus far applied multilevel modelling techniques to explicitly address the measurement of neighbourhood effects are Emer Smith (1999) *Do Schools Differ?* Dublin: ESRI and Trutz Haase & Jonathan Pratschke (2003) *Digital Divide – Analysis of Uptake of Information Technology in the Dublin Region.* Dublin: Dublin Employment Pact. A detailed discussion on the importance of neighbourhood effects is provided by Pratschke in an appendix to Haase & McKeown, *Developing Disadvantaged Areas through Area-Based Initiatives – Reflections on over a Decade of Local Development Strategies.* Dublin: ADM.

3 Carstairs, V. and Morris, R. (1991) *Deprivation and Health in Scotland.* Aberdeen: Aberdeen University Press

4 Townsend, P., Phillimore, P. and Beattie, A. (1988) *Health and Deprivation: Inequality and the North.* London: Croom Helm

5 Department of the Environment UK (1983) *1981 Deprivation Index*. London: HMSO.

6 Department of the Environment UK (1994) *1991 Deprivation Index: A Review of Approaches and a Matrix of Results*. London: HMSO.

7 Mack, J. & Lansley, S. (1985) *Poor Britain*. London: Allen & Unwin.

8 Forrest, R. & Gordon, D. (1995) *People and places: social and economic distinctions in England.* Vol. 2. Bristol: School for Advanced Urban Studies.

9 Robson, B., Bradford, M. & Deas, I. (1994a) *Relative Deprivation in Northern Ireland. Manchester: Centre for Urban Policy Studies*, Manchester University.

10 Noble, B. et al (2001) *Measures of Deprivation in Northern Ireland.* Belfast: NISRA

11 Haase, T. (1993) *Identifying Prospective Areas for Inclusion in the Local Development Programme*, Report to the Combat Poverty Agency; Haase, T. (1999) *Affluence and Deprivation: A Spatial Analysis Based on the 1996 Census of Population.* Dublin: Report to Area Development Management.

12 SAHRU (1997) *A National Deprivation Index for Health and Health Services Research.* Dublin: TCD

13 Wilson, W. J. (1996) *When Work Disappears: the New World of Urban Poor*. New York: Alfred A. Knopf.

14 Duncan, G. & Aber, J. L. (1997) 'Neighbourhood models and measures'. In J. Brooks-Gunn et al. (Eds.) *Neighbourhood Poverty: Context and Consequences for Children*. Vol. I. New York: Russell Sage Foundation.

Table 2.1: Comparison of the most widely-used deprivation indices in Britain and Ireland

Domain / Census Variable	Townsend (1988)	Carstairs-Morris (1989)	Jarman (1984)	DoE 1983	DoE 1994	NI 1994 (Robson)	NI 2001 (Noble)	Haase (1995)	Haase (1999)	Haase-Pratschke (2004)
Labour Market										
Unemployment	✓	✓	✓	✓	✓	✓		✓	✓	*2*
Males in part-time employment						✓				
Small farming								✓	✓	
Low Skills										✓
Housing / Amenities										
Overcrowding	✓	✓	✓	✓	✓	✓		✓		✓
Not owner-occupied / LA housing	✓							✓		
No car access	✓	✓			✓	✓		✓		
Lacking amenities				✓	✓					
Children in unsuitable accommodation					✓	✓				
Children in low earner household					✓	✓				
Households with no bath, shower or WC						✓				
Properties without public sewerage						✓				
Vacant dwellings				✓						
Pensioners with no central heating						✓				
Education										
Educational participation					✓	✓		✓	✓	*2*
Health										
Permanent sickness				✓		✓				
Social Class										
Social class		✓	✓					✓	✓	*2*
Single parent			✓					✓	✓	✓
Under age 5			✓							
Lone pensioners			✓							
One-year immigrants			✓							
Ethnic minorities			✓	✓						
Large household				✓						
Demography										
Age dependency								✓	✓	✓
Population change										✓
Non-Census variables										
Income					✓		*8*			
Employment					✓	✓	*4*			
Health					✓		*5*			
Education					✓		*6*			
Services					✓		*9*			
Social Environment							*10*			
Housing/Environment					✓	✓	*3*			

** Numbers indicate multiple indicators*

There is a much lower level of agreement, however, regarding which and how many variables to include in a deprivation index. This debate is often characterised by a rather arbitrary approach, influenced more strongly by the variables that are most readily available than by conceptual ideas. Some have argued that deprivation indices should include only variables reflecting 'material' deprivation, in contrast to social characteristics, at best described as 'risk factors' (SAHRU, 1997). We disagree with this distinction, and would argue that it fails to recognise that *all* indicator variables derived from aggregate census data require a probabilistic interpretation. For example, not all unemployed individuals are poor, car ownership is not an infallible measure of affluence and not all people living in cramped housing conditions are deprived.

As all aggregate indicator variables must be interpreted in probabilistic terms, it is not important whether a variable is directly or inversely correlated with deprivation (cf. SAHRU, 1997). The absence of individuals with high educational attainments is not merely an indicator of deprivation, but may also contribute to disadvantage, due to the key role of middle-class families in lobbying, cultural promotion, social organisation and the provision of positive role models. Moreover, the *absence* of individuals with a high social class position is not synonymous with the *presence* of individuals with a low social class position, as the relative size of the intermediate categories can also vary. Thus, it is perfectly reasonable to include measures of both 'high' or 'low' social class or educational attainments in an index of deprivation.

The major methodological challenge posed by the construction of a synthetic index is to produce a single measure using a number of indicator variables, lying along one or more dimensions. The most straightforward approach involves adding together the values of the variables, following standardisation.[15] We believe that this general approach suffers from serious methodological and conceptual problems, primarily because it does not take into account the pattern of relationships between the indicator variables. If multiple dimensions are present, as is typically the case, then an implicit weighting will be applied in accordance with the number of indicators included from each dimension. Robson et al. (1994b) implicitly accept this point, but argue that "where there are high pairwise correlations, the selected indicators represent different conceptual aspects of deprivation and their spatial coincidence should not be used to lessen their contribution to deprivation". But this glosses over the issue of bias, as the implicit weighting of the Robson Index prioritises disadvantaged urban areas.[16] The Noble Index is equally flawed in this respect, but has a number of additional problematic aspects, including the nature of the transformation applied to the variables, which does not take the distribution of the indicator variables into account and renders comparisons over time impossible.[17]

The second approach to the weighting of indicator variables uses a specially-commissioned survey.[18] For example, Gordon uses an individual-level survey to derive weights for six census 'proxies'. The weights are calculated using a statistical model in which the key outcome variable is a measure of individual deprivation constructed using a 'checklist' of deprivation items; an individual is classified as deprived if they lack three or more 'essential

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15 This procedure was, for example, adopted in the construction of the UK Department of the Environment Index of Deprivation (1983) and, in different forms, by Robson (1994), Jarman (1984) and Noble (2001). The Robson and Noble indices rely on various mathematical transformations of values prior to summation, whilst the Jarman Index relies on the subjective ratings of General Practitioners.

16 For example, the Robson Index contains numerous indicators associated with 'urban' patterns of disadvantage (unemployment and long-term unemployment, children in low-earner households, overcrowding, 17-year-olds not in education, births not jointly registered, etc.) but the more 'rural' facets of deprivation are measured indirectly by very few variables.

17 The domains specified by Noble and his collaborators for income and employment (both based on benefits data, both with a weighting of .25), as well as those for educational attainments (weighting of .15) and crime (the 'social environment', with a weighting of .05) all capture a distinctively 'urban' pattern of disadvantage. Given the weightings associated with these variables, it is unlikely that the variables relating to housing (.05), services (.10) and health (.15) can counteract this and yield a more balanced measure.

18 cf. Forrest & Gordon (1993) *ibid*; Gordon, D. (1995) 'Census based deprivation indices: their weighting and validation', in *Journal of Epidemiology and Community Health*, No. 49, Supplement 2, pp. S39-S44.; Mack & Lansley (1985) *ibid*; Townsend (1987) *op. cit.*

goods'.[19] But this assumes that deprivation is a unidimensional concept, as survey-based approaches require a single, definitive measure of disadvantage at the individual level.

The survey-based approach can also be criticised for deriving individual-level weights which are subsequently applied at the aggregate level; in fact, there is no reason why spatial aggregates should be bound by the same relationships as individuals. Neighbourhood and group effects, a key finding of sociological research over the course of the last decade, point in the opposite direction.[20] Finally, the exclusive emphasis of the survey-based approach on measurable, individual attributes leads inevitably to methodological individualism, and the specific, social forms of disadvantage experienced by remote rural areas and urban areas of concentrated deprivation, are consequently overlooked.

The third approach to the weighting of indicator variables encountered in the applied research literature relies on Principal Components Analysis (PCA). The methodological reviews carried out by Bartholomew[21] and Bell[22] identify this as the most robust approach, and an international survey commissioned by the OECD indicates that it is the most commonly-used approach in the construction of disadvantage indices.[23] The popularity of PCA is attributable to the fact that it controls for the pattern of relationships between the indicator variables and that the scaling of components does not depend on the number of indicators used. It is therefore consistent – at least in principle – with a dimensional analysis.

A large number of variables can be included in a PCA analysis without requiring specific theoretical justification, and in fact PCA is typically referred to as a 'data-driven' procedure. This is both a strength and a weakness: although the resulting indices are apparently 'objective' and precise, they are also rather unstable and often quite counter-intuitive.[24] Because of the importance of PCA within disadvantage research, we provide a detailed account of the drawbacks associated with this statistical technique in Appendix B.

Since all of the approaches cited above have major drawbacks, we believe that it is necessary to consider adopting a new approach. To return to the previous discussion, the main problems that must be overcome in the construction of deprivation indices are the need to produce a stable and interpretable set of dimensions and to avoid arbitrary operational decisions. We believe that Structural Equation Modelling[25] provides satisfactory solutions to these problems and that this technique, which has never been used in the context of deprivation indices, has great potential in this area.

In contrast to PCA (or *Exploratory* Factor Analysis), Structural Equation Models use a method of *Confirmatory* Factor Analysis; i.e. the dimensions of disadvantage are first conceptualised using theory and prior research findings and indicator variables are then selected to measure these. Each dimension is linked with a subset of indicator variables, which simplifies interpretation as well as giving greater scope for the exact use of indicator variables.[26] Like

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19 Gordon, D. (1995) *op. cit.*

20 cf. Haase, T. and Pratschke, J. (2003) *op. cit.*

21 Bartholomew, D. (1988) *Measuring Social Disadvantage and Additional Educational Needs. A Report to the Department of the Environment.* London: LSE Department of Statistical and Mathematical Sciences.

22 Bell, D. (1990) *Data Sources for Area Prioritisation: Section A – Review and Analytical Topics*. Edinburgh: DG Information Services.

23 Haase, T. (1998) "The Role of Data in Policies for Distressed Areas", Chapter in *Integrating Distressed Urban Areas*, Paris: OECD.

24 Examples of indices that use Principal Components Analysis include Townsend (1988), Carstairs & Morris (1989a, b; 1990), Duncan & Aber (1997), Haase (1996, 1999), SAHRU (1997) and Wilson et al. (1996); PCA was also recommended by Coombes et al. (1994) in their report to the UK Department of the Environment.

25 This field of statistical analysis was initially developed as an extension of Exploratory Factor Analysis , and developed into 'Confirmatory Factor Analysis' (see Jöreskog, K. (1969) 'A general approach to confirmatory Maximum Likelihood Factor Analysis'. *Psychometrika*, 34, pp. 183-202) and later 'Structural Equation Modelling' (Bollen, K. (1989) Structural Equations with Latent Variables. New York: John Wiley; Hayduk, (1987) *ibid*; Hoyle, R. (1995) *Structural Equation Modelling: Concepts, Issues and Applications*. Thousand Oaks: Sage; Loehlin, (1992) *op. cit.*).

26 In PCA, all variables are loading on each of the dimensions which makes it impossible to use variables for one dimension only and frequently leads to counter-intuitive factor loadings. Structural Equation Modelling, in contrast, allows much more specific models to be postulated with each dimension being specifically related to a subset of variables only. For example, population decline is a central variable to understand rural decline, but can have a positive meaning in the context of an overcrowded urban area. Thus the variable should be used for the rural dimension only.

Principal Components Analysis, Structural Equation Models can be used to estimate disadvantage scores for individual areas, and the scores estimated by a Structural Equation Model have the advantage that they measure precisely the theoretical constructs specified by the researcher. Above all, where a common model is implemented, these scores are comparable from one period of time to another and from one country to another. This represents a major breakthrough in the construction of deprivation indices as, for the first time, they may be used not only for resource allocation, but also for monitoring and evaluation. In the following sections of this report we will show how this approach can be applied to the Republic of Ireland, using the 1991, 1996 and 2002 Censuses of Population.

2.3 The Underlying Dimensions of Social Disadvantage

Based on an extensive review of deprivation indices in OECD countries, as well as a detailed study of census-based indices in use in Ireland, Northern Ireland and Britain, we believe that three dimensions can explain a large proportion of the variation of most commonly-used indicators of affluent and disadvantaged locations. These are **Demographic Decline**, **Labour Market Deprivation** and **Social Class Disadvantage**. These three underlying dimensions contribute to the significant regional variations in affluence and deprivation that are observed, and represent distinct entities that cannot be further simplified. Using the Irish example, we shall briefly elaborate on the main characteristics of these three dimensions and outline their significance to the study of social disadvantage.

2.3.1 Demographic Decline

Emigration has characterised Ireland's demographic experience for more than a century, setting it apart from the countries of central Europe. Historically, the rural Western counties have experienced major population loss, leading to the demographic distortion and demoralisation captured in Brody's *Inishkillane* (Brody, 1973). The *Report of the Commission on Emigration and other Population Problems* (1955) defined the West of Ireland as a "Region of Special Demographic Disadvantage", highlighting the consequences of demographic decline, including the 'hollowing-out' of working age cohorts.

Unlike their manifestation as unemployment blackspots in urban areas, long-term adverse labour market conditions in rural areas tend to manifest themselves either in agricultural underemployment or in emigration. The former occurs due to the strong social incentives that encourage farmers to maintain small landholdings, even where these do not provide a full income. Moreover, individuals who are unable to find paid employment in disadvantaged rural areas may withdraw from the labour market in order to assist a relative engaged in farming. Where agricultural employment is scarce, long-term adverse labour market conditions generally lead to emigration. Emigration is also, and increasingly, the result of mismatches between education and skill levels, on the one hand, and available job opportunities, on the other. In both cases, the (rural) unemployment rate is likely to vastly understate the real extent of labour market disadvantage. Thus, Noble et al. (2001: 7) make a considerable oversight when they assert that "high rates of unemployment can in principle occur in both rural and urban wards, and would then be captured by the rate of people claiming the relevant benefits". Although this argument may be correct in principle, in practice it is misleading, as the process of demographic decline in disadvantaged rural areas tends precisely to deflate the prevailing unemployment rate.

Demographic Decline is thus conceptually quite distinct from other measures of acute labour market deprivation, such as the unemployment rate. There is, however, a second reason why we believe that this constitutes an important dimension of social disadvantage. Areas which experience prolonged population decline also suffer in other ways: emigration tends to be socially selective, and as emigrants are mainly drawn from the better-educated working-age cohorts, it leaves behind aging populations with greater economic dependency rates and frequently with lower levels of education. Thus, areas which experience Demographic Decline tend to enter a downward spiral where they become increasingly less attractive for new firms

and investments. Furthermore, as population decline continues, existing services such as transport, banks, post offices and shops have increasing difficulty merely in justifying their existence, adding further to the sense of deprivation experienced by the communities concerned.

It is not surprising that many of the British-based indices ignore this demographic dimension of disadvantage, as the main focus within British debates – reflecting the greater urbanisation of British society – is on urban forms of disadvantage. For similar reasons, we should not be surprised that the Irish deprivation indices for 1991 and 1996 attracted a high level of support, as they were truly multidimensional and included an explicit rural dimension.

2.3.2 Labour Market Deprivation

Unemployment and long-term unemployment remain important causes of disadvantage at national level, and are responsible for the most concentrated forms of multiple disadvantage found in urban areas. In areas with particularly high unemployment rates, young people face considerable difficulties in obtaining educational credentials and are handicapped by 'labelling effects', by a lack of role models and by initial difficulties in entering the labour market.

As Wilson[27] (1987) argues, in relation to the American context, the social isolation and disorganisation which characterises areas of concentrated unemployment itself represents an obstacle to the labour force participation of young people: "Macroeconomic conditions have reduced the demand for unskilled labour and limited the chances of those less equipped by education and background to compete for scarce jobs. Institutional resources within poverty neighbourhoods have declined with the exit of middle-class residents seeking more desirable locations and the limited commitment of government to sustain inner-city institutions". Fürstenberg & Hughes (1997) also report that in neighbourhoods characterised by high unemployment rates, families often experience a breakdown of social ties and a loss of community consensus, leading to a further decline in participation in community institutions and informal networks. This process leads to increasing despair regarding the possibility of intervening at local level and reversing the cycle of decline.

The extent of deprivation in areas of high unemployment can lead to levels of marginalisation from mainstream society that may threaten social cohesion, as the civil unrest that occurred in a number of American and British cities during the 1970s and 1980s testifies. In Ireland, high unemployment, particularly long-term unemployment, contributed to high levels of drug abuse and drug-related crime in certain urban areas during the 1980s, leading to the designation of the first twelve pilot areas to combat long-term unemployment under the PESP agreement in 1991.

2.3.3 Social Class Disadvantage

The third determinant of the well-being of communities is their social class composition: areas with a weak social class profile are more vulnerable to the effects of economic restructuring and recession and are more likely to experience low pay, poor working conditions and inadequate housing. Research has shown that social class is relatively stable over time and constitutes a major factor in the inter-generational transmission of economic, cultural and social assets.

Social class is not an easily-defined or readily-observable attribute, although this concept has considerable resonance with the general public. In fact, most people have an intuitive notion of class position and an implicit understanding of its effects on educational achievements, health, housing conditions and economic status. Interestingly, when we think about social class in most everyday situations, we intuitively perform the kinds of calculations that social scientists carry out using factor analysis, abstracting from individual indicators to a 'latent' or implicit conception of class. Thus, when we distinguish between observable outcomes, such

[27] Wilson, W. J., 1987; quoted in Fürstenberg & Hughes, 1997: 26

as income levels, housing quality and occupational mobility, on the one hand, and the underlying causal factor ('social class advantage/disadvantage'), we are merely formalising a common-sense understanding of class that is current in our society. Conversely, the results of Confirmatory Factor Analysis models of social class may be readily explained in terms of this everyday process of reasoning about concepts and characteristics that are not directly observable.

2.4 Indicator Selection and Transformation

Arguably, we should select as many variables as are necessary in order to adequately identify each of our underlying dimensions. Typically, three or four variables will suffice, and additional indicators will frequently contribute little to the estimates and may create interpretational difficulties. Based on the insights that we have gained during previous research, we have selected the age dependency rate and the decline in population over the previous five years as the main indicators of the first dimension of deprivation, **Demographic Decline**. The justification for this choice derives from the fact that out-migration is a key component of disadvantage in rural areas and is typically concentrated amongst the core working-age population. In addition to these two variables, the percentage of adults with no more than a Primary School education and the percentage with a Third Level qualification are also used as indicators of Demographic Decline. The reason for including these variables rests with the selective nature of out-migration, which gives rise to a demographic structure which is skewed towards elderly people, who tend to have relatively lower levels of educational attainments; average levels of educational participation have tended to increase with each successive age cohort over the course of the last century.

Turning to **Social Class Disadvantage**, the Census of Population assigns individuals to class categories depending on both their occupation (Professionals, Managerial and Technical Employees, Non-manual Employees, Semi-skilled Manual and Unskilled Manual) and their landholdings. The 'Semi-skilled Manual' category includes 'small farmers' with less than 30 acres of land. By combining the semi- and unskilled manual social classes, therefore, we can obtain a useful indicator of weak social class composition. The absence of affluent and well-connected individuals from an area is also relevant to its social class profile, because these people provide additional resources for community self-organisation, and for this reason we have included a measure of 'high social class' as well as one of 'low social class'. The 'Professional' social class includes farmers with 200 acres of land and more, and those with between 100 and 199 acres are allocated to the 'Managerial and Technical' class. When combined, these two categories provide a powerful measure of affluence.

It is nevertheless evident that the definition of social class categories in the Irish Census of Population is somewhat problematic, as the category 'Other Non-manual' inexplicably groups together all 'white-collar' employees who cannot be assigned to the 'professions'. The weakness of this classificatory scheme is further underlined by the fact that a significant proportion of the workforce cannot be classified at all. The percentage of people whose social class position is 'unclassified' can reach very high levels, exceeding 40 per cent in the most deprived areas of Dublin, Waterford and Limerick. This clearly casts doubt on the adequacy of the remaining categories. As the 'unclassified' category includes – amongst others – people who have never been in paid employment, it seems likely that the size of the semi- and unskilled manual categories understates the extent of disadvantage in deprived areas. In order to counteract this problem, we have removed all 'unclassified' individuals from the denominator of our measure of the semi- and unskilled manual social classes.

In order to minimise these weaknesses, we include additional indicators of social class disadvantage. The close relationship between class and education has encouraged social scientists to explore the ways in which their class background conditions young people's experience of the school environment, thus reproducing the class structure over time. For many disadvantaged school students, the perceived likelihood of unemployment or low-skilled work feeds into disillusionment with the educational system. Conversely, low educational

attainments represent a considerable handicap within a 'credentialised' labour market in a state of rapid change. These processes form part of a broader system of inequality that is highly resistant to change and educational variables therefore represent important indicators of social class disadvantage. Our indicators of Social Class Disadvantage include the percentage of adults with no more than a Primary School education and the percentage of adults with a Third Level qualification. These two variables have already been mentioned in relation to Demographic Decline, and we intend to use them as indicators of this dimension as well as that measuring Social Class Disadvantage. The final indicator of Social Class Disadvantage is the average number of persons per room, which reflects housing quality and overcrowding.

As far as **Labour Market Deprivation** is concerned, we have selected the following indicators: the percentage of economically-active men and women who are unemployed and the percentage of households containing children aged 15 years and under which are headed by a single parent. We have decided to distinguish between the male and female unemployment rates, as these follow slightly different dynamics. The inclusion of unemployment variables requires little justification, given the centrality of paid work to individual and collective well-being in contemporary society, and there is little or no controversy within the literature in this respect. On the contrary, theoretical arguments may be required in order to broaden prevailing definitions of labour market deprivation beyond unemployment. For example, we have included a measure of lone parenting because those in receipt of Lone Parent Allowance are not classified as unemployed, because lone parenthood is an established risk factor for poverty and because high rates of lone parenting and unemployment tend to coincide spatially, due to the criteria used to allocate social housing as well as other factors.

Preliminary statistical modelling results, using 1996 Census of Population data, suggested two relationships that were not initially anticipated, but which make considerable sense from a theoretical point of view. Firstly, there is a significant link between Labour Market Deprivation and the size of the semi- and unskilled manual social class (an indicator of Social Class Disadvantage). The reason for this is that unskilled workers have a particularly weak labour market situation which exposes them to a disproportionate risk of unemployment. Secondly, Demographic Decline is inversely related to the percentage of lone parent households. In fact, areas with high rates of lone parenting often also have moderate to high rates of demographic growth, and this variable may thus be used as an (inverse) indicator of demographic decline. Both of these cross-loadings generalise to the 1991 and 2002 data. Table 2.2 below lists the names and definitions of all indicator variables included in the model.

Table 2.2: Variable Names, Areas Affected and Dimensions[28]

Name	Principal Dimensions	Types of Areas Affected	Description
AGEDEP	Demographic Decline	Mainly rural	Percentage of population aged under 15 or over 64 years
POPCHG	Demographic Decline	Mainly rural	Percentage change in population over previous five years
EDLOW	Demographic Decline + Social Class Disadvantage	Especially deprived rural	Percentage of adult population with a Primary School education only
EDHIGH	Demographic Decline + Social Class Disadvantage	All	Percentage of adult population with a Third Level education
HLPROF	Social Class Disadvantage	All	Percentage of persons in households headed by 'Professionals' or 'Managerial and Technical' employees, including farmers with 100 acres or more
PEROOM	Social Class Disadvantage	All	The mean number of persons per room
LONPAR	Labour Market Deprivation	Especially deprived urban	The percentage of households with children aged under 15 years and headed by a single parent
LSKILL	Social Class Disadvantage + Labour Market Deprivation	Mainly urban	The percentage of persons in households headed by 'Semi-skilled Manual' and 'Unskilled Manual' workers, including farmers with less than 30 acres
UNEMPM	Labour Market Deprivation	Mainly urban	The male unemployment rate according to the Census of Population
UNEMPF	Labour Market Deprivation	Mainly urban	The female unemployment rate according to the Census of Population

[28] As the distribution of some of the variables is not perfectly normal, we have used mathematical transformations to facilitate the modelling process; for example, the natural logarithm transformation was applied in four cases to correct for 'skew' (see Table 7.1 in Appendix B). Table 7.2 (Appendix B) provides descriptive statistics for the transformed indicator variables, drawing on the Irish Census of Population 1986-2002. It is also worth noting that we have "detrended" all of the educational variables by subtracting the mean for each census wave in order to control for the long-term tendency for average education levels to rise.

2.5 Estimating Overall Deprivation

The disadvantage model for a single wave of census data may be represented in graphical form (Figure 2.1). Three dimensions are indicated (shown as ellipses in the diagram) and each of these is associated with a number of indicators (denoted by rectangles).

Figure 2.1: Basic Model of Disadvantage

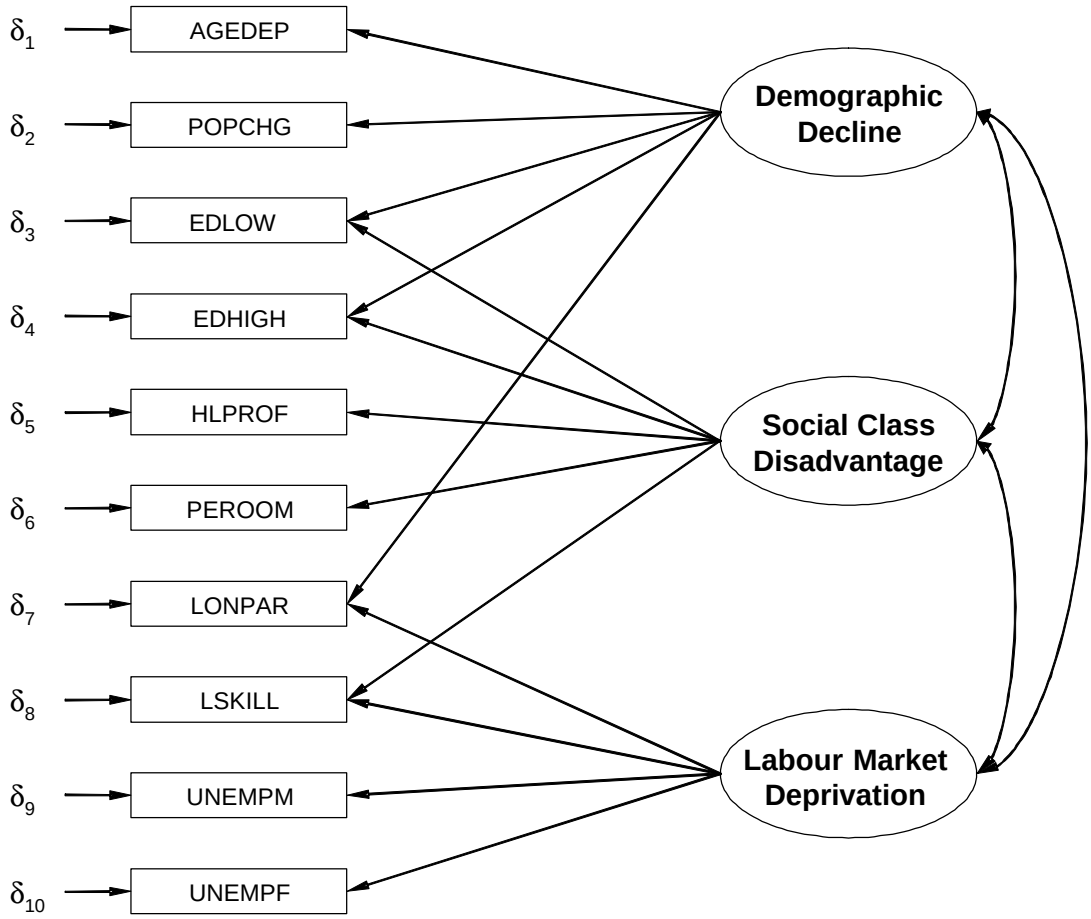


Figure 2.1 provides a graphical representation of the theoretical assumptions underlying our model of social disadvantage. An arrow in a diagram such as this indicates a causal relationship and hence the arrow pointing from Demographic Decline to population change indicates that Demographic Decline causes the latter. In fact, within the factor analytic tradition, dimensions are typically conceptualised as causing their indicator variables.[29] Further information on the specification of this model is provided in Appendix B.

It is important to recognise that the nature of census data imposes limits on our conceptualisation and measurement of disadvantage. Hitherto, we have treated the units of analysis as if they were homogeneous entities, although this obviously represents a simplification: census tracts represent a relatively arbitrary sub-division of space that often does not coincide with the boundaries of local communities. Thus, like other researchers, we

[29] Pratschke, J. (2003) "Realistic Models? Critical Realism and Statistical Models in the Social Sciences". *Philosophica* 71, pp. 13-38.

are forced to adopt a definition of the 'community' or 'local area' that is synonymous with the census tract.[30]

The main difficulty in this respect derives from the uncertainty that surrounds the interpretation of spatial estimates. In order to understand this issue, it is helpful to remember that an unemployment rate of 10 per cent may result from the presence of a single unemployment 'black-spot' within an otherwise affluent census tract or from a uniform geographical distribution of unemployed individuals. The policy implications of these two scenarios are clearly quite distinct, and we must therefore conclude that the heterogeneity resulting from the 'under-bounding' and 'over-bounding' of communities generates a degree of uncertainty.

The only way of dealing with this uncertainty is to make certain assumptions; for example, we assume that the unemployment rate indicates a 'risk of unemployment' which is distributed evenly within census tracts. Although this assumption will be rather inaccurate in some cases, it is not an unreasonable starting-point, bearing in mind that the most common uses of disadvantage indices do not require that we distinguish between different spatial patterns at the sub-tract level or between different functional forms.

The results of our disadvantage model when estimated separately using data from the 1991, 1996 and 2002 Censuses of Population are shown in Figures 7.1 to 7.3 in Appendix B. One of the most important substantive conclusions resulting from these models is the very weak relationship between Demographic Decline and Labour Market Deprivation. This indicates that labour market ('urban') and demographic ('rural') forms of disadvantage do not coincide spatially, in line with our initial hypothesis. **The implication of this finding is that there is no necessary correlation between the level of unemployment and the degree of disadvantage in rural areas.**

2.6 Achieving Comparability over Time

As far as the comparison of disadvantage scores is concerned, there are two pre-conditions for making valid comparisons between variables over time: they must have the same definition and their measurement scales must be the same. Unfortunately, these conditions are sufficient to rule out all existing disadvantage indices, creating difficulties for monitoring, policy evaluation and the assessment of long-term processes of change. This represents the primary motivation for developing a new disadvantage index for the Republic of Ireland. The methodology adopted in the construction of the measures presented in this report overcomes this problem by using the same model structure and measurement techniques for each successive wave of census data.

When we apply the model discussed above to data from the 1991, 1996 and 2002 Censuses, we find that the pattern of relationships between the observed variables remains stable over this extended period. We can therefore proceed to estimate factor scores and provide a geographical representation of the distribution of disadvantage in Ireland. In substantive terms, the results of our analysis indicate that there has been a significant and continuous improvement on all three dimensions of deprivation throughout the 11-year period between 1991 and 2002. Furthermore, the observations are more narrowly clustered around their mean at the end of this period.

The substantial economic growth that has occurred in Ireland over the past decade has also had the effect of slightly reducing the polarisation between the most affluent and most deprived areas with regard to their social class composition and their labour market and demographic experiences. The data also suggest that, during this period, Demographic Decline and Labour Market Deprivation were more responsive to economic growth than

[30] Bennett, L. (1993) 'Rethinking neighbourhoods, neighbourhood research, and neighbourhood policy: Lessons from Uptown'. *Journal of Urban Affairs*, Vol. 15, No. 3, pp. 245-257; Chaskin, R. (1994) 'Defining neighbourhood'. Background paper prepared for the Neighbourhood Mapping Project of the Annie E. Casey Foundation.

Social Class Disadvantage. This confirms our earlier suggestion that social class is both more deeply-rooted and more resistant to change than the other two dimensions, and thus less subject to cyclical variations.

The disadvantage model presented here represents a considerable step forward in the quantitative study of the spatial articulation of social disadvantage, opening up a number of possibilities. As we have already indicated, it provides policy-makers with comparable estimates of social disadvantage that are theoretically and statistically defensible. By including a marker for areas of public intervention in the model, and by controlling for relevant background variables, it can be used for monitoring purposes. This is of considerable importance, particularly given the current emphasis in policy-making circles on the use of objective criteria to assess the impact of public programmes. Moreover, it facilitates a precise, scientific analysis of changing patterns of disadvantage.

In order to illustrate the spatial distribution of disadvantage, we will use a series of thematic maps. In Chapter 3, we will analyse the three individual dimensions of disadvantage for the 2002 Census, as well as overall deprivation, for all three Census waves. Each of the maps based on the overall deprivation scores uses an eight-point scale, with equal ranges (except for the two extremes, which are wider, but contain relatively few cases). The ranges are held constant over time in order to reveal the changes that have occurred in actual affluence and deprivation scores over the 11-year period in question. The maps presented in Chapter 4, by contrast, show the distribution of scores around the average for each wave of data, and highlight the changes that occurred between 1991 and 2002 in the *relative* situation of local areas.

Whilst inspection of the individual dimensions sheds light on the determinants of disadvantage in specific areas, the overall scores remain of primary importance. It is therefore important to show how these may be derived from the component dimensions. Whereas unidimensional techniques always yield a single measure, multidimensional indices require a means of combining scores on component dimensions. The discussion in this regard parallels the previous discussion of weighting techniques: to simply add together a large number of scores gives rise to ‘double-counting’ and bias if certain dimensions are over-represented.

Because our disadvantage index comprises just three dimensions – Social Class Disadvantage, Demographic Decline and Labour Market Deprivation – the creation of the overall deprivation score is extremely straightforward. As we have shown, in deprived rural areas, social class disadvantage co-occurs with a structure of demographic decline caused by selective out-migration, and in deprived urban areas, social class disadvantage coincides with a structure of labour market deprivation caused by social/spatial polarisation and neighbourhood effects. Because of the weak relationship between the demographic and labour market dimensions, we can estimate overall disadvantage by adding together the scores for the three dimensions. ‘Double-counting’ is avoided because the structure is symmetrical and the correlation between the demographic and labour market dimensions is effectively zero. We use an equal weighting of the dimensions, as the distribution of the Irish population between ‘urban’ and ‘rural’ areas is roughly equal.

3 The Geographical Distribution of Deprivation, 1991, 1996, 2002

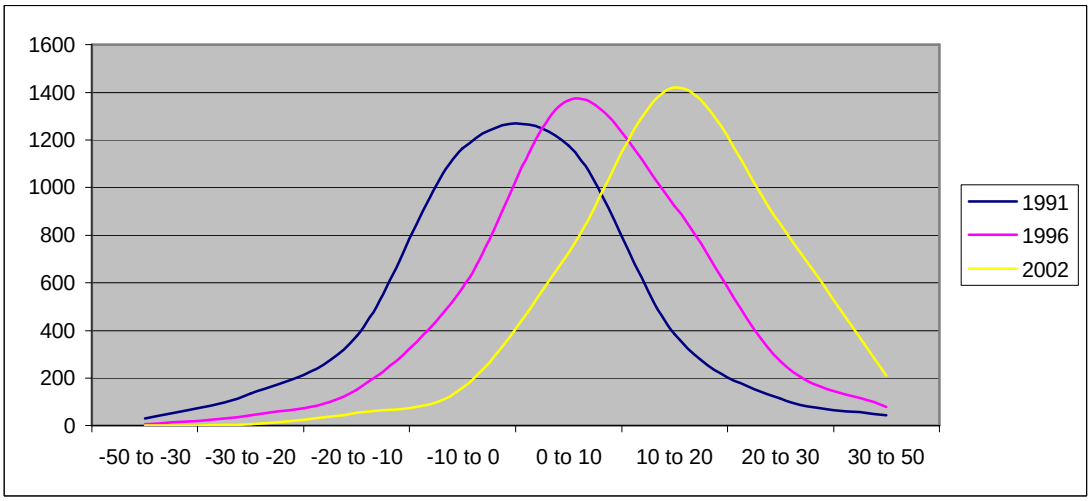
In this chapter and the next we will look at the substantive findings of our research and compare the overall scores for affluence and disadvantage. We will rely heavily on the use of thematic mapping techniques, and our conclusions will be largely based upon these graphical depictions of the distribution of social disadvantage in the Republic of Ireland. We will first present the three underlying dimensions – Demographic Decline, Social Class Disadvantage and Labour Market Deprivation – as these are central to our conceptual approach. Rather than repeating these for all three Census waves, we have decided to simplify by providing the scores for the component dimensions of the 2002 Deprivation Index only. The chapter concludes with a comparison of the three indices of overall affluence and deprivation for the years 1991, 1996 and 2002. In Chapter 4 we will present a similar analysis, emphasising the relative distribution of affluence and deprivation (i.e. after subtracting the means for each wave of Census data) rather than the actual scores used in this chapter.

3.1 Some Considerations in the Mapping of Census Data

Figure 3.1 below shows the distribution of overall deprivation scores for the three successive Census waves and illustrates the increase in affluence that occurred over the 11-year period between 1991 and 2002, in line with the exceptional national growth rates experienced. Positive scores on our overall index denote situations of affluence and negative scores indicate disadvantage. All three curves are "bell-shaped" and roughly follow what is referred to as the 'Normal Curve', a distribution that is found in a large number of contexts, including, for example, the height of a group of adults chosen at random: there are many people of average height, with diminishing occurrences as we move towards the extremes. Similarly, in the context of disadvantage, we are generally more interested in extreme scores than in the large number of areas clustered around the average score.

Maps or deprivation scores based on percentile distributions tend to exaggerate small deviations from the average, whilst failing to differentiate sufficiently at the extremes of the distribution. We have therefore decided to use fixed ranges for all of our maps. Whilst percentiles (i.e. deciles, quintiles) always have an equal number of cases in each category, maps based on fixed ranges capture the actual shape of the distribution of affluence and disadvantage, with a large number of cases in the ranges immediately above and below the national average, and decreasing numbers towards the extremes.

Figure 3.1: Distributions of Overall Deprivation Scores, 1991, 1996 and 2002



3.2 The Underlying Dimensions of Deprivation, 2002

Map 3.1 shows **Areas of Demographic Decline in 2002**, which measures population decline and the effects of long-term population loss (i.e. high age dependency ratios and the loss of population with higher levels of education). As anticipated, this dimension primarily captures 'rural' deprivation. The main areas of demographic decline are concentrated in the Border, Midland and Western Region. The highest levels of demographic decline are found mainly in counties Mayo and Donegal, although counties Roscommon, Leitrim, Longford and Cavan are also almost entirely below the average. In the Southern and Eastern Region, the most extensive areas of demographic decline are to be found in Kerry and at the border between Kerry, Cork and Limerick.

Demographic decline is almost non-existent in urban areas, although the older working-class areas of Dublin (Cabra, Inchicore, Crumlin and Walkinstown) represent an exception to this pattern. The limited form of demographic decline observed in urban settings is due to the particular life cycle of the neighbourhoods concerned, including their relatively ageing population, cohort effects associated with low levels of education and the impact of 'empty nests' on population levels.

Map 3.2 shows **Areas of Social Class Disadvantage in 2002**. This dimension reflects the proportion of professionals and low-skilled workers resident in a given area as well as levels of educational attainments and housing quality. Unlike the other two dimensions, social class composition is a determining factor in both urban and rural areas.

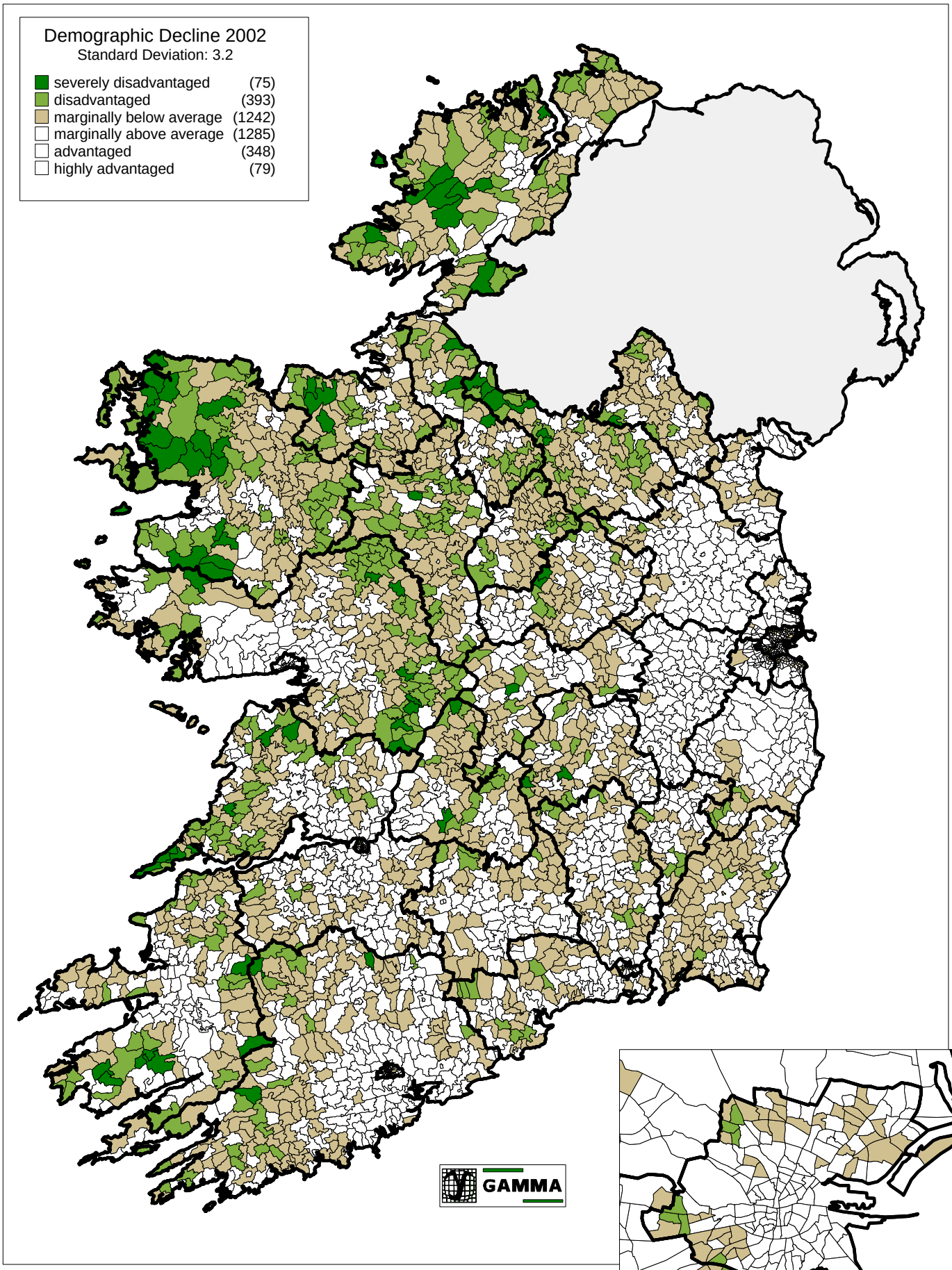
In rural Ireland, areas of social class disadvantage are to be found, once again, in the BMW Region, with high levels of deprivation visible to the west of Mayo and in parts of Donegal. Outside these two counties, social class disadvantage in rural areas is more dispersed in nature, but nevertheless affects parts of the Border counties (Leitrim, Cavan, Monaghan), the Midlands (Offaly, spreading into West Kildare and North Laois), West Galway, and the area straddling the Kerry-Limerick border.

Taken on its own, social class composition is an accurate indicator of spatial segregation in the urban environment. In Dublin, all of the known areas of social disadvantage are readily recognisable: parts of Raheny, Coolock/Darndale, Ballymun, Finglas and Cabra, parts of Blanchardstown and Clondalkin, Inchicore and Cherry Orchard, Crumlin/Walkinstown and West Tallaght. Large parts of Dublin's Inner City still show signs of social class disadvantage, although many of the EDs situated along the Liffey quays, which formed part of the most disadvantaged group of EDs in 1991, have undergone gentrification. We will discuss this phenomenon in greater detail at a later stage. In other Irish cities and urban centres, the estimates presented in the maps also conform with the known areas of social disadvantage.

Map 3.3 indicates the distribution of **Areas of Labour Market Deprivation in 2002**. This dimension is based on the male and female unemployment rates, the skills base of the local population and the presence of lone-parent families, a significant share of whom do not participate actively in the labour market. Lone parents also represent a significant share of those residing in social housing complexes, where unemployment rates and economic dependency are typically elevated.

The labour market dimension is predominantly urban in nature, and the most accentuated concentrations of unemployment are to be found in urban areas. Interestingly, however, there are also extensive areas of acute labour market deprivation in rural Ireland, notably large parts of Donegal, West Mayo and West Galway. Other than this, labour market deprivation is less significant within rural Ireland, in line with our hypothesis that prolonged negative labour market conditions in rural areas tend to lead to emigration from these areas, as well as to underemployment, both of which artificially reduce the extent of current labour market deprivation, as measured by such indicators as the unemployment rate.

Map 3.1: Areas of Demographic Decline, 2002



Boundary data by permission of the Ordnance Survey of Ireland

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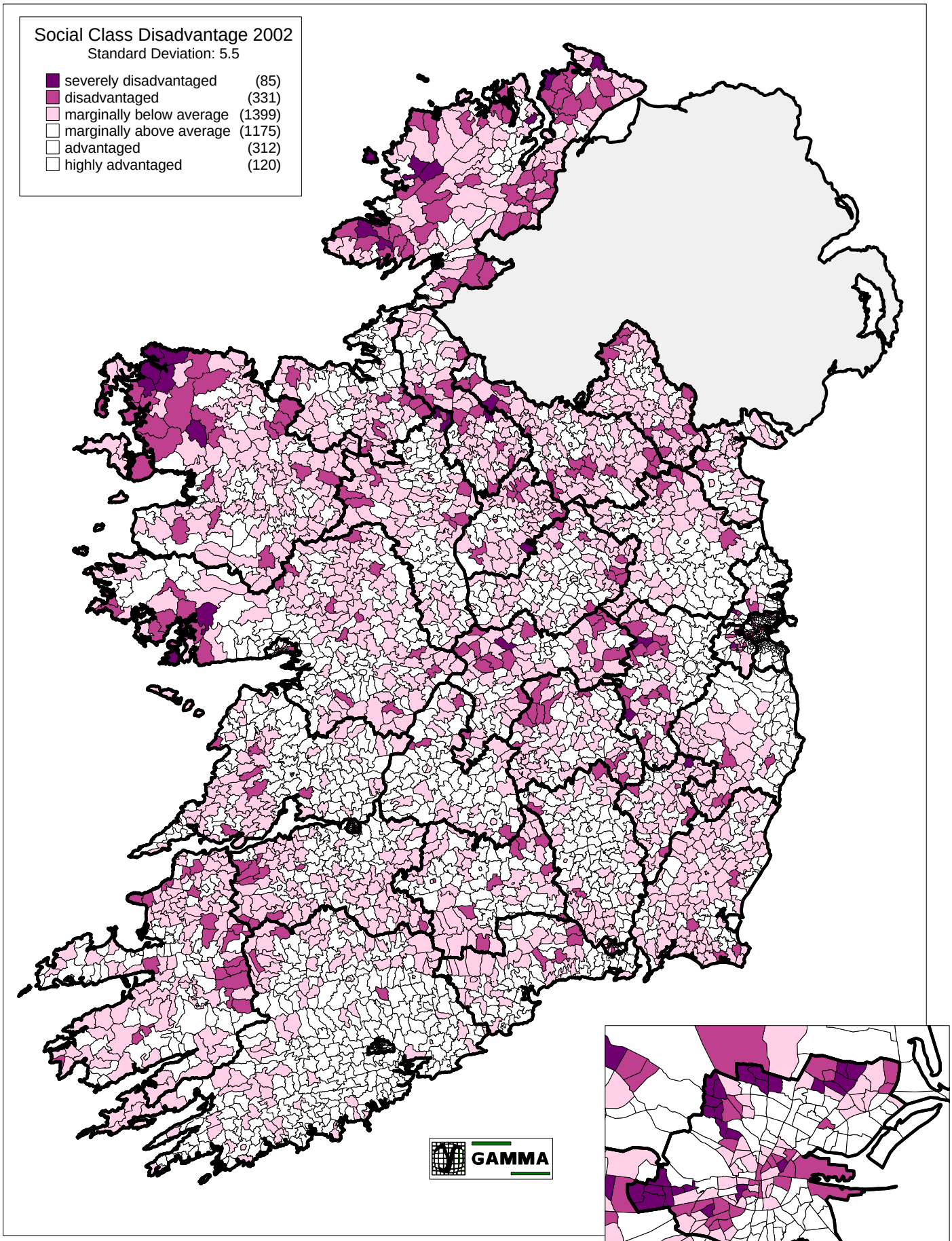
Map 3.2: Areas of Social Class Disadvantage, 2002



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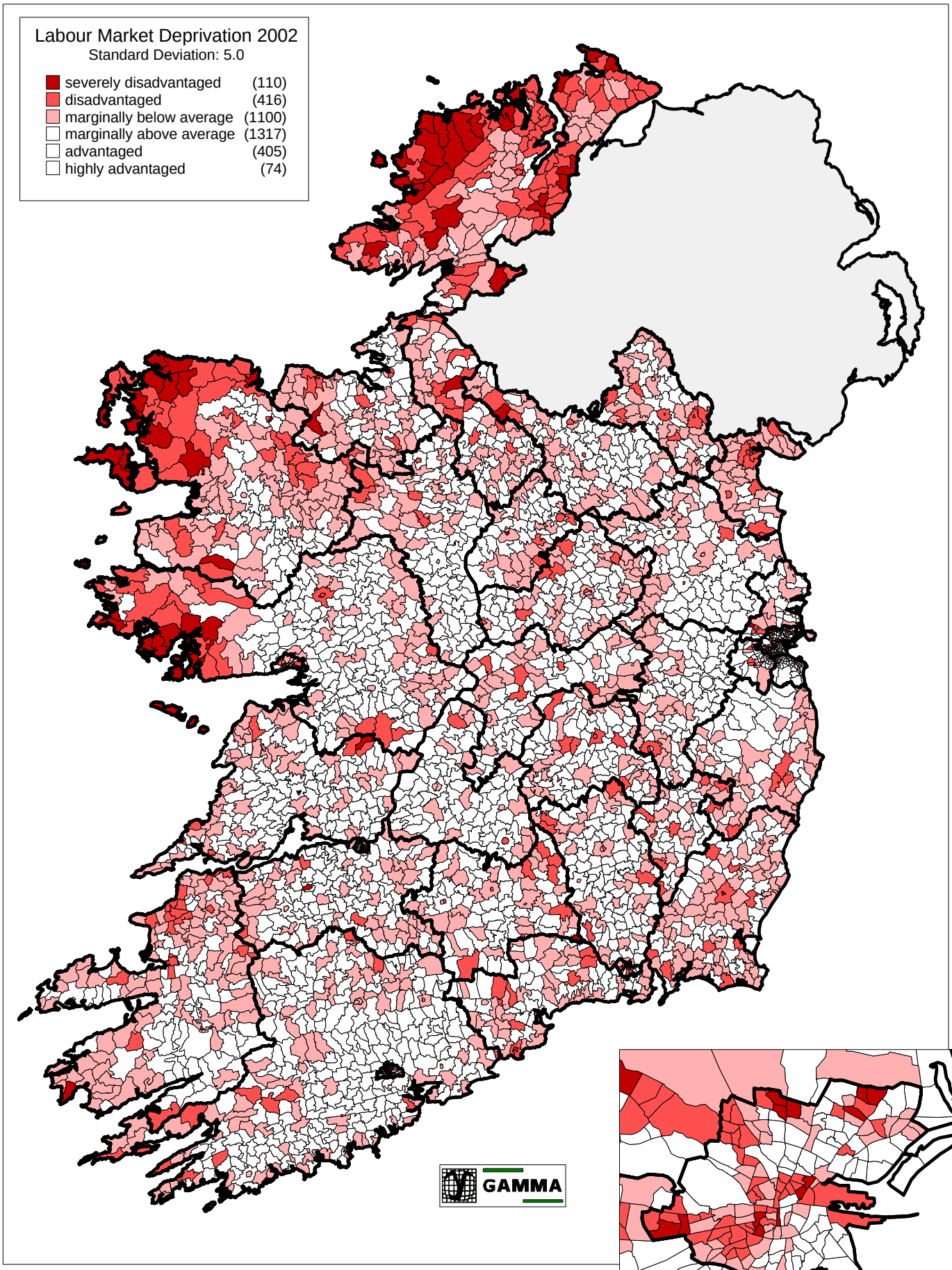
Map 3.3: Areas of Labour Market Deprivation, 2002



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3.3 The Spatial Pattern of Overall Deprivation, 1991, 1996 and 2002

Maps 3.4, 3.5 and 3.6 show the actual level of overall affluence and deprivation in 1991, 1996 and 2002, based on the aggregation of the three dimensions discussed in the previous section. Like the other maps presented in this report, these depict the level of affluence and deprivation using fixed intervals for all three waves of Census data. The scores range, in broad terms, from -50 to +50, with higher values indicating greater affluence, and negative values indicating disadvantage. The scores are not de-trended: the mean for 1991 is zero and the averages for 1996 and 2002 reflect the changes that occurred in average levels of affluence and deprivation over the course of the latter periods. The summary statistics for the three sets of scores show the underlying growth experienced during the past decade (Table 3.1).

Table 3.1: Summary Statistics for Deprivation Scores, 1991, 1996 and 2002

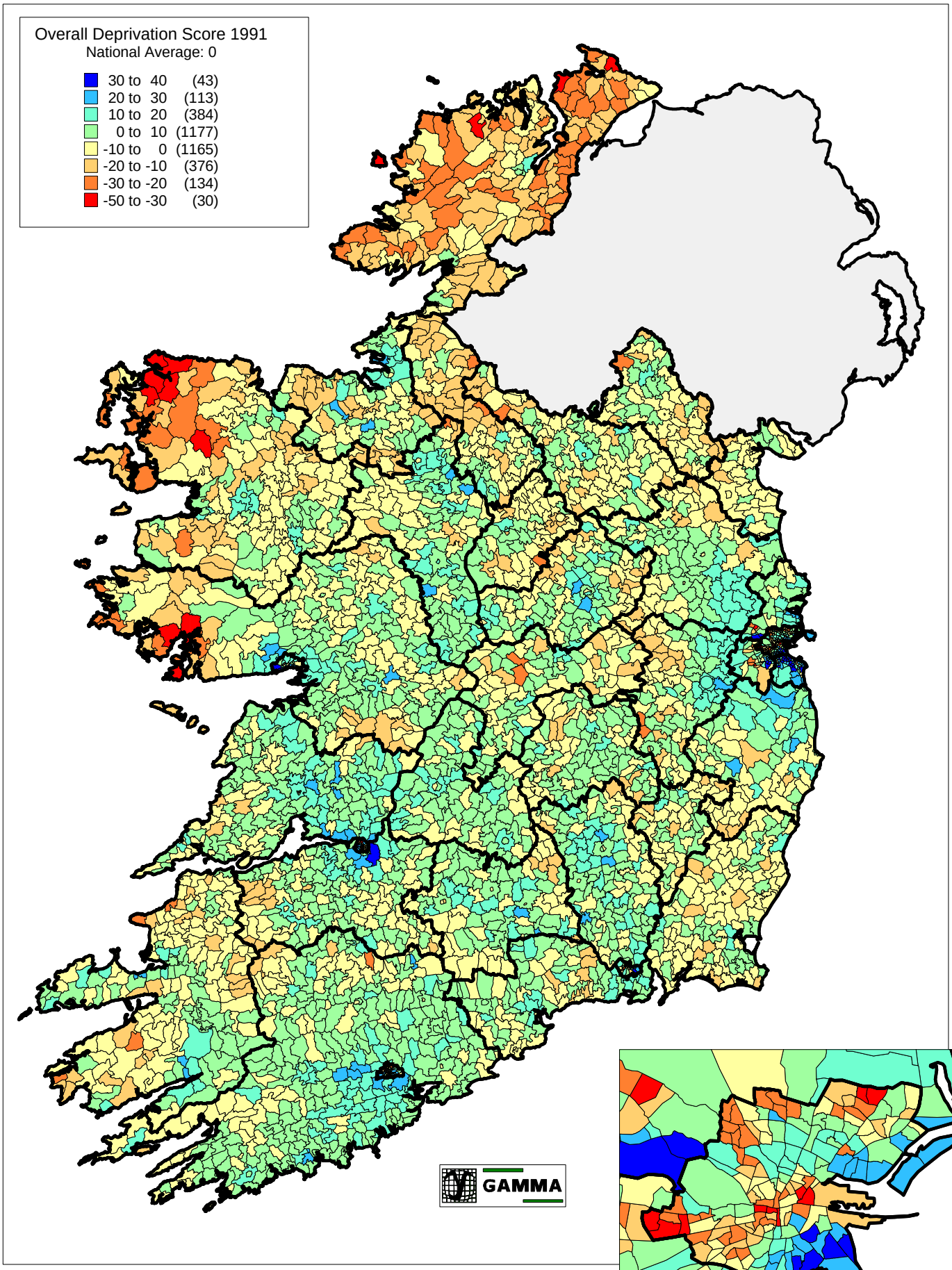
	Minimum (most deprived)	Maximum (most advantaged)	Mean	Standard Deviation
Overall Deprivation Score 1991	-42	38	0	11.4
Overall Deprivation Score 1996	-38	44	7	10.9
Overall Deprivation Score 2002	-36	44	15	10.1

The range of scores, from greatest deprivation to greatest affluence, remained effectively constant over the 11-year period in question, but there was a significant shift in the mean (in the direction of greater affluence), amounting to seven units between 1991 and 1996 and 8 units between 1996 and 2002. As the slight reduction in the standard deviation shows, one can also conclude that the distribution has become slightly more concentrated around the mean.

Whilst the overall picture is one of substantial national growth, the maps provide insights into the spatial distribution of this growth, most importantly its nodal character and the overriding importance of Ireland's urban centres. As pointed out in a previous analysis,[31] the most affluent areas of the country are distributed in concentric rings around the main population centres, demarcating the urban commuter belts. Comparison of the three sets of scores (i.e. for 1991, 1996 and 2002) reveals the extent to which these have expanded over a relatively short period of time. The outer urban periphery has been at the centre of new, large-scale private housing developments which have led to high concentrations of relatively affluent young couples. Furthermore, after many decades of relative deprivation in Dublin's Inner City, for the first time there is evidence of a substantial gentrification effect, particularly along the Liffey Quays.

[31] Jackson J. and Haase T. (1996) 'Demography and the Distribution of Deprivation in Rural Ireland' in Curtin C., Haase T. and Tovey H. *Poverty in Rural Ireland,* Dublin: Combat Poverty Agency and Oak Tree Press.

Map 3.4: Overall Affluence and Deprivation, 1991



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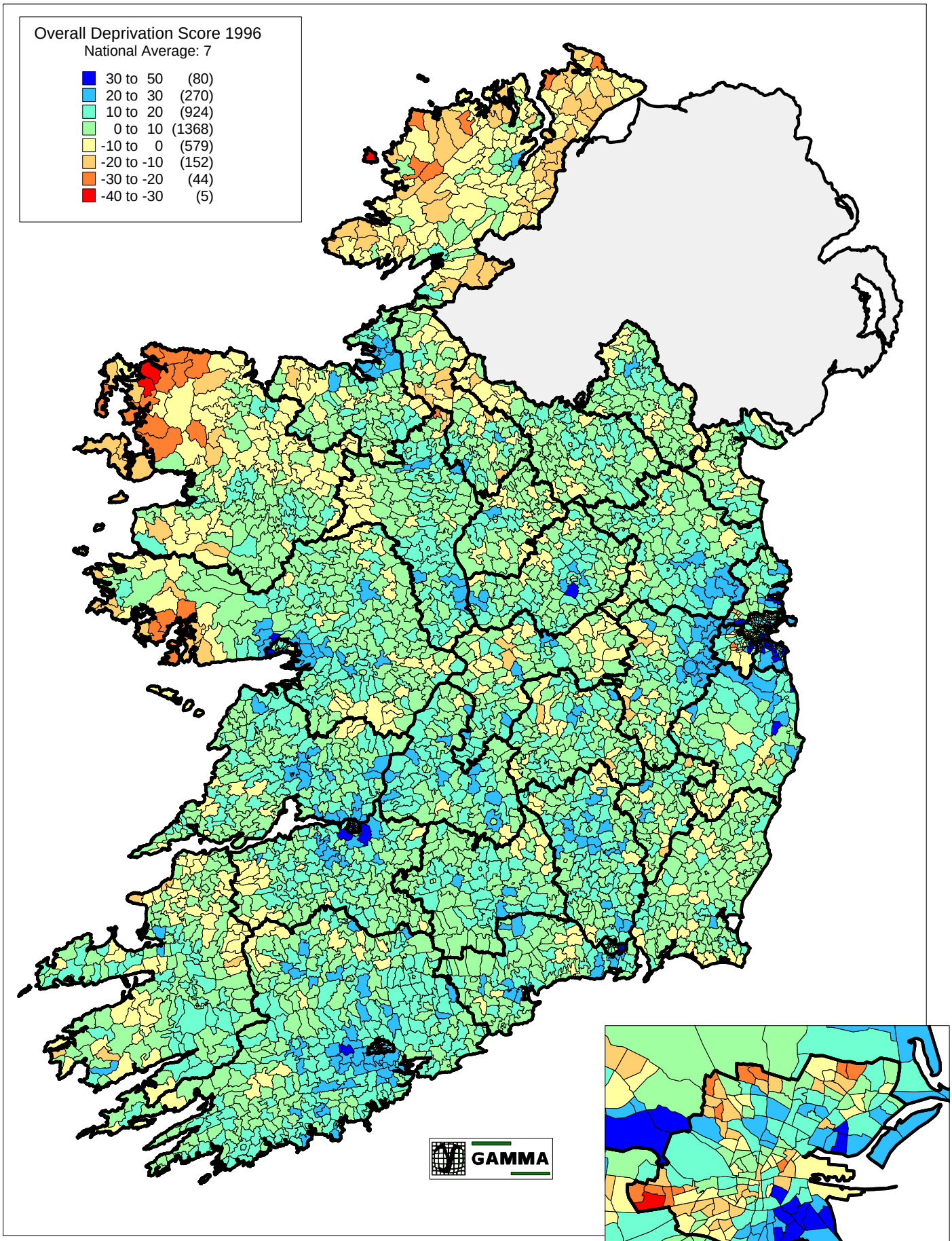
Map 3.5: Overall Affluence and Deprivation, 1996



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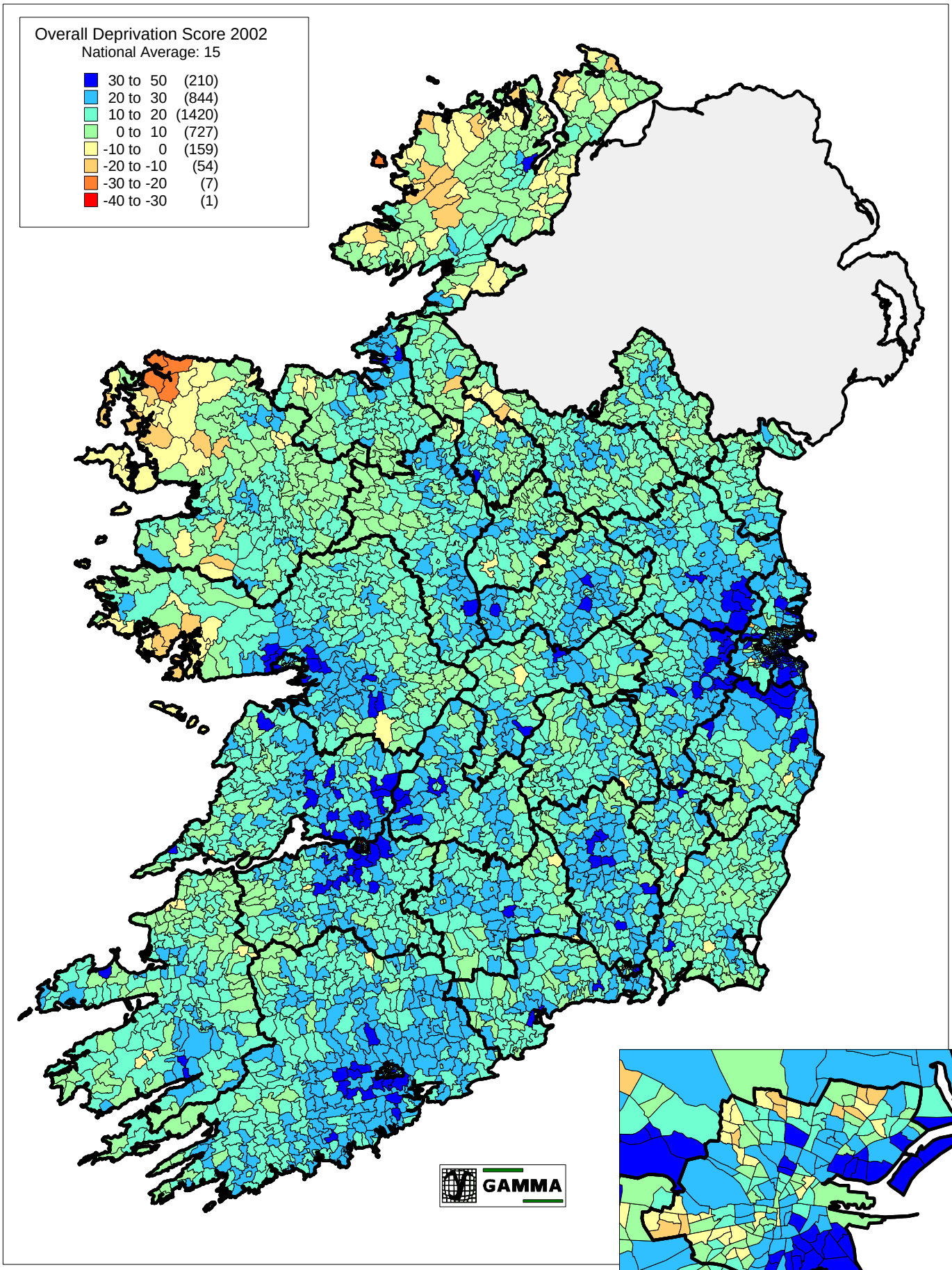
Map 3.6: Overall Affluence and Deprivation, 2002



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4 Changes in Relative Deprivation, 1991-2002

Whilst Maps 3.4, 3.5 and 3.6 are based on the actual affluence and deprivation scores for the three Census waves, the second set displays the same data expressed as deviations from the mean at each point in time. The maps thus reveal the position of each area *relative to all other areas* at each point in time, removing the trend component discussed earlier.

It has become clear from analyses conducted in various countries that the spatial distribution of relative deprivation alters little, in broad terms, from one census period to the next. Indeed, as a recent study of England and Wales has shown, the ranking of areas has changed comparatively little over a period of one hundred years, despite the massive reduction in absolute levels of deprivation over the same period.[32] As a consequence, we feel that greater attention must be paid to the precise measurement of the depth of deprivation in local areas rather than relying on decile or quintile rankings.

Furthermore, once target areas have been identified and interventions have been put in place to address the underlying structural effects, development agencies should be assisted in targeting their resources at the most disadvantaged locations *within* their respective target areas. In the past, this has mainly been achieved by mapping deprivation scores ranked into quintiles or deciles. Maps based on percentiles, however, have a major drawback: they tend to exaggerate the extent of differentiation between areas with scores close to the mean, whilst failing to draw sufficient attention to areas which persistently experience high levels of deprivation. For this reason, we have decided to change the presentation of relative deprivation in this study from percentile distributions to a distribution based on the deprivation scores themselves. For convenience, we will use the labels shown in Table 4.1 for the maps that follow (the number of EDs falling within each category is shown in the legend for each map).

Table 4.1: Ranges and Naming Conventions for Maps of Relative Deprivation

Legend Label	Range
extremely affluent	30 and over
very affluent	20 to 29.99
affluent	10 to 19.99
slightly above national average	0 to 9.99
slightly below national average	-9.99 to 0
disadvantaged	-19.99 to -10
very disadvantaged	-29.99 to -20
extremely disadvantaged	-30 and under

4.1 The Spatial Pattern of Relative Deprivation, 1991, 1996 and 2002

The maps show the limited degree to which the relative position of local areas in Ireland has changed over the past decade. The most deprived areas in 1991 were, in general, amongst the worst-affected in 2002. In broad terms, the maps for Ireland as a whole are very similar, which clearly indicates that the designation of areas to be targeted via area-based initiatives does not need to be reviewed in a major way in the short- to medium-term.

[32] Gregory I.N., Dorling D. and Southall H.R. (2001) 'A century of inequality in England and Wales using standardized geographical units' in *Area*, Vol. 33, No. 3 (297-311).

The most deprived areas, in 2002, were as follows:

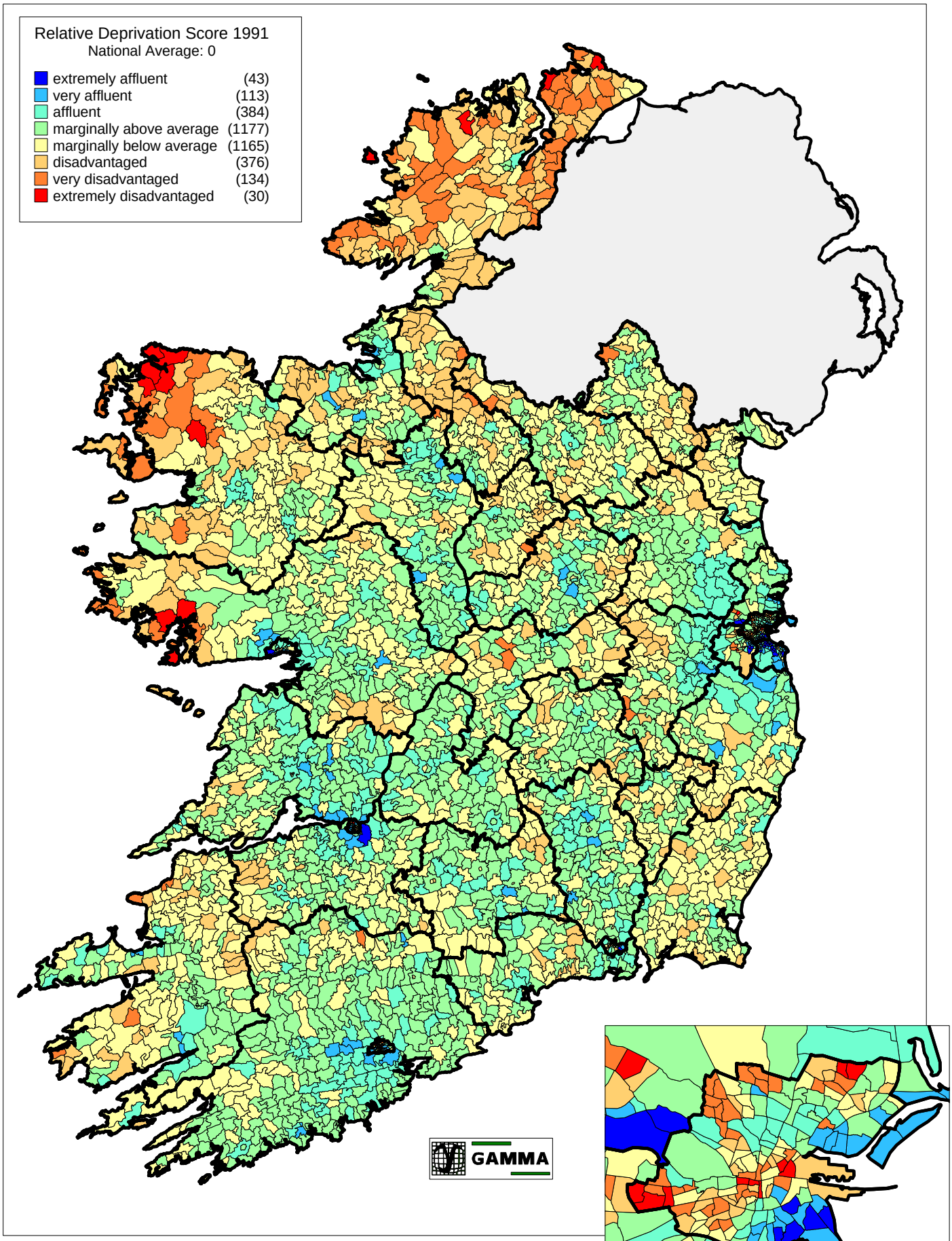
Dublin: Coolock, Darndale, Ballymun, Finglas, Cabra, Ballyfermot, Inchicore, Cherry Orchard, Clondalkin, Blanchardstown, Crumlin, Walkinstown, Tallaght, and parts of Dublin's Inner City.

Other urban locations: parts of Cork, Limerick, Galway and Waterford cities, as well as parts of the towns of Dundalk, Drogheda and Wexford.

Rural locations: most of Donegal and Mayo, large parts of West and East Galway, significant parts of Leitrim, Cavan, Monaghan, Longford and Roscommon, North and West Kerry and Wexford.

Despite the high level of overall stability observed, comparison of the relative distribution of affluence and deprivation in Dublin over the 11-year period between 1991 and 2002 highlights the striking reversal in the fortunes of Dublin's Inner City and the extension and intensification of the affluent belt surrounding Dublin and the other major urban centres. These changes in the pattern of affluence and disadvantage *relative* to the country as a whole are all the more remarkable given the underlying stability of affluence and deprivation and must be interpreted in the context of the exceptional economic growth of the past decade. This change will be discussed in greater detail in the next section.

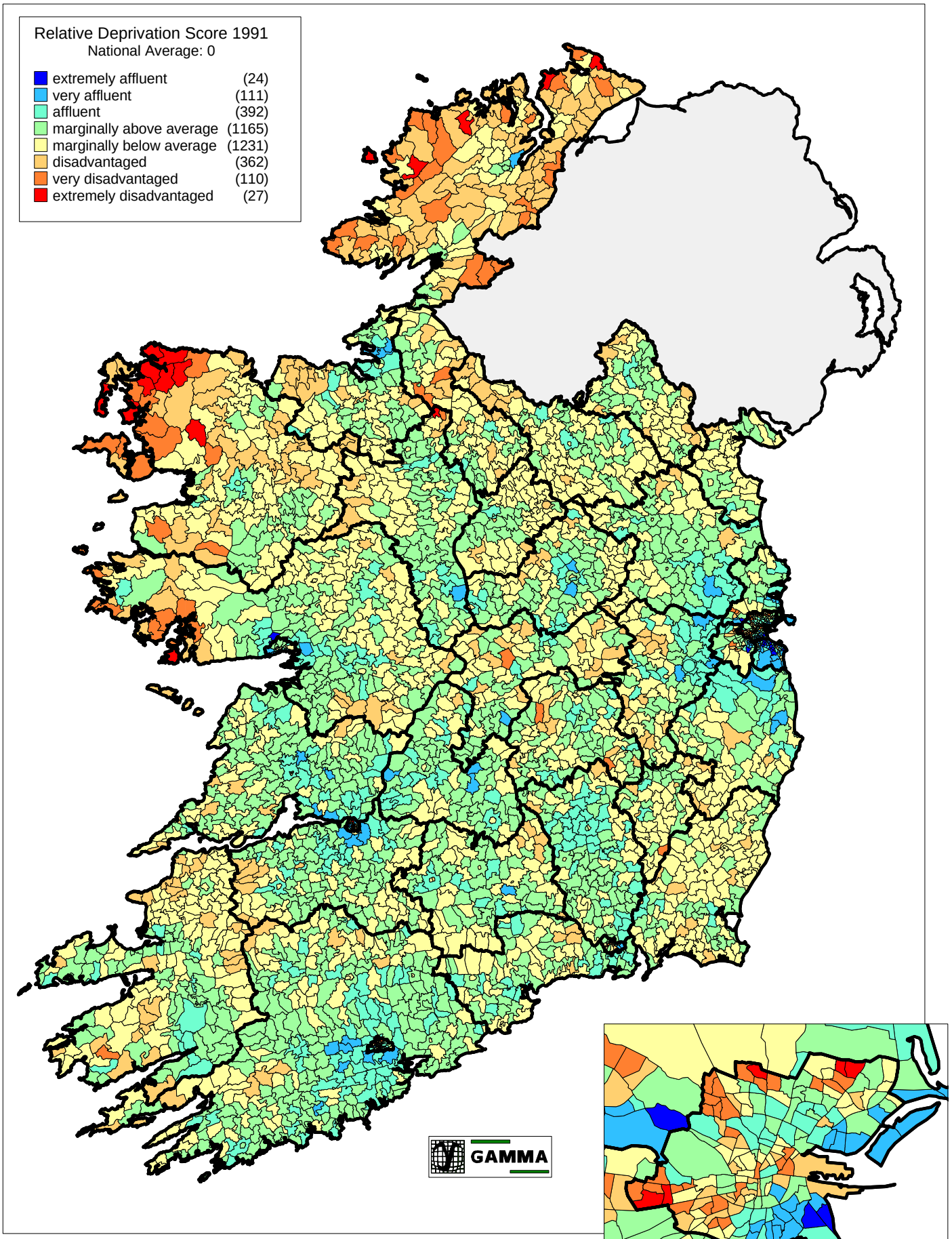
Map 4.1: Relative Affluence and Deprivation, 1991



Boundary data by permission of the Ordnance Survey of Ireland

Haase - Pratschke 2004

Map 4.2: Relative Affluence and Deprivation, 1996



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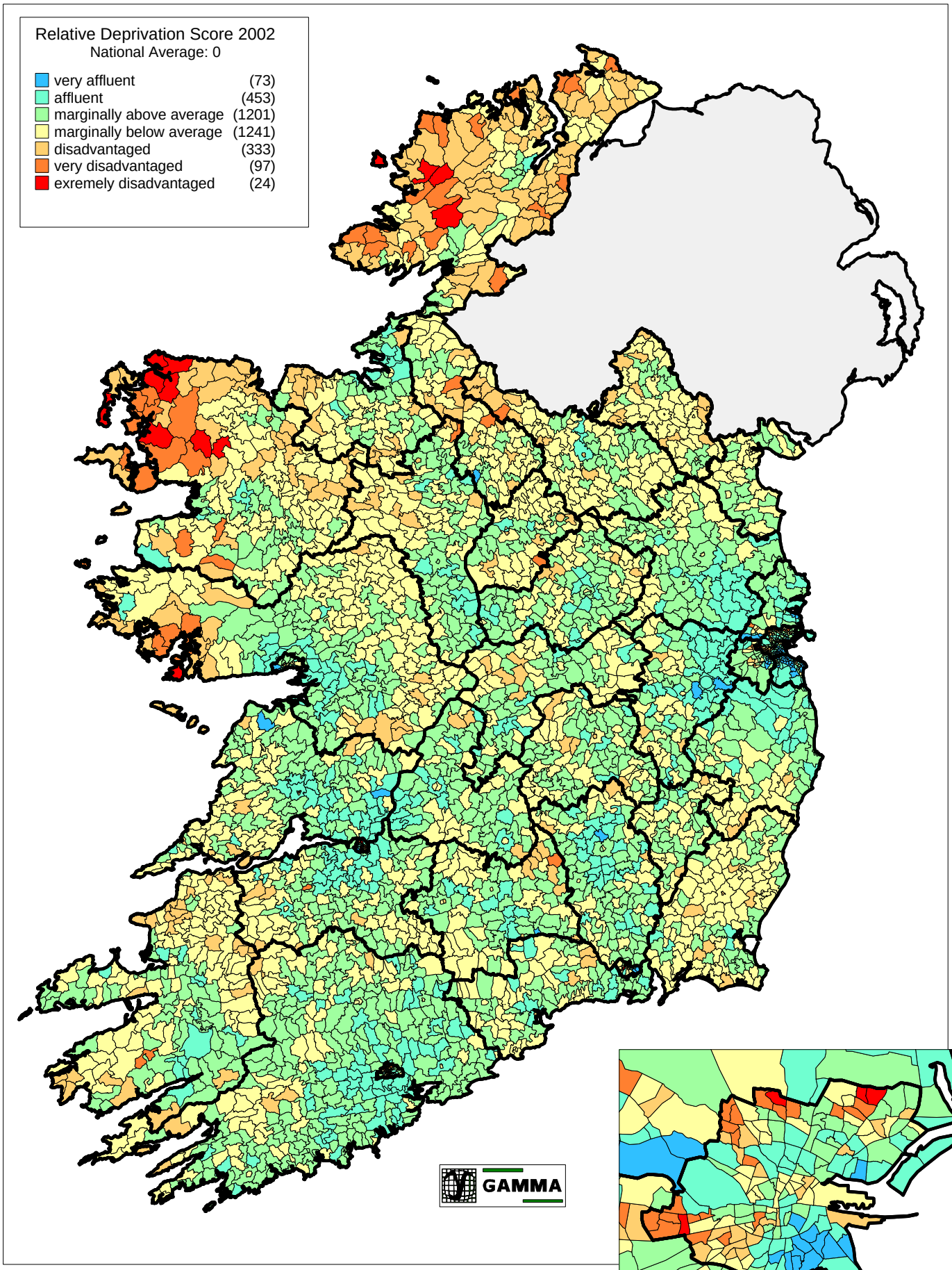
Map 4.3: Relative Affluence and Deprivation, 2002



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4.2 Changes in Relative Deprivation, 1991- 2002

The final all-Ireland map included in this report (Map 4.4) shows the changes observed in overall levels of affluence and deprivation between 1991 and 2002. As pointed out earlier, other multivariate deprivation indices do not permit accurate comparisons over time, as their underlying structure changes with each Census wave, rendering temporal comparisons problematic; comparisons may only be made in terms of changes in rankings or percentiles (e.g. a shift from one decile to another).

However, this limited form of analysis of change is unsatisfactory. As shown at the beginning of Chapter 3, the majority of areas have scores which are relatively close to the overall mean. Within this group, therefore, a small change in deprivation score can result in a shift of one, two or even three deciles, despite the fact that this change has little substantive importance. In contrast, even a very significant improvement at extreme levels of deprivation may fail to have any impact on the percentile ranking of a disadvantaged area. Inter-temporal comparisons of percentile rankings thus essentially draw attention to random variations around the mean, whilst minimising or overlooking more important changes at the extremes of the distributions.

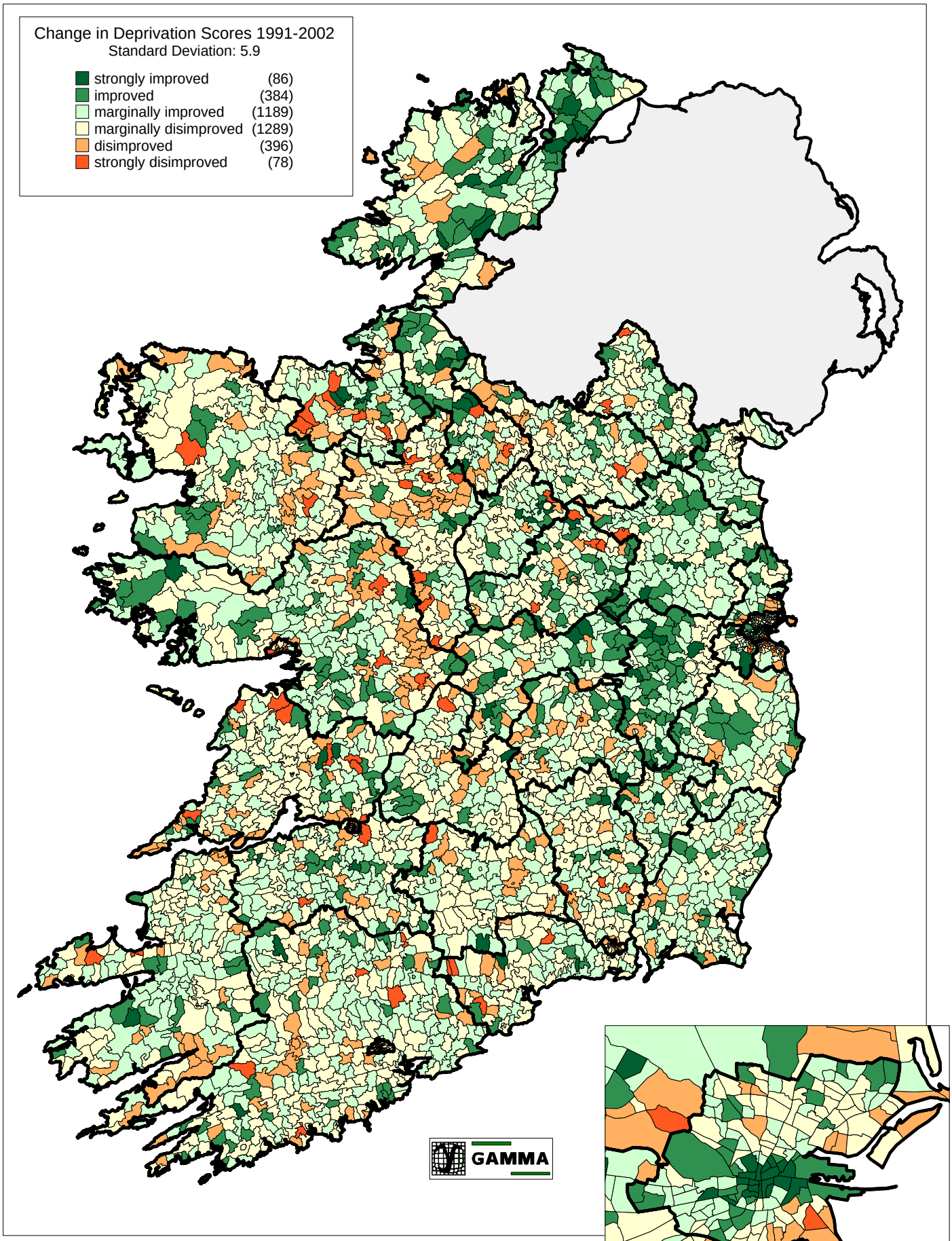
In contrast, the changes in levels of affluence or deprivation shown in Map 4.4 are based on the magnitude of change in actual deprivation scores between 1991 and 2002. As our indices have an identical structure and common units of measurement for each Census wave, we are in a position to present a precise measurement of the changes observed in the level of deprivation experienced at local level during the 1990s. Naturally, the magnitude of these changes, like the scores themselves, follow an approximately normal distribution: many areas have undergone small changes and relatively few areas have experienced larger shifts.

Map 4.4 shows that, outside Dublin, the most significant improvements over the 1991-2002 period occurred to the West of Dublin (mainly in Kildare), as well as in West Galway and parts of Donegal. By contrast, signs of deterioration are visible in East Galway, East Mayo and Roscommon, although this relates mainly to EDs which were already relatively prosperous in 1991. There does not appear to be any systematic deterioration across the Western counties, as some commentators have suggested, although some deprived parts of Donegal and Mayo appear to have lost further ground with respect to the rest of the country. The only systematic change of substantive importance observed outside Dublin therefore involves the widening of the belt of affluence surrounding the capital city, following changing patterns of commuting.

4.3 Dublin's Regeneration, 1991- 2002

As we noted earlier when discussing changes in the distribution of affluence and deprivation, the most important of these involves the transformation of a substantial section of Dublin's Inner City, resulting in a considerable change in its social composition and in deprivation profile. Looking at the Dublin map, there has been a rapid and massive gentrification of the Inner City, which has affected the Liffey Quays in particular. This is clearly visible from the maps and is undoubtedly of considerable impact. Parts of Blanchardstown and West Tallaght also show significant improvements. Both of these observations are confirmed by direct observation and are due to the large-scale private housing developments that have taken place in these areas. This has led to a significant influx of dual-earner couples and young families, a relatively income-rich and affluent population which has produced a significant change in these areas' social composition. The transformation of the Inner City is all the more dramatic given our previous remarks regarding the overall stability of the spatial pattern of relative affluence and disadvantage in general.

Map 4.4: Change in Relative Deprivation, 1991-2002



Boundary data by permission of the Ordnance Survey of Ireland

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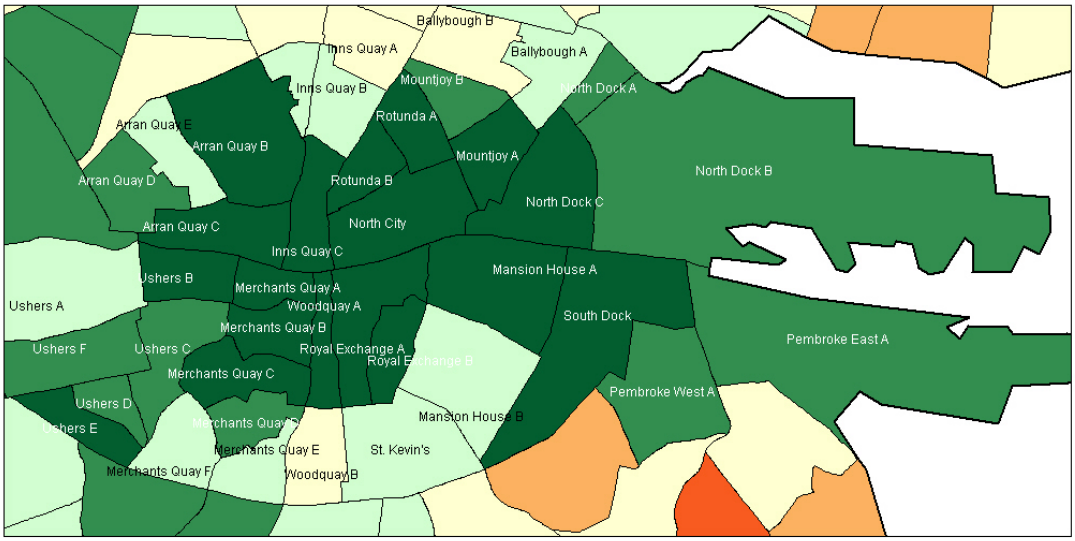
Map 4.5: Dublin's Inner City, 1991 - 2002



** Shadings as in Map 4.4 above*

Table 4.2 overleaf reports the extraordinary transformation that occurred in Dublin's Inner City during the 1990s. The Inner City population (defined here as the 37 EDs shown in Table 4.2) grew by approximately 24,000 residents (31%). Five out of the 37 EDs more than doubled in population within this 11-year period, and another 8 grew by more than half. Accompanying these huge population increases were even greater changes in social composition. Particularly in those areas which experienced the greatest population increases, the proportion of adults who did not proceed beyond Primary School declined by a factor of two or more. On the other end of the educational spectrum, the proportion of adults with a Third Level education rose from about 10 per cent, on average, to approximately 40 per cent, marking an extraordinary transition.

It is not the purpose of this study to provide a definitive interpretation of the impact of the transformation experienced by Dublin's Inner City during the 1990s. Nevertheless, a number of questions must urgently be addressed regarding the social and geographical trajectories of the people who were living in these areas prior to the onset of the economic boom. Are these individuals and families still living in these areas, or have they effectively been displaced to more peripheral locations? Do the latest Census figures hide the existence of smaller pockets of persistent deprivation nested within the Inner City EDs, or have those who were resident in 1991 been able to benefit from urban renewal and economic growth? Has the displacement of poor individuals and families from the Inner City led to significant changes in the composition of residential areas outside the city centre, and what will be the long-term effects of these processes, particularly in the context of increasing competition within the labour market at lower levels of economic growth?

As we showed in Map 4.4, the general picture that emerges in relation to the inter-temporal distribution of disadvantage is one of considerable resilience to change, a finding also supported by other studies which have analysed changes over even greater periods of time. It is this background that makes the recent history of Dublin's Inner City even more remarkable.

Table 4.2: Changes in Dublin's Inner City, 1991 – 2002

ED NAME	Change	Population			Primary Education Only		Third Level Education	
	in Score *	1991	2002	Change	1991	2002	1991	2002
				%	%	%	%	%
North Dock C	49.46	2324	3568	53.53	74.2	24.3	1.0	44.2
Arran Quay C	48.75	921	2375	157.87	62.7	12.1	7.6	59.3
Ushers B	46.64	565	1072	89.73	62.0	18.9	1.5	46.6
Merchants Quay A	43.31	1124	1824	62.28	74.5	26.1	4.3	39.3
Royal Exchange B	42.50	1183	1936	63.65	59.7	17.7	7.9	47.2
Mansion House A	39.03	3011	4269	41.78	64.6	24.1	5.7	41.9
Merchants Quay B	36.46	1621	3449	112.77	54.3	15.7	8.5	55.0
North City	36.28	819	3942	381.32	41.6	7.7	19.0	62.2
Mountjoy A	35.57	2983	3242	8.68	71.6	30.0	2.1	27.2
Royal Exchange A	34.50	1140	3569	213.07	49.5	13.8	15.3	53.7
South Dock	33.47	2589	3764	45.38	44.7	15.6	16.7	56.4
Inns Quay C	31.88	1698	2359	38.93	64.7	30.6	3.5	31.4
Woodquay A	29.96	1949	2866	47.05	66.7	35.9	1.6	22.9
Arran Quay B	29.27	1946	3089	58.74	43.3	16.0	9.7	48.2
Merchants Quay C	28.35	2012	2639	31.16	64.8	34.4	4.7	29.2
Ushers E	27.29	1946	1935	-.57	55.2	27.5	5.6	26.9
Ushers F	25.74	2648	3064	15.71	43.1	22.4	14.9	44.0
Arran Quay D	25.60	3196	3675	14.99	55.1	27.6	7.0	30.9
North Dock B	25.34	3503	3628	3.57	60.1	32.2	3.4	24.2
Mountjoy B	24.44	1657	2725	64.45	52.1	22.2	10.7	38.3
Merchants Quay D	22.67	2142	2084	-2.71	43.3	27.3	11.7	37.8
Ushers D	22.50	1875	1752	-6.56	53.6	28.5	7.6	25.6
North Dock A	22.40	1222	1287	5.32	47.4	25.3	6.6	30.3
Pembroke West A	21.55	3070	3241	5.57	39.5	21.1	16.0	45.9
Pembroke East A	21.50	4427	4304	-2.78	55.6	36.2	5.1	21.0
Ushers C	21.37	2610	2708	3.75	66.1	41.5	4.0	15.5
Arran Quay A	21.03	1092	1390	27.29	38.0	18.9	15.5	49.3
St. Kevin's	21.01	3047	4601	51.00	28.4	11.5	28.2	54.7
Inns Quay B	20.12	2528	2953	16.81	45.0	25.2	12.3	39.3
Arran Quay E	19.10	2965	2902	-2.12	46.9	29.5	8.9	35.6
Merchants Quay F	18.64	2414	2264	-6.21	50.2	28.9	10.0	29.1
Merchants Quay E	18.38	1221	1660	35.95	29.2	13.5	22.7	51.3
Ushers A	16.90	654	1679	156.73	34.3	12.0	15.4	53.8
Kylemore	16.27	3212	2805	-12.67	66.9	53.4	.4	4.8
Mansion House B	15.59	602	990	64.45	13.0	2.6	50.1	72.4
Woodquay B	13.09	3462	3538	2.20	25.4	14.9	24.9	51.1
Inns Quay A	9.99	3109	3373	8.49	36.9	25.9	13.1	35.3

** Note: The average change in score for all EDs in Ireland for the 11-year period is 15.*

5 Overall Deprivation in Local Authority Areas and Regions

In previous sections of this report, we confined our attention to the Electoral Divisions (EDs), currently the lowest spatial level used for census-based indices. In this chapter, by contrast, we will consider the changes observed in affluence and deprivation in Local Authority Areas and Regions.

Aggregate scores may be obtained from the ED estimates in a straightforward way, namely by calculating the weighted mean of the individual ED scores. It may be helpful to use a metaphor to explain this process: when one combines two glasses of water, the temperature of the resulting mixture depends on the temperature of the water in the individual glasses and their respective quantities. In our case, the deprivation scores correspond to the temperature scale and the population count is analogous to the amount of water in each glass.

In this way, overall disadvantage scores can be aggregated across any number of Electoral Divisions, for each of the three Census waves, providing a useful targeting and evaluation tool. The Central Statistics Office has, since 2000, provided estimates of county income and regional GDP. These, however, are purely monetary measures and do not take into account the underlying structural components that measure sustainability and development potential, such as education and skills levels, demographic characteristics and the strains created by sustained emigration. The deprivation indices developed in this study provide a prototype for a potential European-wide measure of disadvantage which would provide a useful tool for targeting structural funds at regions below the NUTS II spatial definitions, as well as constituting a powerful tool for monitoring change over time.

5.1 Key Socio-economic Characteristics

In the following paragraphs, we will briefly highlight the most important observations and developments over the eleven year period. Tables 5.1 and 5.5 provide an overview of the constituent socio-economic characteristics and Table 5.6 of the overall deprivation scores for each Local Authority Area and Region.

Population Growth (Table 5.1)

The last decade has brought about unprecedented population growth in Ireland, and the population increased from 3.5 million in 1991 to 3.9 million in 2002 (nearly 400,000 extra residents, or 11.1%). At the regional level, population growth was most accentuated in the Mid East Region (26.8%) due to the extraordinary expansion of the commuter belt around Dublin. Growth was relatively balanced in the other regions, ranging from 7.3 per cent in the Border Region to 11.0 per cent in the Midlands Region.

With the exception of Cork City, which experienced a decline of 3.3 per cent, all other Local Authority Areas recorded significant population growth. The lowest rates, apart from Cork City, were observed in the Western Border counties (Leitrim 2%, Monaghan 2.5% and Longford 2.5%). At the opposite end, four Local Authority Areas stand out particularly as they saw their population increase by between one-quarter and one-third: Meath (27.2%), Dublin Fingal (28.6%), Galway City (29.5%) and Kildare (33.7%).

Age Dependency Ratio (Table 5.2)

As we noted in the earlier discussion of the underlying dimensions of deprivation, analysis of the age dependency rate can help us to identify deprived rural areas. Not surprisingly, this rate manifests a clear East-West separation, with much lower rates in the Dublin Region (34.2% in 1991) than in the West Region (41.4% in 1991). The favourable economic conditions of the past decade were associated with a change in migration patterns and a reduction in the age dependency rate of 5.8 percentage points at national level, from 38.1 per cent in 1991 to 32.3 per cent in 2002. The Dublin Region experienced the smallest drop

(-4.9%), although this region already had the lowest rate in 1991. The highest decrease was found in the West (-7.4%), and this region had the highest rate in 1991; the net result of these changes was therefore a slight narrowing in the differential between the regions at each extremes of the distribution.

At the level of Local Authority areas, the largest changes in age dependency rates were found in urban areas. Three Local Authority Areas experienced large declines in age dependency rates, exceeding 8 percentage points (Galway City –8.0, South County Dublin –8.1, and Dublin Fingal –8.3). The areas which experienced the smallest decreases (less than 5 percentage points) were also urban (Cork City –4.1, Limerick City –3.9, Dublin City –3.7, Waterford City –3.7, and Dun Loaghaire/Rathdown –1.6). These changes reflect first and foremost prevailing zoning conventions, which have resulted in large new housing estates being built on the outskirts of the major cities. These, in turn, are largely populated by young, two-income families in the early stages of their family life cycles, and with relatively few elderly persons amongst them. Not surprisingly, these areas later emerge as the most affluent growth areas throughout the country.

Lone Parent Families (Table 5.2)

As the stigma associated with lone parenthood has gradually faded over the past decades, the proportion of families with at least one child under 15 years of age headed by a single parent increased by 6 percentage points between 1991 and 2002. The highest percentages of lone parent families are found in urban areas and, as many one-parent families find themselves at risk of poverty, this variable may be treated as an indicator of urban disadvantage.

The Dublin Region stands out in this regard, as 14.8 per cent of families with young children were headed by a lone parent in 1991, rising by 6.3 percentage points to 21.1 per cent in 2002. In contrast, all other regions had scores below 10 per cent in 1991 and less than 18 per cent in 2002.

At the level of Local Authorities, the prevalence of lone parenthood in urban areas is again apparent: by 2002, all cities had rates in excess of 25 per cent (Limerick 31.9%, Dublin 29.1%, Cork 26.9%, Waterford 25.6% and Galway 25.2%). In all other Local Authority Areas lone parent households accounted for between 10 and 20 per cent.

Unemployment Rates (Table 5.3)

In rural areas, long term adverse labour market conditions lead to emigration, thus lowering the prevailing unemployment rates. Hence, the highest rates tend to be found in urban areas. There are, however, some exceptions: labour market conditions in the Border counties of Donegal, Mayo and Louth have been so unfavourable that despite considerable emigration from these counties, they nevertheless remain amongst those with the highest rates.

In 1991, seven Local Authority Areas had male unemployment rates in excess of 20 per cent: Donegal (29.3%), Limerick City (28.3%), Dublin City (23.7%), Cork City (24.2%), Louth (23.8%), Waterford City (23.7%), and Wexford (20.9%).

Female unemployment rates are generally lower than the corresponding male rate, as many unemployed women who cannot find paid employment eventually withdraw from the labour market in order to care for their families on a full-time basis. Female unemployment rates in 1991 were on average 4.4 percentage points lower than male unemployment rates, but this differential exceeded ten percentage points in the poorest urban areas.

By 2002, both male and female unemployment rates had undergone a remarkable decline, dropping to nearly half their 1991 levels. For Ireland as a whole, male unemployment rates dropped from 18.4 per cent to 9.4 per cent, whilst female unemployment rates dropped from 14.1 per cent to 8.0 per cent.

Despite this dramatic reduction, the spatial distribution of unemployment rates changed relatively little: the nine most-affected Local Authority Areas in 1991 were still amongst the worst-affected in 2002, and seven of these conserved their original order. In 2002, the seven highest male unemployment rates were found in Donegal (17.5%), Limerick City (15.9%), Cork City (14.2%), Louth (13.7%), Waterford City (13.3%), Dublin City (11.8%), and Wexford (10.8 %).

Social Class Characteristics (Table 5.4)

Social class differentiation between Local Authority Areas is considerable and encompasses urban and rural areas alike. Broadly speaking, the most prosperous Local Authority Area (Dun Laoghaire/Rathdown) has more than twice as many people in the Professional and Managerial & Technical social classes, in percentage terms (43.9% in 1991, 51.2% in 2002), as the poorest area, Limerick City (18.8% in 1991, 23.5% in 2002). The poorest rural areas in terms of social class composition are Donegal (18.6%, 24.6%) and Leitrim (17.8%, 26.5%).

Conversely, the differentials with regard to the percentage of people in the Semi- or Unskilled Manual social classes are even more pronounced, again involving a sharp contrast between Dun Laoghaire/Rathdown (14.2% in 1991, 9.3% in 2002), on the one hand, and Limerick City (36.0%, 27.7%) and Donegal (40.4%, 27.2%) on the other.

Social class composition has changed greatly over the short period of time separating these two Census waves, reflecting changing occupational patterns in a rapidly developing economy. In just 11 years, the proportion of people classified as belonging to the Professional or Managerial & Technical social classes increased from 25.2 per cent to 31.6 per cent, whilst the proportion of people in the Semi- and Unskilled Manual social classes declined from 28.2 per cent to 20.2 per cent nationally. Nevertheless, the relative position of the Local Authority Areas changed relatively little[33], drawing attention once again to the important distinction between observed rates and differentials.

Education Levels (Table 5.5)

Perhaps the most impressive achievements between 1991 and 2002 were recorded in the field of education, as the share of the adult population with no more than a Primary School education dropped by 14.6 percentage points from 36.8 per cent in 1991 to 22.2 per cent in 2002[34]. Simultaneously, the percentage with a Third Level education exactly doubled, from 13.1 per cent to 26.0 per cent.

Although social class differentials between Local Authority Areas are quite substantial, as we have seen, the disparities in education levels are even more pronounced, and the most advantaged areas can have rates of Third Level education which are three times higher than the most disadvantaged areas. The ranking of areas in terms of educational attainments closely resembles that of social class, reflecting the strong relationship between educational achievement and job opportunities.

Dun Laoghaire/Rathdown is once again the most affluent area in educational terms. The proportion of people with no more than a Primary education was just 19.2 per cent in 1991, falling to 11.7 per cent in 2002. Conversely, the proportion with a Third Level education was 28.4 per cent in 1991, rising even further, to reach 45.0 per cent in 2002. At the opposite end of the distribution, over half of Donegal's adult population had no more than a Primary education in 1991. This nevertheless dropped by a staggering 18 percentage points over the following eleven years, resulting in a rate of 33.7 per cent in 2002. At the same time, the percentage of Donegal's adult population with a Third Level education rose by over 10 percentage points, from 8.2 per cent to 18.3 per cent over the same period.

[33] The correlation between the rankings in 1991 and 2002 is 0.90.

[34] The 1991 Census only reported the numbers of people with Primary, Secondary and Third Level education for those who were within the active labour force. To achieve a comparable dataset for the three census waves, ED-level estimates were computed to match the 1996 and 2002 Censuses, where data were reported for the total adult population.

Table 5.1: Demographic Characteristics for Local Authority Areas, Regions and Ireland

Local Authority Area	TOTPOP 1986	TOTPOP 1991	TOTPOP 1996	TOTPOP 2002	POPCHG 1991 %	POPCHG 1996 %	POPCHG 2002 %
Dublin City	502,749	478,389	481,854	495,781	-4.8	.7	2.9
South County Dublin	199,546	208,739	218,728	238,835	4.6	4.8	9.2
Dublin Fingal	138,479	152,766	167,683	196,413	10.3	9.8	17.1
Dun Laoghaire/Rathdown	180,675	185,410	189,999	191,792	2.6	2.5	.9
Kildare	116,247	122,656	134,992	163,944	5.5	10.1	21.4
Meath	103,881	105,370	109,732	134,005	1.4	4.1	22.1
Wicklow	94,542	97,265	102,683	114,676	2.9	5.6	11.7
Carlow	40,988	40,942	41,616	46,014	-.1	1.6	10.6
Kilkenny	73,186	73,635	75,336	80,339	.6	2.3	6.6
Wexford	102,552	102,069	104,371	116,596	-.5	2.3	11.7
Tipperary SR	77,097	74,918	75,514	79,121	-2.8	.8	4.8
Waterford City	39,529	40,328	42,540	44,594	2.0	5.5	4.8
County Waterford	51,622	51,296	52,140	56,952	-.6	1.6	9.2
Cork City	133,271	127,253	127,187	123,062	-4.5	-.1	-3.2
County Cork	279,464	283,116	293,323	324,767	1.3	3.6	10.7
Kerry	124,159	121,894	126,130	132,527	-1.8	3.5	5.1
Clare	91,344	90,918	94,006	103,277	-.5	3.4	9.9
Limerick City	56,279	52,083	52,039	54,023	-7.5	-.1	3.8
County Limerick	108,290	109,873	113,003	121,281	1.5	2.8	7.3
Tipperary NR	59,522	57,854	58,021	61,010	-2.8	.3	5.2
Galway City	47,104	50,853	57,241	65,832	8.0	12.6	15.0
County Galway	131,448	129,511	131,613	143,245	-1.5	1.6	8.8
Mayo	115,184	110,713	111,524	117,446	-3.9	.7	5.3
Roscommon	54,592	51,897	51,975	53,774	-4.9	.2	3.5
Louth	91,810	90,724	92,166	101,821	-1.2	1.6	10.5
Leitrim	27,035	25,301	25,057	25,799	-6.4	-1.0	3.0
Sligo	56,046	54,756	55,821	58,200	-2.3	1.9	4.3
Cavan	53,965	52,796	52,944	56,546	-2.2	.3	6.8
Donegal	129,664	128,117	129,994	137,575	-1.2	1.5	5.8
Monaghan	52,379	51,293	51,313	52,593	-2.1	.0	2.5
Laois	53,284	52,314	52,945	58,774	-1.8	1.2	11.0
Longford	31,496	30,296	30,166	31,068	-3.8	-.4	3.0
Offaly	59,835	58,494	59,117	63,663	-2.2	1.1	7.7
Westmeath	63,379	61,880	63,314	71,858	-2.4	2.3	13.5
Region							
Dublin	1,021,449	1,025,304	1,058,264	1,122,821	.4	3.2	6.1
Mid East	314,670	325,291	347,407	412,625	3.4	6.8	18.8
South East	384,974	383,188	391,517	423,616	-.5	2.2	8.2
South West	536,894	532,263	546,640	580,356	-.9	2.7	6.2
Mid West	315,435	310,728	317,069	339,591	-1.5	2.0	7.1
West	348,328	342,974	352,353	380,297	-1.5	2.7	7.9
Border	410,899	402,987	407,295	432,534	-1.9	1.1	6.2
Midlands	207,994	202,984	205,542	225,363	-2.4	1.3	9.6
NUTS II Region							
BMW	967,221	948,945	965,190	1,038,194	-1.9	1.7	7.6
SE	2,573,422	2,576,774	2,660,897	2,879,009	.1	3.3	8.2
Ireland	**3,540,643**	**3,525,719**	**3,626,087**	**3,917,203**	**-.4**	**2.8**	**8.0**

***TOTPOP**: Total Population*
***POPCHG**: Percentage change in population over previous five years*

Table 5.2: Family Characteristics for Local Authority Areas, Regions and Ireland

Local Authority Area	AGEDEP 1991	AGEDEP 1996	AGEDEP 2002	LONPAR 1991	LONPAR 1996	LONPAR 2002
Dublin City	32.7	31.3	29.0	19.4	25.4	29.1
South County Dublin	36.8	32.3	28.7	13.6	16.9	19.7
Dublin Fingal	36.9	32.9	28.6	9.6	12.7	14.9
Dun Laoghaire/Rathdown	33.2	32.2	31.6	12.5	14.6	13.9
Kildare	37.3	33.7	30.4	8.6	12.2	14.0
Meath	39.6	35.8	32.3	8.2	10.3	11.0
Wicklow	38.2	35.1	32.5	11.4	14.3	16.7
Carlow	39.0	35.7	32.2	8.8	12.1	18.3
Kilkenny	39.9	37.0	34.2	8.3	10.4	13.0
Wexford	39.7	36.4	34.4	9.2	13.0	17.2
Tipperary SR	40.3	37.4	34.6	9.2	12.3	16.9
Waterford City	35.2	32.7	31.5	13.2	19.2	25.6
County Waterford	40.6	37.1	34.6	9.1	10.6	14.5
Cork City	34.1	32.0	30.0	14.3	20.3	26.9
County Cork	39.5	36.1	33.3	7.9	10.1	12.9
Kerry	40.8	37.7	33.9	8.4	10.7	14.2
Clare	40.0	37.4	34.0	8.6	12.0	14.7
Limerick City	35.0	32.9	31.1	15.8	22.5	31.9
County Limerick	39.0	34.9	31.4	7.3	9.0	11.4
Tipperary NR	40.4	37.3	35.2	7.7	10.3	13.6
Galway City	32.5	29.6	24.5	14.0	19.3	25.2
County Galway	42.0	38.7	35.6	6.9	8.3	10.5
Mayo	44.0	40.3	36.2	8.4	9.8	12.6
Roscommon	43.3	40.2	36.7	6.9	8.8	10.6
Louth	38.5	35.1	33.0	11.2	14.8	20.0
Leitrim	44.4	40.8	37.1	7.2	9.0	11.4
Sligo	40.7	37.2	34.0	9.5	11.5	15.2
Cavan	42.7	40.1	36.6	6.1	8.3	10.6
Donegal	42.3	38.8	36.0	9.5	11.9	15.8
Monaghan	41.6	38.3	34.7	7.4	9.1	12.9
Laois	41.1	37.8	34.5	7.6	9.2	13.0
Longford	42.4	38.7	36.2	8.4	11.5	16.9
Offaly	40.5	37.3	34.9	7.4	10.3	13.3
Westmeath	39.2	36.6	33.9	8.8	12.3	16.0
Region						
Dublin	34.2	31.9	29.3	14.8	18.8	21.1
Mid East	38.3	34.7	31.6	9.3	12.2	13.8
South East	39.4	36.3	33.9	9.4	12.6	17.0
South West	38.5	35.5	32.7	9.4	12.4	15.6
Mid West	38.9	35.8	32.8	9.1	12.2	15.8
West	41.4	37.9	34.0	8.4	10.5	13.2
Border	41.3	38.0	35.0	9.1	11.5	15.5
Midlands	40.6	37.4	34.6	8.0	10.8	14.6
NUTS II Region						
BMW	41.2	37.8	34.6	8.6	11.0	14.5
SE	37.0	34.1	31.4	11.4	14.8	17.5
Ireland	**38.1**	**35.1**	**32.3**	**10.7**	**13.8**	**16.7**

***AGEDEP**: Percentage of population aged under 15 or over 64 years*
***LONPAR**: The percentage of households with children aged under 15 years and headed by a single parent*

Table 5.3: Unemployment Rates for Local Authority Areas, Regions and Ireland

Local Authority Area	UNEMPM 1991	UNEMPM 1996	UNEMPM 2002	UNEMPF 1991	UNEMPF 1996	UNEMPF 2002
Dublin City	24.7	22.4	11.8	17.4	15.2	8.7
South County Dublin	18.3	16.7	8.3	14.4	12.1	7.6
Dublin Fingal	14.1	12.6	7.0	12.1	9.5	6.6
Dun Laoghaire/Rathdown	12.5	10.7	6.1	10.3	8.2	5.2
Kildare	15.5	12.0	5.8	12.0	9.8	6.7
Meath	15.9	12.6	6.2	14.1	10.6	7.1
Wicklow	18.6	15.8	8.4	15.8	12.2	7.7
Carlow	20.1	18.4	9.3	14.6	15.6	10.0
Kilkenny	16.3	14.5	8.2	12.2	10.9	6.8
Wexford	20.9	18.4	10.8	15.2	13.6	9.8
Tipperary SR	19.3	16.8	9.9	15.3	11.6	8.8
Waterford City	23.7	21.4	13.3	16.1	14.8	10.5
County Waterford	16.7	15.0	9.1	14.1	12.0	8.0
Cork City	24.2	23.5	14.2	15.9	16.7	10.1
County Cork	13.2	11.7	6.5	11.1	9.4	6.2
Kerry	18.3	17.3	9.9	12.8	12.2	7.5
Clare	13.8	12.5	7.9	12.4	9.7	7.2
Limerick City	28.3	24.7	15.9	20.5	15.4	11.2
County Limerick	15.3	12.2	7.0	12.0	9.1	6.1
Tipperary NR	16.8	13.7	7.7	11.3	9.5	7.3
Galway City	17.1	16.7	11.1	12.8	11.9	8.8
County Galway	16.7	15.3	9.4	11.9	10.8	7.6
Mayo	17.3	18.7	12.2	12.7	11.7	8.2
Roscommon	10.2	10.3	7.3	10.1	8.1	6.6
Louth	23.8	20.3	13.7	19.1	14.7	12.6
Leitrim	14.1	12.7	9.6	12.6	12.5	7.2
Sligo	16.8	15.3	9.9	11.1	10.2	7.1
Cavan	13.1	12.1	8.1	11.3	10.1	7.7
Donegal	29.3	26.4	17.5	17.2	14.4	12.6
Monaghan	14.7	13.7	10.1	13.1	11.3	9.6
Laois	17.0	14.5	10.8	14.0	12.7	8.2
Longford	16.1	15.6	10.0	11.9	12.4	10.2
Offaly	18.3	16.6	8.2	14.3	12.5	9.6
Westmeath	15.3	14.0	8.5	12.3	11.6	8.6
Region						
Dublin	19.7	17.6	9.3	14.9	12.5	7.6
Mid East	16.5	13.3	6.6	13.8	10.8	7.1
South East	19.3	17.2	10.0	14.6	12.9	8.9
South West	16.9	15.6	8.8	12.8	11.9	7.4
Mid West	17.2	14.5	8.7	13.7	10.5	7.5
West	15.9	15.8	10.3	12.1	11.0	7.9
Border	21.2	19.1	12.9	15.3	12.9	10.5
Midlands	16.7	15.1	9.3	13.2	12.2	9.0
NUTS II Region						
BMW	18.4	17.0	11.1	13.7	12.0	9.2
SE	18.4	16.2	8.8	14.2	12.0	7.6
Ireland	**18.4**	**16.4**	**9.4**	**14.1**	**12.0**	**8.0**

UNEMPM: *The male unemployment rate according to the Census of Population*
UNEMPF: *The female unemployment rate according to the Census of Population*

Table 5.4: Social Class Characteristics for Local Authority Areas, Regions and Ireland

Local Authority Area	HLPROF 1991	HLPROF 1996	HLPROF 2002	LSKILL 1991	LSKILL 1996	LSKILL 2002
Dublin City	21.7	23.8	29.3	29.3	25.6	20.3
South County Dublin	25.6	26.7	32.7	22.4	21.2	16.2
Dublin Fingal	34.9	35.5	40.2	18.9	17.9	13.6
Dun Laoghaire/Rathdown	43.9	47.4	51.2	14.2	12.0	9.3
Kildare	26.7	29.2	35.0	30.2	22.4	18.1
Meath	26.3	28.9	34.2	26.4	23.9	18.5
Wicklow	29.4	30.1	35.3	27.1	23.9	18.8
Carlow	22.9	24.0	26.7	33.1	29.1	24.0
Kilkenny	27.1	29.0	31.7	26.7	23.0	20.0
Wexford	23.4	24.5	27.5	32.7	28.8	24.1
Tipperary SR	23.4	24.8	27.2	33.3	28.7	24.8
Waterford City	20.6	21.9	25.6	30.8	28.4	25.5
County Waterford	26.7	29.0	31.9	29.4	26.7	23.3
Cork City	22.2	22.6	25.7	31.9	27.7	24.7
County Cork	27.8	30.2	34.5	25.9	22.5	19.3
Kerry	22.1	24.1	28.0	30.5	26.2	23.0
Clare	24.9	27.9	32.5	25.6	24.1	19.5
Limerick City	18.8	20.2	23.5	36.0	30.6	27.7
County Limerick	27.0	29.2	32.4	27.6	24.4	20.6
Tipperary NR	25.9	28.0	30.4	27.8	24.9	21.1
Galway City	32.0	33.1	33.1	23.5	19.0	17.8
County Galway	20.8	25.0	29.9	28.8	25.1	21.1
Mayo	19.4	21.7	26.7	34.5	29.0	24.6
Roscommon	21.0	24.4	28.6	27.1	23.6	20.0
Louth	21.8	23.2	27.4	32.2	28.6	24.1
Leitrim	17.8	22.0	26.5	32.9	25.9	22.4
Sligo	24.1	27.3	30.4	28.1	23.8	20.7
Cavan	19.2	22.4	25.5	31.6	25.4	22.7
Donegal	18.6	20.6	24.6	40.4	35.3	27.2
Monaghan	19.0	22.3	25.9	31.2	23.9	22.9
Laois	22.9	25.1	27.9	27.8	26.2	24.1
Longford	20.2	23.4	25.6	32.6	25.4	22.4
Offaly	20.9	22.7	25.8	32.8	29.6	23.9
Westmeath	24.7	26.4	29.8	32.9	24.0	20.9
Region						
Dublin	28.5	30.5	35.7	23.5	20.8	16.2
Mid East	27.4	29.4	34.8	28.0	23.3	18.4
South East	24.2	25.7	28.5	31.0	27.4	23.5
South West	25.1	27.0	31.2	28.3	24.5	21.2
Mid West	24.8	27.1	30.7	28.4	25.4	21.4
West	22.0	25.2	29.3	29.6	25.2	21.5
Border	20.2	22.6	26.4	34.1	28.9	24.2
Midlands	22.5	24.5	27.6	31.5	26.4	22.8
NUTS II Region						
BMW	21.3	24.0	27.7	31.9	27.0	22.9
SE	26.6	28.5	33.0	26.8	23.4	19.2
Ireland	**25.2**	**27.3**	**31.6**	**28.2**	**24.4**	**20.2**

HLPROF: *Percentage of persons in households headed by 'Professionals' or 'Managerial and Technical' employees, including farmers with 100 acres or more*
LSKILL: *The percentage of persons in households headed by 'Semi-skilled Manual' and 'Unskilled Manual' workers, including farmers with less than 30 acres*

Table 5.5: Education Levels for Local Authority Areas, Regions and Ireland

Local Authority Area	EDLOW 1991	EDLOW 1996	EDLOW 2002	EDHIGH 1991	EDHIGH 1996	EDHIGH 2002
Dublin City	39.7	31.5	23.6	13.7	22.5	32.1
South County Dublin	33.7	23.8	18.0	12.6	19.9	27.3
Dublin Fingal	27.1	18.3	13.6	16.9	25.4	33.1
Dun Laoghaire/Rathdown	19.2	14.7	11.7	28.4	38.9	45.0
Kildare	33.0	24.5	17.1	13.4	21.1	28.4
Meath	36.1	27.9	19.1	11.9	18.3	25.3
Wicklow	35.0	26.8	19.7	13.9	21.4	27.5
Carlow	38.3	32.0	24.1	10.9	15.1	20.3
Kilkenny	35.7	28.7	22.1	11.1	16.2	21.5
Wexford	40.6	33.7	26.7	9.2	13.4	17.5
Tipperary SR	37.1	29.3	23.7	10.4	14.8	18.4
Waterford City	36.2	28.1	22.6	10.8	16.5	21.7
County Waterford	36.4	28.4	22.2	11.2	16.5	22.2
Cork City	35.4	28.7	22.8	13.8	20.2	25.9
County Cork	34.4	27.0	19.3	13.1	20.0	26.7
Kerry	39.1	33.2	24.8	11.1	16.8	22.3
Clare	34.8	29.6	21.4	12.7	18.1	24.4
Limerick City	36.8	31.3	26.0	11.7	16.7	22.1
County Limerick	33.1	26.7	20.7	14.0	19.3	25.0
Tipperary NR	36.4	30.6	23.3	10.8	14.5	19.5
Galway City	23.5	18.5	13.5	25.2	33.9	40.8
County Galway	42.5	37.3	27.4	11.1	16.3	22.5
Mayo	44.5	39.4	29.6	9.7	14.7	19.1
Roscommon	40.5	35.0	27.7	9.3	14.4	18.3
Louth	43.4	33.3	25.4	9.7	15.5	21.4
Leitrim	44.5	39.1	28.8	8.4	13.9	19.3
Sligo	36.1	31.2	23.9	13.0	19.7	24.5
Cavan	46.7	41.5	31.3	8.3	13.6	18.4
Donegal	51.7	43.5	33.7	8.2	13.5	18.3
Monaghan	46.4	36.6	29.2	8.5	13.3	17.6
Laois	39.2	33.1	25.4	9.2	13.5	18.3
Longford	44.8	38.3	29.5	8.9	13.5	17.8
Offaly	41.5	34.6	26.1	8.6	12.3	17.7
Westmeath	37.6	31.1	23.4	12.1	16.7	22.1
Region						
Dublin	33.1	25.0	18.7	16.7	25.4	33.5
Mid East	34.6	26.2	18.5	13.1	20.3	27.2
South East	37.7	30.4	24.0	10.4	15.1	19.8
South West	35.7	28.8	21.3	12.9	19.3	25.5
Mid West	34.9	29.1	22.3	12.6	17.6	23.4
West	39.9	34.7	25.9	12.5	18.2	23.7
Border	45.9	38.1	29.3	9.3	14.8	19.9
Midlands	40.2	33.7	25.5	9.9	14.1	19.3
NUTS II Region						
BMW	42.5	35.9	27.2	10.6	15.9	21.1
SE	34.7	27.2	20.4	14.1	21.1	27.7
Ireland	**36.8**	**29.5**	**22.2**	**13.1**	**19.7**	**26.0**

EDLOW: *Percentage of adult population with a Primary School education only (1991 not available)*
EDHIGH: *Percentage of adult population with a Third Level education (1991 not available)*
Note: *Education levels in the 1991 Census of Population were presented as a proportion of the labour force as opposed to the proportion of the adult population as in the 1996 and 2002 Censuses.*

5.2 Overall Deprivation

One of the principal conclusions that may be drawn from the previous section is that it is very difficult to summarise the changes in the indicator variables across Local Authority Areas and to gain a sense of the overall position of each Local Authority Area vis-à-vis the others. Indeed, this is why we have developed an overall index of affluence and deprivation that can be used at multiple scales. By merging the data into a single index with a fixed structure and scale over time, we can start to comprehend the massive absolute changes that have occurred over the past eleven years whilst, simultaneously, appreciating that these may nevertheless result in very small changes in relative standing.

Figure 5.1 shows the aggregate deprivation scores for the 34 Local Authority Areas, and Figure 5.2 for the Regions, NUTS II Regions and Ireland as a whole. In both figures, the areas are sorted from the most affluent to the most disadvantaged areas, based on their 1991 overall disadvantage scores. The national averages for 1991 (2) and 2002 (15) are represented by vertical lines at the appropriate point on the scale.

Figure 5.1: Overall Deprivation Scores for Local Authority Areas, 1991, 1996 and 2002

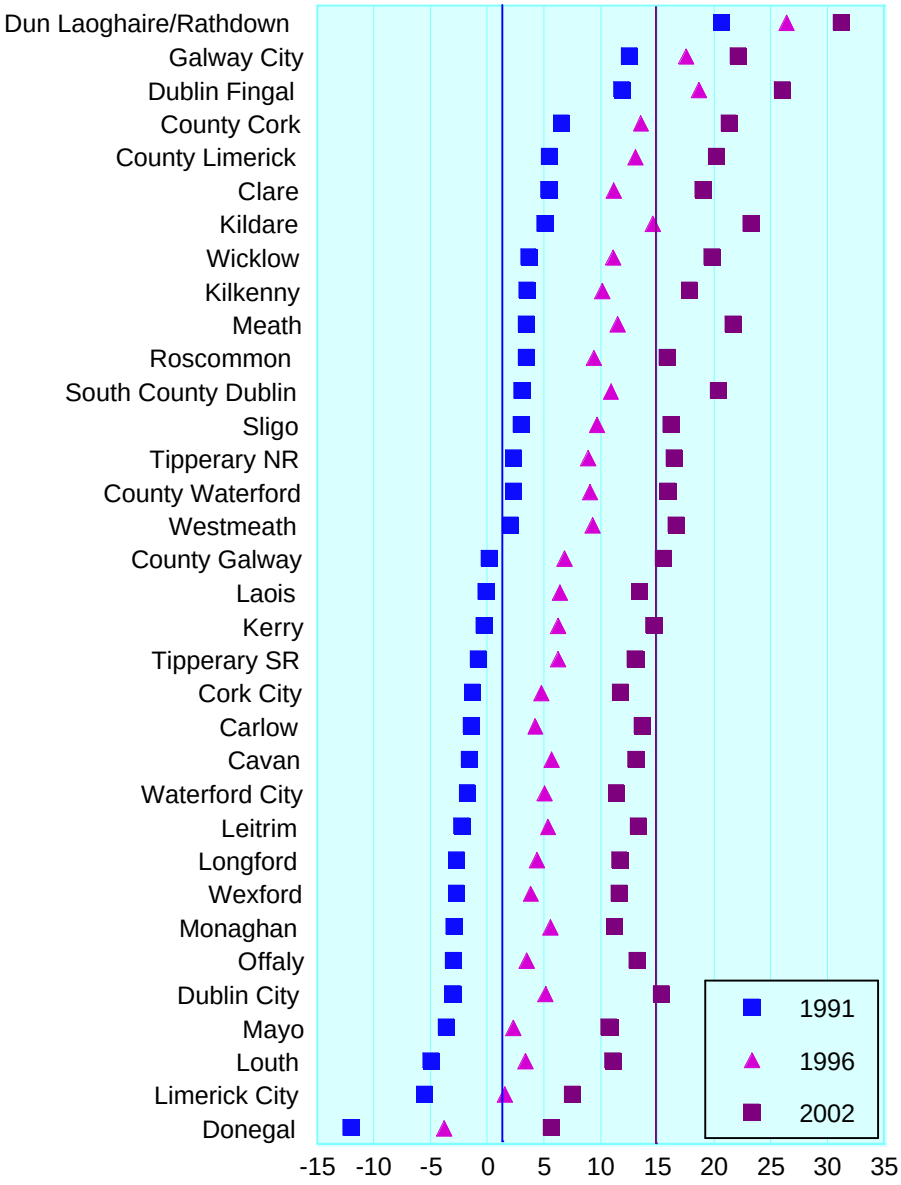


Table 5.6: Overall Deprivation Scores for Local Authority Areas, Regions and Ireland

Local Authority Area	Population 2002	Absolute Score 1991	Absolute Score 1996	Absolute Score 2002	Change 1991 -2002	Zero-centred Score 1991	Zero-centred Score 1996	Zero-centred Score 2002
Dublin City	495,781	-3.1	5.1	15.3	18.4	-3.1	-1.9	.2
South County Dublin	238,835	3.0	10.8	20.3	17.3	3.0	3.9	5.2
Dublin Fingal	196,413	11.8	18.6	26.0	14.2	11.8	11.7	10.8
Dun Laoghaire/Rathdown	191,792	20.6	26.3	31.2	10.6	20.6	19.4	16.0
Kildare	163,944	5.1	14.6	23.2	18.2	5.1	7.6	8.1
Meath	134,005	3.4	11.4	21.6	18.2	3.4	4.5	6.5
Wicklow	114,676	3.6	11.1	19.8	16.2	3.6	4.1	4.6
Carlow	46,014	-1.5	4.2	13.6	15.1	-1.5	-2.8	-1.5
Kilkenny	80,339	3.4	10.1	17.8	14.3	3.4	3.2	2.6
Wexford	116,596	-2.8	3.8	11.6	14.4	-2.8	-3.2	-3.5
Tipperary SR	79,121	-.8	6.2	13.0	13.8	-.8	-.7	-2.1
Waterford City	44,594	-1.8	5.0	11.4	13.2	-1.8	-2.0	-3.8
County Waterford	56,952	2.3	9.0	15.9	13.6	2.3	2.1	.8
Cork City	123,062	-1.4	4.7	11.7	13.1	-1.4	-2.2	-3.5
County Cork	324,767	6.5	13.5	21.3	14.8	6.5	6.6	6.1
Kerry	132,527	-.3	6.2	14.7	15.0	-.3	-.7	-.5
Clare	103,277	5.4	11.1	19.0	13.6	5.4	4.2	3.8
Limerick City	54,023	-5.6	1.5	7.5	13.1	-5.6	-5.4	-7.7
County Limerick	121,281	5.5	13.0	20.2	14.7	5.5	6.1	5.0
Tipperary NR	61,010	2.3	8.8	16.5	14.2	2.3	1.9	1.3
Galway City	65,832	12.5	17.5	22.1	9.6	12.5	10.6	7.0
County Galway	143,245	.1	6.8	15.5	15.4	.1	-.2	.4
Mayo	117,446	-3.6	2.2	10.7	14.4	-3.6	-4.7	-4.4
Roscommon	53,774	3.4	9.3	15.8	12.5	3.4	2.4	.7
Louth	101,821	-5.0	3.3	11.0	16.1	-5.0	-3.6	-4.1
Leitrim	25,799	-2.3	5.3	13.3	15.6	-2.3	-1.6	-1.9
Sligo	58,200	3.0	9.6	16.2	13.2	3.0	2.7	1.0
Cavan	56,546	-1.6	5.6	13.1	14.7	-1.6	-1.3	-2.1
Donegal	137,575	-12.0	-3.9	5.6	17.6	-12.0	-10.8	-9.6
Monaghan	52,593	-3.0	5.5	11.2	14.2	-3.0	-1.4	-4.0
Laois	58,774	-.1	6.3	13.4	13.5	-.1	-.6	-1.7
Longford	31,068	-2.7	4.3	11.6	14.4	-2.7	-2.6	-3.5
Offaly	63,663	-3.0	3.4	13.2	16.2	-3.0	-3.5	-2.0
Westmeath	71,858	2.0	9.2	16.6	14.6	2.0	2.3	1.5
Region								
Dublin	1,122,821	4.7	12.2	21.0	16.3	4.7	5.3	5.8
Mid East	412,625	4.1	12.5	21.8	17.7	4.1	5.6	6.6
South East	423,616	-.3	6.3	13.8	14.1	-.3	-.6	-1.3
South West	580,356	3.1	9.8	17.7	14.7	3.1	2.8	2.6
Mid West	339,591	3.0	9.8	17.1	14.1	3.0	2.9	2.0
West	380,297	1.2	7.5	15.2	14.0	1.2	.5	.1
Border	432,534	-5.3	2.6	10.4	15.7	-5.3	-4.3	-4.7
Midlands	225,363	-.7	6.1	14.1	14.8	-.7	-.8	-1.0
NUTS II Region								
BMW	1,038,194	-1.9	5.1	13.0	14.9	-1.9	-1.8	-2.2
SE	2,879,009	3.3	10.6	18.9	15.6	3.3	3.7	3.8
Ireland	**3,917,203**	**1.9**	**9.1**	**17.4**	**15.4**	**1.9**	**2.2**	**2.2**

Table 5.6 contains the data shown in Figures 5.1 and 5.2. The first three columns represent the overall disadvantage scores for the three Census waves of 1991, 1996 and 2002 and the fourth column indicates the change in scores between 1991 and 2002. The final three columns repeat the data of the first three columns after removing the underlying trend, in order to create a measure of relative disadvantage that is always centred on zero. The two sets of data are identical for 1991, as the trended disadvantage scores have their zero point at the 1991 values. The final three columns thus represent the relative level of affluence and deprivation in each area at each point in time, with positive values indicating above-average affluence and negative values representing above-average deprivation.

By far the most affluent Local Authority Area in 1991 was Dun Loaghaire/Rathdown, followed by Galway City and Dublin Fingal. At the opposite end of the spectrum, Donegal constitutes the most disadvantaged county, followed by Limerick City and County Louth. As Figure 5.1 illustrates, all Local Authority Areas have experienced significant improvements over the eleven-year period in question, as evidenced by a generalised shift to the right on the graph of the markers for 1996 and 2002 vis-à-vis 1991. Nevertheless, all but one of the most affluent and disadvantaged Local Authority Areas in 1991 were in the same relative position in 2002.

Some interesting differences can be observed, however, which seem to be linked with structural changes. Five of the six Local Authorities that experienced the greatest improvements (according to our aggregate disadvantage scores) are situated in Dublin's Inner City and commuter belt, namely Dublin City (18.4), Meath (18.2), Kildare (18.2), South County Dublin (17.3) and Wicklow (16.2). The only other county to have experienced a comparable improvement is Donegal (17.6), although the latter remains the most disadvantaged county in Ireland and may therefore have had greater scope for improvement.

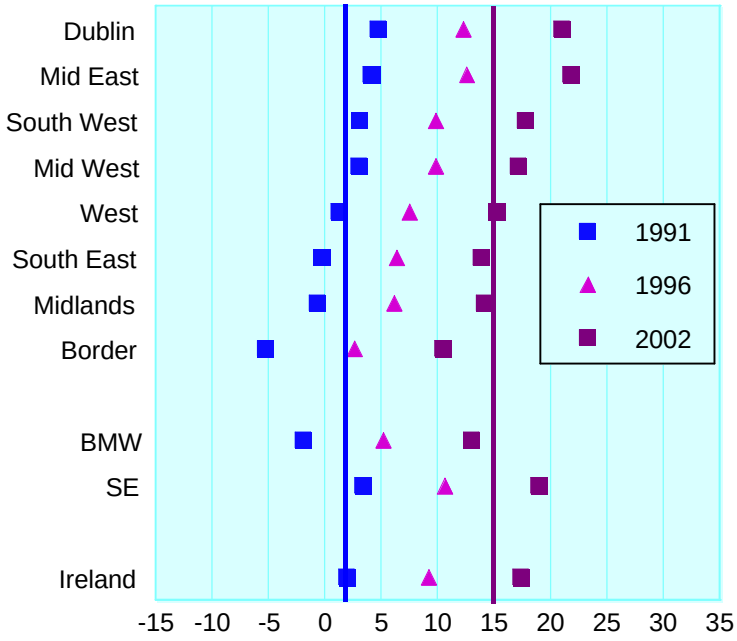
In contrast, five of the six smallest changes were observed in urban areas outside Dublin: Galway City registered the lowest increase (9.6), followed by Dun Laoghaire/Rathdown (10.6), Cork City (13.1), Limerick City (13.1) and Waterford City (13.2). Whilst the increase for Dun Laoghaire/Rathdown is well below the average, it nevertheless remains by far the most affluent area, and may therefore have had less scope for improvement than other areas. The only rural county with a comparably small change was County Roscommon (12.5).

It is thus evident that the exceptional regeneration of Dublin's Inner City was not matched by similar developments in the other cities. Furthermore, the urban expansion of these cities appears to have had a greater influence on the composition of the rural counties that surround them than on the urban areas.

In conclusion, these observations reinforce the general comments made earlier in relation to Maps 3.4 to 3.6, namely the nodal character of the economic growth that has occurred in Ireland over the past decade and the fact that areas of affluence are increasingly distributed in concentric rings around the main cities, demarcating their commuter belts.

Figure 5.2 shows the aggregate values for the eight Regions, as well as for the Border, Midland & Western Region (BMW), the Southern & Eastern Region (SE) and Ireland as a whole. All Regions have recorded similar improvements, ranging from a high of 17.7 for the Mid East to a low of 14.0 for the West. Since the mid 1990s, the Mid East has overtaken the Dublin region as the most affluent Region. The scores for Local Authority Areas and Regions are shown in Table 5.3. It is interesting to note that the relative affluence of the Regions, as indicated by our index, broadly concurs with the differences in Total Income per Person published by the Central Statistics Office. The only marked difference relates to Dublin which, according to the CSO measure, has a considerably higher Total Income per Person, a difference that is attributable to the wider number of factors taken into account by our deprivation index.

Figure 5.2: Overall Deprivation Scores for Regions and Ireland, 1991, 1996 and 2002



6 Appendix A: Frequently-asked Questions

In this appendix, which summarises the main elements of this report, we will adopt a Question-and-Answer format with a view to anticipating some of the questions that readers are likely to ask. This will enable us to address some potential difficulties in understanding the methodology employed, in the interpretation of disadvantage scores and in the application of the index.

Q 1: Should a disadvantage index be purely census-based?

A 1: It is commonly believed that census data quickly lose their relevance and that it is therefore preferable to use up-to-date information from other (primarily administrative) data sources for measuring disadvantage. However, unlike in the UK and most other European countries, where the Census of Population is held once every ten years, in Ireland the interval between each census is just five years. Furthermore, when we actually look at the degree of relative disadvantage in 1991 and 2002, the vast majority of areas have not changed their *relative* position, even though they experienced massive changes in their absolute scores. Concerns about the timeliness of indicators tend to be driven by a desire for 'quick results' rather than an appreciation of the deep-rooted problems faced by disadvantaged areas.

Moreover, the use of non-census data may make it impossible to accurately study change over time, as the procedures associated with the collection of this data and the definition of entitlements to benefits or health care, for example, change relatively rapidly. It is also worth remembering that administrative data are often only available at a high level of spatial aggregation and that the procedures required to disaggregate them to ED level typically rely heavily on census data.

Overall, the census provides a unique snapshot of social and economic characteristics in a given country at a particular point in time, and this picture is unmatched in its level of detail, accuracy and robustness over time. There are strong reasons therefore, to build the new measures of disadvantage on the basis of the census alone.

Q 2: Should more variables be included in the Deprivation Index?

A 2: Whilst a large number of additional variables were considered for inclusion in the new measures of deprivation, the added value of including extra indicators is not as great as is sometimes imagined. This is because, beyond a certain threshold, the law of diminishing returns prevails, and the key question is how many variables are needed to sufficiently identify the underlying dimensions of disadvantage. In fact, the inclusion of variables with large amounts of systematic error or random variation can have a negative impact on disadvantage scores. The scientific literature indicates that three to four variables are sufficient in order to identify each dimension, and the inclusion of additional variables has only a marginal impact on the accuracy of the models that underlie index construction.

Q 3: Should a deprivation index attempt to 'count' the number of people who are poor or disadvantaged in any one area?

A 3: This approach reflects a rather simplistic understanding of the construction of area-based deprivation indices. For example, we know that unemployed people are more likely to be poor; therefore we also know that areas with high unemployment rates will, all other things being equal, tend to have a larger number of poor people residing within them. However, we do not include the unemployment rate in our index as an estimate of the number of poor people residing in a given area; what matters is that, at the spatial level, living in an area with a higher unemployment rate increases the likelihood that any given individual or family will be disadvantaged. It does not make a major

difference whether we include, for example, the proportion of people in the Professional or Managerial & Technical social classes or the proportion in the Semi- and Unskilled Manual classes. As long as a variable reliably captures a significant differentiation in the likelihood of experiencing disadvantage along one of the conceptualised dimensions, it can be a suitable indicator. Indeed, the two extremes of a distribution sometimes capture distinct different processes: the absence of middle-class families, for example, has an impact on educational outcomes (due to the lack of role models), on the organisational fabric of the local community and on its political representation. Areas with a large proportion of unskilled workers and a small proportion of professionals are therefore objectively more disadvantaged than areas which retain a certain social 'mix'.

Q 4: Must all variables be directly and positively associated with the presence of disadvantaged groups or individuals?

A 4: Whilst most variables are indicative of the presence of people living in poverty, a general deprivation index should also take into account the structural weaknesses of an area.

One of the most fundamental assumptions which informs the construction of the measures of deprivation in Ireland presented in this report is that unemployment, whilst arguably the most significant factor associated with deprivation, does not in isolation provide a comprehensive guide to the classification of local areas. Indeed, high unemployment rates are a predominantly urban phenomenon which, taken in isolation, would introduce considerable bias into any nationwide index. The reason for this is the high level of emigration from many rural areas, which effectively reduces their unemployment rate. However, as emigration tends to be selective, involving primarily the working-age population, it tends to leave behind a disproportionately large economically-dependent population.

The potential of these measures of deprivation relies on the fact that they provide a practical tool for policy-making in a wide range of areas. In this sense, the considerations underlying the construction of these indices differ from those which might be appropriate to the design of a sector-specific index.

Q 5: What is the difference between 'domains' and 'dimensions'?

A 5: The term 'domain' refers to the different areas of life in which observations may be made and data gathered. The domains generally believed to be of importance in the measurement of disadvantage include age and family structure (demography), employment, welfare, social class, education, health, housing and ethnicity. However, many observations, and the resulting variables, are highly correlated across these different domains, as they represent different facets of the same underlying factors or dimensions. Unlike 'domains', 'dimensions' reflect the distinct causal influences which determine the degree of disadvantage or affluence of a given area.

Q 6: What does the term 'multi-dimensional' mean?

A 6: A multi-dimensional deprivation index identifies two or more underlying dimensions either on theoretical grounds or by means of an Exploratory Factor Analysis. Factor analysis helps to identify the dimensions of variation underlying a group of variables and avoids the risk of 'double-counting'. Factor analysis remains the preferred technique in the construction of area-based deprivation indices and is used in more than 80 per cent of all deprivation indices currently in use throughout the OECD countries.

In order to respect the multi-dimensional nature of disadvantage, the aggregation of scores on the different dimensions must be handled carefully. There has been considerable discussion about this in the social science literature, and some authors

initially proposed to retain only one of the dimensions identified by Exploratory Factor Analysis, in line with a 'unidimensional' approach. The resulting index, whilst using multiple indicators drawn from different domains, will not capture distinct structural causes of disadvantage such as demographic decline in rural Ireland. On the contrary, the first factor identified by Exploratory Factor Analyses typically reflects the specific forms of urban deprivation.

Q 7: What's new in the 2002 Index?

A 7: Rather than considering new domains or additional variables, perhaps derived from non-census data, the most important development in relation to the 2002 Index regards the comparability of scores. It has become clear over the last number of years that there is an overwhelming need for an index that can reliably and accurately detect even small amounts of change from one census wave to the next. One of the weaknesses of prevailing methods is that the resulting estimates use different combinations of variables for each census period, ruling out the direct comparison of disadvantage scores. The inability to draw valid comparisons in net outcomes has become the single greatest issue in the evaluation of area-based programmes that aim to alleviate deprivation.

To this end, the authors of the current study have developed a new approach, based on **Confirmatory Factor Analysis**. This approach uses a different statistical procedure, a more powerful form of factor analysis known as **Structural Equation Modelling**. This uses prior research findings and theoretical hypotheses to specify the variables associated with each dimension, which means that the structure of the index can be 'fixed' across successive waves of census data. The 'fit' of the statistical model can be evaluated using powerful statistical tests, ensuring high validity and reliability. The resulting scores are directly comparable, as they measure the same concept at each point in time. The use of Confirmatory Factor Analysis to construct the 2002 Index of Relative Affluence and Deprivation allows us, for the first time, to evaluate the net changes that occurred in the degree of disadvantage at local level in Ireland between 1996 and 2002. This approach to index construction – and some preliminary results – were presented at an international social science methodology conference in Cologne in October 2001, where it was greeted as an important methodological breakthrough.

Q 8: What is the purpose of the new measures of deprivation in Ireland?

A 8: All deprivation indices must fulfil at least two key functions: firstly, they must provide a reliable tool for targeting funds at the objectively most disadvantaged areas. Secondly, they must assist in creating the political consensus necessary to allow funding to be distributed in this way.

The 1993 and 1998 Indices of Relative Affluence and Deprivation have satisfied both of these goals. Unlike their UK counterparts, which have been subject to frequent alterations and have attracted widespread criticism, the Irish index has been used by a large number of Government departments and is widely praised within the community development arena.

Building on this success, the new measures of deprivation add a third key function in the use of disadvantage indices: the monitoring and quantification of change over time in the level of disadvantage observed within specific areas and across the country as a whole.

Q 9: How should the new measures of deprivation be used?

A 9: Whilst the 1993, 1998 and 2002 Deprivation Indices are presented at the level of individual Electoral Divisions, they are intended primarily for use at higher levels of spatial aggregation. These measures are not designed to 'count the number of poor people in a given area', but to identify underlying structural strengths and weaknesses. Thus, the political response to these weaknesses must also be formulated at an aggregate level[35]. In order to develop and sustain effective administrative structures, an intervention area should probably have a population of at least 20,000 residents; this was the threshold used for the designation of Partnership Areas under successive Irish Local Development Programmes. At this level, the index developed here is particularly robust and highly reliable, reinforcing its role in formal resource allocation models.

At lower spatial levels, and particularly at the level of the individual ED, greater caution is required in the interpretation of scores. The indices are quite robust even at this level and do not suffer from the 'small number problem' to which a number of UK and Northern Ireland indices are subject. Thus, they provide a reliable measure of disadvantage on the basis of the socio-economic indicators used in their construction. However, at this level, fluctuations in the values of these indicators due to local factors could have an excessive impact on disadvantage scores. It is therefore worth repeating that deprivation indices should be viewed first and foremost as a tool for identifying the most deprived areas as an intervention area, and that local knowledge should be used as a complement when interpreting scores at lower levels of spatial definition.

[35] For some reflections on this question, see Haase, T. & McKeown, K. (2003) *Developing Disadvantaged Areas through Area-Based Initiatives – Reflections on over a Decade of Local Development Strategies.* Dublin: ADM.

7 Appendix B: Model Specification and Results

Table 7.1: Variables, Transformations, Estimation and Scaling

Name	Transformations[36]	Estimation of missing waves	Scaling Factor[37]
POPCHG	Values constrained to the range +/- 25%	None	1
AGEDEP	None	None	1
EDLOW	Centred by subtracting mean for each wave of data	Values for 1991 estimated by applying regression weights (obtained using 1996 Census data) to the 1991 percentage of people who had left school by 16 years of age and the percentage who remained in school beyond 19 years of age	1
EDHIGH	Natural logarithm of percentage of population with a Third Level education plus one; centred by subtracting mean for each wave of data	Values for 1991 estimated by applying regression weights (obtained using 1996 Census data) to the 1991 percentage of people who had left school by 16 years of age and the percentage who remained in school beyond 19 years of age	10
HLPROF	None	None	1
PEROOM	None	Values for 1996 estimated by calculating the arithmetic mean of the 1991 and 2002 values and adding a random error variable of mean 0 and standard deviation 0.02	100
LSKILL	None	None	1
UNEMPM	Natural logarithm of male unemployment rate plus one	None	10
UNEMPF	Natural logarithm of female unemployment rate plus one	None	10
LONPAR	Natural logarithm of percentage of lone parent families plus one	None	10

[36] These transformations were determined by inspecting each variable and have the effect of improving their distributional characteristics and enhancing the stability of the disadvantage index.

[37] An arbitrary scaling factor is typically used in Structural Equation Modelling to render the variances more homogeneous.

Table 7.2: Summary Statistics for Transformed Indicator Variables

Variable	Mean	Std. Dev.	Skewness	Kurtosis
POPCHG91	-2.15	7.83	0.63	1.61
AGEDEP91	40.61	5.03	-0.70	1.77
EDLOW91	0.00	11.32	-0.37	0.56
EDHIGH91	0.00	0.54	-0.06	0.92
HLPROF91	22.77	10.03	0.89	1.60
PEROOM91	0.66	.07	0.17	1.42
LSKILL91	29.34	10.79	0.70	1.54
UNEMPM91	2.70	0.54	-0.36	1.21
UNEMPF91	2.44	0.74	-1.47	3.24
LONPAR91	1.93	0.81	-0.94	0.83
POPCHG96	0.61	7.66	0.83	1.55
AGEDEP96	37.61	4.79	-0.53	2.10
EDLOW96	0.00	11.07	-0.12	0.15
EDHIGH96	0.00	.48	0.01	1.28
HLPROF96	25.73	9.82	0.84	1.62
PEROOM96	0.59	0.059	0.44	2.28
LSKILL96	25.78	9.42	0.63	1.36
UNEMPM96	2.59	0.57	-0.32	1.14
UNEMPF96	2.32	0.71	-1.30	2.72
LONPAR96	2.10	0.85	-0.92	1.05
POPCHG02	4.47	10.50	0.25	-0.37
AGEDEP02	34.64	4.83	-0.71	2.88
EDLOW02	0.00	9.33	0.25	0.45
EDHIGH02	0.00	0.41	0.13	0.88
HLPROF02	29.44	9.59	0.71	1.36
PEROOM02	0.53	0.05	0.94	3.56
LSKILL02	22.32	7.96	0.58	1.28
UNEMPM02	2.09	0.61	-0.40	1.33
UNEMPF02	1.97	0.65	-1.03	1.91
LONPAR02	2.26	0.85	-0.94	1.34

7.1 Principal Components Analysis: An In-depth Discussion

Although Principal Components Analysis (PCA) is a widely-used technique in the field of deprivation modelling, and undoubtedly offers a number of advantages, it is important to be aware of its limitations. The first of these is related to the selection of components: the decision regarding how many components to retain is typically based on the 'scree slope test' (the 'Cattell criterion') or the pattern of declining Eigenvalues (the so-called 'Kaiser criterion')[38], which at best represent a lower bound for the 'correct number of components'[39]. Arguably, the appropriate number of dimensions to include in a model should be determined by the theoretical ideas that guide the research process, rather than being relegated to automated statistical procedures.

Secondly, even where researchers specify a given number of components on theoretical grounds, all of the variables included in a PCA 'load' on all of the components. This can lead to ambiguities in interpretation, as the definition of components depends on the precise pattern of the loadings. As Stevens (1996) notes, "[t]he components are artificial variates designed to maximise variance accounted for, not designed for interpretability" (p. 368). For this reason, it is not uncommon for researchers to brush aside inconsistencies and contradictions in their findings. For example, Duncan & Aber (1997) fail to explain why, in their PCA, the percentage of adults out of work has a negligible loading on what they refer to as the 'Male Joblessness' component and why the percentage of adults with less than 12 years of schooling loads on 'High SES' but not 'Low SES'.

Further problems arise from the tendency for researchers to use the first component of a Principal Components Analysis as a unidimensional index of disadvantage. Although this component may account for a large proportion of the overall variance, it is almost certain to be 'urban' in character. This is because the first component typically expresses the close association between social class disadvantage and labour market deprivation observed in urban areas. The social and spatial polarisation of urban areas generates a strong pattern of relationships between indicators of social class disadvantage and labour market deprivation. It is interesting to note, however, that in relatively underdeveloped regions, such as the South of Italy, the first component extracted in Principal Components Analyses of census data may represent a combination of social class disadvantage and demographic decline.[40]

The third problem with PCA is its sensitivity to the attributes of individual datasets. For example, because of the interpretational difficulties mentioned above, the components in a PCA are often 'rotated'; different rotations give rise to different relationships between the indicators and the components. The choice between 'oblique' and 'orthogonal' rotations determines whether the components will be correlated or not, but even these are algebraically equivalent representations of the same mathematical solution.[41] In other words, an attribute as fundamental as the correlation of the dimensions is contingent upon the operational decisions made during the analysis.[42] Where an oblique rotation is selected – the most sensible course of action when studying disadvantage – the problem of interpretation remains, as a multiplicity of oblique rotations are possible, each yielding a different interpretation. As a consequence of this volatility, PCA scores are not comparable over time and space and are therefore not suitable for monitoring spatially-targeted public programmes.

Another considerable weakness of all of the above approaches to index construction is that they ignore the question of measurement error. Most researchers are in agreement that census data are far from perfect, and we must avoid the danger that, by adding together a set of indicators, we amplify these forms of error. Arguably, this requires a 'latent variables'

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38 Stevens, J. (1996) *Applied Multivariate Statistics for the Social Sciences*. Third Edition. NJ: LEA. Pages 366-368.

39 Hayduk, L. (1999) 'Jiving the Four-Step, waltzing around factor analysis, and other serious fun'. *Structural Equation Modeling*, Vol. 7, No. 1, pp. 1-35.

40 Maddaloni, D. (1997) 'La diseguaglianza sociale in prospettiva spaziale: Un'analisi sul territorio salernitano al 1991'. Salerno: IRIDISS Working Paper.

41 Harman, H. (1967) *Modern Factor Analysis*. Second Edition. Chicago: University of Chicago Press.

42 Pedhazur, E. & Schmelkin, L. (1991) Measurement, Design and Analysis. New Jersey: LEA.

approach, as latent variables are defined as the variance shared by a set of indicators, rather than their weighted sum, which reduces the problem of measurement error.[43] On the basis of all of these considerations, we have decided to use Structural Equation Modelling techniques to develop a new set of indices for the Republic of Ireland.

7.2 Model Estimation and Fit Statistics: Technical Details

All statistical models presented in this report were estimated using Structural Equation Modelling (SEM) software. In statistical terms, Structural Equation Models place constraints on the joint distribution of a set of observed variables by omitting paths or correlations from the saturated model and by imposing 'equality constraints' on the parameters.[44] Because SEM models draw on theoretical knowledge to specify constraints, they are empirically testable: the theoretical assumptions imply a pattern of correlations between the observed variables; model adequacy can be assessed by confronting this with the observed variances and covariances (or correlations).

Model estimation is accomplished by using a 'fitting function', which indicates how closely the covariance matrix implied by the model conforms to the observed data. In mathematical terms, we can express this in terms of the null hypothesis, where Σ is the population covariance matrix of the observed variables, $\Sigma(\theta)$ is the covariance matrix implied by the model and θ is a vector containing the free parameters of the model. Bollen & Long (1993) summarise the motivation behind this approach: "If the model [is] specified correctly and the distributional assumptions for the data [are] satisfied, analysts [can] use a test statistic with an asymptotic chi-square distribution to test the null hypothesis that the specified model leads to an exact reproduction of the population covariance matrix of the observed variables. A significant test statistic would cast doubt on the model specification" (p. 2).[45]

Before a model can be estimated and tested, however, the theoretical model must be translated into a statistical model for a set of linear equations among observable and latent variables, and this system of equations must be 'identified', i.e. it must be possible, at least in principle, to obtain unique estimates for each parameter in the model. All of our analyses rely on the Maximum Likelihood (ML) fitting function and are evaluated using a range of statistics and indices. Given the magnitude of our sample, the chi-square statistic is likely to have 'excessive' statistical power. In fact, the formula for chi-square shows that this statistic is dependent, in part, upon the sample size (N). Although perfectly accurate models will always have a non-significant chi-square (to within sampling error) regardless of sample size, small discrepancies between the model and the observed data are 'magnified' by large samples: "with very large samples we run into the opposite embarrassment, in that we may obtain highly significant χ^2s and hence reject models in cases where the discrepancies between model and data, although presumably not due to chance, are not large enough to be of any practical concern".[46]

Karl Jöreskog highlighted this danger in one of his early contributions to the development of the statistical theory underlying Structural Equation Modelling.[47] As Cudeck & Henly (1991) point out, if models are treated as a simplification of real processes, the traditional approach to hypothesis testing loses some of its relevance, as researchers rarely believe that their models are capable of perfectly reproducing an observed variance/covariance matrix.[48] The

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43 Loehlin, J. (1992) *Latent Variable Models: An Introduction to Factor, Path and Structural Analysis*. Hillsdale: Erlbaum; Hayduk, L. (1987, 1996) *op. cit.*

44 Bentler, P. (1995) *EQS Structural Equations Program Manual*. California: Multivariate Software, Inc.

45 Bollen, K. & Long, J. S. (Eds.) (1993) *Testing Structural Equation Models*. Newbury Park: Sage.

46 Loehlin, 1992, op. cit., p. 65 and p. 71.

47 Jöreskog, K. (1969) 'A general approach to confirmatory Maximum Likelihood Factor Analysis'. *Psychometrika*, 34, pp. 183-202; cf. Tanaka, J. (1993) 'Multifaceted conceptions of fit'. In Bollen, K. & Long, J. S. (Eds.) *Testing Structural Equation Models*. Newbury Park, CA: Sage, pp. 12-13; Fan, X., Thompson, B. & Wang, L. (1999) 'Effects of sample size, estimation methods, and model specification on structural equation modeling fit indices'. *Structural Equation Modeling*, Vol. 6, No. 1, pp. 56-83.

48 Cudeck, R. & Henly, S. (1991) 'Model selection in covariance structure analysis and the "problem" of sample size: A clarification'. *Psychological Bulletin*, 109, pp. 512-519.

use of chi-square as a central chi-square statistic is based on the assumption that the model holds exactly in the population, an assumption that is unreasonable in most empirical research.

Because of the high power of the chi-square test when large samples are used, a range of alternative, descriptive indices of model fit have been proposed. These indices enable researchers to evaluate models that may be satisfactory despite the presence of substantively trivial discrepancies (which are nevertheless sufficient to lead to model rejection when using large samples). Hu & Bentler (1999) review a range of indices and on the basis of their discussion we have decided to evaluate the goodness-of-fit of our models using the Comparative Fit Index (CFI) (this index should be equal to or above .95) and the Standardised Root Mean Square Residual (SRMR) (which should be equal to or less than .08).[49]

Table 7.3: Goodness of Fit Statistics and Indices for 1991, 1996 and 2002 Data

	1991	1996	2002	Combined Model 1991 - 2002
ML Chi-square:	892.73 (27 df)	546.92 (27 df)	881.38 (27 df)	6297.13 (346 df)
Probability:	0.00000	0.00000	0.00000	0.00000
S-B Scaled Chi-square:	673.40	403.78	662.36	4498.46
CFI:	0.95	0.97	0.95	0.94
Bollen IFI:	0.95	0.97	0.95	0.94
SRMR:	0.05	0.03	0.05	0.07
RMSEA:	0.10	0.08	0.10	0.07

The first three models (1991, 1996 and 2002) have good fit to the data according to the alternative fit indices, and the combination of the CFI and the SRMR meet the criteria specified earlier for model acceptance. The CFI for the 1991, 1996 and 2002 models is 0.95, 0.97 and 0.95 respectively and the SRMR is 0.05, 0.03, 0.05. One modification was made to the original model in order to achieve acceptable fit to the data: a correlation between the error terms associated with the age dependency rate and population change over the previous five years was added. This implies that the observed correlation between these two variables cannot be accounted for completely by the latent variable Demographic Decline. In fact, there is a particularly intimate relationship between (selective) out-migration and the subsequent demographic profile of local areas, and this effect is therefore fully in accord with our theoretical model. The fact that it generalises to all three waves of data reinforces the view that this is a necessary structural component of the model.

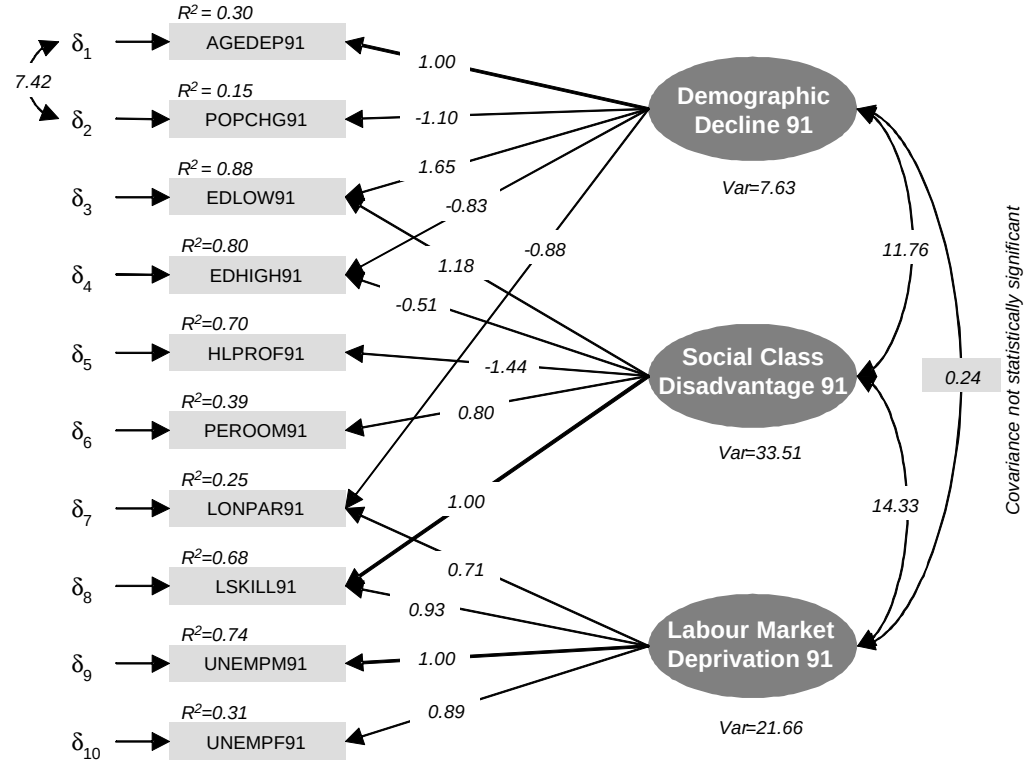
The combined model, which we will describe below, is summarised in the final column of the table, and it is immediately evident that this model falls slightly below the Hu-Bentler decision rule based on the combination of the CFI and the SRMR (the CFI is .94, compared to a suggested cut-off value of .95). The size of this discrepancy is nevertheless negligible and it is possible to meet the threshold value by including a small number of 'nuisance' factors which have very little impact on the estimated coefficients in the model.

7.3 Parameters for the 1991, 1996 and 2002 Models

Figures 7.1, 7.2 and 7.3 summarise the results of our disadvantage model when estimated separately using data from the 1991, 1996 and 2002 Censuses of Population. The (unstandardised) parameter estimates have been incorporated into the path diagrams. The coefficient of determination (R^2) is reported for each dependent variable (this indicates the proportion of the variation of each indicator variable that is accounted for by the factors on which it loads), and the variances of the latent variables are also indicated.

[49] Hu, L. & Bentler, P. (1999) 'Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria Versus New Alternatives'. *Structural Equation Modeling*, Vol. 6, No. 1.

Figure 7.1: Results of the Disadvantage Model, 1991 Census Data (N=3403)*



***All coefficients unstandardised, all effects statistically significant at the .05 level except where indicated.**

Figure 7.2: Results of the Disadvantage Model, 1996 Census Data (N=3403)*

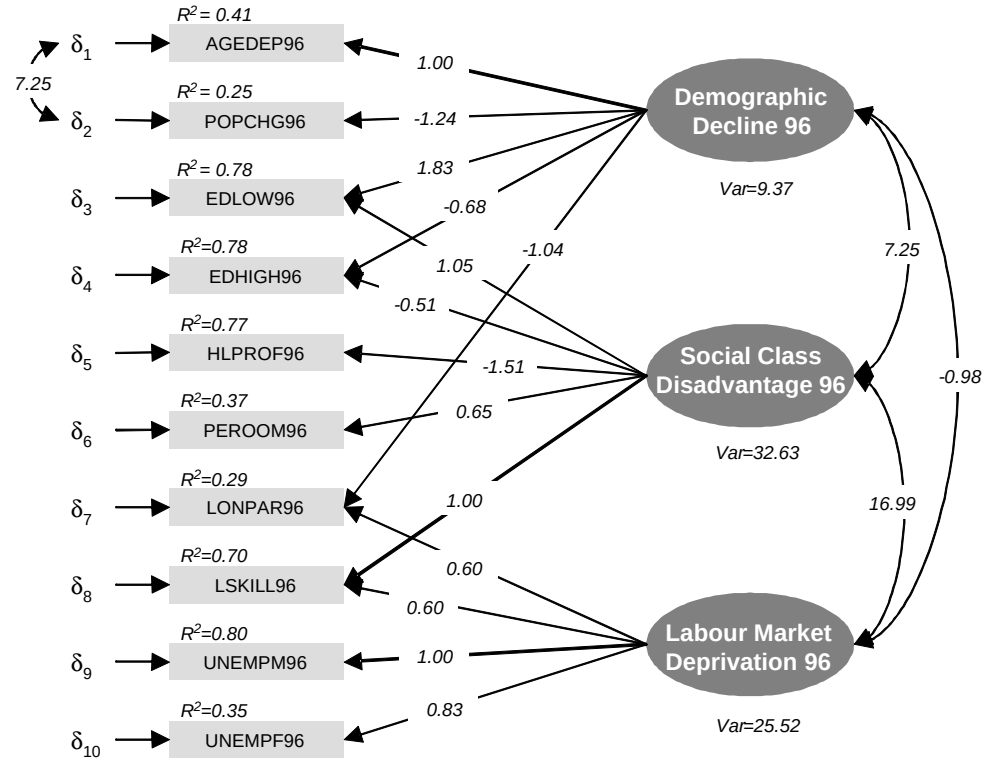
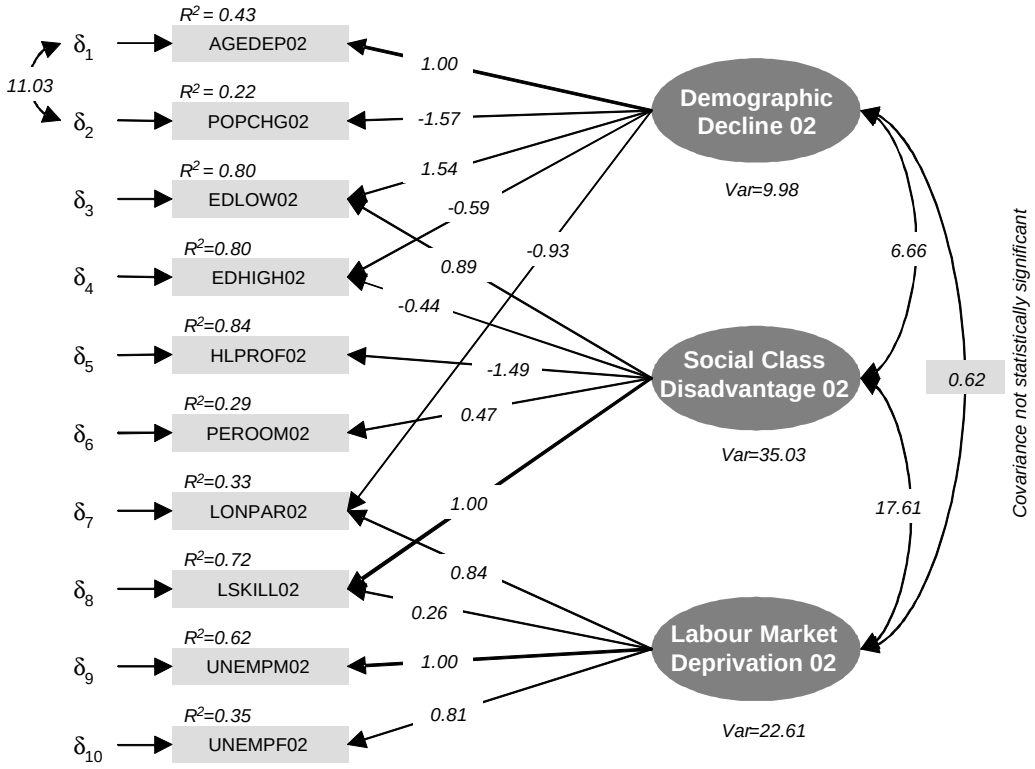


Figure 7.3: Results of the Disadvantage Model, 2002 Census Data (N=3403)*



***All coefficients unstandardised, all effects statistically significant at the .05 level except where indicated.**

In the path diagrams presented above, latent variables (corresponding to the three dimensions of deprivation) are indicated by an ellipse, whilst observable indicators are enclosed by a rectangle. Directed arrows correspond to regression equations in the statistical model, in which a dependent variable is regressed on its determinants. The 'delta' variables to the left of the diagrams are 'error variables' and they account for the variance in the indicator variables not explained by the respective latent variables.

7.4 The Problem of "Small Numbers"

A number of writers have drawn attention to the issue of the sensitivity of socio-economic indicator variables to random fluctuations in areas with small populations (the problem of 'small numbers'). Indeed, as we have already mentioned, the Robson Index (Robson et al., 1994) uses a 'chi-square' transformation in an attempt to overcome this problem. In a rather complicated manner, this transformation adjusts each observation according to the population of the local area and the distance of the observed value from the national average. This means that extreme values for small populations are adjusted towards the average for the country as a whole, and consequently a weighting is introduced which favours more populous areas. As Robson et al. state, this methodology yields an index that measures both relative deprivation and population size.

The integration of population size into an index of deprivation may initially appear attractive, as it is undoubtedly true that, at parity of disadvantage, larger areas face greater problems than smaller ones. However, this has revealed itself to be a handicap, as the confounding of size and disadvantage level introduces a systematic bias towards more populous, urban areas. As a result, pockets of deprivation will often be overlooked, the targeting of resources towards areas of social need becomes more difficult and alternative population and deprivation weightings are rendered impossible. Rather than automatically considering more populous areas to be more disadvantaged, we should seek to maintain a disadvantage index

that is like a thermometer, yielding comparable measurements in all areas. These measurements can then be weighted by population size if this is required for the purposes of resource allocation.

Having rejected the chi-square transformation, however, we must still address the 'small numbers' problem, as the main attraction of this technique is that it provides more robust observations. A key consideration is that the problem of sensitivity to population size afflicts, in particular, measures whose denominator represents a subset of the population. It is quite understandable that Robson was worried about this, as some of his indicator variables refer to extremely small populations, such as pensioners (pensioners with no central heating), 17-year-olds (who have left the education system), young people (with no qualifications) and the unemployed (long-term unemployment).

By contrast, our index uses variables with very large denominators: four of our indicators have the total population as their denominator (population change, the age dependency rate, the percentage of the population in high social classes and the number of rooms per person), another has a slightly smaller denominator (the percentage of the population in low social classes, excluding those who are 'unclassified' from the denominator), two indicators have the economically-active population as their denominator (the unemployment rates), two more have the adult population as their denominator (educational attainments) and the final indicator uses families with children under 15 years of age. After examining their distributions, we believe that these variables are stable for the vast majority of Irish census tracts.

7.5 The Estimation of a Combined Model, 1991-2002

One of our aims in developing a new set of deprivation indices was to overcome what we saw as the main problem with existing measures: their failure to accommodate a precise analysis of changing patterns of deprivation over time. The standardisation of indicator variables in the simple additive and 'expert-weighted' approaches changes their scale, which means that indices based on these techniques will typically have a different measurement scale at each time point. For example, when used within a comparative framework, the 'chi-square' transformation used in the Robson Index leads to misleading conclusions, as changes in the national averages can create the impression of change in areas where no alterations have actually occurred. The sensitivity of Principal Components Analysis to particular datasets results in different components, 'loadings' and different measures of disadvantage at each time point, which affects all indices based on this technique. Naturally, the above indices may be used to make comparisons over time by using ED, Ward or District rankings. However, this yields little information and does not allow us to monitor the impact of a public programme or to assess changes in deprivation levels.

As we noted earlier, the survey-based approach uses census variables as proxies to produce an estimate of the percentage of people in each local area who are disadvantaged. The resulting estimates may therefore be comparable over time if the same proxy variables are used at all time points and if the same definition of disadvantage is used in the individual-level model. However, there are nevertheless problems with this approach, as the list of items defined as 'basic essentials' may become outdated in a relatively short period of time. For example, Layte et al. report that the percentage of people who viewed a telephone as a necessity increased from 45 per cent to 82 per cent between 1987 and 1997, and the increase for colour televisions was similarly large (from 37% to 75%).[50]

In contrast, Structural Equation Modelling facilitates comparisons across time and space without giving rise to additional problems, as the definition of the latent variables can be held constant. In factor analytical terms, the latter is referred to as 'factorial invariance', and requires that corresponding factor loadings be constrained to be equal at successive time points. As long as the same indicator variables are used, the resulting disadvantage scores

[50] Layte, R., Nolan, B. & Whelan, C. (2000) 'Targeting poverty: Lessons from monitoring Ireland's national anti-poverty strategy'. *Journal of Social Policy*, 29 (4), 553-575.

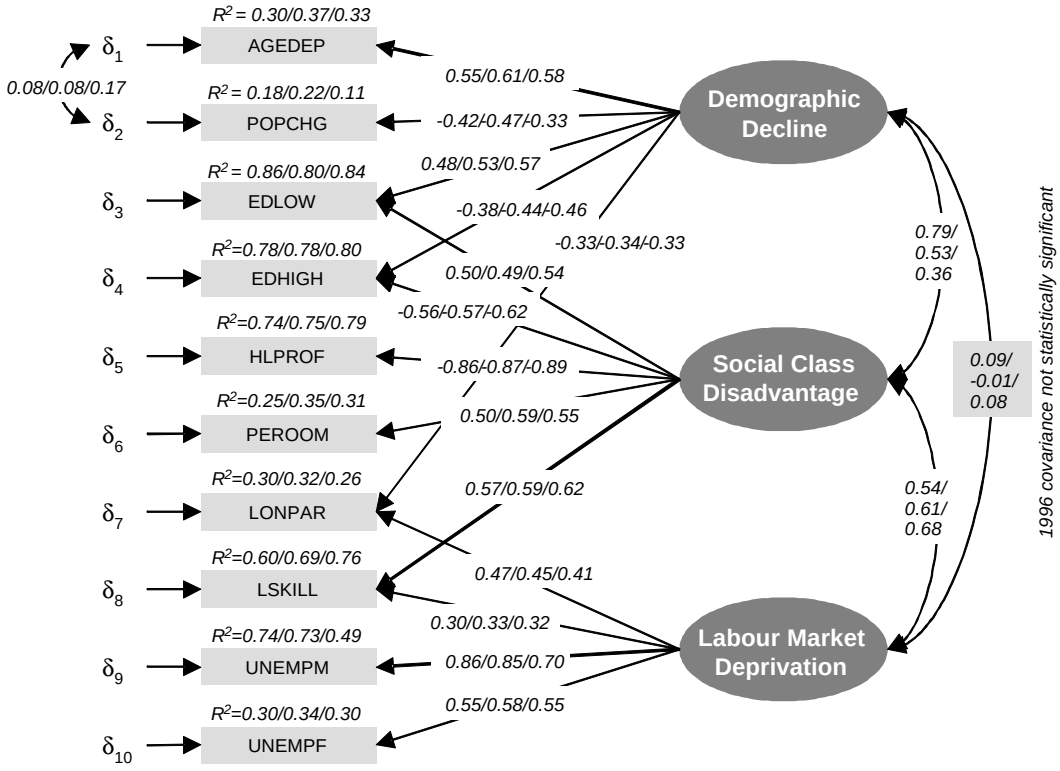
may be compared. Naturally, gradual changes in social structures may lead to changes in the nature of disadvantage, necessitating a revision of the model. In this case, model fit statistics will alert us to the problem.

We will now estimate a comprehensive disadvantage model in which we simultaneously draw on data from the 1991, 1996 and 2002 Censuses of Population, specifying correlations between the latent variables. This model is more complex than the preceding ones, as it incorporates a number of additional correlations and equality constraints. Firstly, the error variables associated with corresponding indicators are allowed to covary across all three time points, a standard practice in longitudinal research. These covariances captures the similarities between observations relating to the same variable at different points in time, after controlling for the relationship between the latent variables.

Secondly, all corresponding factor loadings are constrained to be equal across time in order to ensure that the meaning of the latent variables remains constant. For example, the effect leading from the latent variable Social Class Disadvantage in 1991 to HLPROF91 is constrained to be equal to the effect leading from Social Class Disadvantage in 1996 to HLPROF96, and both are constrained to be equal to the equivalent effect in 2002.

Figure 7.4 provides the *standardised* factor loadings and covariances comprising the 'measurement' part of the model. The three sets of loadings and correlations are for the years 1991, 1996 and 2002 respectively. This is the final model used to estimate the factor scores from which, in turn, our overall deprivation score is derived[51].

Figure 7.4: Path Diagram of the Disadvantage Model, 1991-2002 Census Data (N=3403)*



***All coefficients are standardised, all loadings constrained to be equal and corresponding variables at different times are correlated; all effects statistically significant except where indicated (N=3403).**

[51] During the process of index construction, consideration was given to the question of whether the three dimensions should be completely standardised before calculating the overall scores. For example, it would be possible to divide each dimension by the mean standard deviation for that dimension in 1991, 1996 and 2002. However, as the three dimensions already have rather similar standard deviations, we decided that it was not necessary to apply any further transformations.

When estimating factor scores for the latent variables in the above model, we also specify a structure for the means, using a technique known as 'structural means analysis'. Standard Structural Equation Models assume that all variables have a mean of zero, but by including the means in the model we can obtain estimates for the means of the latent variables, allowing us to draw conclusions about the nature of the absolute change in social disadvantage in Ireland between the three Census waves. Table 2.3 shows the means and standard deviations for the factor scores of the three dimensions of disadvantage across the three Census waves.

Table 7.4: Means and Standard Deviations for the Dimensions of Deprivation

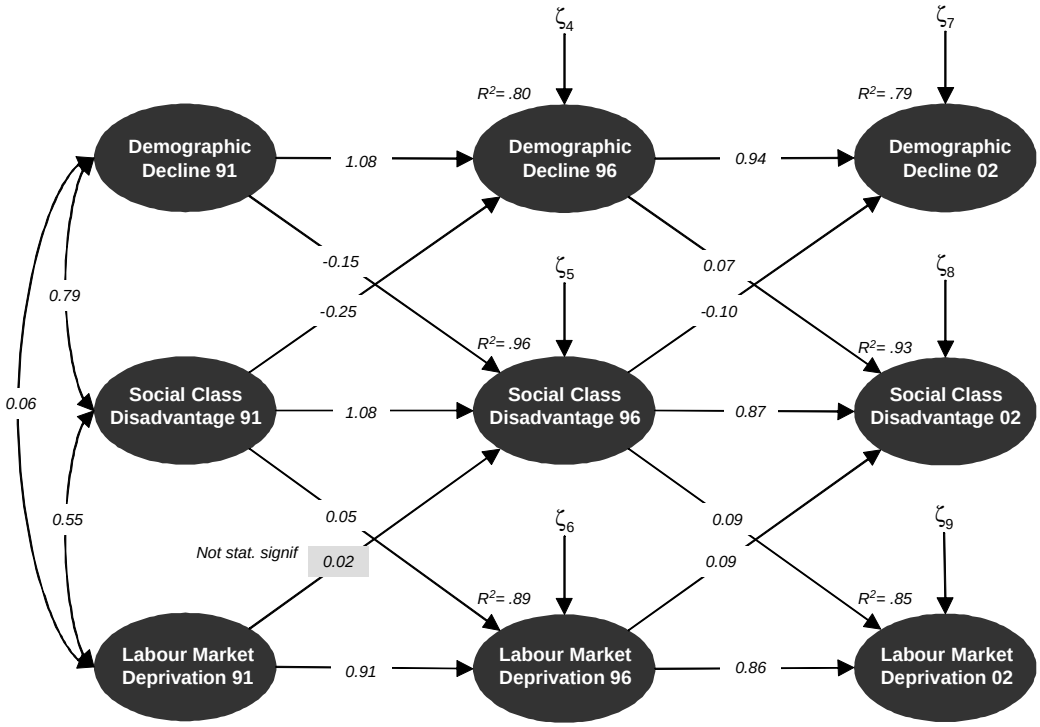
Dimension	1991	1996	2002
Demographic Decline	*Mean: 0.0 STD: 3.3*	*Mean: 3.0 STD: 3.4*	*Mean: 6.0 STD: 3.2*
Social Class Disadvantage	*Mean: 0.0 STD: 6.3*	*Mean: 2.9 STD: 5.9*	*Mean: 3.1 STD: 5.5*
Labour Market Deprivation	*Mean: 0.0 STD: 5.4*	*Mean: 1.1 STD: 5.4*	*Mean: 6.1 STD: 5.0*
Overall Deprivation	*Mean: 0.0 STD: 11.5*	*Mean: 6.9 STD: 10.9*	*Mean: 15.2 STD: 10.1*

7.6 A Longitudinal Model of Spatial Deprivation

In order to enhance our understanding of the dynamics of disadvantage in Ireland, we can refine the previous model by replacing the correlations between the latent variables by directed causal effects. This longitudinal panel model yields a number of interesting insights into the reproduction of disadvantage over time. The most striking aspect of this model, which is depicted in graphical form in Figure 7.5, is the extreme stability of the latent variables between 1991 and 2002. The standardised regression coefficients representing the stability of Demographic Decline between 1991 and 1996, and between 1996 and 2002, are 1.08 and 0.94 respectively, and the model explains four-fifths of the variance of the 1996 and 2002 latent variables. The stability coefficients for Social Class Disadvantage are 1.08 and 0.87, and once again the model explains a very large proportion of the variance of the 1996 and 2002 latent variables (0.96 and 0.93 respectively). Finally, the stability coefficients for Labour Market Deprivation are 0.91 and 0.86, with a variance explained of 0.89 and 0.85 for the 1996 and 2002 latent variables.

In other words, there is only a small amount of variation over time in the relative positions of areas undergoing demographic decline, even less in relation to labour market deprivation and practically none in terms of their relative social class composition. This serves to underline the durability of the geographical distribution of disadvantage in the Republic of Ireland. As a result of this overwhelming stability, the other effects represented in the model are relatively small in size.

Figure 7.5: Dynamic Path Diagram of the 1991 to 2002 Disadvantage Models*



***All coefficients are standardised, all loadings constrained to be equal and corresponding variables at different times are correlated; all effects statistically significant except where indicated (N= 3403).**