



The 2011 All-Island HP Deprivation Index

**Consistent Deprivation Measures for the Island of
Ireland, based on the 2011 Census of Deprivation**

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1 Introduction

This study presents an area-based deprivation measure for the island of Ireland based on the 2011 Census. Conceptually, it builds on the study undertaken by the authors in 2011 (Haase, Pratschke and Gleeson, 2012), which used small area (SA) data from the Republic of Ireland and Northern Ireland to construct a prototype of an all-island deprivation index. The index presented here embodies further advances, made possible by recent developments in data availability and harmonisation.

The first major development relates to the 2011 Census itself, which was carried out concurrently in almost all European countries, providing data for both the Republic of Ireland and Northern Ireland. Secondly, small areas (SA) were introduced in both jurisdictions for the publication of aggregate data from the census, providing a better alignment of geographical units. Thirdly, the CSO and NISRA have worked together on an ambitious programme of data harmonisation, leading to a joint publication using socio-economic statistics from the census on an all-island basis (CSO and NISRA, 2014).

The new All-Island HP Deprivation Index builds on these developments and draws on a combined set of equivalent indicators to form a single deprivation index, providing a powerful tool for researchers and policymakers who are interested in understanding and seeking to reduce the social gradient that characterises a multiplicity of different outcomes in the economic, social and political spheres.

2 History of Deprivation Measures

2.1 Northern Ireland

Deprivation Indices have a long history in both Northern Ireland and the Republic of Ireland. Indices for Northern Ireland have, without exception, followed the design of those adopted in England. The first deprivation index for Northern Ireland was based on the 1981 Census of Population and was developed to allow the Department of the Environment to identify Urban Priority Areas for targeted interventions under the 1978 Inner Urban Areas Act (DoE, 1983). The resulting index included eight indicators, seven of which were calculated using the 1981 Census. The indicators sought to identify groups known to have a higher risk of poverty, such as lone parents, elderly people living alone and those born outside the Commonwealth.

Following the 1991 Census, a new multidimensional index was constructed, referred to as the *Index of Local Conditions* (ILC, also known as the Robson Index) (DoE, 1994). The construction of the ILC was guided by hypotheses regarding “domains” of deprivation and differed from its predecessor in making a conceptual shift from the notion of “groups at risk of poverty” to more direct measures, referred to as indicators of “incidence”. This new index attracted considerable interest, providing a basis for the designation of eligible areas under successive EU and IFI initiatives to foster peace and reconciliation in Northern Ireland.

The *Indices of Multiple Deprivation* (IMD, also known as the Noble Index) were the next, in chronological order, to be adopted. The IMD provided new area-based measures for the UK, incorporating eleven separate studies (Noble et al., 2000 to 2007). The IMD differed from previous indices in that they were derived almost entirely from administrative data. The most recent *Index of Multiple Deprivation for England* (Noble, 2007) is based on seven domains: income, employment, health, education, housing, environment and crime. Each domain comprises a number of indicators, which are combined using the first factor of an Exploratory Factor Analysis (EFA). The domain scores are then combined into a single index score using expert weights. In Northern Ireland, the Index is known as the *Multiple Deprivation Measure* (MDM) and was updated in 2001, 2005 and 2010. Index scores are available from the Northern Ireland Statistics and Research Agency.

2.2 Republic of Ireland

Deprivation indices for the Republic of Ireland originated with a series of local development programmes that were implemented from the late 1980s onwards, and followed a different trajectory to that described above.

The *Index of Relative Affluence and Deprivation* for the Republic of Ireland relied on the 1991 Census (Haase, 1996). When compared with the DoE (UK) index based on the 1981 UK Census, this index differs primarily due to its sensitivity to the dimensionality of urban and rural forms of deprivation. In fact, there was a growing perception in Ireland during the 1980s and 1990s that UK indices tended to have an urban bias, given their origin in the designation of Urban Priority Areas and due to the more urban character of UK society.

When developing subsequent indices, Haase and Pratschke introduced an important additional innovation, which was to become the hallmark of the Irish approach to measuring deprivation, namely the estimation of scores which can be compared over time. This approach was first applied in Haase and Pratschke's analysis of data from the 1991, 1996 and 2002 census (Haase and Pratschke, 2005), and subsequently extended to include 2006 data (Haase and Pratschke, 2008; Pratschke and Haase, 2007). This methodology is used in the current Pobal HP Deprivation Index for Small Areas (Haase and Pratschke, 2012). In contrast to the UK, where the census is carried out every 10 years, the Irish Census is repeated every 5 years, providing a stronger incentive to develop deprivation measures that are comparable over time.

The key methodological innovation that allows for comparable scores is the application of a technique known as Confirmatory Factor Analysis (CFA). This methodological technique is quite different to Exploratory Factor Analysis (EFA), which has been widely used in the construction of deprivation indices at international level, but tends to yield different results each time a new set of data is analysed. The method applied by Haase and Pratschke to data from the Republic of Ireland conserves the positive features of EFA, whilst allowing the underlying dimensions of deprivation to be conceptualised and fixed on theoretical grounds. A range of empirical tests enable the researcher to assess whether the hypothesised model provides an adequate fit to the data, whilst the stability of the measurement structure and scales permit comparisons to be made between index scores relating to different census periods. This combination of a strong conceptual framework, multidimensionality and stable measurement structure provides comparable deprivation scores which are sensitive to the different forms of deprivation observed in different contexts.

3 Developing the 2011 All-Island HP Deprivation Index

The 2011 Census is the result of a far-reaching consultation process involving all European countries, and the definitions and procedures used provide the basis for the development of small area deprivation measures at a European level. In the context of cross-border cooperation, the 2011 Census data for the Republic of Ireland and Northern Ireland provide a unique opportunity to study the spatial distribution of deprivation from a comparative perspective. This naturally requires a harmonised cross-national dataset, in addition to a statistical model of deprivation that is appropriate in both jurisdictions. Recent UK indices, such as the IMD/MDM, which are based on administrative data, cannot be extended in this way, as equivalent data are not available for the Republic of Ireland. For this reason, an All-Island Deprivation Index (or any supra-national deprivation index in Europe) must be based on the Census of Population.

The development of an all-island index also requires the use of appropriate methodological techniques, which are similar to those used to develop measures which are comparable across time. This was the subject of a previous research project (Haase, Pratschke and Gleeson, 2012), which set out to test the feasibility of extending the statistical techniques used in recent years to estimate deprivation in the Republic of Ireland to provide comparable scores on an all-island basis. Particular attention was paid to the following issues: (i) the comparability of indicator variables, (ii) temporal

synchronicity, (iii) common dimensionality of deprivation, (iv) fitting a common statistical model, and (v) standardising index scores across multiple jurisdictions.

The main finding of the aforementioned study was that it was feasible to fit a two-group CFA statistical model to data from two jurisdictions, although attention was drawn to the additional work needed to satisfactorily align the raw variables. The current study overcomes all of these remaining obstacles, primarily as a result of excellent work by the CSO, which was able to provide matching census data for all ten indicators used in the construction of the 2011 All-Island HP Deprivation Index.

4 Common Indicator Variables across multiple Jurisdictions

The 2011 All-Island HP Deprivation Index is unique in being based on a fully-harmonised set of aggregate-level data from two jurisdictions, an exciting precedent in cross-national research and one which would have been considered impossible until just a few years ago. Although the proof-of-concept study referred to above showed that it was technically possible to construct an all-island index – even where there are differences in the way certain variables are constructed – the 2011 index renders these sophisticated techniques largely irrelevant. This lends greater legitimacy to the index, as the variables on which it is based are defined in exactly the same way for the Republic of Ireland and Northern Ireland. Although there may be some small differences in how the social class position of families is coded in the two jurisdictions, we believe that these are practically negligible for the variables used here.

Whilst there have never been particular problems with aligning measures of population change or demographic composition, the greatest challenge for harmonisation arose with the measurement of (i) educational attainments, (ii) social class and (iii) unemployment rates. Following considerable work by the CSO in coding and reclassifying variables to match those available for Northern Ireland, we are satisfied that we now have a matched set of indicators for both jurisdictions.

Education

There are considerable differences between the educational and qualification systems that operate in Ireland and Northern Ireland and these are reflected in differing census questions. In Ireland, the census question asked respondents to identify their highest level of education completed, while in Northern Ireland the question asked for qualifications held. In order to produce comparable census data for Ireland and Northern Ireland, the CSO and NISRA undertook a mapping exercise to identify comparable levels of educational qualification between the two sets of census data (CSO and NISRA, 2014, Appendix 4). Table 1 shows the resulting match between qualification levels which provides for a good alignment of the two indicators used for the construction of the 2011 All-Island HP Deprivation Index, namely the proportion of persons with low levels and high levels of qualification (marked in a darker shade in Table 1). It should be noted that this measure differs from that used in previous deprivation indices by Haase and Pratschke, where the category “low education” refers to the proportion of the adult population with no or primary education only. The 2011 All-Island index, by contrast, includes lower secondary education in the “low qualification” category.

Table 1: Highest Level of Education

Northern Ireland	%	Republic of Ireland	%
No qualifications:		None, primary, lower secondary, not stated	
Level 1 qualifications	40.6		36.8
Level 2 qualifications		Upper secondary, higher certificate	25.7
Level 3 qualifications	27.2		
Apprenticeship	4.2	Apprenticeship	5.4
Other qualifications	4.3	Vocational	8.6
Level 4 qualifications and above	23.6	Third Level (degree or higher)	23.5
All usual residents: Aged 16+ years	100.0	Education Total	100.0

Social Class

The second set of indicators that entail a major novelty are those concerning social class. Historically, two socio-economic classifications were widely used both in the UK and Ireland in both official statistics and academic research: Social Class based on Occupation (SC) and Socio-economic Groups (SEG). Following a review commissioned by the predecessor of the Office of National Statistics (ONS) in 1994, the Economic and Social Research Council (Rose and Pevalin 1998) recommended that a new SEC, the National Statistics Socio-economic Classification (NS-SEC) replace both SC and SEG. The NS-SEC was developed from a sociological classification that had been widely used in pure and applied research (Goldthorpe 1980, 1987, 1997, 2007) and centres on a validated measure which acts as a good predictor of health, educational and many other outcomes. In practise, the NS-SEC overcomes difficulties in the ordering of Social Class, notably between administrative and secretarial occupations versus skilled trade occupations, the treatment of farmers, the inclusion of employment status, and the assignment of NS-SEC to persons across the household on a wider set of considerations as to who constitutes the head of household. The NS-SEC has been revised a number of times since its first introduction and exists in a number of different specifications regarding the number of categories included. The small area statistics of the 2011 Northern Ireland census fully embraced the latest version of the NS-SEC, but this also meant that it is no longer possible to state the class composition in the North in terms of the previously used measures of SC and SEG, as well as making it impossible to compare with the traditional measures of SC and SEG used in the Irish Census. The 2011 All-Island HP Deprivation Index utilises a match of the Irish 2011 Census data using the NS-SEC7 classification.

Table 2: National Statistics Socio-economic Classification

Northern Ireland	%	Republic of Ireland	%
Large employers and higher managerial and administrative occupations Higher professional occupations	8.9	Employers in large Establishments, Higher managerial and administrative occupations, Higher professional occupations	11.2
Lower managerial, administrative and professional occupations	22.2	Lower professional and higher technical occupations, Lower managerial and administrative occupations, Higher supervisory occupations	21.9
Intermediate occupations	15.1	Intermediate occupations	14.4
Small employers and own account workers	11.3	Employers in small organisations, Own account workers	14.6
Lower supervisory and technical occupations	8.2	Lower supervisory occupations, Lower technical occupations	6.0
Semi-routine occupations	18.4	Semi-routine occupations	16.3
Routine occupations	15.9	Routine occupations	15.7
NS-SEC Total	100.0	NS-SEC Total	100.0
Never worked, Long-term unemployed, not classified and Full-time students		Full-time students, Occupations not stated or inadequately described	

There remain some difficulties as to the treatment of those who have never worked, full-time students and those unable to be classified, but once these entities are removed, the NS-SEC7 provides a strong set of matching categories which lend themselves to the creation of two social class indicators, one signifying High Class and one indicating Low Class as indicated by the darker shaded rows in Table 2.

Unemployment

The third and final set of indicators that required special efforts in creating matching indicators North and South concerns unemployment. In the 2011 censuses, the questions and methodologies used to compile data on economic status differed in several important aspects. While the Irish census used the question on Principal Economic Status (PES), in Northern Ireland the International Labour Organisation (ILO) measure was used. Accordingly, comparisons of economic indicators between the two jurisdictions are difficult. In order to make the comparisons between the two jurisdictions more meaningful, the CSO undertook a special exercise to convert the Irish data from the PES based results to an ILO basis (CSO and NISRA 2014, Appendix 3).

Table 3: Unemployment

Northern Ireland	%	Republic of Ireland	%
Male ILO Unemployment Rate	9.6	Male ILO Unemployment Rate	19.3
Female ILO Unemployment Rate	5.2	Female ILO Unemployment Rate	12.2

Comparison of Key Indicators North and South

Having achieved a tightly matched set of indicators for both jurisdictions, we can now look at a comparison of the indicators on which the 2011 All-Island HP Deprivation Index is built across the 23,025 small areas that make up the island.

Table 4: Comparison of Key Indicators across Jurisdictions

Key Indicator	Northern Ireland n = 4,537		Ireland n = 18,488		All-Island n = 23,025	
	Mean	STD	Mean	STD	Mean	STD
Age Dependency	34.4	5.9	32.7	8.2	33.0	7.8
Lone Parents	30.6	19.9	21.5	16.5	23.3	17.6
Low Qualification	42.2	13.3	36.8	15.2	37.8	15.0
High Qualification	22.6	11.5	23.5	14.1	23.3	13.6
Low Class	36.2	14.3	27.4	11.5	29.1	12.6
High Class	29.7	12.9	27.3	13.3	28.0	13.3
Male ILO Unemployment Rate	11.2	7.8	20.1	10.8	18.3	10.9
Female ILO Unemployment Rate	6.1	4.9	12.5	7.1	11.3	7.2
Average Persons per Room	.45	.06	.51	.18	.50	.16

* Population Change omitted here, as means are unduly affected by some extreme rates of change

5 A Conceptual Model of Deprivation

The 2011 All-Island HP Deprivation Index is constructed along the same lines as the *New Measures of Deprivation* (Haase and Pratschke, 2005, 2008) and the *Pobal HP Deprivation Index for Small Areas* (Haase and Pratschke, 2010, 2012), all of which are based on the same set of hypotheses regarding the underlying dimensions of deprivation, and all of which use Confirmatory Factor Analysis (CFA). The index relies on ten variables, each of which expresses a distinct aspect of relative affluence and deprivation. The rationale for the choice of the three component dimensions and their respective indicators is outlined in Haase and Pratschke (2005). The dimensions are referred to as Demographic Profile, Social Class Composition and Labour Market Situation, with the following measurement structure:

The Demographic Profile is measured by five indicators:

- percentage change in population over the previous five years;

- percentage of people aged under 15 or over 64 years of age;
- percentage of people with low educational achievement;
- percentage of people with a third-level education; and
- mean number of persons per room.

The Social Class Composition is also measured by five indicators:

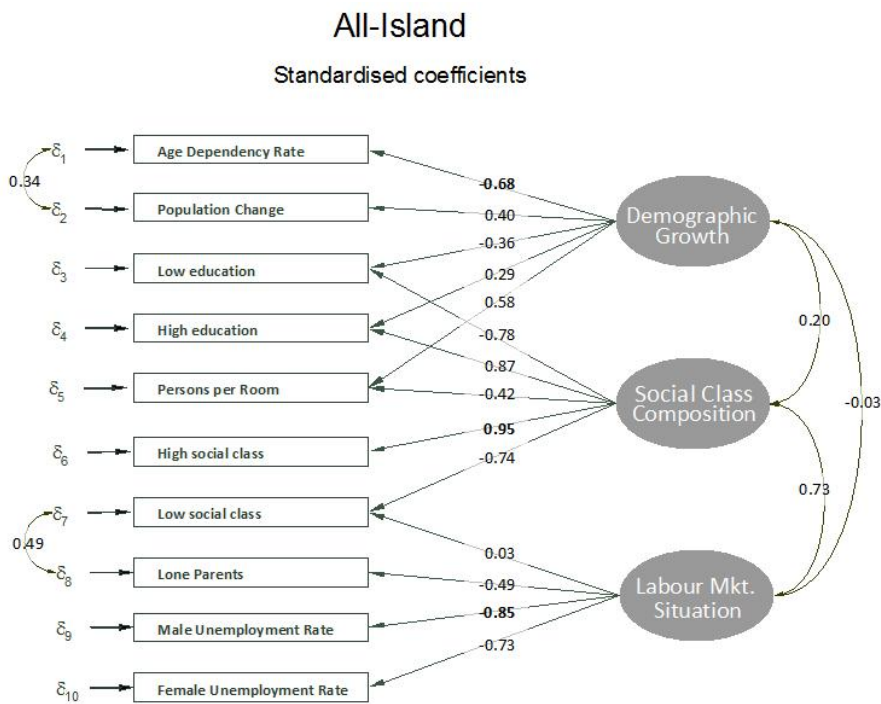
- percentage of people with low educational achievement;
- percentage of people with a third-level education;
- percentage of households of high social class;
- percentage of households of low social class; and
- mean number of persons per room.

The Labour Market Situation is measured by four indicators:

- percentage of households with children aged under 15 years and headed by a single parent;
- male unemployment rate;
- female unemployment rate; and
- percentage of households of low social class.

Figure 1 shows the model applied in the construction of the 2011 All-Island HP Deprivation Index.

Figure 1: Model Specification



CFI = .97 Robust CFI = .98 SRMR = .04 RMSEA = .08

Satorra-Bentler scaled chi-square = 2820 (26 df)

The final model for the 2011 All-Island HP Deprivation Index fully supports the multidimensional structure of affluence and deprivation that was hypothesised and tested in previous analyses using Irish data. The model fits very well according to the fit indices most commonly used to assess this kind of model (CFI = 0.97; SRMR = 0.04; RMSEA = .08). In order to assess whether the relationships implied

by the model are appropriate for both jurisdictions, we also analysed both sets of data separately and estimated a multi-group model with constraints on all free factor loadings to test the invariance of the measurement model (CFI = 0.95; SRMR = 0.08). The only evidence of poor fit in the constrained multi-group model relates to low social class, suggesting that this variable may have a slightly different meaning in each jurisdiction or that it may not be perfectly aligned.

6 Interpreting the 2011 All-Island HP Deprivation Index

When faced with the new All-Island HP Deprivation Measures, practitioners will understandably be interested in comparing these scores with those provided by other indices, and any differences demand explanation. This is not a major issue for the Republic of Ireland, as the all-island index builds upon previous indices for the Republic and the small area scores for the 2011 All-Island HP Deprivation Index are almost identical to those published for the Pobal HP Deprivation Index for small areas (with a Pearson bivariate correlation of 0.96), which are available online at www.pobal.ie and are widely used by Government Departments and community groups throughout Ireland.

A much greater challenge is posed by the new estimates for Northern Ireland, as the deprivation scores presented here differ significantly from those provided by the Multiple Deprivation Measures. For this reason, it is necessary to discuss some of the differences in how these two indices are conceptualised and constructed. The most important difference is that the MDM, as mentioned earlier, aim to estimate the number of people in each area who are poor. The All-Island HP Deprivation Index, by contrast, conceptualises affluence and deprivation as the extremes of a continuous distribution which reflects not just poverty but also structural weaknesses in socio-economic terms, including disadvantaged rural areas where some of the “would-be poor” have already emigrated.

Secondly, the MDM build exclusively on variables which appear to represent direct and count-like expressions of deprivation. The All-Island HP Deprivation Index, by contrast, is based on the understanding that, when considered at aggregate level, all indicators express the risk or probability that any given individual or family experiences poverty/deprivation. As a result, there is no reason to prefer indicators which are directly correlated with deprivation over indicators which are inversely correlated. For this reason, the All-Island HP Deprivation Index utilises measures of affluence as well as deprivation, including, for example, the proportion of people with a third-level education and members of households which are classified in the higher social classes.

Thirdly, the MDM derive overall scores by summing domain-specific deprivation measures. The All-Island HP Deprivation Index, by contrast, estimates the three underlying (“latent”) dimensions of deprivation, which are measured by ten indicator variables, using Confirmatory Factor Analysis. We believe that by adding domain-specific scores, the MDM involves an arbitrary “double counting” of the same underlying dimensions of deprivation.

Fourthly, the MDM and All-Island HP Deprivation Index result in two very different kinds of distributions. The All-Island HP Deprivation Index is based on a continuous measurement which ranges from extremely affluent to extremely disadvantaged, and the scores are approximately normally distributed (i.e. trace a bell-shaped curve). Measurements are centred on zero (i.e. have a mean of zero) and a standard deviation of ten, which represent true distances from the mean. The MDM, by contrast, aim to capture a one-tailed distribution, without attempting to distinguish between areas characterised by different degrees of affluence. This is clearly less important when using small area maps to identify highly disadvantaged areas (and in this case, both indices perform equally well). It is, however, of great relevance when aggregating to larger areas, as the All-Island HP Deprivation Index generates a population-weighted average across affluent as well as disadvantaged areas, whilst the MDM counts the extent of disadvantage only.

Having constructed a consistent measure of relative affluence and deprivation throughout the island of Ireland, we can now determine where the areas of greatest disadvantage are located and how the two jurisdictions perform in relative terms.

7 Mapping and Comparing the 2011 All-Island HP Deprivation Index

After inspecting the scores for the three dimensions that make up the overall index, several observations may be made:

- The ranges of all three dimension scores are roughly similar in both jurisdictions, with the exception of Demographic Growth, which has a higher standard deviation in the Republic of Ireland, probably reflecting the tail end of population growth and spatially uneven development of residential housing driven by the economic boom.
- Mean Demographic Growth is much lower in Northern Ireland than in the Republic of Ireland (-3.3 compared with 0.8).
- Social Class Composition is, on average, higher in Northern Ireland (1.5 compared to -0.4).
- Most importantly, however, the Labour Market Situation is much more positive in Northern Ireland (8.1 compared with -2.0).

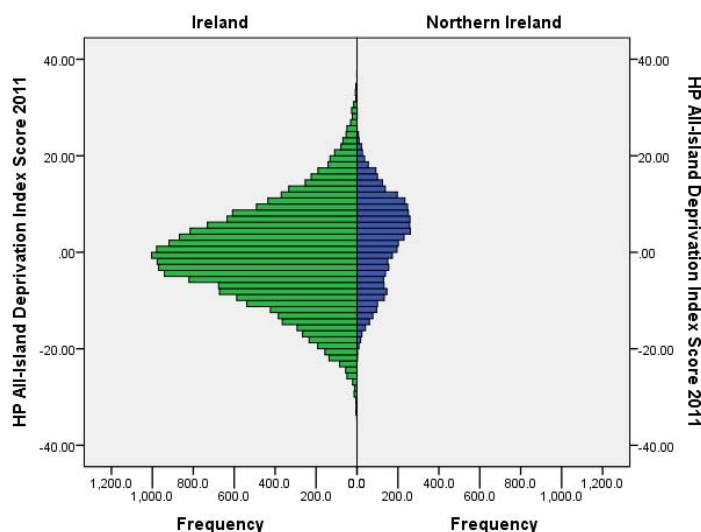
Table 5: Comparison of 2011 All-Island Deprivation Scores across Jurisdictions

	Northern Ireland n = 4,537		Ireland n = 18,488		All-Island n = 23,025	
Key Indicator	Mean	STD	Mean	STD	Mean	STD
Demographic Growth	-3.3	6.0	0.8	10.6	0.0	10.0
Social Class Composition	1.5	9.6	-0.4	10.1	0.0	10.0
Labour Market Deprivation	8.1	9.6	-2.0	9.1	0.0	10.0
2011 All-Island HP Deprivation Score	3.0	8.9	-.7	10.1	0.0	10.0

Looking at the combined Index Scores, we can see that:

- Northern Ireland is more affluent than the Republic of Ireland (3.0 compared to -0.7).
- The Republic of Ireland has more extreme values, particularly reflecting areas of severe deprivation (with a minimum of -34.8, compared with -22.1 in Northern Ireland).

Figure 2 Distribution of All-Island HP Deprivation Index Scores



Three deeper observations emerge from the current analysis, starting with the obvious result that, by 2011, Northern Ireland had become the more affluent of the two jurisdictions. This is of considerable interest, as the relative positions of Northern Ireland and the Republic of Ireland are reversed compared with our previous analysis, which was based on the 2001 Census for Northern Ireland and the 2006 Census for the Republic of Ireland. Figure 2 shows the distribution of deprivation scores in the two jurisdictions. The scores for the Republic of Ireland have a mean of -0.7 and are approximately normally distributed. The mean for Northern Ireland (3.0) is considerably higher, and the scores follow a bi-modal distribution with shorter tails and fewer highly-deprived areas.

Secondly, the driving factor in this striking development has been the ability of Northern Ireland to maintain a comparatively high level of employment despite the unfavourable economic climate since roughly the mid-point of the inter-census period. Ireland, by contrast, has experienced the collapse of the Celtic Tiger and an intensification of economic difficulties and austerity policies. Naturally, these observations relate to 2011, and do not take account of any changes which may have occurred over the past three years in relation to deprivation and its spatial distribution.

The third observation that emerges from this analysis relates to the different ways in which rurality constitutes itself in the Republic of Ireland and Northern Ireland. In terms of deprivation, the key question is the degree to which peripheral location implies opportunity deprivation, and there appear to be quite marked differences between the two jurisdictions in this regard. In Northern Ireland, people with high educational attainments, prestigious occupations and a high social class position appear to be able to maintain a rural lifestyle whilst nevertheless accessing work-related (and other) opportunities associated with more urban areas. In the Republic of Ireland, the most important social opportunities (such as accessing more dynamic labour markets) are mainly concentrated in urban areas but, in contrast to Northern Ireland, it appears to be much more difficult to access these from certain areas of the country, presumably due to geographical remoteness, the nature of the transport network and related difficulties.

These factors give rise to a much greater degree of differentiation between urban and rural areas in the Republic of Ireland with regard to population growth and decline, their ability to retain residents in the central working-age cohorts and their attractiveness to more highly-educated individuals. It would therefore appear that rural areas in the Republic of Ireland are much more negatively affected by opportunity deprivation than equivalent areas in Northern Ireland. Furthermore, practically all areas in the Republic of Ireland have experienced the dramatic and combined impact of economic crisis and cuts in public expenditure, whilst the impact of the crisis in Northern Ireland appears to have been weaker and perhaps somewhat mitigated by the policies that were adopted.

A slide show showing the 2011 All-Island HP Deprivation Index can be downloaded at:
<http://trutzhaase.eu/deprivation-index/the-2011-all-island-hp-deprivation-index/>