

**HOUSEHOLD ANALYSIS REVIEW GROUP: SPECIFICATION OF RESEARCH
INTO THE PROJECTIONS METHODOLOGY****Introduction**

1. This paper aims to summarise the issues to be considered in reviewing and further developing the methodology for household projections for Scotland and Scottish councils. It draws on discussion of Jan Freeke's paper to the April HARG meeting, on users' views on the categories of household and projections periods for which it would be useful to have projections, and on more recent developments.

2. Members of HARG are invited to comment on:-

- Whether this is a fair summary of the issues, and
- How best to take this forward.

Background

3. The approach we have adopted to updating household projections taking account of the results of the 2001 Census is in two stages:-

Stage 1: Update projections to a 2002 base using the present methodology with headship trends updated to include 2001 Census headship.

Stage 2: Commission research into the projections methodology with the overall aim of providing more robust projections.

This twin track approach was adopted, partly because of the need to quickly update the 2000 based projections – which have important known weaknesses; and partly to maintain the current two yearly publications schedule. A key issue for Stage 1 is the choice of Census years, trend formula and headship basis.

4. At the April meeting Jan presented a useful paper – based on a paper he had previously presented to the 2002 British Society for Population Studies conference – setting out ways in which Scottish household projections could be improved. In summary the paper:-

- Highlighted limitations in the existing Scottish methodology; including a tendency to overestimate household formation during the 1990s;
- Identified the need to test the quality of current projections by comparisons with Census data;
- Recommended a review of projection methods leading to an agreed methodology which:-
 - Meets user requirements as identified in the various user surveys,
 - Benefits from methodological advances elsewhere, particularly incorporating age cohort effects as in the ODPM projections,
 - Uses new data sources – particularly the Scottish Household Survey.

4. From the consultations, the main issues for users of the projections was in the period covered – a preference for the full population projections period; and timeliness. There was an interest in projections for areas below LA level. There were no strong views on the household types to be covered but one non-LA respondent did point to the need for a better alignment with Census household categories.

5. More recent academic work on assessing housing need has raised the possibility that projections for 5 year age bands for household types based on groupings of the household types used in the ODPM projections¹, would be more useful than existing projections in the assessment of the demand/ need for social housing.

6. At the April meeting, it was agreed that we should consider whether/ how we might move to a methodology closer to the ODPM approach (see Annex A). We planned to hold a further follow-up meeting in summer/ early autumn to take forward the specification of additional work/ supporting research to develop a new methodology. Unfortunately, partly because of a long vacancy in the relevant housing assistant statistician post, this work has not yet been taken forward.

Issues

7. Issues to be considered in arriving at a new methodology² are:-

- The pros and cons of using a ‘household representative’ approach.
 - For 1991 this would require ‘representative’ rates based on 10% coded census data. [Initial work on Household Reference Person headship under current methodology doesn’t look too bad].
- The household/ family groupings to use.
 - The ODPM method gives separate projections of ‘concealed couple families’.
 - If ‘married’ and ‘co-habiting’ are to be distinguished, projections will be needed by marital status. The ODPM method uses GAD projected marital status at England level and pro-rates to sub-national.
 - Could usefully be informed by wider potential uses of projections in assessing affordable housing need.
- The age groups for which the household/ family representative rates would be calculated/ projected.
 - 5 year age groups are important in the ODPM projections process – which combines cohort and age effects in 5 year chunks.
 - 5 year age groups also look to be important in housing needs work.
- Projections method.
 - We could, in theory use the current two point/ three point exponential methods on household/ family representative rates.
 - If we wish to explore the use of the more sophisticated ODPM methodology, we will need to commission this from capable academics.

¹ i.e. based on household membership rates rather than headship rates.

² Drawn in the main from Jan’s paper.

Next steps

8. For discussion by HARG, either at the meeting or in a follow-up meeting, as suggested at the April HARG meeting.

DD-ASD
14 January 2004

EXTRACT FROM ODPM HOUSEHOLD PROJECTIONS REPORT: TECHNICAL ANNEX**Annex A - Definitions and Concepts**

A **household** is defined as in the 1981 and 1991 Census as:

- One person living alone, or
- A group of people who share common housekeeping or a living room.

This differs from the definition used in the 1971 and earlier censuses. Previously, people who catered separately were to be counted as separate households even if they shared a living room. For example, three people each with a room of their own and catering separately, but sharing a sitting room or living room would, under the 1971 census definition, have been counted as three "one person households", but would in 1981 and 1991 be counted as one "other multi person household".

A **family** is defined as in the 1991 Census as:

- a. a married couple with or without their never married child(ren) including childless married couples (**married couple families**);
- b. a cohabiting couple with or without their never married child(ren) including childless cohabiting couples (**cohabiting couple families**);
- c. a father or mother together with his or her never married child(ren) (**lone parent families**);
or
- d. grandparent(s) with grandchild(ren) if there are no apparent parents of the grandchild(ren) usually resident in the household.

Families of type (d) are classified as a married couple family, cohabiting couple family or lone parent family as appropriate. This definition differs from that used in the 1981 and earlier censuses in its inclusion of cohabiting couple families. In the context of the household projections, the term "child" is taken to refer only to a dependent child, that is one aged 0 -15; or aged 16 - 18, never married and in full time education. A lone parent living with his/her non-dependent children (only) would not therefore constitute a lone parent family. This contrasts with the 1989-based and earlier projections where the "children" could be of any age. It should be noted that the terms "household" and "family" are not synonymous. A household may contain no families (for example one person living alone, or a household of unrelated, non cohabiting adults), or it may consist of one or more families with or without additional non family members.

Households are sub divided into five **household types**:

- a. **Married couple household**: a household which contains one or more married couple families;
- b. **Cohabiting couple household**: a household which contains one or more cohabiting couple families, but no married couple families;
- c. **Lone parent household**: a household which contains one or more lone parent families, but no married couple or cohabiting couple families;

- d. **Other multi person household:** a multi person household that is neither a married couple household nor a cohabiting couple household nor a lone parent household. Examples include, lone parents with only non dependent children, brothers and sisters and unrelated (and non-cohabiting) adults sharing a house or flat;
- e. **One person household:** a person living alone who shares neither housekeeping nor a living room with anyone else.

The definitions (a), (b), (c) and (d) are as in the 1992-based projections, but differ from earlier projections. The category of "married couple household" includes households which contain a married couple but in which an individual other than the husband and wife was recorded as the head of household by the census. An example would be a married couple living with an elderly relative, where the relative was entered first on the census form, for instance because he or she owned the house. The definition of "lone parent household" is restricted to exclude lone parents with only non-dependent children: in most contexts, the interest in lone parents is in lone parents with dependent children. Lone parents with only non-dependent children belong to the "other multi- person household" category. Cohabiting couples are distinguished as a separate household type. Before the 1992-based projections, cohabiting couples were included among lone parent households and "other households" (now called "other multi-person households") according to whether the household included children and whose children they were. The definition of "one person households" is the same as in all previous projections.

The **household membership** variable has eleven categories. All household members are classified to one (and only one) of these categories:

- a. **Married couple household representative:** the eldest married couple husband in the household;
- b. **Cohabiting couple household representative:** the eldest male cohabiter in a cohabiting couple household;
- c. **Lone parent household representative:** the eldest male lone parent in a lone parent household, if any; the eldest female lone parent if not.
- d. **Other multi-person household representative:**
 - i. in an other multi person household containing a lone parent (of non-dependent children only), the eldest lone parent if any; the eldest female lone parent if not; or
 - ii. in an other multi-person household containing no lone parents, the eldest male, if any; the eldest female if not.
- e. **One person household representative;**
- f. **Husband in a concealed married couple family:** any husband in a married couple family who is not included in (a);
- g. **Male cohabiter in a concealed cohabiting family:** any cohabiting male who is not included in (b);
- h. **Parent in a concealed lone parent family:** any lone parent who is not included in (c);
- i. **Wife in married couple family;**
- j. **Female cohabiter;**
- k. **Other individual.**

Individuals in categories (a) to (e) are household representatives, in the sense that each household contains one person (and only one) in one of these groups and the total number of households is equal, by definition, to the number of individuals in these groups. The categories to which a household representative belongs defines the type of household.

For which types of household a man or woman can be household representative depends on legal marital status and whether he or she is cohabiting unmarried.

Male				Female			
Married	Widowed	Divorced	Single	Married	Widowed	Divorced	Single
Not cohabiting							
MCH	LPH	LPH	LPH	LPH	LPH	LPH	LPH
LPH	OMPH	OMPH	OMPH	OMPH	OMPH	OMPH	OMPH
OMPH	OPH	OPH	OPH	OPH	OPH	OPH	OPH
OPH							
Cohabiting							
CCH	CCH	CCH	CCH	none	none	none	none

MCH = Married couple household

CCH = cohabiting couple household

LPH = Lone parent household

OMPH = Other multi person household

OPH = One person household

Only a legally married man can be the household representative for a married couple household. A cohabiting man, whatever his marital status, can be household representative only for a cohabiting couple household. A cohabiting woman cannot be a household representative. A legally married woman can be a household representative only if not usually resident in the same household as her husband. This does not necessarily imply that she is separated, in the sense that her marriage has broken down. The same applies when a legally married man is household representative for a household which is not a married couple household.

The rationale for the concept of the household representative was explained in *Projections of Households in England to 2016* (page 61). In brief, the main reason was to avoid the distortions that could arise from inconsistencies among census form fillers about who was entered as "first person". In household interview surveys, the interviewer follows specified rules about which member of a household is designated head of the household (HoH). The rules for selecting the household representative select, in a high proportion of instances, the same person who would be selected as HoH according to interview survey rules, but not in all instances. In interview surveys, the HoH is the person whose name the accommodation is owned or rented, with rules of precedence if it is owned or rented in the names of two persons or more. However, who is household representative is not affected by who owns or rents the accommodation. Thus the husband in an elderly couple who live with their son and daughter-in-law (for example) is the household representative; but the son is HoH if he and his wife own the house. Differences between the household head and the household representative do not affect the number of households in the population. They affect the way households in the census population are classified, not their

number. They may, however, affect the projection, because the rates of change of the population in different age/sex/marital status categories are not the same. Selecting as household representative a member of a quickly growing population category instead of a member of a group that is increasing more slowly will raise the projected increase in the number of households, other things being equal.

Any family other than that of the household representative is referred to as a **concealed family**. These are categorised as:

- a. **Concealed married couple family:** a married couple family living within a household where another person is household representative;
- b. **Concealed cohabiting couple family:** a cohabiting couple family living within a household where another person is household representative;
- c. **Concealed lone parent family:** a lone parent with dependent child(ren) living within a household where another person is household representative.

The number of individuals in categories (f), (g) and (h) [above] determines the number of concealed families of each type. This publication presents combined totals for concealed married couple families and concealed cohabiting couple families, the combined group being referred to as "concealed couple families".

Household representative rate: the proportion of a population group which are household representatives (sometimes expressed as a percentage). The population groups are defined for the 1996-based national projections and sub national projections according to sex, age (15 bands from 15 - 19 to 85 and over), legal marital status (married widowed, divorced, single) and cohabitational status: hence there are 240 population groups and 240 representative rates in total.

Household membership rate: the proportion of a population group who are of a particular household membership type. Eleven household membership types are defined, but some of these categories are necessarily empty for some population groups (for example, the category of "married couple wives" must be empty for all male groups). Taking into account these structural zeros, there are 825 defined household membership rates for each area.

Marital status factors: the proportions of a population who are (separately) married, widowed, divorced and single, cross analysed by whether cohabiting or not. There are eight marital status categories.

Resident population: all persons who usually live in the area, whatever their nationality. Members of HM and non-UK Armed forces in England are included on a residential basis. HM forces stationed outside England are not included. Students are taken to be resident at their term time address.

Institutional population: the population wholly resident in communal establishments, such as residential care homes, nursing homes and long stay hospitals. Resident staff as well as other residents are included.

Private household population: the resident population minus the institutional population.

Annex B - Methodology and Sources of Data

The Method

The household projections are compiled by applying projected household membership rates to a projection of the private household population disaggregated by age, sex and marital/cohabitational status and summing the resulting projections of household representatives. This technique is substantially the same as the headship rate method which was first applied in this country by the Registrar General in the Housing Report of the 1931 census and subsequently developed in the Housing Report of the 1951 census and in Walkden (1961). Projection into the future of past rates of change of headship rates was first employed in the household projections produced by the Ministry of Housing and Local Government in 1968 and described fully in Allnutt, Cox and Mullock (1970). Those projections and all subsequent household projections published by the Department of the Environment up to and including the 1989-based projections published in 1991 (DoE, 1991), were in terms of legal marital status and took no explicit account of unmarried cohabitation. The 1992-based projections took explicit account of cohabitation and the present 1996-based projection do so in the same way.

The household projections are compiled through a six stage process:

- a. the resident population is projected by the Government Actuaries Department (GAD) at national level and by the Office for National Statistics (ONS) for sub national areas of England. The latest household projections utilise the 1996-based national population projections which are summarised in Annex C. The subnational population projections are also 1996-based.
- b. the marital status of the population is projected by GAD. This projection is made for England and Wales combined. It projects the population by legal (de jure) marital status (within sex and age) cross analysed by whether or not cohabiting. The proportions cohabiting in 1996 were estimated by ONS and projected for future years by GAD. This cross analysis is described in Annex D. The marital status projection is at national level only. Estimates of marital status in future years at subnational level are made by applying national/local differentials in marital status from the 1991 census to projected marital status factors.
- c. the institutional population is projected by DETR from the 1991 census and information from the Department of Health about residents in residential care homes from 1991 to 1996. At ages under 75, the number of residents in institutions is kept constant at 1991 levels in each sex/age/marital status category. The marital status classification groups individuals into de jure categories only, as members of the institutional population do not cohabit by definition (resident staff with self contained accommodation are not part of the institutional population). In the 75 - 79, 80 - 84 and 85 and over age bands, the proportion of the population in each category resident in communal establishments is assumed to fall slowly from 1996 to 2001 and after that remain constant. Details of the 1996-based projection of the institutional population are in Annex E.
- d. the institutional population is subtracted from the total resident population projection to leave the private household projection, analysed by sex, age and marital status (cross classified by cohabitation status) in the years required for household projections.

- e. within each age/sex/marital cum cohabitational status category, household membership rates are projected from historical data derived from censuses and (at national level) Labour Force Survey (LFS) data. The projected household membership rates are then multiplied by the appropriate private household population projection.
- f. projections for sub national areas are initially made independently of the national projections, but are subsequently adjusted for consistency with the national projection. Similarly, projections for sub regional areas are adjusted for consistency with the regional projections. These adjustment processes are termed "regional controlling".

Data Sources

The data sources used for projecting household membership rates are a special analysis of a 10 per cent sample of the 1991 Census; the ONS Longitudinal Study samples from the 1971 and 1981 Censuses and the Labour Force Survey (LFS) from 1992 to 1997. The Labour Force Survey is considered the best available source of data about household membership rates after the 1991 Census. The way in which the 1971 and 1981 ONS Longitudinal Study samples and the 1991 Census sample were used to estimate comparably defined household membership rates for 1971, 1981 and 1991 was described fully in Annex B of *Projections of Households in England to 2016*. These household membership rates were used without change in the 1996-based household projections, so the description of them is not repeated here.

The Labour Force Survey has been used to extend the time series of household representative rates beyond the most recent available Census year. Compared with the Census 10 per cent sample, the Labour Force Survey samples are small, less than 1 per cent of the population. To minimise the effect of any systematic bias, the LFS data for 1992 - 97 have been adjusted to reflect the discrepancies between Census and LFS data in 1991. Because of the smaller sample used in the LFS, LFS household representative rates are calculated only by age and sex. Fully disaggregated household membership rates for 1992 to 1997 are produced by projecting Census data and then controlling the results to be consistent with the LFS based age/sex membership rates. These household membership rates are then used in conjunction with the Census data for national projections of household representative rates.

Projection Method for Household Representative Rates

Household representative rates in future years are projected from time trends estimated from the census based values for 1971, 1981 and 1991 and then the values from the Labour Force Survey. The "life cycle" method (Corner 1992) is used. This method makes use of the fact that the household membership rates in a particular cohort (defined by age) will vary smoothly with time. Furthermore, the changes in a particular rate in a given cohort will be the result of effects such as leaving the parental home, marriage and mortality, which are strongly dependent on the stage of the cohorts life cycle. It follows that, for each household membership status and marital status, plots of the cohorts membership rates against its age will have shapes which are recognisably similar for all cohorts. The projection method models this characteristic development of membership rates within cohorts as life cycle curves, which are assumed to undergo only trend changes in shape from cohort to cohort.

In practice, the household membership rates are modelled in terms of cohort birth date and cohort age by a two dimensional curve fitting method which makes a maximum likelihood fit to the available membership rate data. This method automatically weights data points according to sample size so that, for example, rates calculated for a small population group or from the LFS based data sets (which have comparatively small sampling fractions) are not given undue weight in determining the membership rate projections. In addition, explicit weights are applied for other purposes. An exponential weighting system is used to give greater weight to more recent data and further variations in the weights are incorporated to allow for uncertainties arising from definitional modifications and the errors introduced by estimation procedures such as those used in forming LFS based data sets.

Projection by time trend is appropriate where the observed changes are the result of numerous influences whose effects cannot be estimated separately. With only three census data points, the possible effects of economic variables such as real income, unemployment rates and mortgage rates cannot be distinguished one from another by statistical means, or together be distinguished from the effects of social changes. Upward trends in household membership rates and headship rates have been very long established. Rising trends are evident for the 1960s and 1950, as well as the 1980s and 1970s. Nothing is in view that could reasonably be expected to cause changes of trend in this respect, though of course the projected rising trends in individual household membership rates slow down as the maximum limit of 100 per cent is approached.

Medium term and longer term trends are the basis of the projections of households and of the underlying projections of population and marital status (Annexes C and D). In the shorter term there can be fluctuations around these trends. Such fluctuations are outside the scope of the projections, which can depict only medium term trends.

Regional Controlling

Separate household projections are made independently for each projection area. This gives rise to inconsistencies, in the sense that the projected number of households in a given area is not normally equal to the sum of the household projections for its constituent sub areas. This problem stems from the non linearity of the household membership rate model and from the use of LFS-based data for England and Wales. A similar situation arises regarding private household population projections, originating in the division of the age/sex groups by marital status. In addition, the non-linearity of the projection method is such that unadjusted the projections will not normally have equal numbers of male and female cohabiters, or of husbands and wives in married couples.

The purpose of the regional controlling procedure is to adjust the household projections so that all of these consistency conditions are achieved. At the same time, it must maintain the age/sex resident population projections made by GAD and ONS. To accomplish this task, a "top down" procedure is used. The separate projections for England and for Wales are first modified to agree with those for the combined area of England and Wales. At the next stage, the projections for the English Regions are calibrated to the controlled projections for England. This procedure is continued down the "tree", the controlled projections for each area being used to calibrate the projections of its sub areas. Given the interdependence of the various constraints which apply, it is not possible to achieve consistency with a simple scaling technique. A mathematical optimisation method was used in the 1989-based and

earlier projections to accomplish the controlling, but this approach was replaced in the 1992-based projections by a technique which is a generalisation of the scaling approach, which is retained in the present 1996-based projection.