‘Estimating with Confidence’ and hindsight: Population estimates for areas smaller than districts, revisions to levels of 1991 Census non-response

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Micro-geography of UK demographic change 1991-2001

Aim: “Quantify and map changes in population size and social characteristics which occurred in UK’s small geographical areas between the 1991 and 2001 Censuses”

Challenges: calculating population change

Make 1991 and 2001 mid year populations comparable:

- Adjust populations to a consistent geography
  - Boundary changes both EDs/OAs & ‘wards’
- Ensure student location & age-groups compatible
- Allow for post-2001 view of 1991 Census undercount

Paul Norman: ESRC RES-163-25-0012 for 2005-07
‘Estimating with Confidence’ and hindsight: Population estimates for areas smaller than districts, revisions to levels of 1991 Census non-response

• 1990s view
  ▪ Official (local authority)
  ▪ Estimating with Confidence small area population estimates for mid year 1991
• Post-2001 official revised adjustments for 1991
• Revising EwC small area estimates
• Implications of revised estimates
‘Estimating with Confidence’ (EwC) 1991 small area MYEs (original)

Following Official Mid-Year Estimates (MYEs) for 1991 districts

**Area-specific** application of official district level adjustments

Raw 1991 Census counts with enhancements for:

**‘Other’**
- Student term-time address
- Demographic change between census and mid-1991
- Modification adjustment (table consistency)

**‘Non-response’**
- Armed forces postings
- Residual non-response by age & sex

(Simpson *et al.* 1997)
EwC 1991 adjustments (original)
Bradford Metropolitan District, wards

Non-response adjustments

Other adjustments
After 2001 Census 1991 MYEs revised

Adjustments
- Non-response revised downwards (E&W & Sc)
- Simple location of sex ratio mid-way between 1981 & 2001
- Other adjustments remain the same
Revising 1991 EwC small area MYEs

Post-2001 viewpoint (revised)

• Adjust EwC populations & components to allow for 1991 to 2001 boundary changes
• Revise original EwC non-response enhancements
• No revisions to other adjustments (student, timing or modification)

Output definitions

• Demography: Single year of age (to 90+) & sex
• Geography: 2001 OAs & ‘wards’ for all UK
• Ensure small area data sum hierarchically to the 1991 revised district MYEs
Revising the original 1991 EwC estimates

Broad steps:
By five year age (to 85+) and sex …

• Calculate total non-response for each 1991 ED
• Constrain ED Census, non-response & other components to ward equivalents
• Convert ED data to 2001 OA geography
• Scale original non-response enhancements by change at district level
• Sum components to be a revised 1991 estimate
• Estimate single year of age detail using available information for within five-year groups & above 85+
Converting between geographies (ED/OA)

<table>
<thead>
<tr>
<th>Source</th>
<th>Census data</th>
<th>Conversion weight to 00CXGD0032</th>
<th>Intersection estimate</th>
<th>Estimate for Males 20-24 in 00CXGD0032</th>
</tr>
</thead>
<tbody>
<tr>
<td>ED91</td>
<td>Males 20-24</td>
<td>0.1984</td>
<td>2.7778</td>
<td>5.8591</td>
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<td>08CXGD01</td>
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<tr>
<td>08CXGD02</td>
<td>7</td>
<td>0.4402</td>
<td>3.0813</td>
<td>(2.7778 + 3.0813)</td>
</tr>
</tbody>
</table>

(Simpson 2002; Norman et al. 2003)
Revising the non-response (ward)

Males aged 20-24 in two wards in Bradford

<table>
<thead>
<tr>
<th></th>
<th>Ilkley</th>
<th>University</th>
</tr>
</thead>
<tbody>
<tr>
<td>Census count of residents</td>
<td>413</td>
<td>1197</td>
</tr>
</tbody>
</table>

Adjustments for:
- Net student adjustment                     | -68    | +783       |
- Timing                                      | +1     | +2         |
- Modification                                | +6     | +36        |
**Other adjustments (total)**                 | -61    | 820        |

Non-response according to:
- Unemployment                                |        |            |
- Imputed residents                           |        |            |
- Armed forces postings                       |        |            |
**Non-response (total) (o)**                  | +39    | +233       |

**Estimating with Confidence (o)**             | 391    | 2250       |

**Bradford district**
- Non-response (o)                             |        | 3150       |
- Non-response (r)                              |        | 1809       |
- Scale factor (r / o)                          |        | 0.57       |

**Non-response (r)**                           | +23    | +134       |

\[(39 \times 0.57)\]                            |        | \[(233 \times 0.57)\] |

**Estimating with Confidence (r)**              | 374    | 2151       |
### Estimating single year of age by IPF (ward)

#### a.)

<table>
<thead>
<tr>
<th>Ward</th>
<th>Males 0-4</th>
<th>Total Initial</th>
<th>m0</th>
<th>m1</th>
<th>m2</th>
<th>m3</th>
<th>m4</th>
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</thead>
<tbody>
<tr>
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<td>428.54</td>
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<td>Bingley</td>
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<td>Bingley Rural</td>
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<td>109.95</td>
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<tr>
<td>Bolton</td>
<td>428.90</td>
<td>424.01</td>
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<tr>
<td>Wibsey</td>
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<td>506.05</td>
<td>104.23</td>
<td>100.46</td>
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<td>Worth Valley</td>
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<td>Wyke</td>
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<td>146.62</td>
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<tr>
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<td>3854.80</td>
<td>3721.60</td>
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<tr>
<td>Marginal</td>
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<td></td>
<td>3676.00</td>
<td>3663.00</td>
<td>3731.00</td>
<td>3625.00</td>
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</tbody>
</table>

#### b.)

<table>
<thead>
<tr>
<th>Ward</th>
<th>Males 0-4</th>
<th>Estimates by single year of age following IPF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>m0</td>
</tr>
<tr>
<td>Baildon</td>
<td>427.27</td>
<td>88.45</td>
</tr>
<tr>
<td>Bingley</td>
<td>396.23</td>
<td>75.59</td>
</tr>
<tr>
<td>Bingley Rural</td>
<td>549.74</td>
<td>122.06</td>
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<tr>
<td>Bolton</td>
<td>428.90</td>
<td>83.73</td>
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<tr>
<td>University</td>
<td>1014.77</td>
<td>216.90</td>
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<tr>
<td>Wibsey</td>
<td>502.28</td>
<td>105.82</td>
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<tr>
<td>Worth Valley</td>
<td>471.11</td>
<td>92.19</td>
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<tr>
<td>Wyke</td>
<td>733.12</td>
<td>157.39</td>
</tr>
<tr>
<td>Marginal</td>
<td>3913.00</td>
<td>3676.00</td>
</tr>
</tbody>
</table>
Assessing EwC (revised) outputs

Relationships should be maintained

Correlation 0.89

Correlation 0.48

Original ward level non-response

Revised ward level non-response
Implications of EwC revisions

• Analyses of population change

• Use of census year estimates as a base population
  ▪ Projections of future populations
  ▪ Estimates for post-censal years

• Use of populations as the denominators in rates
  ▪ Numerators stay the same but denominators reduce
  ▪ This implies increased rates
• Pattern of 1981-91 change very similar
• Growing wards do not experience the same level of growth
• Wards reducing have reduced even more
• Different conclusions on natural change & migration balance
Population projections & estimates

- Projections from 1991 using original & revised as the base
- Curves are parallel
- After 2001, difference due to fertility variation larger than differences due to base

- Estimates for 1996 using original & revised as the base
- At extremes same wards growing or contracting
- Middle ground estimates based on original, wards increasing. Revised base leads to reduced, static or small growth
- Considerable divergence in estimates over 5 years
Population used as a denominator

Male unemployment, 1991

Male SMRs, 1991

More variation using 1996 estimates
‘Estimating with Confidence’ and hindsight

- 1990s view, substantial undercount in 1991 Census
- Post-2001 official view revised adjustments for 1991
- Revised EwC small area estimates for geography and non-response
- Revised estimates now used in various projects

Implications of revised estimates

- Re-worked research affects demographic, health and social indicators, especially the ranking of areas’ population and population change
- The extent of the revisions may often not result in different conclusions being drawn about trends and patterns
- EwC is now more useful to more people: internally consistent, on 2001 geography & for any age-groups
‘Estimating with Confidence’ and hindsight

Estimates by OA & single year of age are estimates!

Data availability to other researchers?

• Currently: on request
• Future, via
  ~ Data Archive?
  ~ Dedicated website?

References