

PROGRESS IN UPDATING PROJECTIONS USING CURRENT METHODOLOGY

Introduction

1. This paper summarises exploratory work on the impact of updating headship projections using information from the 1991 and 2001 Censuses. Members of HARG are invited to comment on the approach and outcomes.

Background

2. The 1998 and 2000 based household projections used headship information projected from the 1981 and 1991 Censuses using the 'modified exponential' projections method, described in detail in the technical notes to the projections bulletin. [See extract at Annex A].

3. To provide the first set of household projections drawing on 2001 Census headship information on the 2002 based population projections¹, we plan to project for the same groups of households using the same methodology, but possibly incorporating the most recent 3 Census years.

Methodological issues

4. Within this general approach there are a number of options available to us on the choice of years from which to extrapolate headship trends and on the basis of the headship measurement.

Headship basis

5. Headship information – covering the household categories for which we currently project - is available from **the 2001 Census** on two different bases:-

Head of Household: This is from special analyses provided by GRO(S) and is the equivalent for 2001 of the basis on which headship information was supplied for previous Censuses.

Household Reference Person: This is a new form of analysis of headship information compared to earlier Censuses – see Annex B.

6 GRO(S) supplied headship information on both bases for 2001 for Scotland, councils and structure plan area; analysed on the basis of 100%.

7. For earlier Census the headship information household projections was based on the head of household concept.

8. For comparison purposes GRO(S) have also supplied headship rates for Scotland, councils and structure plan areas based on the household reference person concept for 1991. These rates are derived from 10% Census data – because of the need to use information about the relationship between individuals in the household to construct the rates.

¹ The first set of sub-national population projections drawing on the 2001 Census.

Projection basis

9. In past projections, alternative methods tried before deciding on the basis of the projections used either a two point or three point modified exponential method. Final decisions on the method adopted for the projections were based on the extent to which the projections required an ‘adult adjustment’ for individual councils and years. The projection method requiring the least amount of adjustment was taken to be the most reliable.

Options for 2002 based projections

10. The options which might be tested are set out in the table.

Type	Years	Headship	Comment
2 point exponential	1991: 2001	Household Reference Person	Based on current Census definition. 91 data would be 10% only.
	1991: 2001	Head of household	Based on ‘out of date’ concept. 91 data would be 100%
	1981: 2001	Head of household.	Based on ‘out of date’ concept. Would 81 – 01 trends be more robustly measured?
	1971: 2001	Head of household	Based on ‘out of date’ concept. 71 – 01 trends probably too long-term.
3 point exponential	1981: 1991: 2001	Head of household	Based on ‘out of date’ concept. Would this improve on 81-01?
3 point weighted exponential	1981: 1991: 2001	Head of household	Based on ‘out of date’ concept. Would this improve on 81-01?

Exploratory analysis

11. While we can’t explore these different approaches until we have the population projections by council area, we felt that it would be useful – partly to test the IT system, and partly to get a better understanding of the headship information from the Census – to run the headship information from 1991 and 2001 against the 2000 based population projections.

12. Table 1 shows, by council, the projected growth in the number of households between 2000 and 2014 from running 2000 based population projections against 1991 and 2001 headship extrapolated using the modified 2 point exponential method applied separately on ‘household reference person’ and ‘head of household’ bases. The main points are:-

- For all areas, and for Scotland as a whole 1991-2001 headship trends imply lower household growth – **on the same 2000 based population projections.**
- Generally the ‘head of household’ basis gives lower growth than household reference person.
- For those councils where we had specific concerns at the time of the 2000 projections – the new headship information implies significantly lower household growth in Aberdeen City; and growth a little lower (a reduction of about a quarter) in Glasgow.

13. **It must be emphasised that these analyses are not projections.** Their purpose is to illustrate the impact of incorporating more up-to-date headship information.

Conclusion

14. Members of HARG are invited to comment on this analysis and on the choices available for headship data and methodology for the 2002 based household projections to be produced later this year when the population projections become available.

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Table 1:- Growth in households between 2000 and 2014: 2000 based population projections on different headship projections

Local Authority	2000 based HH projections	Head of household basis	Household reference person basis
Scotland	11.7	7.3	8.5
Aberdeen City	4.4	0.1	2.7
Aberdeenshire	14.6	9.6	10.2
Angus	6.4	1.0	3.6
Argyll & Bute	5.8	-1.3	0.8
Clackmannanshire	10.8	9.0	4.6
Dumfries & Galloway	6.1	2.1	1.9
Dundee City	-4.6	-9.5	-9.1
East Ayrshire	5.0	0.4	1.4
East Dunbartonshire	13.2	11.6	11.7
East Lothian	21.8	15.8	17.4
East Renfrewshire	19.8	13.7	15.2
Edinburgh (City of)	17.9	11.5	13.4
Eilean Siar	3.4	-0.4	1.2
Falkirk	12.1	8.8	9.7
Fife	12.4	9.3	10.5
Glasgow City	14.1	9.0	9.4
Highland	11.9	7.2	7.4
Inverclyde	2.7	-1.5	-0.1
Midlothian	16.4	14.7	14.4
Moray	6.6	0.6	0.8
North Ayrshire	11.1	7.2	8.0
North Lanarkshire	13.0	10.8	12.4
Orkney	8.1	4.7	5.5
Perth & Kinross	10.1	6.9	7.9
Renfrewshire	8.9	4.6	5.7
Scottish Borders	10.9	7.2	7.4
Shetland	10.9	8.6	8.7
South Ayrshire	7.5	4.2	5.8
South Lanarkshire	11.6	6.0	9.1
Stirling	20.3	18.3	21.6
West Dunbartonshire	8.7	4.5	4.6
West Lothian	24.0	19.8	21.4

ANNEX A: Description of the current methodology**A.2 Method Used for 2000-Based Household Projections***A.2.1 Population projections*

The first main inputs to the projection of households are the 2000-based population projections for Scotland produced by GROS. These are produced for Scotland by local authority and age group using assumptions about births, deaths and migrations. See the publication 'Population Projections Scotland (2000-based)' for further information on the assumptions used (www.gro-scotland.gov.uk). The relevant population for household formation is taken to be the adult population, aged 16 or over.

The projected number of households is derived from projections of the numbers of adults living in private households. To obtain this from the population data, estimates of the numbers living in communal establishments have been subtracted from the total adult population for each projection year. Work was carried out prior to the 1994-based projections to estimate the number of people living in communal establishments in 1994. The 1994, 1996 and 1998-based projections all used the assumption that the proportion of the population living in communal establishments remained unchanged (within each age group in each LA) since 1994. For this round of projections Local Authority Population and Migration Group Members were consulted on the estimate for 2000 and any amendments (based on more detailed local information) were incorporated. Revised proportions were produced (using the consulted year 2000 communal establishment figures) and applied to the GROS population projections. (Note that although the base year proportions were updated, the methodology still assumes constant proportions for each of the 14 projection years.)

A.2.2 Household Composition

The second main input to the household projections is the historic information on the number of households from the 1981 and 1991 population censuses. This information is available for each combination of age group, household type and area within Scotland.

Household types were classified in terms of household composition, that is, the number of adults and children in a household (for example, one adult with two or more children). Relationships between persons in the household were not distinguished. The proportions of households by local authority area, household type, and age group of the head of household are known for each of the 1981 and 1991 census years. The proportions of each household type sum to one within each age group within each Local Authority area.

An example, for Dumfries and Galloway 1991 census data for persons aged 35 to 44 years old, is given below.

Table A1: Number and Proportion of Heads of Households (HoH) by Household Type

	Number	Proportion
1 adult: male	730	0.037
1 adult: female	404	0.020
2 adults	1,345	0.068
1 adult + 1 child	276	0.014

3+ adults	840	0.042
1 adult, 2+ children	301	0.015
2+ adults, 1+ children	6,456	0.326
Persons who are not a head of household	9,450	0.477
Total persons in age group	19,802	1.000

The number of persons who head particular household types will be the same as the number of households of this type. The proportion of these within any particular age group and Local Authority area are known as the headship rates and it is these that are projected forwards then applied to GROS population projections (by age group and Local Authority area) to give the household projections.

We also know the residual number of persons who are in each area and age group but who are not the head of household. This allows both the 'headship' and 'non-headship' rates to be projected to avoid the theoretical possibility of negative 'non-headship' rates. This improvement was recommended from the research done by CHRUS, University of Glasgow, on viable alternatives for the method of projecting headship rates (see section A.3) and was also used in the 1994, 1996 and 1998-based projections. Previously, projected 'non-headship' rates were calculated as the residual for each group when projected headship rates were subtracted from 1.

These headship (and non-headship) rates were then projected forward using the modified two-point exponential model, the formula for which is as follows:

$$y_i = k + a*(b^{x_i})$$

where y_i = headship rate in year i

i is each projection year, from 2000 to 2014

y_{1981} = known headship rate for census year 1981

y_{1991} = known headship rate for census year 1991

$x_i = (i - 1981)/(1991 - 1981)$

$k = 1$ if $y_{1991} \geq y_{1981}$

0 if $y_{1991} < y_{1981}$

$a = y_{1981} - k$

$b = (y_{1991} - k)/(y_{1981} - k)$

The projected headship (and non-headship) rates are constrained in two ways, firstly so that they cannot individually go above 1 or below 0, and secondly so that they sum to 1 within an area and household type.

The household projections are then calculated by applying these projected headship rates to the population projections to give an estimate of the number of heads of household in each of the projection years for each household type, age group of head of household and area.

These figures are then controlled, so that figures for the structure plan areas sum to the figure for Scotland, and figures for local authorities sum to the total for their structure plan area.

Figures are then adjusted, so that the total number of households within each Local Authority for the base projection year (2000) equals the 2000 household estimate

produced by the Scottish Executive. Any adjustments required to bring the figures for the base projection year into line with the household estimate for that year are then applied to the figures for the other projection years to preserve the trends.

Finally the figures are adjusted to ensure that the minimum number of adults required to fill the projected households (i.e. a minimum of 2 adults would live in the household type '2 or more adults') are not greater than the projected adult private household population. The Household Analyses Review Group considered this an important adjustment because the GROS population projections (from which the private household populations are derived) are the primary input into the household projections, and therefore they should tie up. The adjustment required was much greater for the current 2000-based projections than was required for the 1998-based projections and was an important factor in the choice of headship rate projection methodology (**see Chart A3**). The reasons for this increasing adjustment are discussed further in **Annex B**.

ANNEX B: CENSUS DEFINITION OF HOUSEHOLD REFERENCE PERSON ETC.

Concealed family	A concealed family is one that does not include the Household Reference Person
Household Reference Person	The concept of Household Reference Person (HRP) is new in 2001 output. It replaces Head of Household used in 1991. For a person living alone, it follows that this person is the HRP. If the household contains only one family (with or without ungrouped individuals) the HRP is the same as the Family Reference Person (FRP). If there is more than one family in the household, the HRP is chosen from among the FRPs using the same criteria as for choosing the FRP (economic activity, then age, then order on the form). If there is no family, the HRP is chosen from the individuals using the same criteria. In 1991, the Head of Household was taken as the first person on the form unless that person was aged under 16 or was not usually resident in the household.
Family	A family comprises a group of people consisting of a married or cohabiting couple with or without child(ren), or a lone parent with child(ren). It also includes a married or cohabiting couple with their grandchild(ren) or a lone grandparent with his or her grandchild(ren) where there are no children in the intervening generation in the household. Cohabiting couples include same sex couples. Children in couple families need not belong to both members of the couple.
Family Reference Person	In a Lone parent family, the Family Reference Person (FRP) is taken to be the lone parent in a Lone parent family. In a couple family, the FRP is chosen from the two people in the couple on the basis of their economic activity (in the priority order; full-time job, part-time job, unemployed, retired, other). If both people have the same economic activity, the FRP is identified as the elder of the two or, if they are the same age, the first member of the couple on the form.