



HAL
open science

The measurement of social disadvantage and its spatial articulation in the Republic of Ireland

Jonathan Pratschke, Trutz Haase

► **To cite this version:**

Jonathan Pratschke, Trutz Haase. The measurement of social disadvantage and its spatial articulation in the Republic of Ireland. *Regional Studies*, 2007, 41 (06), pp.719-734. <10.1080/00343400601120197>. <hal-00514635>

HAL Id: hal-00514635

<https://hal.science/hal-00514635v1>

Submitted on 3 Sep 2010

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



HAL Authorization



The measurement of social disadvantage and its spatial articulation in the Republic of Ireland

Journal:	<i>Regional Studies</i>
Manuscript ID:	CRES-2004-0006.R2
Manuscript Type:	Main Section
JEL codes:	C33 - Models with Panel Data < C3 - Econometric Methods: Multiple/Simultaneous Equation Models < C - Mathematical and Quantitative Methods, I32 - Measurement and Analysis of Poverty < I3 - Welfare and Poverty < I - Health, Education, and Welfare, I38 - Government Policy Provision and Effects of Welfare Programs < I3 - Welfare and Poverty < I - Health, Education, and Welfare, R23 - Regional Migration Regional Labor Markets Population < R2 - Household Analysis < R - Urban, Rural, and Regional Economics
Keywords:	Ireland, SEM, census, deprivation, disadvantage, index

SCHOLARONE™
Manuscripts

1
2
3
4
5
6
7
8
9
10
11
12 THE MEASUREMENT OF
13
14
15 SOCIAL DISADVANTAGE
16
17
18
19 AND ITS SPATIAL ARTICULATION
20
21
22
23 IN THE REPUBLIC OF IRELAND
24
25
26
27

28 Jonathan Pratschke
29 Dipartimento di Sociologia e Scienza della Politica,
30 Università degli Studi di Salerno,
31 Via ponte don Melillo,
32 Fisciano 84084 (SA),
33 Italy.
34 email: jpratschke@unisa.it
35
36

37 &

38
39 Trutz Haase
40 Social & Economic Consultant
41 17 Templeogue Road,
42 Terenure,
43 Dublin 7W,
44 Ireland.
45 email: thaase@iol.ie
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

ABSTRACT

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

This article contributes to policy research by developing a reliable aggregate measure of social need in small areas and by describing how this index can be used to evaluate public interventions in disadvantaged areas. Spatially-targeted initiatives to combat disadvantage have been implemented in many OECD countries, and the availability of EU funding has encouraged their diffusion. The longitudinal analysis and evaluation of these initiatives is difficult using existing indices, as these do not facilitate comparisons over time. In this article, we describe an alternative approach that relies on Confirmatory Factor Analysis and permits diachronic analyses.

1
2
3
4
5
6
7 Word count abstract: 100 approx.
8
9

10
11 Word count article: 8,000 approx. (including references, tables and
12 figures)
13

14
15
16
17 Keywords: *index, census, deprivation, disadvantage, Ireland,*
18
19 *SEM.*
20
21

22
23
24 JEL codes:

25
26 I32 - Measurement and Analysis of Poverty
27

28 I38 - Government Policy | Provision and Effects of Welfare
29 Programs
30

31
32 C33 - Models with Panel Data
33

34 R23 - Regional Migration | Regional Labor Markets |
35
36 Population
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

I Introduction

One of the aims of the European Union is to achieve greater social and economic cohesion between member states, and the EU has also committed considerable resources in recent years to the achievement of greater regional cohesion *within* member states. The initial development of disadvantage indices in Europe and elsewhere coincided with a growing awareness that single indicator variables can provide only a partial picture of social disadvantage within the context of spatially-targeted interventions. Over the past two decades, a number of multivariate indices have been developed with the aim of identifying localities where social need is particularly accentuated¹.

Multi-faceted local development initiatives became prominent during the 1960s as a response to concerns about the spatial concentration of poverty in inner-city areas of the US and the UK. They were first introduced to Ireland by the European anti-poverty programmes of the 1970s and gathered momentum as a result of the establishment of twelve pilot 'Area Partnerships' under the Programme for Economic and Social Progress in 1991 and the nation-wide expansion of the Partnership idea under the Global Grant 1992-1995.

As an increasing quantity of longitudinal data on local areas has become available, researchers and policy-makers have come to realise that the methodology underlying most existing indices precludes analysis of one of the most fundamental questions relating to the spatial distribution of social disadvantage, namely how this evolves over time. Most existing indices of social disadvantage provide a static, cross-sectional view

1
2
3 of disadvantage, producing scores that cannot be compared directly over time. The aim
4
5 of this article is to present a theoretically-grounded, robust and innovative approach to
6
7 the measurement of disadvantage that can overcome this obstacle and, as a result,
8
9 provide a tool for evaluating area-based initiatives.
10

11 12 13 14 15 II Conceptualising Social Disadvantage 16

17
18
19 The most widely-used definitions of disadvantage found in the social science literature
20
21 emphasise differential access to resources, following Townsend's seminal work in
22
23 *Poverty in the United Kingdom*: "Individuals, families and groups can be said to be in
24
25 poverty if they lack the resources to obtain the types of diet, participate in the activities
26
27 and have the living conditions and amenities which are customary, or at least widely
28
29 encouraged or approved in the societies to which they belong" (1979: 31). Townsend's
30
31 definition remains extremely influential and has been incorporated into successive
32
33 British government reports and independent research. Noble *et al.* (1999), for example,
34
35 suggest that deprivation "refers to unmet need, which is caused by a lack of resources of
36
37 all kinds, not just financial" (p. 7).
38
39
40

41
42 In this article we will seek to extend this approach by adopting a broad definition of
43
44 resource exclusion and by shifting our theoretical focus from the individual to the
45
46 aggregate level. Whereas Townsend and other researchers have tended to conceptualise
47
48 disadvantage as an *individual* attribute, we emphasise social resources such as labour
49
50 market opportunities and demographic vitality as well as the impact of broader social
51
52
53
54
55
56
57
58
59
60

Deleted: others

1
2
3 structures and processes such as social stratification: "From a structural perspective
4 individual characteristics such as education and income are determined by broader
5 social factors that in turn provide the primary route for social policy interventions. ...
6
7 Area-based measures of deprivation, although mainly aggregates of individual
8 characteristics, move towards reflecting structural elements related to area and
9 community..." (Salmond and Crampton, 2002: 14-15).

10
11
12
13
14
15
16
17 A number of consequences follow from this: firstly, the most deprived areas are not
18 always those with the highest percentages of deprived individuals. Secondly, key
19 concepts in individual-level analysis such as "multiple deprivation" and "at-risk groups"
20 become increasingly problematic as we move to the aggregate level. This is because the
21 coincidence within a given area of high levels of unemployment and poor health, for
22 example, does not imply that the same individuals are affected by both unemployment
23 and poor health.
24
25
26
27
28
29
30
31

Deleted: shift in emphasis

32
33 The meaning of certain indicators can also undergo transformation as we shift from the
34 individual to the aggregate level. At the individual level, being 25 to 44 years of age
35 does not even denote membership of a population that could be considered "at risk of
36 deprivation". However, at the aggregate level, the relative size of this age cohort is a
37 powerful indicator of a real, demonstrable form of social disadvantage, characterised by
38 sustained emigration and the "demographic decline" that this provokes.
39
40
41
42
43
44
45

Deleted: undergoes a

Deleted: The worst-hit areas do not contain large concentrations of disadvantaged residents; nevertheless, we believe that their specific difficulties in sustaining community life should be recognised.

46
47 Taylor (1998) sustains that the construction of deprivation indices should be guided by
48 the policy goals which they are intended to serve. As far as the present index is
49 concerned, the main aim is to provide the Irish Government (which has supported the
50
51
52
53
54
55
56
57
58
59
60

1
2
3 research over a number of years and adopted the resulting measure as the official area-
4 based index of affluence and disadvantage) with a means (a) to identify significant
5 clusters of disadvantage in order to establish area-based initiatives; (b) to construct
6 resource allocation models that take disadvantage into account; (c) to provide
7 community groups and local service providers with an overview of the spatial
8 articulation of affluence and disadvantage within their catchment areas; (d) to monitor
9 and evaluate area-based interventions; (e) to explore the influence of social
10 disadvantage in epidemiological, educational, economic and political research.
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

III The Dimensions of Social Disadvantage

One of the most important characteristics of disadvantage, when conceptualised as a collective, social phenomenon, is its multidimensional nature. Before discussing the nature of the specific dimensions of disadvantage in Ireland, however, it is important to clarify what we mean by the term “dimension”. A number of researchers use the terms “dimension” and “domain” interchangeably to refer to thematic areas such as education or income. In measurement theory, however, a set of indicators form part of a single dimension if their values vary together systematically, and this holds regardless of whether they belong to different *thematic* domains. For example, educational attainments are strongly associated with occupation and income, and these variables are often viewed as forming a single dimension of variation due to their close causal links.

All disadvantage indicators are inter-related in this way and lie along a stable number of dimensions. Whilst thematic domains can represent a useful heuristic tool when surveying the available data sources, analysis of dimensional structure should arguably take precedence during the final stages of index construction. These considerations are of relevance, for example, to the indices developed by Michael Noble and his team at the University of Oxford (Noble *et al.*, 2000a, 2000b, 2001, 2003). Their Index of Multiple Deprivation 2000 comprises six ward-level domains: Income, Employment, Health Deprivation and Disability, Education, Skills and Training, Housing and Geographical Access to Services. When these domains are weighted and summed, the dimensions that most strongly characterise them are also implicitly assigned a weighting. In this case, a mainly “urban”, labour market-based dimension predominates,

Deleted: : “[t]hose facing the broadest range of choices (the more money you have or are able to borrow the greater your choice in the housing market) tend to be those who have already enjoyed choices and opportunities earlier in life (which university to attend, which career to follow). Advantages also accumulate inter-generationally. Those who inherit money from parents or grandparents are more likely to be able to use that to pay for housing or perhaps to improve the condition of their home” (Shaw *et al.*, 2001: 299).

Deleted: it would appear that

1
2
3 given the absence of measures more fully reflecting social class composition and “rural”
4
5 forms of disadvantage, and given the low weighting assigned to the domain measuring
6
7 access to services². In Ireland and in most countries of the Southern and Eastern
8
9 European periphery, the failure to address rural disadvantage leads to an
10
11 underestimation of the problems faced by disadvantaged areas where long-standing
12
13 adverse labour market conditions have given rise to sustained emigration.
14

Deleted: this approach would underplay

15
16
17 We are now in a position to return to the question of how the underlying dimensions of
18
19 disadvantage should be theorised. A detailed literature review and exploratory statistical
20
21 analyses have led us to identify three dimensions of social disadvantage: demographic
22
23 decline, social class disadvantage and labour market deprivation (Haase, 1999;
24
25 Pratschke, 2002). The first of these – ‘demographic decline’ – is based on the insight
26
27 that emigration has influenced Ireland’s demographic experience for more than a
28
29 century, with the result that the unemployment rate tends to understate the extent of
30
31 labour market disadvantage in certain areas, as this is partly concealed by under-
32
33 employment or withdrawal from the labour market (Haase, 1999).
34

35
36
37 Unemployment, and particularly long-term unemployment, nevertheless remain
38
39 important causes of disadvantage and are responsible for the most concentrated forms of
40
41 disadvantage found in urban areas. In areas with particularly high unemployment rates,
42
43 young people face considerable difficulties in obtaining educational credentials and are
44
45 handicapped by ‘labelling effects’, by the lack of role models and by initial difficulties
46
47 in entering the labour market. As Wilson (1987) has argued in relation to the US, the
48
49 social isolation and disorganisation which characterises areas of concentrated
50
51 unemployment itself represents an obstacle to the labour force participation of young
52
53
54
55
56
57
58
59
60

1
2
3 people. Furstenberg and Hughes (1997) report that in US neighbourhoods characterised
4
5 by high unemployment rates, families often experience a breakdown of social ties and a
6
7 loss of community consensus, leading to a decline in participation in community
8
9 institutions and informal networks.

10
11
12 The third determinant of the well-being of communities is their social class
13
14 composition: areas with a weak social class profile are more vulnerable to the effects of
15
16 economic restructuring and recession and are more likely to experience low pay,
17
18 dangerous working conditions and poor housing. By virtue of its relational nature,
19
20 social class should be treated as a social relationship defined by the level of control
21
22 exercised by social groups over productive resources (Shaw *et al.*, 2001; Wright, 1985).
23
24 Not only is low-skilled work associated with low wage levels and poor working
25
26 conditions, communities in which a large proportion of the workforce are engaged in
27
28 low-skilled jobs or small farming have profound structural weaknesses.
29
30
31
32
33
34

35 IV Indicator Selection

36
37
38
39

40 Most existing disadvantage indices rely on data from the Census of Population,
41
42 although recent developments in Britain have established an important precedent in
43
44 relation to the use of non-Census data (see, for example, Noble *et al.*, 2000b). This is
45
46 superficially rather attractive, as data on benefits take-up, for example, are strongly
47
48 linked with disadvantage and are available on a more timely basis than the Census.

49 However, the use of such data creates a number of rather intractable problems: where
50
51
52
53
54
55
56
57
58
59
60

1
2
3 Legislative measures, administrative practices and technical procedures change,
4
5 administrative data can undergo transformation, rendering comparisons difficult across
6
7 time and between jurisdictions. It is striking, for example, that the recent UK Indices of
8
9 Multiple Deprivation preclude the comparative analysis of English, Scottish and Welsh
10
11 deprivation scores along the borders. Moreover, historical data relating even to the
12
13 recent past are generally not available, rendering retrospective analysis impossible.

14
15 Nevertheless, where stable administrative data are available at a high level of spatial
16
17 disaggregation, their inclusion within deprivation indices may be warranted, although
18
19 this is not yet possible within the Irish context.

20
21
22
23 As far as the timeliness of Census data is concerned, we have found area-level
24
25 disadvantage scores to be highly stable over time, implying that we do not need to
26
27 constantly update our analyses (cf. Dorling *et al.*, 2000; Gregory *et al.*, 2000; SEU,
28
29 1998). Although the raw values of the individual indicators may vary over time
30
31 (particularly those relating to the labour market), the relative values of the aggregate
32
33 index scores tend to be much more stable, as we will show later in this article. This
34
35 relative invariance is in line with the existing literature on area-level deprivation, which
36
37 emphasises the difficulties involved in reversing the fortunes of disadvantaged areas
38
39 (Lupton, 2003).

40
41
42
43 Having outlined the three main dimensions of social disadvantage for the Republic of
44
45 Ireland, we will now provide a brief summary of the indicator variables that we have
46
47 selected to measure these. We will use the age dependency rate³ and the decline in
48
49 population⁴ over the previous five years as the first two indicators of Demographic
50
51 Decline. The core working-age population has the highest rate of geographical mobility,
52
53
54
55
56
57
58
59
60

Deleted: as

Deleted: the resulting

Deleted: constant

Deleted: extremely

Deleted: On the other hand, as

Formatted: Space After: 0 pt

1
2
3 which means that areas of decline typically have disproportionate shares of young
4 children and elderly people. In addition to these two variables, the percentage of adults
5 with no more than a Primary School education and the percentage with a Third Level
6 qualification will also be used as indicators. Emigration is selective in nature, giving
7 rise to a demographic structure which is skewed towards elderly people, who tend to
8 have relatively low levels of educational attainments; average levels of educational
9 participation tend to increase with each successive age cohort.
10
11
12
13
14
15
16

17
18
19 Turning to Social Class Disadvantage, the Irish Census of Population assigns
20 individuals to class categories depending on both their occupation (higher or lower
21 professional, non-manual, semi-skilled manual and unskilled manual classes) and their
22 land-holdings (for farmers). The 'Semi-skilled Manual' category includes small
23 farmers, and by combining the semi- and unskilled manual social classes, we obtain a
24 powerful indicator of weak social class composition. The absence of affluent and well-
25 connected individuals from an area is also relevant to its social class profile – middle-
26 class families provide additional resources for community self-organisation – and for
27 this reason we have included measures of 'high social class' as well as of 'low social
28 class'. The 'Higher Professional' social class includes farmers with 200 acres of land
29 and more, and those with between 100 and 199 acres are allocated to the 'Lower
30 Professional' class. We therefore combine the 'Higher Professional' and 'Lower
31 Professional' social class categories in order to obtain a robust measure.
32
33
34
35
36
37
38
39
40
41
42
43
44

45
46
47 The definition of social class categories employed in the Irish Census of Population is
48 problematic, however, as the category 'Other Non-manual' groups together 'white-
49 collar' employees who cannot be assigned to the 'professions'. The weakness of this
50
51
52
53
54
55
56
57
58
59
60

Deleted: inexplicably

1
2
3 classificatory scheme is further underlined by the fact that a significant proportion of the
4
5 workforce cannot be classified at all. The percentage of people whose social class
6
7 position is 'Unclassified' can reach very high levels, exceeding 40 per cent in the most
8
9 deprived areas of Dublin, Waterford and Limerick. This clearly casts doubt on the
10
11 adequacy of the remaining categories. As the 'Unclassified' category includes –
12
13 amongst others – people who have never been in paid employment, it is likely that the
14
15 size of the semi- and unskilled manual categories understates the extent of disadvantage
16
17 in deprived areas. In order to counteract this problem, we have removed all
18
19 'Unclassified' individuals from the denominator of our measure of the semi- and
20
21 unskilled manual social classes.
22

23
24
25 The close relationship between class and education has encouraged social scientists to
26
27 explore the ways in which class background conditions young people's experience of
28
29 the school environment, thus reproducing the class structure over time. For many
30
31 disadvantaged school students, the perceived likelihood of unemployment or low-
32
33 skilled work feeds into disillusionment with the educational system. Conversely, low
34
35 educational attainments can represent a major handicap within a 'credentialised' labour
36
37 market in a state of rapid change, and these processes form part of a broader system of
38
39 inequality that is highly resistant to change. Our indicators of Social Class Disadvantage
40
41 include the percentage of adults with no more than a Primary School education and the
42
43 percentage of adults with a Third Level qualification. These two variables have already
44
45 been mentioned in relation to Demographic Decline, and we will use them as indicators
46
47 of both this and Social Class Disadvantage. The final indicator of Social Class
48
49 Disadvantage is the average number of persons per room, which reflects housing quality
50
51 and overcrowding.
52
53
54
55
56
57
58
59
60

1
2
3
4
5 As far as Labour Market Deprivation is concerned, we will use the following indicators:
6
7 the percentage of economically-active men who are unemployed, the percentage of
8
9 economically-active women who are unemployed and the percentage of households
10
11 containing children aged 15 years and under which are headed by a single parent. The
12
13 inclusion of unemployment variables requires little justification, given the centrality of
14
15 paid employment to individual and collective well-being in contemporary society.
16
17 However, theoretical arguments may be required in order to broaden prevailing
18
19 definitions of labour market deprivation beyond unemployment. We have included a
20
21 measure of lone parenting because those in receipt of Lone Parents' Allowance are not
22
23 classified as unemployed and because high rates of lone parenting and unemployment
24
25 tend to coincide spatially, due to the criteria used to allocate social housing.
26

27
28
29 Preliminary modelling results, using Census of Population data for 1996, suggested two
30
31 relationships that were not initially anticipated. Firstly, there is a significant relationship
32
33 between Labour Market Deprivation and the size of the Semi- and Unskilled Manual
34
35 social classes (an indicator of Social Class Disadvantage). This is because unskilled
36
37 workers have a particularly weak labour market situation, which exposes them to a
38
39 disproportionate risk of unemployment. Secondly, Demographic Decline is inversely
40
41 related to the percentage of lone-parent households. In fact, areas with high rates of lone
42
43 parenting often have moderate to high rates of demographic growth, and this variable
44
45 may thus be used as an (inverse) indicator of demographic decline. These cross-loadings
46
47 generalise to both 1991 and 2002 data, indicating their robustness.
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 Table 1 lists the names and definitions of all indicator variables included in the model,
4 as well as the dimensions of disadvantage with which they are associated. Two of the
5 variables were estimated using proxies for 1991, due to changes in variable definitions,
6 and one was interpolated for 1996 on the basis of the 1991 and 2002 values, as housing
7 data are only collected every ten years in Ireland⁵. As the distribution of some of these
8 variables is not perfectly normal, we have transformed certain indicators to improve
9 their distributional properties (see Table 2).
10
11
12
13
14
15
16

17
18
19 Table 1 Variable Names, Areas Affected and Dimensions
20

21 *Insert here*
22
23

24
25 Table 2 Variables, Transformations, Estimation and Scaling
26

27 *Insert here*
28
29

Formatted: Space Before: 0 pt,
After: 0 pt, Line spacing: Double

30
31
32
33 V Review of Existing Methodologies
34

Formatted: Space After: 0 pt

35
36
37 The methodological challenge posed by the construction of a disadvantage index is to
38 combine a set of indicator variables, lying along one or more dimensions, in order to
39 produce a single measure. In the case of the current index, we have ten indicator
40 variables and wish to obtain estimates for three dimensions. The most straightforward
41 approach would involve adding together the values of each of the variables
42 corresponding to a given dimension, perhaps following standardisation, and this
43 technique has been widely applied within the field of deprivation modelling. However,
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Formatted: Space After: 0 pt

1
2
3 it has been criticised on the grounds that it fails to take into account the pattern of
4
5 covariances between indicator variables and domains (Folwell, 1995; Hayduk, 1987:
6
7 212-216). As we have argued, disadvantage is a multi-dimensional concept, and all
8
9 additive approaches tend to apply an implicit weighting according to the number of
10
11 indicators or domains falling within each dimension.

Deleted: . This procedure was adopted in the construction of the Department of the Environment UK Index of Deprivation (1983); the Robson et al. (1994a, b), Jarman (1984) and Noble et al. (2000a, 2000b, 2001, 2003) indices use variations on the same basic approach⁶. This approach

Deleted: .

12
13
14
15 The second approach to the weighting of indicator variables that one encounters relies
16
17 on a specially-commissioned survey (Forrest and Gordon, 1995; Gordon, 1995). For
18
19 example, Gordon (1995) uses an individual-level survey to derive weights for six
20
21 Census proxies. The weights are calculated using a logistic regression equation in which
22
23 the dependent variable is a dichotomous measure of individual deprivation constructed
24
25 using a 'checklist' of deprivation items; an individual is classified as deprived if they
26
27 are lacking three or more 'essential goods' (cf. Gordon and Townsend, 1990). This
28
29 assumes that deprivation is a unidimensional concept, as survey-based approaches
30
31 require a single, definitive measure of deprivation at the individual level, which in this
32
33 case appears rather arbitrary. Arguably, no single individual-level variable can capture
34
35 the different dimensions of social disadvantage. Above all, however, the survey-based
36
37 approach may be criticised for deriving weights from an individual-level model and
38
39 then applying them at the aggregate level.

Deleted: to be

40
41
42
43 The third approach to the weighting of indicator variables found in the literature relies
44
45 on Principal Components Analysis (PCA) or other forms of Exploratory Factor Analysis
46
47 (EFA), and these are undeniably the most commonly-used techniques in the
48
49 construction of disadvantage indices (cf. Haase, 1998; McIntyre and Gilson, 2000;
50
51 Salmond and Crampton, 2002). PCA and EFA techniques extract 'variance
52
53
54
55
56
57
58
59
60

1
2
3 components' from a set of variables, which may be said to reflect the different
4 dimensions of disadvantage. They are therefore consistent – at least in principle – with a
5 dimensional analysis and a large number of variables can be included in the analysis
6 without requiring specific theoretical justification. Examples of indices that use PCA
7 include Carstairs and Morris (1990), Duncan and Aber (1997), Haase (1995, 1999),
8 McIntyre *et al.* (2000), SAHRU (1997) and Salmond and Crampton (2002). Noble *et al.*
9 use a different form of Factor Analysis, Maximum Likelihood Exploratory Factor
10 Analysis (EFA), instead of PCA.
11
12
13
14
15
16
17
18

19
20
21 The main weakness of EFA and PCA, as far as the measurement of disadvantage is
22 concerned, is that all of the variables included in the analysis are treated as being related
23 to all of the components or factors. This can lead to ambiguities in interpretation, as the
24 definition of the components or factors depends on the precise pattern of the loadings⁷.
25
26
27
28
29 Further problems arise from the tendency for researchers to use the first component of
30 an EFA or PCA as a unidimensional index of disadvantage. Although this component or
31 factor may account for a large proportion of the overall variance, this practice can
32 sideline important aspects of disadvantage.
33
34
35
36
37

38
39 The third problem with EFA and PCA is their sensitivity to the attributes of individual
40 datasets. For example, because of the interpretational difficulties mentioned above,
41 components and factors are often 'rotated'; different rotations give rise to different
42 relationships between the indicators and the components/factors. The choice between
43 'oblique' and 'orthogonal' rotations determines whether the components/factors will be
44 correlated or not, but even these are algebraically equivalent representations of the same
45 mathematical solution. In short, EFA factor scores and PCA scores are not comparable
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 over time and space and are therefore not suitable for monitoring spatially targeted
4
5 public programmes.
6

7
8
9 A number of important methodological debates have taken place in recent years in
10
11 relation to other aspects of the construction of disadvantage indices, including the
12
13 standardisation, smoothing, transformation and estimation/extrapolation of values.
14
15 However, as far as the weighting of indicator variables is concerned, the only
16
17 approaches found in the literature are those described above: adding the standardised
18
19 and/or transformed variables (with or without the use of ad hoc weights), using a
20
21 separate regression model with sample data or applying factor analytic techniques.
22

23
24
25 To summarise, the main problems that must be overcome when combining indicator
26
27 variables involve (a) controlling for dimensionality and measurement error; (b)
28
29 producing a stable and interpretable set of dimensions and (c) avoiding arbitrary
30
31 operational decisions that make it impossible to compare scores. A more powerful and
32
33 general form of statistical analysis, known as Structural Equation Modelling, can
34
35 provide acceptable solutions to all of these problems, enabling us to incorporate latent
36
37 variables within longitudinal analyses (Bollen, 1989; Loehlin, 1992)⁸. The dimensions
38
39 of disadvantage are conceptualised on theoretical grounds and indicator variables are
40
41 constructed to measure these. There are statistical tests to assess whether the dimensions
42
43 specified by the model are consistent with the data. Each dimension is linked with a
44
45 subset of indicator variables, which simplifies interpretation, and the latent variables
46
47 control for errors of measurement in the observed variables. Weights can be created for
48
49 the indicator variables according to established statistical criteria, which can be used to
50
51 estimate disadvantage scores for each individual area. Above all, factor score estimates
52
53
54
55
56
57
58
59
60

1
2
3 are comparable from one period of time to another, and from one country to another, as
4
5 long as the model has the same structure (Meredith, 1993).
6
7

8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Formatted: Space After: 0 pt

VI Model Specification and Assessment

Formatted: Space After: 0 pt

All of our statistical models will be estimated using Structural Equation Modelling (SEM) software⁹. In statistical terms, Structural Equation Models (of which Confirmatory Factor Analysis models represent a special case) place constraints on the joint distribution of the observed variables by omitting paths or correlations from the saturated model and by imposing 'equality constraints' on parameters (Bentler, 1995). Because SEM models draw on theoretical knowledge to specify these constraints, they are empirically testable.

Deleted: : the theoretical assumptions imply a pattern of correlations between the observed variables and model adequacy can be assessed by confronting this with the observed variances and covariances

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, one can express this in terms of the null hypothesis $\Sigma = \Sigma(\theta)$, 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 and 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

1
2
3 population covariance matrix of the observed variables. A significant test statistic would
4
5 cast doubt on the model specification” (p. 2)¹⁰.
6

7
8
9 All of the analyses presented in this article will rely on the Maximum Likelihood fitting
10 function¹¹ and will be evaluated using a range of statistics and indices. Given the
11 magnitude of our sample (well over 3,000 cases), the chi-square statistic is likely to
12 have ‘excessive’ statistical power. The formula for chi-square shows that this statistic is
13 dependent, in part, upon the sample size, which means that small discrepancies between
14 the model and the observed data are ‘magnified’ in the context of large samples: “with
15 very large samples we run into the opposite embarrassment, in that we may obtain
16 highly significant χ^2 s and hence reject models in cases where the discrepancies between
17 model and data, although presumably not due to chance, are not large enough to be of
18 any practical concern” (Loehlin, 1992: 65; see also p. 71; Fan *et al.*, 1999).
19
20
21
22
23
24
25
26
27
28

29
30
31 Because of the high power of the chi-square test when large samples are used, a range
32 of descriptive indices of model fit have been proposed. These indices enable researchers
33 to evaluate models which may be satisfactory despite the presence of substantively
34 trivial discrepancies (which are nevertheless sufficient to lead to model rejection when
35 using large samples). Hu and Bentler (1999) review a range of indices, and on the basis
36 of their discussion, we have decided to evaluate the goodness-of-fit of the models
37 presented in this article using a decision rule which combines the Comparative Fit Index
38 (CFI) (if this index falls below .95 we reject) with the Standardised Root Mean Square
39 Residual (SRMR) (which should be equal to or less than .08). In the current case, we
40 will use the 1996 Census of Population data to refine the hypothesised structural model,
41 re-tested this using data from both 1991 and 2002.
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Deleted: that

Deleted: greater

VII Model Assessment and Interpretation

The path diagrams shown in Figures 1, 2 and 3 provide a graphical representation of the theoretical assumptions underlying ~~our model of social disadvantage~~, as well as providing the results for three waves of Census data. One-headed arrows in path diagrams correspond to regression equations in the statistical model and the 'delta' variables to the left of the diagrams denote error variables which account for the variance in the indicators not explained by the latent variables in the model. Two-headed arrows, by contrast, represent correlations between the variables concerned. The three diagrams provide the results of the disadvantage model when estimated *separately* using data from the Census of Population for 1991, 1996 and 2002. The ~~unstandardised~~ parameter estimates are included in the path diagrams, and the coefficient of determination (R^2) is reported for each dependent variable, together with the latent variances.

Figure 1 Results of the Disadvantage Model, 1991 Census Data

(N=3403)*

Insert here

Figure 2 Results of the Disadvantage Model, 1996 Census Data

(N=3403)*

Insert here

Formatted: Space After: 0 pt

Formatted: Space After: 0 pt

Deleted: the

Deleted: that we have developed

Formatted: Font: 12 pt, Not Italic, Complex Script Font: 12 pt

Formatted: Space Before: 0 pt

Formatted: Space Before: 0 pt, After: 0 pt

1
2
3
4
5 Figure 3 Results of the Disadvantage Model, 2002 Census Data
6
7 (N=3403)*
8

9
10 *Insert here*

Formatted: Space After: 0 pt

11
12
13 The models depicted in Figures 1, 2 and 3, which are Confirmatory Factor Analysis
14 (CFA) models, have good fit to the data according to the alternative fit indices, and the
15 combination of the CFI and SRMR fit indices meet the criteria specified earlier: the CFI
16 for the 1991, 1996 and 2002 models is 0.95, 0.97 and 0.95 respectively, and the SRMR
17 is 0.05, 0.03, 0.05 (see the Appendix for additional information on fit). One
18 modification was made to the original model in order to achieve acceptable fit: a
19 correlation between the error terms associated with the age dependency ratio and
20 population change was added. This implies that the observed correlation between these
21 two variables cannot be accounted for completely by the latent variable that they share,
22 namely Demographic Decline. There is thus an intimate relationship between (selective)
23 emigration and the subsequent demographic profile of local areas, and this effect is in
24 accord with our theoretical model. The fact that ~~this relationship~~, generalises to all three
25 waves of data reinforces the view that this is a necessary structural component of the
26 model.
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45

Deleted: it

46 VIII Analysing the Changing Pattern of Disadvantage

47
48
49 In this section we will estimate our final disadvantage model, in which we
50 simultaneously draw on data from the 1991, 1996 and 2002 Censuses of Population,
51
52
53
54
55
56
57
58
59
60

Formatted: Space After: 0 pt

1
2
3 specifying correlations between the latent variables. This model is more complex than
4
5 the preceding ones, as it incorporates a number of additional correlations and equality
6
7 constraints. Firstly, the error variables associated with corresponding indicators are
8
9 allowed to covary across all three time points, a standard practice when specifying
10
11 longitudinal models. Secondly, all corresponding factor loadings are constrained to be
12
13 equal across waves in order to ensure that the meaning of the latent variables remains
14
15 constant. These constraints make the strong assumption that a single set of parameter
16
17 estimates can provide an adequate representation of the pattern of relationships between
18
19 the observed variables over this eleven-year period.
20

21
22
23 The combined model falls slightly below the Hu-Bentler decision rule based on the
24
25 combination of the CFI and the SRMR (the CFI is .94, compared to a suggested cut-off
26
27 value of .95, although the SRMR is satisfactory at 0.07). The size of this shortfall is
28
29 nevertheless negligible and it is possible to meet the threshold value by including a
30
31 small number of 'nuisance' factors which have very little impact on the estimated
32
33 coefficients in the model. We will therefore proceed to estimate the factor scores using
34
35 the combined model in its current form, using GLS Factor Score Estimation within EQS
36
37 6.1.
38

39
40
41 Whilst inspection of each of the three individual dimensions of disadvantage can shed
42
43 light on the determinants of disadvantage in specific areas, the calculation of overall
44
45 disadvantage scores remains of primary importance. It is therefore important to show
46
47 how these can be derived from the component dimensions. Here it is necessary to return
48
49 to our earlier methodological discussion, as the combination of dimension scores raises
50
51 once again the question of dimensionality and bias.
52
53
54
55
56
57
58
59
60

Formatted: Space After: 0 pt

Deleted: It is therefore important to evaluate the different options that are available to us when combining Demographic Decline, Social Class Disadvantage and Labour Market Deprivation to form an overall disadvantage score.

1
2
3
4
5 It may be argued that both Demographic Decline and Labour Market Deprivation reflect
6
7 the effects of adverse labour market conditions, and that an equal weighting should be
8
9 accorded to these two dimensions due to the roughly equal division of the Irish
10
11 population between rural and urban areas. It is less clear how they should be weighted
12
13 vis-à-vis Social Class Disadvantage, however, as one could argue that the social class
14
15 composition of a local area is its most fundamental attribute. However, this could lead
16
17 to areas with a relatively weak social class composition being classified as more
18
19 disadvantaged than areas with very high unemployment or emigration rates. As the
20
21 correlation between Demographic Decline and Labour Market Deprivation is near zero,
22
23 we should be concerned primarily about balancing each of these dimensions against
24
25 Social Class Disadvantage. In order to give due weight to current labour market
26
27 conditions as well as social class composition, we will estimate overall disadvantage by
28
29 applying unit weights¹². 'Double-counting' is avoided because the structure of the
30
31 model is symmetrical and the correlation between the demographic and labour market
32
33 dimensions is very small. This decision does not generate bias, as we have controlled
34
35 for the dimensional structure of the indicator variables and ensured that the resulting
36
37 structure provides a balanced view of the phenomenon.

Deleted: could plausibly

Deleted: appear to

38
39
40
41 Returning to the analysis of change in small areas, it is now possible to show how
42
43 programme evaluation can be carried out in a rigorous fashion¹³. In this context, it is
44
45 worth noting that a considerable amount of work has been carried out in Britain in
46
47 relation to the evaluation of area-based initiatives (NESS, 2005; CRESR, 2004). Despite
48
49 their methodological sophistication, it is noteworthy that these evaluations do not draw
50
51 on the Indices of Multiple Deprivation for 2000 and 2004, despite the fact that the
52
53
54
55
56
57
58
59
60

1
2
3 authors express their desire for a summary measure that could be compared over time
4
5 (e.g. NESS, 2005: 65). Due to changes in the administrative data used in these indices
6
7 and the way in which they are estimated, such comparisons are effectively impossible.
8
9

10 11 12 IX The Spatial Articulation of Social Disadvantage in Ireland, 1991-2002

13
14
15
16
17 In order to illustrate the spatial distribution of disadvantage, in this section we will
18
19 present a series of thematic maps. Due to space constraints, we will not provide maps
20
21 for each of the three underlying dimensions, but will confine our attention to the index
22
23 of overall relative affluence and disadvantage for 1991 and 2002, in Ireland as a whole
24
25 and Dublin. Each of the maps uses a three-point scale with equal ranges, all scores
26
27 being centred on their mean for each timepoint, yielding a comparable measure of
28
29 relative disadvantage for each wave of census data. The scores range, in broad terms,
30
31 from -50 to +50, higher values indicating greater disadvantage,
32
33

34
35 Figure 4 Social Disadvantage in Ireland, 1991

36
37 *Insert here*

38
39
40
41 Figure 5 Social Disadvantage in Ireland, 2002

42
43
44
45
46
47 *Insert here*

48
49 Figures 4 and 5 reveal the great resilience of the socio-spatial patterning of disadvantage
50
51 in Ireland over the past decade. A very clear geographical pattern emerges, capturing
52
53
54
55
56
57
58
59
60

Formatted: Space After: 0 pt

Formatted: Space After: 0 pt

Deleted: affluence

Formatted: Space Before: 0 pt,
After: 0 pt

Formatted: Space After: 0 pt

1
2
3 the social geography of the Republic of Ireland: the dark areas in the map indicate the
4 most disadvantaged tracts, which are concentrated primarily in the North-West and in
5 the urban areas, which are themselves sharply polarised. An affluent belt is discernible
6 around all of the major urban centres, indicating the desirability of these areas and their
7 relatively privileged residential status. Figures 4 and 5 also provide an insight into the
8 ways in which Dublin has expanded over the last ten years, and the relatively affluent
9 areas of population growth in the hinterland of the city are clearly evident. The
10 extension of the commuter belt outwards from the city is also apparent, due to
11 population growth in areas such as Glendalough, Blessington, Rathmore, Naas,
12 Newcastle, Maynooth, Celbridge, Kilcock and Dunshaughlin.
13
14
15
16
17
18
19
20
21
22

23
24
25 The inserts for Dublin are equally striking, confirming the social polarisation of this
26 city, which assumes the form of a marked North-South divide. These maps reveal the
27 processes of repopulation and gentrification of the Inner City, with the result that the
28 area within the two canals is now rather affluent. Large-scale private housing
29 development in the City Centre, driven by the economic boom, has led to a significant
30 influx of dual-earner couples and young families, a relatively income-rich and affluent
31 population which has produced a significant change in social composition (Pratschke,
32 2004). The transformation of the Inner City is all the more dramatic given the overall
33 stability of the spatial pattern of relative affluence and disadvantage in Ireland. Two
34 important consequences flow from this: firstly, given the stability of relative
35 disadvantage scores over time, it is arguably not necessary to update these scores at
36 regular intervals, as we are unlikely to detect significant changes over a period of less
37 than ten years. Secondly, where substantial changes *are* detected, following for example
38 an intense period of economic growth and redevelopment as in the case of Dublin, it is
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 clear that we need composite measures that can actually measure the magnitude of the
4
5 changes observed. Indices that do not permit comparisons to be made over time or
6
7 which base their analysis of change on rankings rather than the disadvantage scores
8
9 themselves are therefore of limited value.
10

11 12 13 14 15 X Concluding Remarks

16
17
18 In this paper, we have applied Confirmatory Factor Analysis techniques to Census of
19
20 Population data from the Republic of Ireland to construct an estimate of social
21
22 disadvantage at local level. We emphasised the importance of building operational
23
24 hypotheses upon an understanding of the characteristics of communities and the areas
25
26 they live in, rather than automatically referring to an individual-level model which may
27
28 not be appropriate. Indeed, one of the consequences of using spatial data from the
29
30 Census of Population to estimate social disadvantage is that definitions and theories
31
32 relating to individuals and households are no longer sufficient. By focusing on the
33
34 attributes of areas, however, it is possible to provide a superior picture of how spatially-
35
36 differentiated outcomes emerge and are reproduced over time.
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Formatted: Space After: 0 pt

Formatted: Space After: 0 pt

Appendix

Table 3 below summarises goodness of fit statistics and alternative fit indices for the 1991, 1996, 2002 and combined models.

Table 3 Goodness of Fit Statistics and alternative fit indices for 1991, 1996 and 2002 models as well as combined model

Insert here

Formatted: Space Before: 0 pt

Formatted: Line spacing: Double

Bibliography

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

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

Bollen K. (1989) *Structural Equations with Latent Variables*. John Wiley, New York.

Carstairs V. and Morris R. (1990) Deprivation and Health in Scotland, *Health Bulletin* **48**, 162-74.

CRESR (2004) *New Deal for Communities: The National Evaluation*. NRU, London.

Cressie N. (1993) *Statistics for Spatial Data*. Wiley, New York.

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

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

Dorling D, Mitchell R, Shaw M, Orford S, Davey Smith G (2000) The health effects of poverty in London in 1896 and 1991, *British Medical Journal* **321**, 1547-1551.

Duncan G. and Aber J. L. (1997) Neighbourhood models and measures, in J. Brooks-Gunn *et al.* (Eds) *Neighbourhood Poverty: Context and Consequences for Children*, Vol. 1, pp. 62-78. Russell Sage Foundation, New York.

Fan X., Thompson B. and Wang L. (1999) Effects of sample size, estimation methods, and model specification on structural equation modeling fit indices, *Structural Equation Modeling*, **6**(1), 56-83.

Folwell K. (1995) Single measures of deprivation, *Journal of Epidemiology and Community Health* **49** (Supplement 2), S51-S56.

1
2
3 Forrest R. and Gordon D. (1995) *People and places: social and economic distinctions in*
4 *England*, Vol. 2. School for Advanced Urban Studies, Bristol.

5
6
7 Furstenberg F. and Hughes M. (1997) The influence of neighbourhoods on children's
8 development: A theoretical perspective and a research agenda, in J. Brooks-Gunn *et al.*
9 (Eds.) *Neighbourhood Poverty*, Vol. 2, pp. 23-47. Russell Sage Foundation, New York.

10
11
12 Gordon D. and Townsend P. (1990) Measuring the Poverty Line, *Radical Statistics* **47**,
13 5-12.

14
15
16
17 Gordon D. (1995) Census based deprivation indices: their weighting and validation,
18 *Journal of Epidemiology and Community Health* **49** (Supplement 2), S39-S44.

19
20
21 Gregory I., Southall H. and Dorling D. (2000) A century of poverty in England and
22 Wales, 1898-1998: A geographical analysis, in J. Bradshaw and R. Sainsbury (Eds),
23 *Getting the Measure of Poverty. The Early Legacy of Seebohm Rowntree*, pp. 130-159.
24 Policy Press, Bath.

25
26
27
28 Haase T. (1995) *The Designation of Disadvantaged Areas in the Local Development*
29 *Programme*, Report to Area Development Management Ltd., Dublin.

30
31
32
33 Haase T. (1998) The Role of Data in Policies for Distressed Areas, in OECD,
34 *Integrating Distressed Urban Areas*. Organisation for Economic Cooperation and
35 Development (OECD), Paris.

36
37
38
39 Haase T. (1999) *Affluence and Deprivation: A Spatial Analysis Based on the 1996*
40 *Census of Population*. Report to Area Development Management, Dublin.

41
42
43 Hu L. and Bentler P. (1999) Cutoff Criteria for Fit Indexes in Covariance Structure
44 Analysis: Conventional Criteria Versus New Alternatives, *Structural Equation*
45 *Modeling* **6**(1), 1-55.

46
47
48
49 Jarman B. (1984) Underprivileged Areas: Validation and Distribution of Scores, in
50 *British Medical Journal* **289**, 1587-92.

1
2
3 Loehlin J. (1992) *Latent Variable Models: An Introduction to Factor, Path and*
4 *Structural Analysis*. Erlbaum, Hillsdale.

5
6
7 Lupton R. and Power, A. (2004) What We Know About Neighbourhood Change: A
8 Literature Review, Case Report 27, London School of Education, London.

9
10
11 McIntyre, D. and Gilson L. (2000) Redressing Dis-advantage: Promoting Vertical
12 Equity within South Africa, *Health Care Analysis* **8**, 235–258.

13
14
15 McLennan W. (1998) *1996 Census of population and housing: Socio-economic indexes*
16 *for areas*. Australian Bureau of Statistics, Canberra.

17
18
19 Meredith W. (1993) Measurement invariance, factor analysis and factorial invariance,
20 *Psychometrika* **58**, 525-543.

21
22
23 NESS (2005) *Changes in the Characteristics of Sure Start Local Programmes Areas in*
24 *Rounds 1 to 4 between 2000/2001 and 2002/2003*. HMSO, London.

25
26
27 Noble M., Penhale B., Smith G. and Wright G. (1999) Index of Deprivation 1999
28 Review: Measuring Multiple Deprivation at the Local Level. Working Paper,
29 Department of Applied Social Studies and Social Research, Oxford.

30
31
32
33 Noble M., Smith G., Penhale B., Wright G., Dibben C., Owen T. and Lloyd M. (2000a)
34 *Measuring Multiple Deprivation at the Local Level: The Indices of Deprivation 2000*.
35 Department of the Environment, Transport and the Regions, London.

36
37
38
39 Noble M., Smith G.A.N., Wright G., Dibben C., Lloyd M. and Penhale B. (2000b)
40 *Welsh Index of Multiple Deprivation*. National Assembly for Wales, Cardiff.

41
42
43 Noble M., Smith G.A.N., Wright G., Dibben C. and Lloyd M. (2001) *Measures of*
44 *Deprivation in Northern Ireland*. Northern Ireland Statistics and Research Agency,
45 Belfast.
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 Noble M., Wright G., Lloyd M., Dibben C., Smith G., Ratcliffe A., McLennan D.,
4
5 Sigala M. and Anttila C. (2003) Scottish Indices of Deprivation. Department of Social
6
7 Policy and Social Work, Oxford.

8
9 Noble M., Barnes H., Smith G., McLennan D., Dibben C., Anttila C., Sigala M.,
10
11 Avenell D., Smith T. and Mokhtar C. (2005) Northern Ireland Multiple Deprivation
12
13 Measure. Northern Ireland Statistics and Research Agency, Belfast.

14
15 Pratschke J. (2002) *Mapping the Dynamics of Disadvantage in the Republic of Ireland.*
16
17 MA Dissertation in Social Science Data Analysis, Essex Summer School in Social
18
19 Science Data Analysis and Collection, University of Essex, Colchester.

20
21 Pratschke J. (2004) The Dynamics of Social Disadvantage in Dublin, 1991-2002, in N.
22
23 Boccella and A. Billi (Eds.) *Développement, inégalités, pauvretés*, pp. 331-376.
24
25 Éditions Karthala, Paris.

26
27 Robson B., Bradford M. and Deas I. (1994a) *Relative Deprivation in Northern Ireland.*
28
29 Centre for Urban Policy Studies, Manchester University, Manchester.

30
31 Robson B., Bradford M. and Tye R. (1994b) A matrix of deprivation in English
32
33 authorities 1991, in Department of the Environment UK (1994) *1991 Deprivation*
34
35 *Index: A Review of Approaches and a Matrix of Results.* HMSO, London.

36
37 SAHRU (1997) *A National Deprivation Index for Health and Health Services Research.*
38
39 Technical Report No. 2 (August), Small Area Health Research Unit, Trinity College,
40
41 Dublin.

42
43 Social Exclusion Unit (SEU) (1998) *Bringing Britain together: a national strategy for*
44
45 *neighbourhood renewal.* SEU, London.

46
47 Salmond C. and Crampton P. (2002) Heterogeneity of deprivation within very small
48
49 areas, *Journal of Epidemiology and Community Health* **56**, 669-670.

1
2
3 Shaw M., Dorling D., Gordon D. and Smith, G. (2001) Putting time, person and place
4 together: the temporal, social and spatial accumulation of health inequality, *Critical*
5 *Public Health* **11**(4), 289-304.
6
7

8
9 Taylor D. (1998) The natural life of policy indices: Geographical problem areas in the
10 US and UK, *Social Science and Medicine* **47**(6), 713-725.
11

12
13 Townsend P. (1979) *Poverty in the United Kingdom: A Survey of Household Resources*
14 *and Standards of Living*. Penguin, Harmondsworth.
15

16
17 Townsend, P., Phillimore, P. and Beattie, A. (1988) *Health and Deprivation: Inequality*
18 *and the North*. Croom Helm, London.
19

20
21 Wilson W. J. (1987) *The Truly Disadvantaged: The Inner City, the Underclass, and*
22 *Public Policy*. University of Chicago Press, Chicago.
23

24
25 Wright E. O. (1985) *Classes*. Verso, London.
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Table 1 Variable Names, Areas Affected and Dimensions

Name	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

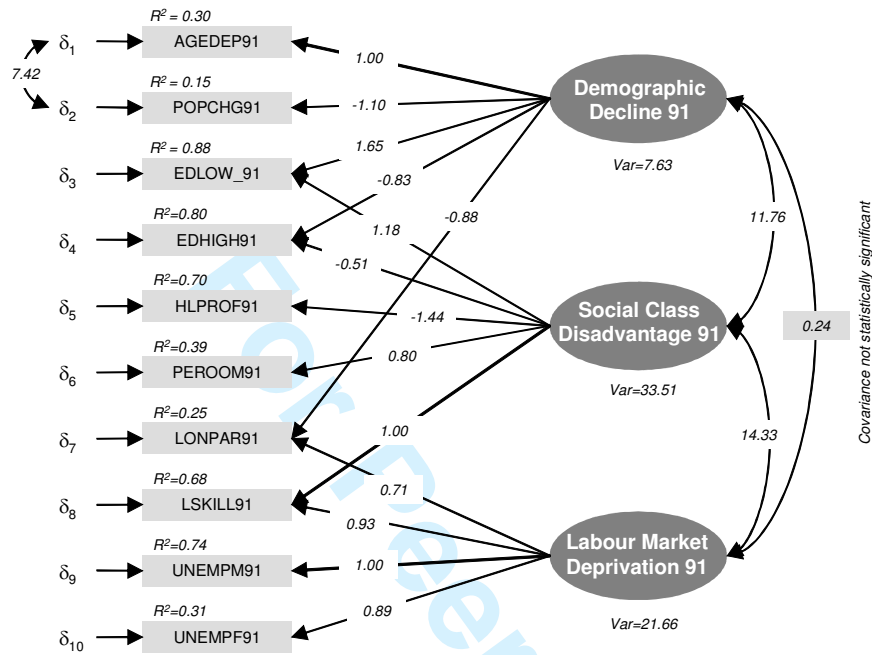
* We exclude all those people whose social class position is 'Unclassified' from the denominator of this percentage, as to include them would lead to artificially-reduced scores in disadvantaged urban areas.

Table 2 Variables, Transformations, Estimation and Scaling

Name	Transformations	Estimation of missing waves	Scaling Factor**
POPCHG	Values constrained to the range +/- 25%	None	1
AGEDEP	None	None	1
EDLOW_	None	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	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

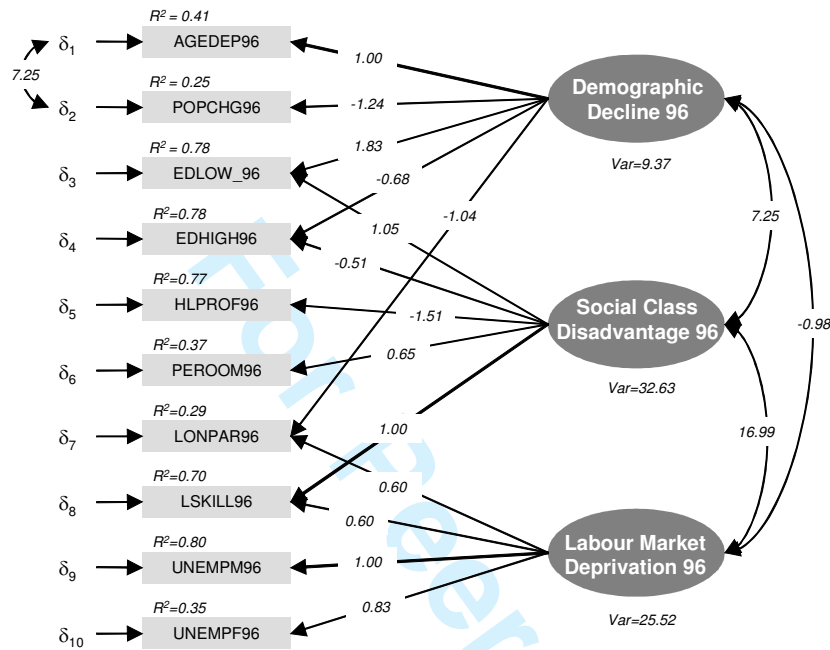
** An arbitrary scaling factor is used prior to statistical modelling with Structural Equation Modelling software in order to render the variances of the variables more homogeneous.

Figure 1 Results of the Disadvantage Model, 1991 Census Data
(N=3403)*



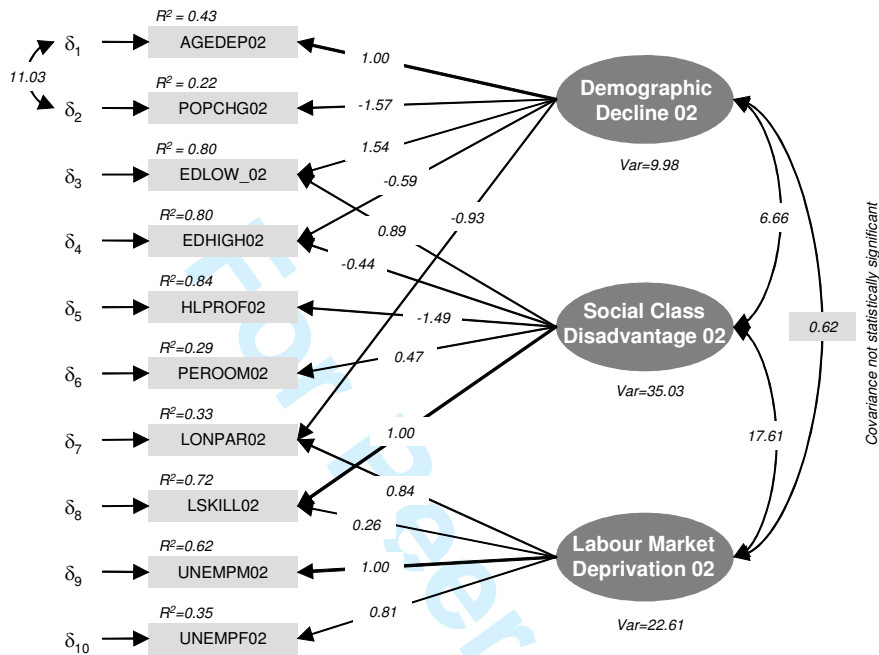
*All coefficients are unstandardised and all effects are statistically significant at the .05 level except where indicated. The unit factor loadings indicated in the graph (1.00) were imposed in order to identify the scale of the latent variables.

Figure 2 Results of the Disadvantage Model, 1996 Census Data
(N=3403)*



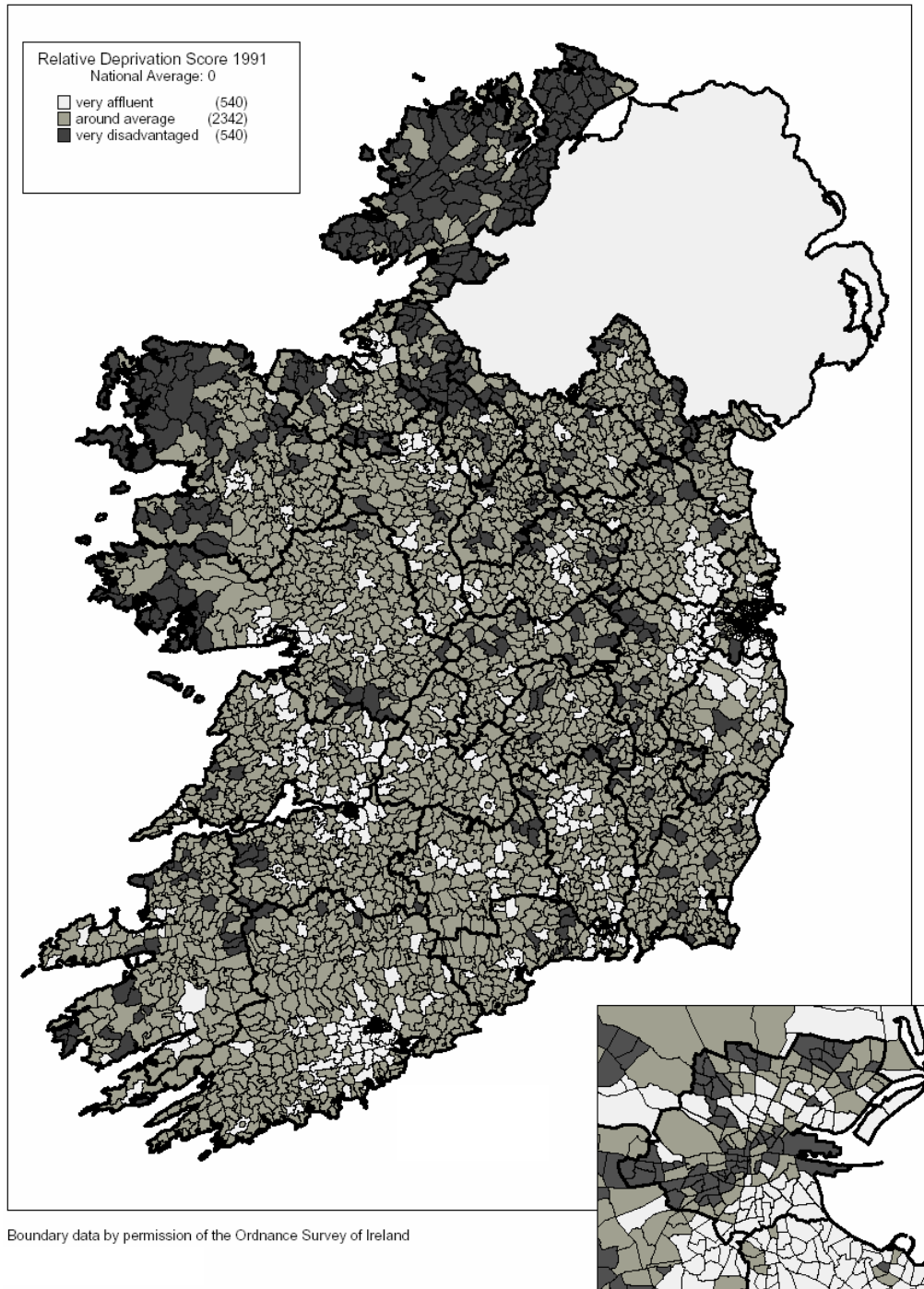
*All coefficients are unstandardised and all effects are statistically significant at the .05 level except where indicated. The unit factor loadings indicated in the graph (1.00) were imposed in order to identify the scale of the latent variables.

Figure 3 Results of the Disadvantage Model, 2002 Census Data
(N=3403)*



*All coefficients are unstandardised and all effects are statistically significant at the .05 level except where indicated. The unit factor loadings indicated in the graph (1.00) were imposed in order to identify the scale of the latent variables.

Figure 4 Social Disadvantage in Ireland, 1991



1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Figure 5 Social Disadvantage in Ireland, 2002

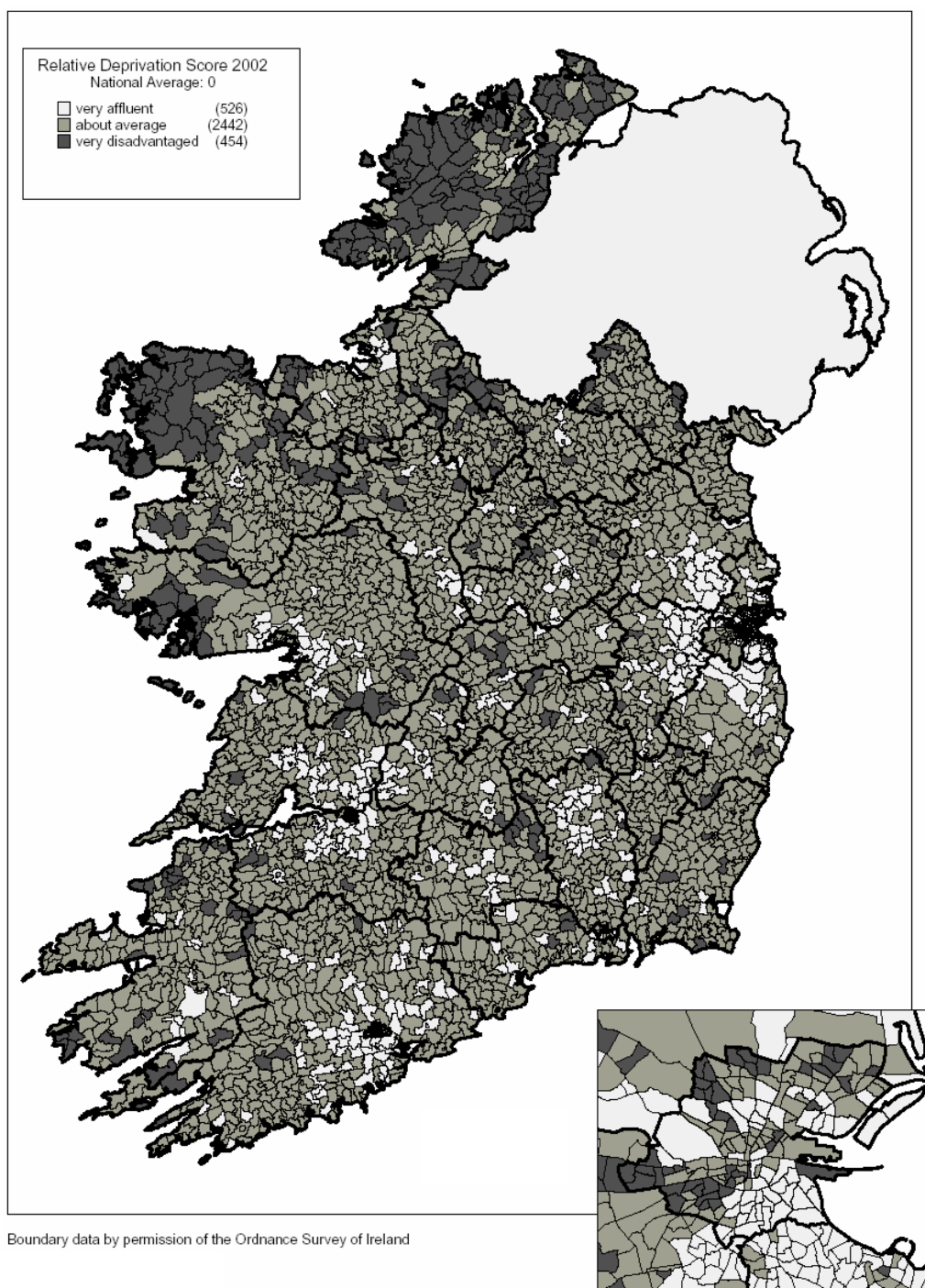


Table 3 Goodness of Fit Statistics and alternative fit indices for 1991, 1996 and 2002 models as well as combined model

	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

¹ Well-known British indices include the Carstairs Index (Carstairs and Morris, 1990), the Jarman Index (Jarman, 1984), the Townsend Index (Townsend, Phillimore and Beattie, 1988), the DoE 1981 Index of Deprivation (DoE, 1983), the UK Index of Local Conditions (DoE, 1994), the English, Welsh, Scottish and Northern Irish Indices of Multiple Deprivation (Noble *et al.*, 2000a, 2000b, 2001, 2003), the Northern Ireland Index of Relative Deprivation (Robson *et al.*, 1994a) and the 'People and Places' Index (Forrest and Gordon, 1995). Indices for the Republic of Ireland have been proposed by Haase (1995) and SAHRU (1997). Duncan and Aber (1997) use Census of Population data from the US to construct an index of neighbourhood conditions. Outside Europe there are several other examples of deprivation indices, including South Africa (McIntyre *et al.*, 2000), Australia (McLennan, 1998) and New Zealand (Salmond and Crampton, 2002).

² It is interesting, in this context that Geographical Access to Services, the most "rural" domain, is described as being negatively correlated with the other domains. The Northern Ireland Multiple Deprivation Measure (Noble *et al.*, 2005) seeks to address the issue of urban/rural bias within a similar set of domains. In relation to employment deprivation, for example, the authors conclude that "[t]here are no indicators which apply more specifically to urban areas than rural areas" (p. 12). This conclusion stands in marked contrast to the position set out in this article, as we will show in the following section. We believe that the correct measurement of

Deleted: revealing

deprivation in rural areas requires the development of theoretical models that address this issue directly.

3 Given that the average population of the census tracts in the Republic of Ireland is roughly 3,000, we feel that the presence of a Children's Home or Nursing Home is unlikely to exert an undue influence on this variable.

4 As the age profile directly affects rates of population change, it is important to consider whether it is possible to identify relatively affluent areas with elderly populations where population decline is directly attributable to the age profile rather than "demographic decline". If we take the example of relatively affluent "retirement villages", it will be clear that their elderly population profile does not necessarily lead to population decline, given the desirability of these areas: vacant properties will tend to be either re-let or sold.

5 The Census of Population 2001 was deferred until 2002 due to an outbreak of Foot-and-Mouth Disease.

7 It is not uncommon for inconsistencies and contradictions to be brushed aside: for example, Duncan and Aber (1997) never 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'.

8 Confirmatory Factor Analysis initially developed as an extension of Exploratory Factor Analysis, and subsequently developed into 'Structural Equation Modelling'.

9 All model estimation and testing is carried out using Peter Bentler's programme EQS 6.1.

10 Another consideration that must be borne in mind when developing statistical models using spatial data is that the units of analysis are not independent, a fundamental assumption of linear models. Although this form of non-independence is likely to have an impact on standard errors and on global fit statistics (Cressie, 1993), statisticians have indicated that it is unlikely to bias parameter estimates themselves. This suggests that linear models may be used to generate disadvantage scores, even in the context of spatial data, but that one should use alternative measures of model fit and exercise considerable caution when carrying out hypothesis tests.

11 The ML fitting function yields an (asymptotic) chi-square, $\chi^2 = (N-1)F_{\min}$, where F_{\min} is the value of the discrepancy function at the point of best fit and N is the sample size (assuming multivariate normality and a 'reasonably large' sample size; Loehlin, 1992: 59).

12 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 for 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.

13 This can be achieved by specifying a longitudinal model with directed arrows (causal effects) between latent variables corresponding to successive timepoints. Each latent variable receives a causal input from the three dimensions of disadvantage at the previous wave. We then include a dummy variable identifying the areas targeted under the intervention, specifying this as an additional causal

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

influence on the latent variables for the later wave, and allowing it to correlate with the latent variables for the previous wave. If we obtain a statistically significant coefficient for this effect, we can conclude that the intervention had an impact on the dimension concerned. This methodology will be explained in greater detail in a separate article due to space constraints.

For Peer Review Only