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The Index of Local Area Relative Disadvantage
A Cross-Country Comparison

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ABSTRACT

This paper proposes a measure of ecological disadvantage– the Index of Local Area Relative Disadvantage (ILARD) - for use in comparative cross-country research on neighbourhood effects.

A simpler synthetic index composed of basic ecological socio-economic characteristics is more apt in this type of cross-cultural research than the UK Indices of Multiple Deprivation (IMD)s. We contextualise the methodological challenges affecting neighbourhood research within such a comparative framework. We ran analyses within the UK at different levels of geographic aggregation and – the main goal of the paper – across the UK and US, for a total of seven replications. ILARD behaves consistently across all analytic runs and ranks geographic areas of residence along the continuum “Non-Disadvantage to Disadvantage” in the UK and US in a very similar manner.

KEYWORDS

Cross-National Research, Ecological Disadvantage, Neighbourhood Effects, Principal Component Analysis

1. INTRODUCTION

In the last decades, the growing literature on neighbourhood effects has shown how the wider environment of residence affects the individual. Effects arise from one (or more) of four main mechanisms: social-interactive (e.g. deprivation, collective socialisation, social networks, etc); environmental (e.g. exposure to unhealthy/polluted neighbourhoods); geographical (e.g. spatial mismatch and lack of access to adequate public services); and institutional (e.g. stigmatisation by people living outside a given neighbourhood) (Galster, 2012).

However, besides some econometric studies (Márquez *et al*., 2017), quantitative sociological cross-national studies on the topic are lagging behind in spite of attempts to develop a trans-national research framework (Darcy and Gwyther, 2012) and the opportunities for international comparison of panel and cohort studies. Their potential to investigate the interplay between neighbourhood conditions and consequences on people's health, well-being and well-becoming cross-nationally is under-exploited[1].

The present paper is part of the ESRC-funded research Home moves in the early years: The impact on children in UK and US. It addresses the problem of reducing a range of socio-demographic information about geographical areas in different countries to one single measure which is comparable and meaningful in both contexts. Drawing on the literature on small-area deprivation indices, the paper explains the steps we took to construct a bespoke single comparative measure of neighbourhood socio-economic conditions – the Index of Local Area Relative Disadvantage (ILARD). ILARD uses census and administrative data to rank geographic areas along the continuum “Non-Disadvantage to Disadvantage” with low numbers referring to “absence of disadvantage” and high numbers representing “disadvantage”. The index summarises information about social resources of people and households within each country at a level of (dis)aggregation of census areas chosen to maximise content-equivalence of measures. We specify “relative” in labelling the index (as opposed to an implicit “absolute”) to stress the need for contextual interpretation: an area is disadvantaged not only

1 For example, among birth cohorts studies, there are some whose cases are all born around the turning of the millennium, for example: in the UK Millennium Cohort Study (MCS) children were born between 2000-2002; in the US, the Early Childhood Longitudinal Study–Birth Cohort (ECLS-B) and the Fragile Families and Child Well-being Study (FFCWS) involve children born in 2001 and between 1998-2000 respectively. Our project used data from MCS and FFCWS.

compared to others, but also in relation to the resources that the wider community has available at a specific time.

The rest of the paper is organised as follows. The first section gives an overview of the rationale for constructing single indices that capture local socio-economic conditions, and describes in more detail one of the most recent and commonly-used batch of such indices in the UK – the Indices of Deprivation and explains their unsuitability for comparative research. The rest of the paper describes the steps taken to construct ILARD under three headings: the geographical scale of analysis, the input indicator variables and the method used to combine them into a single figure index. For each of them the problems that arise and that are specific to comparative research are highlighted, providing a useful extension to the existing literature on small area indices.

2. MOTIVATING CONSIDERATIONS

The UK has a long tradition, starting from the 1960s, of area-based policies, which accompanied a move to identify priority areas to target national programmes more effectively (OECD, 1998; Smith, 1999). While geographically-concentrated poverty occurs in many countries, Britain has been at the leading edge in implementing area-based policy initiatives (Lupton, 2003; Smith, 1999) which have entailed the continuous development of best practices to target the areas of most acute deprivation. This has led to a series of indices measuring deprivation at the local level, originally based on Census data and, more recently, also including administrative data (Noble, Wright, Smith, & Dibben, 2006).

Traditionally, such indices have been *compositional* measures: areas were defined as deprived if they contained a large proportion of deprived people. Small-area deprivation indices did not measure the *environmental* characteristics of areas, such as lack of services or amenities. Even among *compositional* indices, important distinctions can be made – whether deprived areas are defined by the presence of groups *at risk* of deprivation, for example, as was done in the 1970s, for the elderly or ethnic minorities. Or whether, instead, the definition is based on actual deprivation outcomes, for example lack of employment, of housing of good quality, or of adequate education. During the 1990s there was, in Britain, a shift from a definition based on potentially deprived groups to actually deprived people (Coombes, Raybould, Wong, and Openshaw, 1995). To identify relatively deprived areas in the UK, various indices have been devised such as the Townsend index (1987); the Carstairs index

(Carstairs and Morris, 1989); the Index of Local Conditions (DoE, 1983 and 1994), all measuring deprivation but including different input variables. Because these indices are predominantly based on census-derived variables and the UK census does not ask a question on income, income poverty is not included but deprivation is defined as lacking the possession of certain items.

During the 2000s, a new index – the index of multiple deprivation – was created, which included a much wider range of information, covering aspects related to income, education, health, housing, crime and access to services. As the policies making use of local targets were largely devolved to the four countries of the UK, similar but not identical indices were produced for each UK nation: the Index of Multiple Deprivation (IMD, Office of the Deputy Prime Minister 2004) in England; the Scottish Index of Multiple Deprivation (SIMD, Scottish Executive, Office of the Chief Statistician 2004); the Welsh Index of Multiple (WIMD, National Assembly for Wales, Statistical Directorate 2005;) and Northern Ireland Multiple Deprivation Measure (NIMDM, Northern Ireland Statistics and Research Agency 2005). The IMD differed from its predecessors in several important ways. First, it conceived deprivation as being made up of multiple aspects of individual resources as well as lack of access to services. Thus the IMDs also go some way to capturing the complexity of neighbourhoods, in that they conceive of neighbourhoods as being characterised by multiple physical, social and economic dimensions. Second, it was based on a mixture of census and administrative data, which allowed the indices to be updated intermittently during the 2000s, at 3 to 5 year intervals. Because of these features, the IMD has become the most common approach to measuring neighbourhood 'quality' in the UK.

Yet, from a comparative perspective, the IMD is highly problematic. When comparing the entire UK to another country, one is confronted with 4 indices rather than one. Second, the IMD, by taking into account access to services is highly contextual. For example, the inclusion of a measure of distance to a General Practitioner's surgery makes the English IMD relevant only in its own context. Likewise, the inclusion of crime indicators or traffic accidents makes it difficult to apply the IMD to another country.

Third, there is a complex system of exponential transformation and weighting of subdomains before they are combined (McLennan et al. 2011), which makes the IMD ill-suited to capture changes in ranking over time, let alone across countries.

For all these reasons our approach to devise an index that was comparable between the US and the UK was different, and started from the index proposed for the US by Wodtke, Harding and Elwert (2011).

3. METHODOLOGICAL CONSIDERATIONS

As mentioned above, neighbourhood research should be in the context of cross-country investigation, and should aim to maximise the content-equivalence of any measures of neighbourhood. In our research the goal was to create a synthetic index of ecological socio-economic characteristics, which although not covering the entire semantic field of the concept of deprivation, could measure objective conditions of *social disadvantage* that some people may experience *relative to others*, contingent on their place of residence.

3.1. THE NEIGHBOURHOOD UNIT OF ANALYSIS

The first problem we tackled regarded the choice of the ecological unit, which in turn depended on the working definition of neighbourhood we stipulated for our investigation. At the most general level, "neighbourhood" is a residential environment with characteristics that are both social (e.g. network enhancing feelings of identification and cohesion) and geographic (e.g. internal street system with deflection of heavy traffic along perimetrical arteries, location of physical structures, etc). Along those dimensions, the neighbourhood is a unit of spatial proximity conveying a sense of community with more or less harmonious physical characteristics. We were interested in the neighbourhood as a social unit, thus ILARD was conceived as a social-interactive measure (Galster, 2012), and the criterion used for selecting the appropriate (level of the) unit of analysis was based on an *equivalent* (average) population size across countries. We could translate this in a more mathematical language, so that for the generic $country_k$:

$$Unit_k = Tot.\ Pop_k \,/\, Tot.\ Units_k$$

that is, "Unit (average) population size in $country_k$" equals "$country_k$ Total Population count" divided by "$country_k$ Total number of Units/(or universe size)[2]". In a trans-national investigation the quest becomes how to operationalise the criterion "equivalent (average) population size of the unit" in light of the fact that "equivalent" carries both the meaning of "equal" and "proportional". In the above formula,

2 Of course the argument remains the same also when dealing with "samples" rather than entire "universes".

depending on the interpretation, “equal” and “proportional” will alternate either in the position of the “quotient/unit size” or in that of the “divisor/universe size” (the “dividend” remains fixed since it represents “$country_k$ Total Population”).

An ideal typical version of the problem we faced in our research can help to further unveil the dilemma. The respective total populations of the UK and US are in an approximate ratio of '1:5' for the year 2000[3]. Assuming they equal to '200' and '1,000', then the two alternatives translate into:

- One that could be termed as “equal unit size-proportional universe size (or equal quotient-proportional divisor), which consists in deciding on a desired size for the unit of analysis, and then divide the total population count in each country by a proportional number of units (i.e. '$Unit_k$ = 20 people' in the UK equals '200/10', whereas in the US equals '1,000/50' – the above ratio '1:5' is transferred on the two denominators, that is “$country_k$ Total number of Units/universe size”);
- The other, that could be labelled as “proportional unit size-equal universe size” (or proportional quotient-equal divisor), assumes an equal number of units (i.e. equal universe size) for both countries in order to obtain a proportional unit size (i.e. assuming that we want an equal universe size for both countries, say '20 units', then in the UK the “Unit (average) population size” would be '10 = 200/20' in the UK, and '50 = 1,000/20' in the US – this time the ratio '1:5' is attributed to the two quotients, i.e. the size of the neighbourhood unit).

Both solutions can introduce bias in the investigation: the first choice, by assuming that valid inferences are secured by equal unit size across countries, could distort the analysis by not taking into consideration their different population densities and relative concentration of “(dis)/advantage”; the second choice instead, while taking into consideration those cross-country differences at the unit level, may alter the quality of the inferences because of the use of different level of geographic aggregation of the data in the two countries. The selection of the appropriate spatial scale of analysis has been referred as the Modifiable Areal Unit Problem (MAUP) – although in the literature this quest has been mostly developed assuming a single “context” analysis rather than a trans-cultural framework. One of the main aspects of the MAUP is that analysts can draw different inferences depending on the level of geographic aggregation of the data, because the variation of a measure gets progressively reduced

3 Rounded to the closest million, the figure is 59MM people in the UK, and 281MM people in the US, which corresponds to a '1:4.8' ratio.

the larger the spatial unit of analysis[4] (Openshaw, 1984; Schuurman *et al*., 2007)[5]. Hence, the decision regarding the above dilemma should be made by considering data availability, and the specific technique that will be used in the analytic stage. Specifically, since data are available within each country at different levels of aggregation[6], the researchers have the possibility to select them at a country-specific scale to maximise content-equivalence, which in turn will affect the respective universe sizes. This decision in turn should be made also in relation to how the final index will be created, since some scaling techniques are sensitive to universe size, such as in our case where we used Principal Component Analysis to create ILARD (see details below).

3.1.1. SELECTION OF THE UNIT(S) OF ANALYSIS

In light of the above argumentation, we used "population size" as the criterion for selecting the geographic unit(s) of analysis across all the countries. The optimal selection was based on the following benchmarks, that is the unit: 1) had an ideal congruency with the "neighbourhood" of residence; 2) optimised the cross–country comparability within the UK, and across the UK and US; 3) had all the relevant variables (to create the intermediate measures to be then combined into ILARD) available at its selected level of (dis)aggregation. Accordingly, we chose: within the UK, Lower-level Super Output Area (LSOA) for both England and Wales; Data-Zone (DZ) for Scotland; and Electoral/Council Ward for Northern Ireland. The corresponding unit for the US was the census tract.

Details for both the UK and the US are displayed in the next two tables[7], beginning with Table 1 that shows type of units selected for each UK country and their respective descriptive statistics:

4 Another aspect of MAUP refers to the artificiality of the boundaries (of the ecological units) traced by the Census and/or other administrative agencies, which could also be a source of bias. In this regard, Manley and colleagues (2006) suggested that in the study of spatial inequality, boundaries should reflect socio-economic homogeneity.

5 We think of MAUP as a methodological hypothesis that can be subjected to empirical falsification or corroboration during the investigation: the replication of the creation of ILARD within the UK (i.e. for England, Wales, Scotland, Wales singularly taken, and then Great Britain) presented below goes in this direction.

6 As examples for the UK, we can mention LSOA (Lower-layer Super Output Area), and MSOA (Middle-layer Super Output Area); while for the US, typical illustrations are Census block, and Census tract.

7 All computed statistics are rounded to the closest unit: calculation of population totals based on them produces results that are slightly different from the official figures (at most in the order of less than 20,000 for the US). However, whenever needed to facilitate the reading of the argument, we will use our computed results rather than the official ones.

Table 1. Descriptive Statistics for Population Size at each Selected Geographic Unit of Analysis across UK Countries

UK Country	Unit of Analysis	N	Mean	SD	Min–Max Population
England	LSOA[a]	32,482	1,514	204	963–6,522
Wales		1,896			
Scotland	DZ[b]	6,505	778	157	347–2,795
Northern Ireland	Ward[c]	582	2,896	1,145	761–9,572
Total GB	*LSOA/DZ*	*40,883*	*1,397*	*197*	*347–6,522*
Total UK	**LSOA/DZ/Ward**	**41,465**	**1,418**	**238**	**347–9,572**

[a] Source: Our analysis of Census data: Table "CS001 – Age by sex and resident type (nomis_2018_05_17_004051.xls)". Retrieved from <http://www.nomisweb.co.uk/query/construct/submit.asp?menuopt=201&subcomp=> (Accessed 17 May 2018).

[b] Source: Our analysis of data: "Table 1 Estimated population by sex, five year age group and data zone area: 30 June 2000 (9600sape-t1-all.xls)". Retrieved from <https://www.nrscotland.gov.uk/files/statistics/9600sape-t1-all.xls> (Accessed 17 May 2018).

[c] Source: Our analysis of Census data: Table "uv096_ward.xls". Retrieved from <http://www.ninis2.nisra.gov.uk/public/Theme.aspx?themeNumber=135&themeName=Census+2001> (Accessed 17 May 2018).

In the US we selected the census tract as unit of analysis and, for the 2000 Census, the country consisted of a total of 65,443 units, with a total population ranging 0–36,146 and a standard deviation equal to 2,142 – a clear sign of the presence of outliers (see Table 2).

Table 2. Descriptive Statistics Total US Census Tract Population in Selected Distributions of the Universe

Percentage of Census Tracts (Upper — Lower Bound)	N	Mean	SD	Min–Max
100% (0.0 – 100.0%)	**65,443**	**4,300**	**2,142**	**0 – 36,146**
99% (0.5 – 99.5%)	64,753	4,271	1,981	1 – 12,065
95% (2.5 – 97.5%)	62,176	4,226	1,747	891 – 9,105

We investigated how severe the presence of outliers was and, for diagnostic purposes, we checked univariate statistics for both the 99% and 95% distribution (see 3rd and 4th row of Table 2): there is little change in the value of the mean for the full universe compared to those of the two curtailed sub-universes *vis-a-vis* substantial changes in the relative SDs and ranges. In the worst case scenario, outliers were confined within 5% of the universe, whereas 95% of it had almost the same range as that for the UK (i.e. 347–9,572), with almost three times the average unit size as the UK one, although their respective dispersions were substantially different.

We retained the entire universe of 65,443 units for the successive analytic steps, which was a little more than 1.5 times the UK universe size.

3.2. SELECTION OF MEASURES

The inverse relation between the complexity of a synthetic index and its trans-national validity emerges fully when deciding which neighbourhood characteristics should be considered. In creating ILARD, we followed the literature and chose basic socio-economic traits relative to six concepts, namely: poverty, unemployment, welfare/public assistance, female-headed households, educational and occupational structure. We reprised the Index of Neighbourhood Disadvantage from Wodtke and colleagues (2011), which in turn reflects the larger literature on the ecology of disadvantage (Krieger et al., 2003). All original variables measuring those concepts belonged either to national censuses (i.e. 2001 UK Census, and 2000 US Census) or administrative sources (for the UK only). All of them were aggregations at the specific geographic level selected for each country (e.g. for England and Wales all variables were extracted at the LSOA level, for Scotland at the DZ level, etc), and in this sense we were somewhat bound to data availability.

We operationalised the above six concepts into seven indicators that we list in Table 3 below:

Table 3. Concepts and Relative Indicators for All Countries

Concept	*Indicator*
Poverty	*Proportion of persons below poverty level*
Unemployment	*Proportion of persons 16+ y.o. in labor force and unemployed*
Welfare/Public Assistance	*Proportion of households receiving welfare/public assistance*
Female-Headed Households	*Proportion of households with own children who are female-headed*
Education	*Proportion of persons 25+ y.o. with no academic title attained*
	Proportion of persons 25+ y.o. with high academic title attained
Occupation	*Proportion of persons 16+ y.o. employed in professional/managerial positions*

When transforming those indicators into variables, we encountered some cross-country differences, in particular for “poverty” and “education”. No variable for “poverty” was available in the UK data sources, which reduced the number of intermediate measures to be combined into ILARD to six. We reasoned, however, that the measure we chose for “welfare/public assistance” (i.e. “Unadjusted Means-tested Benefits Rate” or UMBR; see details below), which is a measure of unemployment and other means-tested benefits, could be a proxy for “poverty” as means-tested benefits imply. However, benefits are more generous in the UK than US and they reach a larger proportion of the targeted group (see Table 5).

The concept of “education” was operationalised differently in the UK and US census (i.e. “qualifications levels” vs “educational attainment”). Moreover, within the UK the relative variables had a different sensitivity of scale among:

- England and Wales, i.e. from 'no qualifications' through 'qualifications level 4 and 5',
- Scotland, i.e. from 'no qualifications' through 'qualifications level 4',
- Northern Ireland, i.e. from 'no qualifications' through 'qualifications level 5'.

- Hence, for content-equivalence we stipulated for the two following educational indicators: *No*

academic title attained corresponded to the combination of 'no qualifications + qualifications of level 1' in the UK, and 'completion of 0-12 years of school but no diploma' in the US;

- *High academic title attained* corresponded to 'qualifications of level 4 or more' in the UK, and 'bachelors or graduate/professional degree' in the US.

In the next two sub-sections, we give full details on the extracted variables corresponding to the above indicators, and the creation of the intermediate measures to be combined into ILARD separately for the UK and US (the entries are reported as "*Indicator*: variable label (VARIABLE NUMBER/NAME)").

3.2.1. UNITED KINGDOM

In the UK, we selected all the variables from the year 2001. There were no available variables to create an ecological measure of "poverty" comparable to the one for the US. The final list was then reduced to a total of six measures: unemployment, welfare/public assistance, female-headed households, education – both 'no academic title attained' and 'high academic title attained', and occupation. All variables, except those to create a measure of welfare/public assistance (see below), came from the UK Census. They were retrieved separately from the four countries, at their selected level of (dis)aggregation of the unit of analysis, from the portal <http://casweb.mimas.ac.uk> at two sub-pages:

- Link 1 (for Scotland) – 2001 Aggregate Statistics Datasets (with digital boundary data) <http://casweb.mimas.ac.uk/2001/start.cfm>;
- Link 2 (for England, Wales and Northern Ireland) – 2001 Aggregate Statistics Datasets for Super Output Area (SOA) Geography <http://casweb.mimas.ac.uk/2001_SOA/start_SOA.cfm>.

The computation of the final measures then consisted in selecting the pertinent counts (or sum of counts) weighted by their relative total. Because of measurement difference (i.e. sensitivity of scale, labelling, order of categories) we performed these operations for each UK country separately. We then created the six final measures to be combined into the ILARD in the following way (see also Table 4 on the next page):

Proportion of persons 16+ y.o. in labor force and unemployed: proportion of people aged 16-74 who are economically active and unemployed. For this measure we used five original variables taken from the Census Table labeled “Economic Activity – KS09a”, that is (see 2nd row of Table 4):

1) Count of people employed part-time (KS09a_0002);
2) Count of people employed full-time (KS09a_0003);
3) Count of people self-employed (KS09a_0004);
4) Count of people unemployed (KS09a_0005);
5) Count of full-time students (KS09a_0006).

Then the final computation consisted in: KS009a_0005/(KS09a_0002 + KS09a_0003 + KS09a_0004 + KS09a_0006).

Table 4. UK 2001 Census Downloaded Variables

Concept **(UK Census Table)**	**England**	**Wales**	**Scotland**	**Northern Ireland**
	Variable (Variable Number in the Census Table)			
Unemployment (Economic Activity – KS09a)	1. part time emp (0002) 2. full time emp (0003) 3. self emp (0004) 4. unemp (0005) 5. full time stud (0006)	1. part time emp (0002) 2. full time emp (0003) 3. self emp (0004) 4. unemp (0005) 5. full time stud (0006)	1. part time emp (0002) 2. full time emp (0003) 3. self emp (0004) 4. unemp (0005) 5. full time stud (0006)	1. full time emp (0002)[a] 2. part time emp (0003) 3. self emp (0004) 4. unemp (0005) 5. full time stud (0006)
Female Headed HHs ("Household Composition – KS02**0**" and "Lone Parent Household with Dependent Children – KS02**2**")	1. married couple HHs with dependent children (_0006) 2. cohabiting couple HHs with dependent children (_0009) 3. lone parent HHs with dependent children (_0011) 4. other HHs with dependent children (_0013) 5. tot. female lone parent HHs with dependent children (**ks022**0005)	1. married couple HHs with dependent children (_0006) 2. cohabiting couple HHs with dependent children (_0009) 3. lone parent HHs with dependent children (_0011) 4. other HHs with dependent children (_0013) 5. tot. female lone parent HHs with dependent children (**ks022**0005)	1. married couple HHs with dependent children (_0006) 2. cohabiting couple HHs with dependent children (_0009) 3. lone parent HHs with dependent children (_0011) 4. other HHs with dependent children (_0013) 5. tot. female lone parent HHs with dependent children (**ks022**0005)	1. married couple HHs with dependent children (_0006) 2. cohabiting couple HHs with dependent children (_0009) 3. lone parent HHs with dependent children (_0011) 4. other HHs with dependent children (_0013) 5. tot. female lone parent HHs with dependent children (**ks022**0005)
Education (Qualifications and Students – KS013)	1. all people 16-74 yo (0001) 2. no qualifications (0002) 3. quals. level 1 (0003) 4. quals. level 4 and 5 (0006)	1. all people 16-74 yo (0001) 2. no qualifications (0002) 3. quals. level 1 (0003) 4. quals. level 4 and 5 (0006)	1. all people 16-74 yo (0001) 2. no qualifications (0002) 3. quals. level 1 (0003) 4. quals. level 3 (0005)[a] 5. quals. level 4 (0006)	1. all people 16-74 yo (0001) 2. no qualifications (0002) 3. quals. level 1 (0003) 4. quals. level 4 (0006)[b] 5. quals. level 5 (0007)
Occupation (Occupation Groups – KS012a)	1. all people 16-74 yo in employment (0001)	1. all people 16-74 yo in employment (0001)	1. all people 16-74 yo in employment (0001)	1. all people 16-74 yo in employment (0001) 2. managers and sen. officials (0002)

	2. managers and sen. officials (0002) 3. professional occups (0003)	2. managers and sen. officials (0002) 3. professional occups (0003)	2. managers and sen. officials (0002) 3. professional occups (0003)	3. professional occups (0003)
Notes	---	---	[a] *There is no Level 5. In the Note to the original Table, the use of "Group" and "Level" is confusing, e.g.: "Group 3: HND, HNC, RSA, Higher Diploma, SVQ level 4 or 5 or equivalent.* *Group 4: First Degree, Higher Degree, Professional Qualifications."* [b] *The OAs□DZs key for aggregation is available (42,604□6,505).*	[a] *"Full time" and "Part time" switched position/numbering compared to other 3 countries.* [b] *Level 4 and 5 are in separate cols/vars.*

Proportion of households receiving welfare/public assistance (not shown in Table 4): the "Unadjusted Means-tested Benefits Rate (UMBR)", created by Fenton (2013) for Great Britain and revalidated in further research on neighbourhood poverty (Gambaro et al. 2013). This is the proportion of households where there is at least one claimant of certain benefits: Job Seeker's Allowance (JSA), Employment Support Allowance (ESA), Income Support (IS), and Pension Credit (PC) Guarantee Element. The dataset is freely available (<http://eprints.lse.ac.uk/61169>). We followed the same methodology, and retrieved the variables to create UMBR for Northern Ireland (<https://www.nisra.gov.uk>): in this case, differences in welfare policies compared to GB, and data limitations, reduced the pool of available claimants to only those for JSA and/or IS – a (compositional) difference with GB that did not seem to have (computational) consequences in the creation of ILARD, as shown below under Methodology. The final computation of this measure in Northern Ireland was therefore: (JSA + IS)/ Total Number of Households.

Proportion of households with own children who are female-headed: the proportion of female lone parent households with dependent children required five variables taken from two Census tables, i.e. "Household Composition – KS020" and "Lone Parent Household with Dependent Children – KS022)", as shown in the 3rd row of Table 4:

1) Count of married couple households with dependent children (KS020_0006);
2) Count of cohabiting couple households with dependent children (KS020_0009);
3) Count of lone parent households with dependent children (KS020_0011);
4) Count of other households with dependent children (KS020_0013);
5) Total female lone parent households with dependent children (KS022_0005).

The final rate was computed as: KS022_0005/(KS020_0006 + KS020_0009 + KS020_0011 + KS020_0013).

Proportion of persons 25+ y.o. with no academic title attained: the proportion of people aged 16-74 with 'no' or 'level-1' academic qualification. This was computed out of three variables from the Census Table "Qualifications and Students – KS013", namely:

1) Total of all people 16-74 yo (KS013_0001);
2) Count of people with no qualifications (KS013_0002);
3) Count of people with level 1 qualifications (KS013_0003).

The final computation was then: (KS013_0002 + KS013_0003)/KS013_0001.

Proportion of persons 25+ y.o. with high academic title attained: proportion of people aged 16-74 with academic qualifications of 'level 4 or more'. The process for creating this measure was the same as the previous one, with the *caveat* that:

1) For England and Wales, we retrieved “Count of people with qualifications of level 4 and 5 (KS013_0006)” and computed the final rate as KS013_0006/KS013_0001;
2) For Scotland, the corresponding highest level was “Count of people with qualifications of level 4 (KS013_0006)”, and since the variable(s) number were the same, the final rate was computed as before, i.e. KS013_0006/KS013_0001;
3) For Northern Ireland, we used instead both “Count of people with qualifications of level 4 (KS013_0005)” and 'Count of people with qualifications of level 5 (KS013_0006)', and then computed the final measure as (KS013_0005 + KS013_0006)/KS013_0001.

Proportion of persons 16+ y.o. employed in professional/managerial positions: the proportion of people aged 16-74 in employment working as 'managers and senior officials' or in 'professional occupations'. For this measure we referred to the UK Census Table labelled as “Occupation Groups – KS012a” and select the following three variables:

1) Total of all people aged 16-74 in employment (KS012a_0001);
2) Count of people employed as managers and senior officials (KS012a_0002);
3) Count of people employed in professional occupations (KS012a_0003).

The final measure was then computed as (KS012a_0002 + KS012a_0003)/ KS012a_0001.

3.2.2. UNITED STATES

All the original variables for the US were extracted from the Neighborhood Change Data Base (NCDB) developed by GeoLytics, Inc. in association with The Urban Institute (see <http://www.geolytics.com/USCensus,Neighborhood-Change-Database-1970-2000,Products.asp>). The NCDB includes US Census ecological data, aggregated at a different levels of local geography, relative to the years 1970, 1980, 1990, and 2000. We used the batch from the year 2000. The final seven measures to combine into the ecological index were then a mix of extracted variables and computed measures, as we report below.

Proportion of persons below poverty level: proportion of total persons below poverty level last year (POVRAT0).

Proportion of persons 16+ y.o. in labor force and unemployed: proportion of persons 16+ years old who are in the civilian labor force and unemployed (UNEMPRT0).

Proportion of households receiving welfare/public assistance: proportion of households with public assistance income (including SSI) last year (WELFARE0).

Proportion of households with own children who are female-headed: proportion of families and subfamilies with own children who are female-headed (FFH0);

Proportion of persons 25+ y.o. with no academic title attained: proportion of persons 25+ years old who have completed 0-12 years of school but no diploma. This measure was computed using three original measures:

1) Count of persons 25+ years old who have competed 0-8 years of school (EDUC80);
2) Count of persons 25+ years old who have completed 9-12 years of school but no diploma (EDUC110);
3) Total persons 25+ years old (EDUCPP0).

The final variable was computed then as “(EDUC80 + EDUC110)/EDUCPP0”.

Proportion of persons 25+ y.o. with high academic title attained: proportion of persons 25+ years old who have a bachelors or graduate/professional degree. This measure was computed extracting one additional variable, namely “Count of persons 25+ years old who have a bachelors or graduate/professional degree (EDUC160)”.

Then, using the total from above, the final computation was “EDUC160/EDUCPP0”.

Proportion of persons 16+ y.o. employed in professional/managerial positions: proportion of persons 16+ years old employed "in professional and technical occupations" and "as executives, managers, and administrators (excluding farms)". The computation involved nine original variables:

1) Count of persons 16+ years old employed in professional and technical occupations (OCC10);
2) Count of persons 16+ years old employed as executives, managers, and administrators, excl. farms (OCC20);
3) Count of persons 16+ years old employed as sales workers (OCC30);
4) Count of persons 16+ years old employed as administrative support and clerical workers (OCC40);
5) Count of persons 16+ years old employed as precision production, craft, and repair workers (OCC50);
6) Count of persons 16+ years old employed as operators, assemblers, transportation, and material moving workers (OCC60);
7) Count of persons 16+ years old employed as nonfarm laborers (OCC70);
8) Count of persons 16+ years old employed as service workers (OCC80);
9) Count of persons 16+ years old employed as farm workers or in forestry and fishing (OCC90).

The final variable was computed as "[(OCC10 + OCC20)/(OCC10 + OCC20 + OCC30 + OCC40 + OCC50 + OCC60 + OCC70 + OCC80 + OCC90)]".

3.3. ANALYTICAL STEPS

Once we had created the (intermediate) measures – six for the UK, seven for the US – we ran seven rounds of analysis: one for each UK country; one for Great Britain; one for the whole United Kingdom; and one for the whole United States. For each of the seven analytic cycles, we first compared univariate and bivariate statistics, and then ran Principal Component Analysis (PCA) to create the Index of Local Area Relative Disadvantage.

PCA captures the correlation among all measures and summarises it into one or more components. Such correlation, mostly referred to as commonality, is what indicates the "relative social disadvantage". Each geographic unit is then assigned a component score representing its rank on the index (Joliffe, 2002). Criteria were set to extract components with eigenvalue '$\lambda > 1$'. However, PCA is sensitive to (sub-)universe/(sample) size, which for the UK meant a greater impact of England in the

creation of ILARD, and for the US a higher likelihood to extract a larger commonality from its corresponding set of the measures. This, in conjunction with the highlights from the other stages, (i.e. cross-country heterogeneity of units of analysis, different number of measures between the UK and US, cross-country different approximation to a multivariate normal distribution), led us to replicate the PCA within the UK to check the stability of the results.

4. RESULTS

We present the results starting with the descriptive analysis followed by the PCA. Within each sub-section, we first present the within-UK comparison, and then that between the UK and US. To note that the data for the US had missing data on 474 tracts (about 0.7% of the universe): we ran all the relative analyses with the listwise deletion option on the analytic (sub-)universe size of 64,969 census tracts.

Table 5. Comparison of Univariate Statistics Across All Countries

Measure (Proportion of …)		England N=32,482	Wales N=1,896	Scotland N=6,505	N. Ireland N=582	GB N=40,883	UK N=41,565	US N=64,969
… persons below poverty level[a]	*Mean*	—	—	—	—	—	—	.13
	SD							.12
	Min-Max							.00–1.00
… persons unemployed	*Mean*	.05	.06	.07	.07	.06	.06	.07
	SD	.04	.03	.05	.05	.04	.04	.06
	Min-Max	.00– .35	.01– .22	.00– .37	.01– .29	.00– .37	.00– .37	.00–1.00
… HHs receiving welfare/public assistance	*Mean*	.20	.24	.23	.33	.21	.21	.09
	SD	.14	.13	.16	.18	.15	.15	.08
	Min-Max	.00–1.00	.03– .79	.00–1.00	.04–1.13[b]	.00–1.00	.00–1.13[b]	.00–2.00[c]
… female-headed HHs	*Mean*	.19	.21	.22	.19	.20	.20	.25
	SD	.11	.10	.14	.12	.12	.12	.16
	Min-Max	.00– .66	.03– .63	.00– .71	.02– .58	.00– .71	.00– .71	.00–1.00
… persons with no academic title attained	*Mean*	.46	.49	.59	.60	.48	.48	.21
	SD	.13	.12	.17	.11	.15	.15	.14
	Min-Max	.02– .82	.07– .78	.07– .89	.12– .88	.02– .89	.02– .89	.00–1.00
… persons with high academic title attained	*Mean*	.20	.17	.26	.15	.21	.20	.23
	SD	.12	.09	.14	.07	.12	.12	.17
	Min-Max	.02– .72	.02– .52	.05– .75	.02– .56	.02– .75	.02– .75	.00–1.00
… persons in professional/managerial positions	*Mean*	.26	.22	.22	.20	.25	.25	.31

Measure (Proportion of …)		England N=32,482	Wales N=1,896	Scotland N=6,505	N. Ireland N=582	GB N=40,883	UK N=41,565	US N=64,969
	SD	.11	.09	.12	.08	.11	.11	.14
	Min-Max	.04– .67	.04– .57	.02– .68	.05– .58	.02– .68	.02– .68	.00–1.00

[a] Not available in the UK.

[b] Two wards in Northern Ireland had a proportion greater than 1.

[c] Five census tracts in the US had a proportion greater than 1.

4.1. DESCRIPTIVE ANALYSIS

The univariate statistics across the four UK countries are in general quite similar. Scotland and Northern Ireland present the largest differences on the averages of some measures (see Table 5).

Those differences are more evident if compared to the averages for either Great Britain or UK, which in turn are (almost) equal: Scotland presents higher averages on both educational measures (i.e. '.59 and .26' vs the means for the UK of '.48 and .20'); Northern Ireland shows higher means on both "welfare/public assistance" and people with "no academic title attained" compared to the national average (i.e. .'33 and .60' vs '.21 and .48').

Across all four UK countries, it does not appear that there is any sign of MAUP effects, in particular in Northern Ireland for which we had selected a larger unit of analysis (in terms of average population size) than the GB countries (see Table 1 above). The relative standard deviations seem to be in line with those of the other three countries singularly taken and the one for the overall GB: some SDs for Northern Ireland are higher, some are the same, others are lower – as one would expect.

In the UK-US comparison, we found that the measure of "welfare/public assistance" presents an inconsistency common to both countries, an upper limit greater than '1.00', which pertained to five units in the US and two in the UK (specifically, two wards in Northern Ireland) respectively: given the modest number of units affected we did not subject them to any "shrinkage" procedure.

From a more substantive point of view, the most marked distributional differences refer to the three measures of: "welfare/public assistance", "no academic attainment", and "professional/managerial positions". For the first two measures, the UK average proportions are more than double the corresponding ones in the US (i.e. '.21 vs .09' and '.48 vs .21' respectively), although on "welfare/public assistance" (only) there is also a difference in their relative dispersion (i.e. 'UK_{SD} = .15' vs 'US_{SD} = .08'). In the case of the third measure instead, it is the UK that shows a smaller proportion of "professional/managerial positions" than the US (i.e. .25 vs .31).

The bivariate correlations across the UK countries appear quite similar too (for an easier comparison we juxtaposed the four correlation matrices in Table 6 on the next page, and we omitted the

correlations for Great Britain since they are identical to those for the whole UK presented in Table 7). There is a complete match in the direction of all associations, where both measures of “advantage” (i.e. “high academic title attained” and “professional/managerial positions”) correlate negatively with the remaining ones and, as expected, positively to one another. Moreover, the magnitude of most correlations are quite close across the four sets: the most notable differences are (see underlined cells in Table 6) are: the lower correlation between “female-headed HHs” and “welfare/public assistance” in Northern Ireland, but above all the lower magnitudes of the correlations for educational measures in England. Of course, since this the largest sub-universe, the correlations for the whole of the UK look more similar to the English ones than those from the other three countries (see “UK” in Table 7). However, the overall tendency is that higher correlations within one country tend to be higher also in the others.

Table 6. Comparison of Bivariate Correlations Across the Four UK Countries[a]

Measure (Proportion of …)	England (N=32,482)						Wales (N=1,896)					
	(1)	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***	***(1)***	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***
(1) … persons unemployed	—						—					
(2) … HHs receiving welfare/public assistance	.90	—					.87	—				
(3) … female-headed HHs	.73	.79	—				.77	.84	—			
(4) … persons with no academic title attained	.51	.58	.46	—			.66	.73	.62	—		
(5) … persons with high academic title attained	-.32	-.39	-.32	-.91	—		-.59	-.65	-.58	-.91	—	
(6) … persons in professional/managerial positions	-.49	-.55	-.51	-.90	.90	—	-.58	-.64	-.59	-.86	.93	—

Measure (Proportion of …)	Scotland (N=6,505)						Northern Ireland (N=582)					
	(1)	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***	***(1)***	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***
(1) … persons unemployed	—						—					
(2) … HHs receiving welfare/public assistance	.86	—					.91	—				
(3) … female-headed HHs	.76	.80	—				.76	.66	—			
(4) … persons with no academic title attained	.60	.70	.56	—			.60	.64	.53	—		
(5) … persons with high academic title attained	-.58	-.67	-.55	-.97	—		-.52	-.58	-.44	-.96	—	
(6) … persons in professional/managerial positions	-.55	-.62	-.56	-.91	.94	—	-.50	-.54	-.45	-.91	.95	—

[a] All correlations are statistically significant at $p = .000$.

Table 7. UK-US Comparison of Bivariate Correlations[a]

Measure (Proportion of …)	UK (N=41,565)							US (N=64,969)						
	(1)	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***	***(7)***	***(1)***	***(2)***	***(3)***	***(4)***	***(5)***	***(6)***	***(7)***
(1) … persons below poverty level[b]	—							—						
(2) … persons unemployed	—	—						.69	—					
(3) … HHs receiving welfare/public assistance	—	.89	—					.75	.63	—				
(4) … female-headed HHs	—	.74	.79	—				.66	.53	.65	—			
(5) … persons with no academic title attained	—	.54	.61	.49	—			.70	.53	.69	.47	—		
(6) … persons with high academic title attained	—	-.36	-.44	-.35	-.80	—		-.42	-.35	-.49	-.37	-.70	—	
(7) … persons in professional/managerial positions	—	-.51	-.58	-.52	-.88	.86	—	-.48	-.38	-.49	-.38	-.71	.92	—

[a] All correlations are statistically significant at $p = .000$.

[b] Not available for the UK.

The correlations in the UK and US, among the six measures they have in common (see highlighted cells in Table 7 above), present general characteristics analogous to those reported for the within-UK comparison. At a more granular level, each country has some stronger correlations (on some measures) compared to the other, but the overall tendency is that either their corresponding correlations are very close (e.g. those relative to both educational measures), or the ones for the UK are somewhat higher than those in the US. Even in this comparison we can observe the same trend noted previously on corresponding correlations in the two nations: higher correlations in the UK tend to be higher in the US too.

4.2. MULTIVARIATE ANALYSIS

We ran PCA to create ILARD for all geographic levels in UK (i.e. the four countries, Great Britain, and the whole of the UK) and for the whole US. Across all countries, the measures showed (almost) identically high internal consistency as measured by Cronbach's alpha, ranging from '.87-.92'[8]. We set the criterion to extract components with eigenvalue '$\lambda > 1$'. The results were quite robust across all runs, and PCA extracted generally two components, with the exception of Wales and Scotland, where only one principal component with '$\lambda > 1$' was extracted. The decision regarding how to select the ILARD was then based on the comparison of results obtained both within the UK and across the UK and US.

In Table 8 (on the next page) we report the results of the PCA. We begin with those relative to the runs within the UK: the components extracted for each of the four countries reproduce cumulatively between more than three quarters (in Wales and Scotland) and more than nine tenths (in England and Northern Ireland) of the total variation of the original measures. If we take into consideration only the first Principal Component (PC-1) extracted, the minimum amount of variation reproduced is still above two thirds (i.e. '68.4' in England).

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8 In detail: for the UK, '$alpha_{Eng.}$ = .89', '$alpha_{Wales}$ = .91', '$alpha_{Scot.}$ = .92', and '$alpha_{NI}$ = .87', '$alpha_{GB}$ = .89', and '$alpha_{UK}$ = .89'; for the US, '$alpha_{US}$ = .88'.

Table 8. Comparison of Factor Loadings on Principal Components (PC) Extracted with Eigenvalue 'λ > 1' Across All Countries

Measure (Proportion of …)	England N=32,482		Wales[a] N=1,896		Scotland[a] N=6,505		N. Ireland N=582		GB N=40,883		UK N=41,465		US N=64,969	
	PC-1	*PC-2*	*PC-1*	*PC-2*	*PC-1*	*PC-2*	*PC-1*	*PC-2*	*PC-1*	*PC-2*	*PC-1*	*PC-2*	*PC-1*	*PC-2*
… persons below poverty level[b]	—	—	—	—	—	—	—	—	—	—	—	—	.85	.33
… persons unemployed	.79	.52	.85	—	.83	—	.83	.49	.81	.48	.81	.48	.85	.39
… HHs receiving welfare/public assistance	.85	.46	.90	—	.89	—	.85	.39	.86	.42	.86	.41	.85	.25
… female-headed HHs	.76	.48	.83	—	.80	—	.74	.47	.78	.45	.78	.45	.72	.38
… persons with no academic title attained	.89	-.39	.91	—	.92	—	.92	-.33	.87	-.36	.87	-.36	.87	-.18
… persons with high academic title attained	-.79	.59	-.89	—	-.91	—	-.89	.45	-.76	.57	-.77	.57	-.76	.60
… persons in professional/managerial positions	-.88	.39	-.88	—	-.88	—	-.87	.45	-.88	.40	-.88	.40	-.78	.57
Percentage Variance Reproduced by Component	**68.4**	**22.7**	**76.9**	**—**	**76.0**	**—**	**72.2**	**18.7**	**68.9**	**20.3**	**68.9**	**20.2**	**63.6**	**16.8**

[a] The runs for Wales and Scotland extracted only one Principal Component (PC) with 'λ > 1'.

[b] Not available for the UK.

The factor loadings across the first PCs (for all four countries) and the second PCs (for England and Northern Ireland only) are consistent in their direction and very close without exception: e.g. the largest differences (in absolute value) on both PC-1 and PC-2 are |.11| (between the run for England and that of Scotland, '-.79' and '-.91' respectively) and |.14| (between England and Northern Ireland, '.59' and '.45' respectively) both on the measure “high academic title attained”. All the differences on the loadings become smaller when compared to those relative to the runs of both GB and UK, which in turn are interchangeable.

However, before discussing whether to use one or two principal components, we move to a discussion of the remaining results of Table 8.

An analogous picture emerges for the UK-US comparison: notwithstanding the fact that the US run includes the additional poverty measure, the underlined structure of relationships (of both sets of measures) captured by the extracted components is strikingly similar in all of the terms depicted above, i.e. variation reproduced by the components, identical direction and close magnitude of factor loadings (the larger difference is |.10| for PC-1 on the measure “professional/managerial positions”, whereas on PC-2 the largest difference is |.18| on “no academic title attained”).

In view of these similarities across all runs, and the further ones that we are about to present, we focus the discussion on the UK and US.

The main body of the table shows that in both countries all the measures have very high loadings on the first component. However, only in the US both “high academic title attained” and “professional/managerial positions” also have medium loading values on the second component. When comparing these two measures across components, the loadings on the first are sensibly larger (in absolute value) than those on the second (respectively '|.76| and |.78|' vs. '|.60| and |.57|'). In other words, the second component seems to mainly reproduce some residual variation of those two measures, and only in the US. This may not be enough to warrant its use.

In summary, the first principal component not only captured a large amount of commonality among the original measures, but it did so consistently across all runs.

Hence, we selected the first principal component to represent “the” Index of Local Area Relative Disadvantage (ILARD) in both the UK and the US. The sign of the component loadings helped identifying the semantic polarity of the index: the two measures of advantage (i.e. “high academic title attained” and “professional/managerial positions”) show negative loadings, whereas the remaining measures indicating disadvantage have positive loadings. Therefore, we interpret the underlying continuum of ILARD as “Non-Disadvantage vs. Disadvantage”.

4.3. UK-US DESCRIPTIVE COMPARISON ON ILARD

The distribution of the ILARD for both the UK and the US is shown in Table 9 below. The US version of the index has a wider range than the one for the UK (i.e. '-2.78–6.83' vs. '-2.81–4.12' respectively), although the most extreme values are confined within 1% (i.e. top and bottom 0.5%) in both universes. The distributions are quite similar for both countries, in particular if we consider the portion included between the 1st and the 99th percentile. The averages of the index do not coincide with their relative 50th percentile (-.11 vs -.12 respectively for UK and US) although they are very close to it and (almost) identical, that is: 'ILARD = 0' lies between the 54th–55th percentile in the UK, and between the 55th–56th percentile in the US. The index, however, is an interval measure that ranks geographic areas in terms of lower/greater incidence of social disadvantage rather than as a ratio scale, that is: an area with a score of '1.5' is not three times as disadvantaged as an area that scores '0.5', although one can claim that the distance between the two areas in terms of disadvantage is '1' (standard deviation).

Table 9. US-UK Comparison of Percentile Distribution of ILARD

Percentile	UK (N=41,465)	US (N=64,969)
.5	-2.17	-1.92
1.0	-2.00	-1.83
2.5	-1.74	-1.65
5.0	-1.49	-1.46
25.0	-0.72	-0.68
50.0	**-0.11**	**-0.12**
75.0	0.66	0.52
95.0	1.78	1.90
97.5	2.11	2.34
99.0	2.50	2.90
99.5	2.79	3.28
Percentile of Mean (i.e. ILARD = 0)	***54–55***	***55–56***
Min–Max	**-2.81 – 4.12**	**-2.78 – 6.83**

Table 10. US-UK Comparison of Means[a] (Standard Deviation in Parentheses) of Measures (Proportion of ...) within ILARD Deciles[b]

ILARD Decile	... persons below poverty level[c]		... persons unemployed		... HHs receiving welfare/public assistance		... female-headed HHs		... persons with no academic title attained		... persons with high academic title attained		... persons in professional/ managerial pos.	
	UK	*US*	*UK*	*US*	*UK*	*US*	*UK*	*US*	*UK*	*US*	*UK*	*US*	*UK*	*US*
1	—	.04 (.03)	.03 (.01)	.03 (.02)	.07 (.05)	.02 (.01)	.10 (.06)	.11 (.06)	.25 (.07)	.04 (.03)	.43 (.11)	.58 (.11)	.46 (.06)	.59 (.09)
2	—	.05 (.04)	.03 (.01)	.03 (.02)	.09 (.05)	.03 (.02)	.11 (.06)	.15 (.08)	.34 (.06)	.08 (.03)	.31 (.08)	.40 (.09)	.36 (.04)	.46 (.07)
3	—	.06 (.05)	.03 (.01)	.04 (.02)	.11 (.06)	.04 (.02)	.13 (.07)	.17 (.08)	.39 (.06)	.11 (.04)	.26 (.08)	.30 (.09)	.31 (.04)	.38 (.07)
4	—	.08 (.05)	.03 (.01)	.04 (.03)	.12 (.06)	.05 (.02)	.14 (.07)	.18 (.09)	.43 (.06)	.14 (.04)	.22 (.07)	.23 (.09)	.27 (.04)	.32 (.07)
5	—	.09 (.05)	.04 (.02)	.05 (.02)	.14 (.06)	.06 (.02)	.16 (.07)	.20 (.09)	.47 (.07)	.17 (.05)	.19 (.07)	.19 (.09)	.24 (.04)	.28 (.07)
6	—	.11 (.06)	.04 (.02)	.05 (.03)	.18 (.07)	.07 (.03)	.18 (.07)	.23 (.10)	.50 (.07)	.20 (.05)	.17 (.07)	.17 (.08)	.22 (.04)	.26 (.07)
7	—	.14 (.06)	.06 (.02)	.06 (.03)	.22 (.07)	.09 (.03)	.22 (.07)	.25 (.10)	.54 (.07)	.24 (.06)	.15 (.07)	.15 (.08)	.20 (.05)	.24 (.06)
8	—	.18 (.06)	.07 (.02)	.08 (.04)	.28 (.08)	.11 (.04)	.26 (.08)	.29 (.12)	.58 (.08)	.29 (.08)	.13 (.06)	.13 (.07)	.17 (.05)	.22 (.07)
9	—	.24 (.07)	.09 (.03)	.10 (.05)	.36 (.08)	.15 (.05)	.30 (.08)	.36 (.14)	.63 (.08)	.35 (.10)	.11 (.05)	.11 (.06)	.14 (.04)	.20 (.07)
10	—	.37 (.11)	.14 (.05)	.17 (.09)	.50 (.12)	.26 (.11)	.39 (.10)	.51 (.20)	.69 (.08)	.46 (.13)	.09 (.04)	.07 (.05)	.11 (.04)	.16 (.08)
Total	**—**	**.13 (.12)**	**.06 (.04)**	**.07 (.06)**	**.21 (.15)**	**.09 (.08)**	**.20 (.12)**	**.25 (.16)**	**.48 (.15)**	**.21 (.14)**	**.20 (.12)**	**.23 (.17)**	**.25 (.11)**	**.31 (.14)**

[a] The means for all measures in both countries exhibit a perfect monotonic pattern within the deciles of the index. However, because of the rounding (up or down) to the second decimal point, some cells show the same value in contiguous deciles.

[b] Size of decile: UK = 4,146/7; US = 6,496/7. [c] Not available for the UK.

Moreover, Table 10 displays means and standard deviations of the original measures computed within the deciles of ILARD: each measure shows a perfect monotonicity with respect to the index. Apart from being a further consistency check, overall these results constitute an interpretative aid for ILARD since they help establish testable thresholds when needed during the investigation.

5. CONCLUSIONS

In the present working paper we make the case for using the Index of Local Area Relative Disadvantage (ILARD) in trans-national research on neighbourhood effects. We created ILARD as a measure to be used in the ESRC-funded project *Home moves in the early years: The impact on children in UK and US*.

Compared to existing measures of deprivation in UK – such as the IMD, which was not conceived to be internationally compatible by virtue of its pragmatic ties to policy intervention, theoretical elaboration, and methodological sophistication – ILARD has been constructed with a comparative goal in mind. The methodological problems affecting neighbourhood research (e.g. the MAUP, selection of content-equivalent measures, their technical synthesis, etc.) have been reconsidered within a trans-cultural framework of investigation. The overall approach embodies a trade-off between complexity and exportability (of the index). Within these limits, any step after the positing of the research question, from the selection of the unit(s) of analysis to the use of a specific analytical technique, should (ideally) have a margin of (re)negotiation, in order to maximise content-equivalence.

The ILARD identifies and ranks geographic areas of residence in terms of their socio-economic disadvantage along the continuum “Non-Disadvantage vs. Disadvantage”. As such, it is an interval scale (not a ratio scale) that allows the computation of distances among areas placed at different levels on its conventional scale: it works consistently in each UK country, and across the UK and US.

Our replicated analyses support the inference that Index of Local Area Relative Disadvantage is cross–nationally valid. The indices created for both the UK and the US exhibit: (almost) equal patterns in the component loadings of the constitutive measures; very similar high percentages of total variation (of the original set measures) reproduced; and substantially the same distribution.

From a methodological standpoint, the overall stability of results is also an indirect sign of the absence of MAUP consequences in our research. Any there may be do

not seem to be substantial enough to obstruct capture of an underlying phenomenon related with conditions of social disadvantage.

We hope ILARD will be used for other UK studies and created for other countries for use in other comparative studies. Further corroborations of its trans-national validity could constitute first steps towards the creation of cross-country research framework of investigation for neighbourhood research.

REFERENCES

Carstairs, V. & Morris, R. (1989). Deprivation: explaining differences in mortality between Scotland, England and Wales. *British Medical Journal* 299: 886-889.

Coombes,M., Raybould, S., Wong, C. and Openshaw, S. (1995) 'Towards an index of deprivation: a review of alternative approaches', Centre for Urban and Regional Development Studies, University of Newcastle in Department of the Environment *1991 Deprivation Index: A review of approaches and a matrix of results*, London: HMSO.

Darcy, M., & Gwyther, G. (2012). Recasting Research on 'Neighbourhood Effects': A Collaborative, Participatory, Trans-National Approach. In M. van Ham, D. Manley, N. Bailey, L. Simpson, and D. Maclennan (Eds.) *Neighbourhood Effects Research: New Perspectives*. New York, NY: Springer. https://doi.org/10.1007/978-94-007-2309-2_11

DoE. (Department of the Environment) (1983). Urban Deprivation: Information Note 2, Inner Cities Directorate. Department of the Environment: London.

DoE. (Department of the Environment) (1994). A 1991 Index of Local Conditions. Department of the Environment: London.

Fenton, A. (2013). Small-Area Measures of Income Poverty. *Discussion Paper CASE No. 173*. London, UK: London School of Economics, Centre for Analysis of Social Exclusion (CASE). Online, available at <http://sticerd.lse.ac.uk/dps/case/cp/casepaper173.pdf> (accessed 10 May 2018).

Galster, G. C. (2012). The Mechanism(s) of Neighbourhood Effects: Theory, Evidence, and Policy Implications. In M. van Ham, D. Manley, N. Bailey, L. Simpson, and D. Maclennan (Eds.) *Neighbourhood Effects Research: New Perspectives*. New York, NY: Springer. https://doi.org/10.1007/978-94-007-2309-2_2

Gambaro, L., Joshi, H., Lupton, R., Fenton, A., & Lennon, M. C. (2015) Developing Better Measures of Neighbourhood Characteristics and Change for Use in Studies of Residential Mobility: A Case Study of Britain in the Early 2000s . *Applied Spatial Analysis and Policy, 9*(4), 569-590. https://doi.org/10.1007/s12061-015-9164-0

Joliffe, I. T. (2002). Principal Component Analysis. New York, NY: Springer. https://doi.org/10.1007/b98835

Krieger, N., Zierler, S., Hogan, J. W., Waterman, P., Chen, J. T., Lemieux, K., & Gjelsvik, A. (2003). Geocoding and Measurement of Neighbourhood Socioeconomic Position: A U.S. Perspective. In Kawachi, I. & Berkman, L. (Eds.), pp. 147–178. *Neighbourhoods and Health*, Oxford, UK: Oxford University Press. https://doi.org/10.1093/acprof:oso/9780195138382.001.0001

Manley, D., Flowerdew, R., & Steel, D. (2006). Scales, Levels and Processes: Studying Spatial Patterns of British Census Variables. *Computers, Environment and Urban Systems, 30*(2), 143-160. https://doi.org/10.1016/j.compenvurbsys.2005.08.005

Márquez, M. A., Lasarte, E., & Lufin, M. (2017). The Role of Neighborhood in the Analysis of Spatial

Economic Inequality. *Social Indicators Research,* published online. https://doi.org/10.1007/s11205-017-1814-y

McLennan, D., Barnes, H., Noble, M., Davies, J., Garratt, E., & Dibben, C. (2011). The English indeces of deprivation 2010. London: Department for Communities and Local Government.

National Assembly for Wales (Statistical Directorate). (2005). Welsh index of multiple deprivation 2005. Technical report. Cardiff: National Assembly for Wales.

Northern Ireland Statistics and Research Agency. (2005). Northern Ireland multiple deprivation measure 2005. Belfast: Northern Ireland Statistics and Research Agency.

Noble, M., Wright, G., Smith, G., & Dibben, C. (2006). Measuring Multiple Deprivation at the Small-Area Level. Environment and Planning A: Economy and Space, 38(1), 169-185. doi:10.1068/a37168

Office of the Deputy Prime Minister. (2004). The English indices of deprivation 2004 (Revised ed.). London: Office of the Deputy Prime Minister.

Openshaw, S. (1984) The Modifiable Areal Unit Problem. *Concepts and Techniques in Modern Geography, 38*: 1-41. Online, available at <https://www.uio.no/studier/emner/sv/iss/SGO9010/openshaw1983.pdf> (accessed 10 May 2018).

Schuurman, N., Bell, N., Dunn, J. R., & Oliver, L. (2007). Deprivation indices, population health

and geography: An Evaluation of the Spatial Effectiveness of Indices at multiple Scales. *Journal of Urban Health, 84*(4), 591-603. https://doi.org/10.1007/s11524-007-9193-3

Scottish Executive (Office of the Chief Statistician). (2004). Scottish index of multiple deprivation 2004: Technical report. Edinburgh: Scottish Executive.

Townsend, P. (1987). Deprivation. *Journal of Social Policy, 15*(2), 125-46. https://doi.org/10.1017/s0047279400020341

Wodtke, G. T., Harding, D. J., & Elwert, F. (2011). Neighbourhood Effects in Temporal Perspective: The Impact of Long-Term Exposure to Concentrated Disadvantage on High School Graduation. *American Sociological Review* 76(5): 713-736. https://doi.org/10.1177/0003122411420816