Population and household projections for smaller areas – the theory

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Topics

- Decisions about the production of projections
- The system of interest:
  - Geography, Demography, Other Population Classifications, Housing, Economy
- The modelling alternatives
- Assumptions, scenarios and uncertainty
- Future proofing the projection

Decisions about the projections

- What is the projection for?
  - An ingredient in planning the future
  - To assess gains and risks to society/areas from population change
  - To test out the results of policy intervention
- Who is the customer?
  - The Registrar General for Scotland, The Scottish Executive, The Scottish Parliament
  - The Scottish Councils (local government)
  - Other governments (national, international)
  - Researchers (Universities, Centres, Think Tanks)
  - Business
  - The public
- Is this a one-off projection or will it be part of a regular series?
- How will the projection be maintained in the future?
- Are the necessary input data available or is there a programme to put them in place?

The system of interest: geography (1)

- What scale do you want to project the population at: country (Scotland), local (health board areas, council areas), small (data zones, output areas, postcode sectors)?
- Different users have competing requirements: administrative vs electoral vs postcode geographies
- Boundaries of areas change all the time with population change and administrative change
- How do you ensure past and future harmonisation
  - You need past harmonisation to provide time series of input data
  - You need future harmonisation to ensure your projections are not out of date as soon as they are published

The system of interest: geography (2)

- Do you want a top-down or bottom up system? i.e. should all Scottish local and small area projections add up to the Scotland projection produced by GAD?
- Usually, a top-down system is adopted and lower scale projections are adjusted to fit higher scale
- But virtually no-one checks what the differences are and what the constraint procedure means for the consistency of inputs (e.g. fertility, mortality, migration rates and babies, deaths, inflows and outflows)

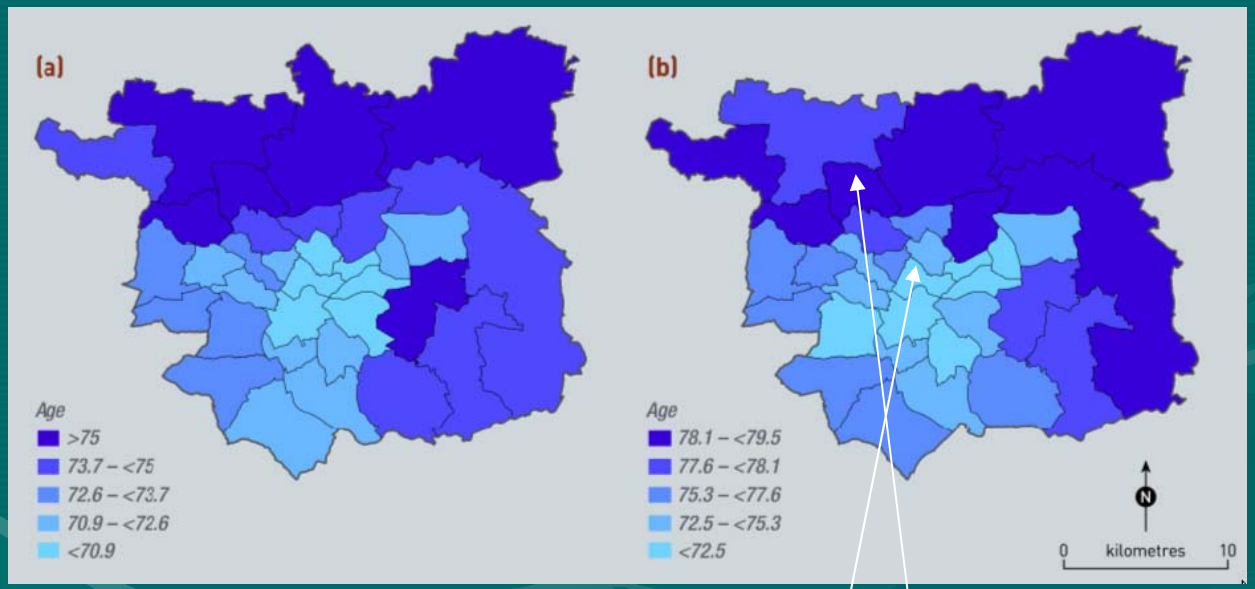
The system of interest: geography (3)

- You choose a relatively stable geography and hope for the best
- In Scotland this might be local councils and data zones
- But you must plan for changes. How?
  - Geographical harmonisation engine = tables that link old and new geographies which contain relevant change probabilities based on use of small building blocks (e.g. output areas, unit postcodes, addresses)
  - The results will be approximate but better than no knowledge at all. Use of output areas might be better than addresses because you would have different census populations to use to estimate the change probabilities. But use of address counts might be better than OAs to keep abreast of new housing developments, for example.
  - This can make outputs flexible. But if you want to change your geographical base the same methods will need application to the input data series as well

The system of interest: geography (4)

- Are the statistical systems set up to produce inputs for small areas?
  - For example, are births and deaths georeferenced accurately so that they can be aggregated to data zones?
  - Do you have in place a method for georeferencing the population (at risk) outside of the census? Is the NHS Central Register adequate for this purpose or does it still suffer from "deadwood", "flotsam and jetsam", "ghosts" etc.
  - If the systems are not yet adequate, can you put in place a statistical inference system for estimating the relevant input variables?

Example of a statistical inference system: the spatial pattern of life expectancies for males, (a) 1990-92 and (b) 2000-02 in the wards of Leeds, West Yorkshire



- Northern and Eastern suburbs favoured
- Spatial pattern very stable over 10 years
- e_0 improves 2.68 years for men, 2.50 for women over 10 years
- For England & Wales, over the 10 years men's e_0 rose by 2.57 years and women's by 1.67 years

Where I board the bus in the morning (Cookridge ward), male life expectancy is 79 years (2000-02)

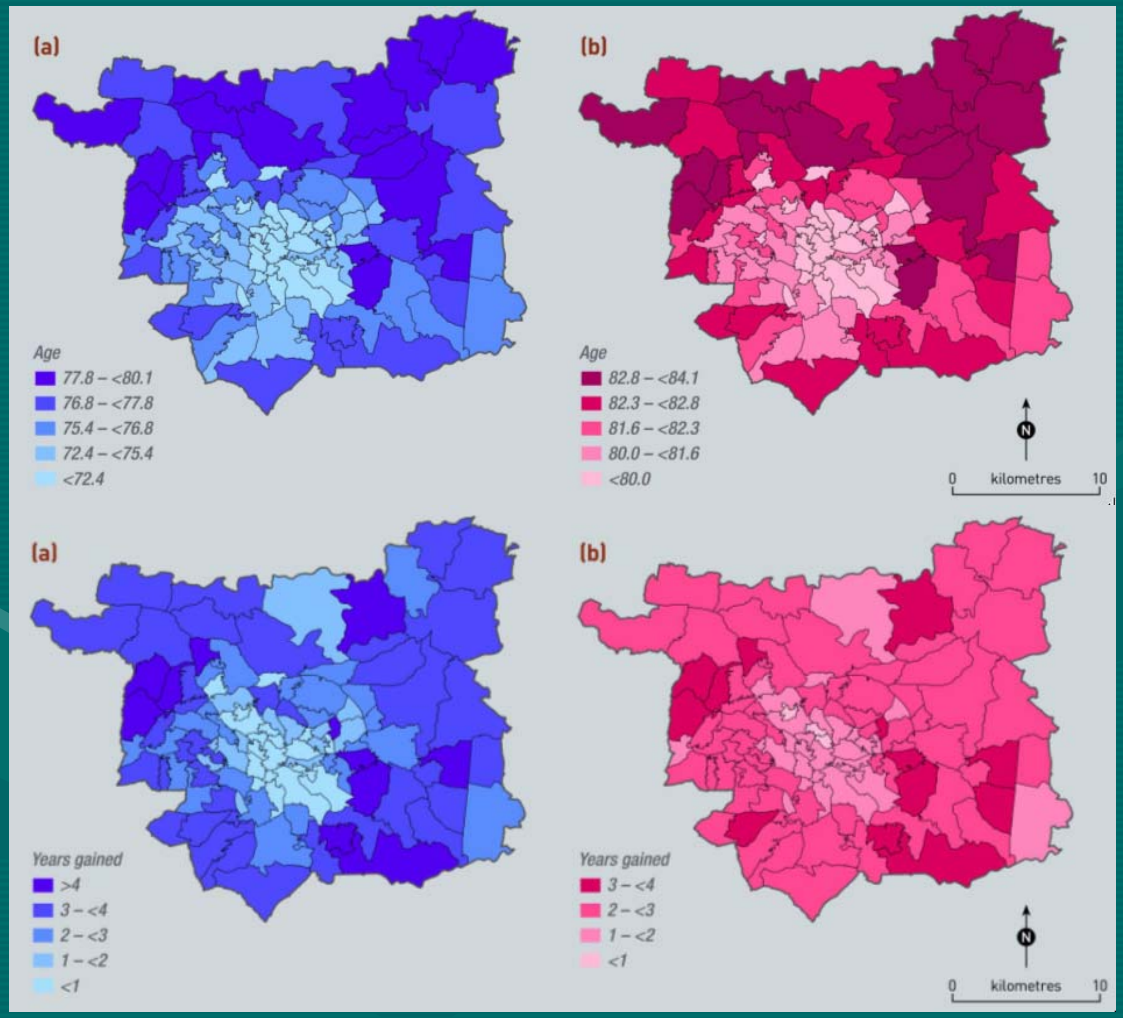
Where I alight from the bus (University ward), men can expect to live only 71 years.

Note: these are period life expectancies and cohort life expectancies will be higher

Estimation of life expectancies for community areas

- Method: regress life expectancy against Townsend deprivation score for 33 wards
- Use equation with Townsend scores for 106 community areas (CAs) to predict life expectancies for community areas
- Adjust the predictions so the weighted sum of CA life expectancies is equal to the ward estimate for life expectancy
- Allows CA life expectancies to vary around their ward means
- Assumes relationship at ward scale holds at CA scale

Neighbourhood life expectancies, 2000-02 and change 1990-92 to 2000-02



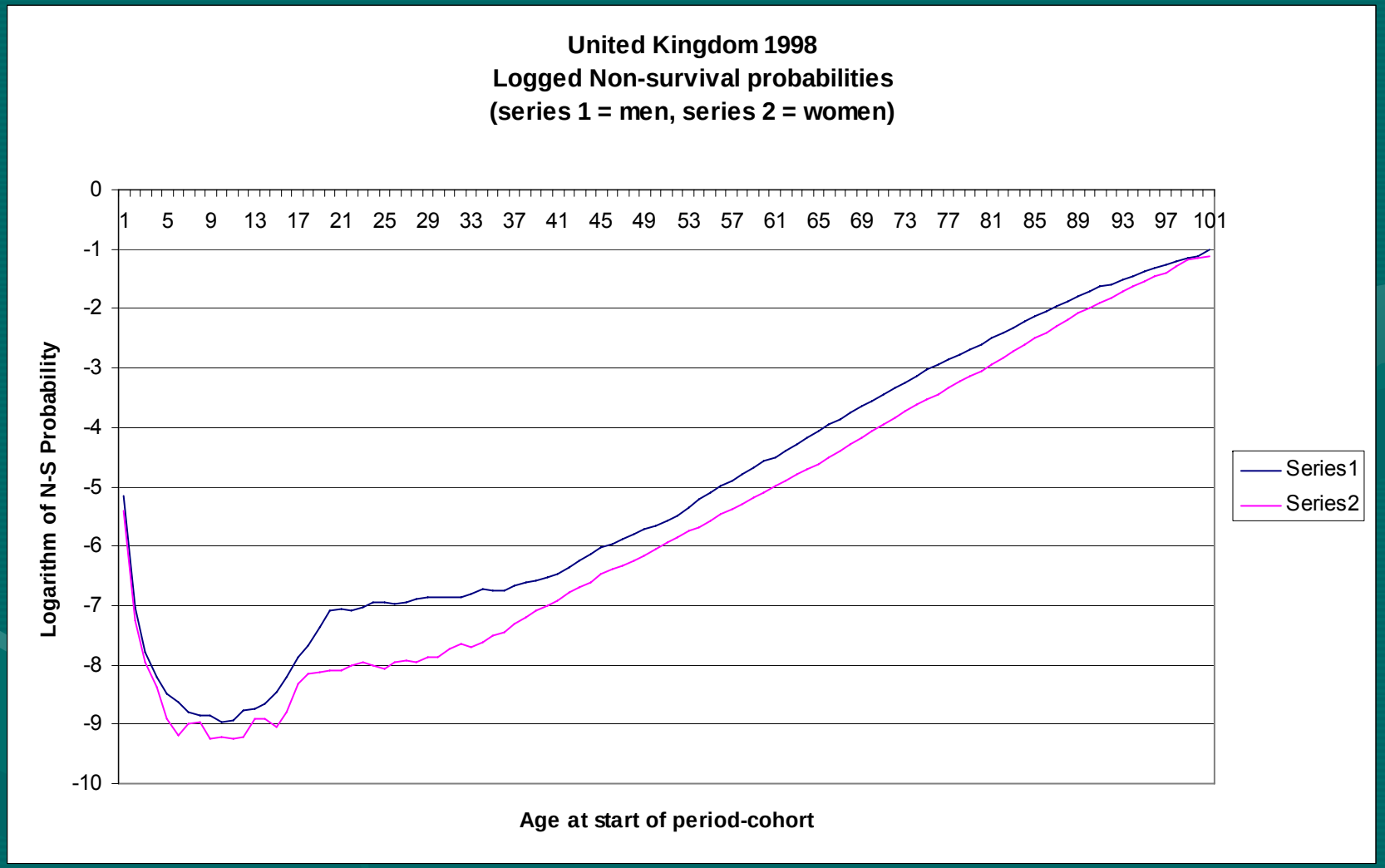
- (a) = men, (b) = women
- Poverty and inner city living seriously affect your health
- Poorer communities are gaining less than richer
- Inequality is greater for men than women and it is increasing more for men

The system of interest: demography (1) – single years of age

- It is vital to use age and sex in projection models because all the drivers vary significantly with age and because projection clients want this information
- It is essential to use single years of age in a projection model because results are wanted for annual intervals and because different users want different age groupings
- Often this means you need to estimate rather than measure the single year of age demographic intensity schedules, though the census provides good tabulations for small areas (at least up to age 24)

The system of interest: demography (2) - final age and age-time plan

- What should be the final age?
  - At least 100+, given improving survival within older ages and given care needs of the oldest old (see next slide of non-survival probabilities)
- What should be the age-time plan?
  - For projections it should be period-cohort (age 10 at time t to age 11 at time t+1)
  - Must get the input data right for the first period-cohort : born in time interval to age 0 at end of time interval (30 years of lobbying for this variable in the UK census migration tables has still not succeeded!)
  - Must get the input data right for the final period-cohort: age 100+ to age 100+ (age 99 to 100 plus age 100+ to 101+)
  - Should try to follow cohort behaviour over time not just period trends (fertility, mortality, perhaps migration)
- Female dominant fertility model or two sex model?
  - Latter needed if ethnic groups are projected

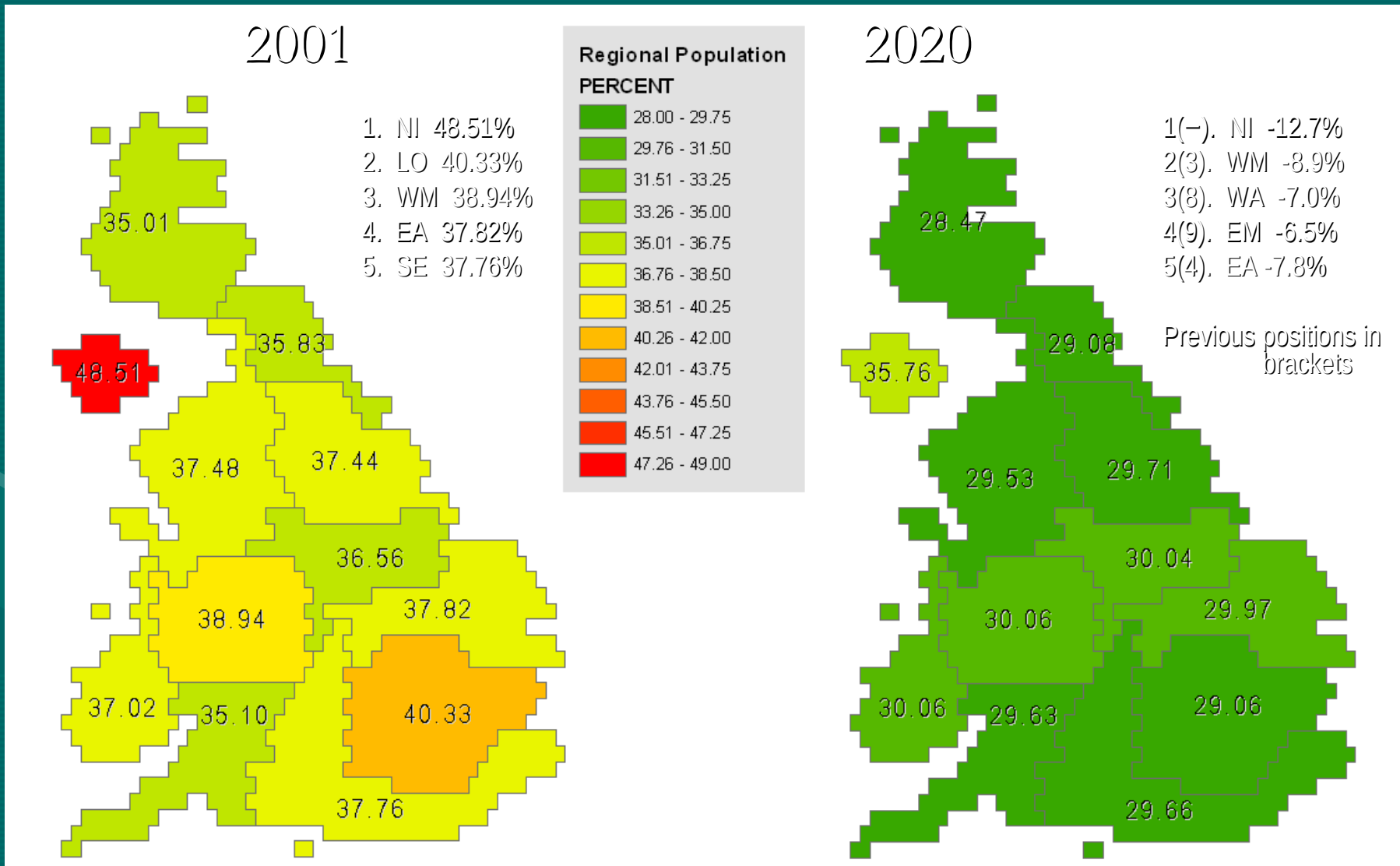

United Kingdom 1998
Logged Non-survival probabilities
(series 1 = men, series 2 = women)
Logarithm of N-S Probability
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57 61 65 69 73 77 81 85 89 93 97 101
Age at start of period-cohort
Series1
Series2

The system of interest: other population classifications

- Household position
  - Reference person, partner of reference person, dependent of reference person, other family member, unrelated individual
- Membership of household of different kinds
  - Size (e.g. 1, 2, 3, 4, 5, 6+ persons)
  - Type (e.g. not in household, lone parent, married couple, cohabiting couple, one person, other multiperson)
  - Number of dependent children (e.g. 0, 1, 2 , 3+)
- Ethnicity/Race
  - UK: White, Mixed, Black, Asian, Chinese, Other
- Educational status
  - Level of highest qualification attained
- Examples follow from a current projection for the Joseph Rowntree Foundation for their Child Poverty project

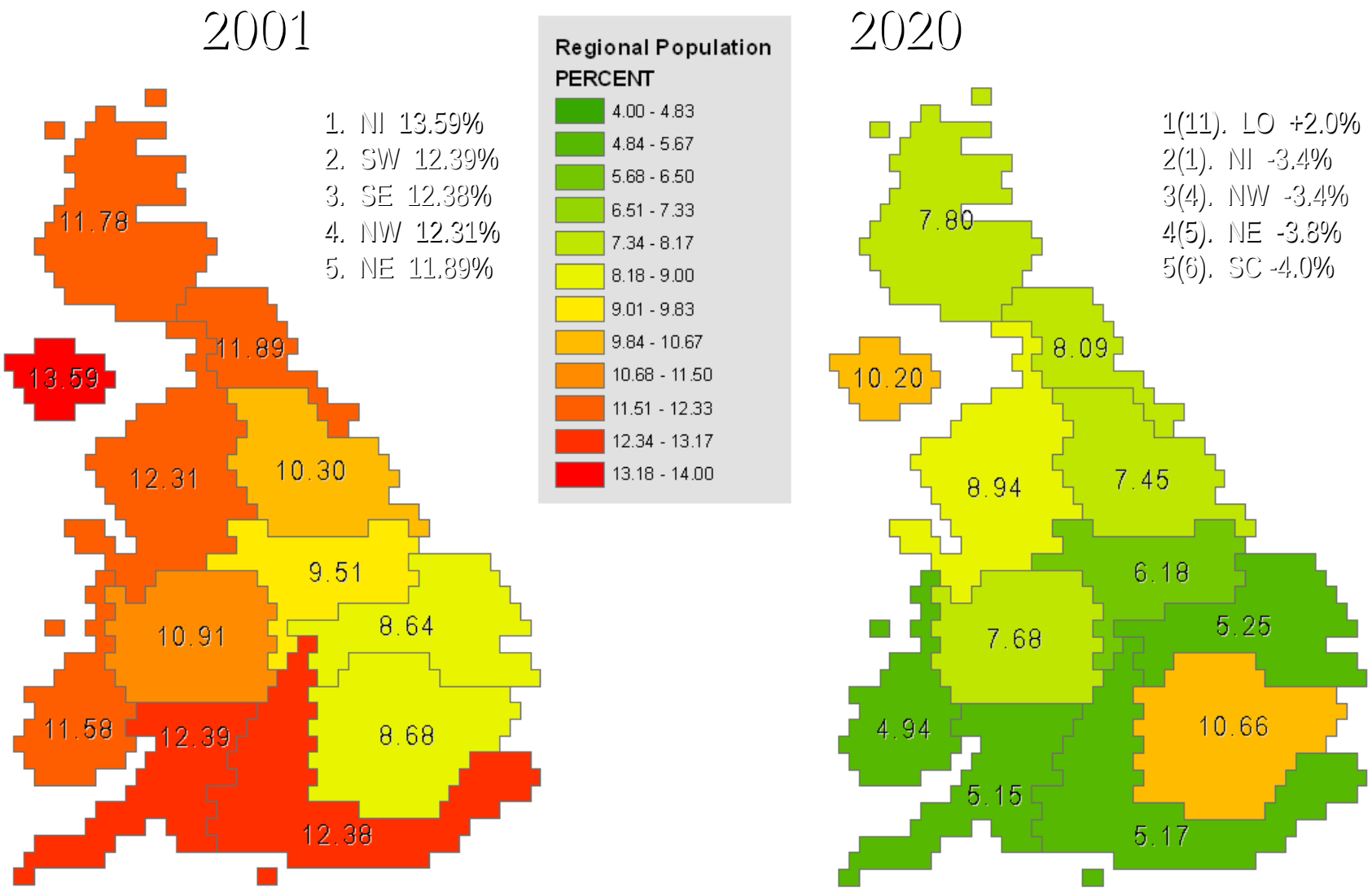
Constraint Projections (ODPM, Census)

1) People in 4+-person Households



Constraint Projections (ODPM)

3) People in Lone Parent Households



Constraint Projections (Rees, ONS)

6b) People in Asian Households