



POPGROUP

Data Modules Methodology

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I Introduction

Data Modules aim to replicate official projections of population and households. They are used not only to examine the official results, but also to explore the outcome of similar projections with updated or alternative assumptions.

To satisfy these needs, the strategy of the Data Modules is to:

- Provide input files that when used without constraints of future population or numbers of future births and deaths produce the official outputs as closely as possible. These allow the modeller to change assumptions about future population or its components of change, or the assumptions about household formation, and use the software to calculate the consequences of these changes.
- The Data Modules also provide input files including projected counts of births and deaths and a constraint file of population, which replicate the official outputs exactly.
- Where official assumptions can be used directly in POPGROUP input files, they are the preferred option.
- Where the official assumptions cannot be exactly replicated within a local POPGROUP model, then inputs for POPGROUP are back-calculated to ensure that they provide the official results as closely as possible. Examples of where this extra calculation or approximation is necessary include:
 - a. When the official model includes an interaction between all districts within a country (e.g. Office for National Statistics' (ONS) model of migration within England), that cannot be replicated in a model for selected districts.
 - b. When the results of an initial projection are constrained to national projection (e.g. National Records of Scotland (NRS) and ONS population), and the official data provided are the inputs before constraint.

- c. When the official projection assumptions about age schedules change over the projection period (e.g. mortality by single year of age in the NRS and ONS population projections). POPGROUP has only one schedule of single year of age inputs, with changes for each year of the projection period limited to counts or differentials in five-year age-sex groups. POPGROUP bases its one single year of age schedules of fertility and mortality on year 2 of the official forecast, because the first year of the official forecast is adjusted by ONS to take into account births and deaths that have already occurred. For the Data Modules, changes in the official projection assumptions over the projection period are back-calculated as differentials specific to each area, each five-year age-sex group and each year of the projection. This reproduces the projections exactly for five-year age-sex groups, but only approximately within each five-year age-sex group.
- d. When the official projection of births, deaths and migrants are rounded to whole numbers before calculating the projection (e.g. NRS and ONS population projections).
- e. When insufficient data are provided to enable the Data Module to replicate the methodology (data on Armed Forces and other special populations are usually not released, although used in the population projections).

The ways in which this strategy is implemented in the official projections of population and households for England, Scotland and Wales are documented below. Each Data Module also has a user manual which summarises the calculations made.

In each case, the documentation provides details of:

- Derivation of each input file for the projection model, for the latest projection round.
- Variants provided by the statistics agency and whether replicated in the Data Module.
- Whether estimates prior to the projection base year are included in the Data Module, and if so their derivation.
- Changes since the previous round of projections.

2 England

2.1. Population

Data was last updated for the ONS 2014-based Sub-National Population Projections (SNPP) in the ONS2014POP Data Module. Documentation of the ONS method can be found [here](#).

ONS detailed output data is available from ONS on request.

Derivation in the Data Module

	Derivation in the Data Module
Base population	Direct from ONS.
Fertility	<p>Area schedules are back-calculated from births by age of mother and population. Those for year 2 of the official projection are used as the POPGROUP schedule.</p> <p>Area fertility differentials by age-group are back-calculated each year from projected births by age of mother and population.</p> <p>Area births by sex are as provided by ONS.</p>
Mortality	<p>Area schedules are back-calculated from deaths and population. Those for year 2 of the official projection are used as the POPGROUP schedule.</p> <p>Area mortality differentials by age-group and sex are back calculated from projected deaths and population by age and sex.</p> <p>Area deaths by age-group and sex are as provided by ONS.</p>
Migration within UK to and from each area	<p>An area schedule is back-calculated from migrants and population, using year 2 of the official projection.</p> <p>Area differentials each year are back-calculated from ONS projected migrants¹ and population by age and sex.</p> <p>Area counts of migrants by age and sex are as provided by ONS¹.</p>

Migration overseas to and from each area	<p>An area schedule is back-calculated from migrants and population, using year 2 of the official projection.</p> <p>Area differentials each year are back-calculated from projected migrants and population by age and sex.</p> <p>Area counts of migrants by age and sex are as provided by ONS.</p>
Constraint	Population by single year of age and sex as provided by ONS.
Special Populations	Not used in POPGROUP's replication of ONS, because not able to be released by ONS.
Other comments	<p>¹ The projected ONS migrants within the UK are adjusted before use, to ensure that the components of change (births, deaths, migration) sum to the population change projected by ONS for each cohort as it ages from age a to age a+1. Without this adjustment, there is an inconsistency in the ONS data due to their (a) separate projection of special populations (armed forces and prisoners) that are included in the final population but not in the migration flows, and (b) scaling preliminary sub-national projections to sum to the national projections. The size of the adjustment is generally small, and is given for each area, year, age and sex in a file within the Data Module titled 'Component Adjustment'.</p>

Variants

Three experimental variants are provided by ONS, as follows:

- High fertility
- 'Zero net migration' (no migration)
- Prisoners as a special population

These are not part of the data commonly used by local authorities, and are not yet implemented in the POPGROUP replication.

Population estimates prior to projections

In addition to the assumptions on input files calculated as above from the latest projections, counts of births, deaths, migration and population from mid-year estimates back to 2001 are

included, taken from the components of change by single year of age and sex in files provided online by ONS. The schedule remains as described above.

	Derivation in the Data Module
Base population	Direct from ONS: the 2001 Mid-Year Estimate
Fertility	Area births by sex are as provided by ONS.
Mortality	Area deaths by age-group and sex are as provided by ONS.
Migration within UK to and from each area	Area counts of migrants by age and sex are as provided by ONS ^{2,3} .
Migration overseas to and from each area	Area counts of migrants by age and sex are as provided by ONS ³ .
Constraint	Population by single year of age and sex as provided by ONS.
Special Populations	Not used in POPGROUP's replication of ONS, because not able to be released by ONS.
Other comments	<p>² The ONS migrants within the UK are adjusted before use, to account for 'special changes' (changes in armed forces, prisoners and school boarders which are estimated separately by ONS), and 'other changes' (including the occasional and usually minor impact of boundary changes). These are given by ONS as net changes from one year to the next. The net impact of both for an age-sex is added to UK in-migration, or if negative it is added to UK out-migration.</p> <p>³ The 'Unattributable Population Change' (UPC) for the years 2001-2011 is also a net change identified by ONS. The user has the option of including it in UK migration, in Overseas migration, or leaving it out. If included, half is added to the in-migration flow, and half deducted from the out-migration flow.</p>

Summary of changes since last round of official projections

No changes were made to the projection. The addition of population estimates prior to the projection is new for the ONS2014POP Data Module.

2.2. Households

Data was last updated for the Department for Communities and Local Government (DCLG) 2014-based Sub-National Household Projections (SNHP) in the CLG2014HH Data Module. Documentation of the DCLG method can be found [here](#).

DCLG detailed data is available from [this page](#).

The replication as a POPGROUP Derived Forecast is based on the second stage of the DCLG method.

Derivation in the Data Module

	Derivation in the Data Module
Population	Direct from ONS.
Population not in households	Numbers (for age-groups under 75) and percentages (for ages 75+) are back-calculated from the ONS population and the household population provided by DCLG.
Household representative rates	Representative rate for age a, for household type h = (Household representatives of age a and household type h) / (All people of age a in households), from detailed DCLG data ⁴ .
Constraint	No DF constraint file is used.
Other comments	⁴ The detailed DCLG data are not consistent with their published totals for each district, due to rounding to whole numbers of households. For this reason, the representative rates calculated as above are scaled so that when households are summed over age and type they give each District's published total of households, each year. The adjustment does not exceed 0.03% in any district.

Variants

No variants are provided by DCLG.

Estimates prior to projection

The Data Module provides a model starting in 2001, using the detailed data provided by DCLG which extends back to 1991.

Summary of changes since last round of official projections

In the 2012 and 2014 rounds, the number of household types is reduced to 8 from the 17 household types provided in the 2010 round.

3 Scotland

3.1. Population

Data was last updated for the NRS 2014-based SNPP in the NRS2014POP Data Module. Documentation of NRS method is available [here](#).

NRS provide detailed data of outputs and inputs on request.

The replication uses the same derivation as for England Districts' population above, with the exception of the fertility and mortality schedules.

Derivation in the Data Module

	Derivation in the Data Module
Base population	Direct from NRS.
Fertility	<p>Area schedules are the national Age-specific Fertility Rates (ASFRs) for year 2 multiplied by the NRS 'scaling factor' for the Council Area.</p> <p>Area fertility differentials by age-group are back-calculated each year from projected births by age of mother and population.</p> <p>Area births by sex are as provided by NRS.</p>
Mortality	<p>Area schedules are the national Age Standardised Mortality Rates (ASMRs) for year 2 multiplied by the NRS 'scaling factor' for the Council Area at each broad age and sex.</p> <p>Area mortality differentials by age-group and sex are back-calculated from projected deaths and population by age and sex.</p> <p>Area deaths by age-group and sex are as provided by NRS.</p>
Migration within UK to and from each area	An area schedule is back-calculated from migrants and population, using year 2 of the official projection.

	<p>Area differentials each year are back-calculated from NRS projected migrants⁵ and population by age and sex.</p> <p>Area counts of migrants by age and sex are as provided by NRS⁵.</p>
Migration overseas to and from each area	<p>An area schedule is back-calculated from migrants and population, using year 2 of the official projection.</p> <p>Area differentials each year are back-calculated from projected migrants and population by age and sex.</p> <p>Area counts of migrants by age and sex are as provided by NRS.</p>
Constraint	Population by single year of age and sex as provided by NRS.
Special Populations	Not used in POPGROUP's replication of NRS, because not able to be released by NRS.
Other comments	<p>⁵ The projected NRS migrants within the UK are adjusted before use, to ensure that the components of change (births, deaths, migration) sum to the population change projected by NRS for each cohort as it ages from age a to age a+1. Without this adjustment, there is an inconsistency in NRS data due to their (a) separate projection of special populations (armed forces and prisoners) that are included in the final population but not in the migration flows, and (b) scaling preliminary sub-national projections to sum to the national projections. The size of the adjustment is generally small, and is given in a file within the Data Module titled 'Component Adjustment'.</p>

Variants

Seven variants are provided by NRS, as follows:

- High fertility
- Low fertility
- High mortality
- Low mortality
- High migration
- Low migration
- Zero migration outside Scotland

These are not yet implemented in the POPGROUP replication.

Population estimates prior to projection

Not yet implemented.

Summary of changes since last rounds of official projections

Prior to the 2014-based SNPP, NRS projected migration as net flows for each area and the rest of the world. The Data Modules for the earlier SNPPs used only two flows of migration rather than the current four.

3.2. Households

Data was last updated for the NRS 2014-based SNHP in the NRS2014HH Data Module. Documentation of the NRS method is available [here](#).

Detailed data are provided by NRS on request (more detailed than are available online).

Derivation in the Data Module

	Derivation in the Data Module
Population	Direct from NRS.
Population not in households	Percentages for each age group, as provided by NRS.
Household representative rates	Headship rate for age a, for household type h = (Households headed by someone of age a and household type h) / (All people of age a in households), from data provided by NRS.
Constraint	No DF constraint file is used.
Other comments	

Variants

Two variants are provided by NRS, as follows:

- High migration
- Low migration

These are not implemented in the POPGROUP replication.

Estimates prior to projection

Not yet provided.

Summary of changes since last rounds of official projections

No changes were made to the projection.

4 Wales

4.1. Population

Data was last updated for the Welsh Government (WG) 2014-based SNPP in the WG2014POP Data Module. Documentation of the WG method can be found [here](#).

Derivation in the Data Module

In Wales, the official projections use POPGROUP software, such that the inputs in POPGROUP Data Module exactly repeat the official projections. No extra calculations are made to prepare the input files.

Variants

Four variants are provided by WG:

- Higher natural change
- Lower natural change
- 10-year migration
- Zero migration

Input files and scenarios are provided by the Data Module so that the user can directly replicate each variant. These are the same as used and provided by WG.

Population estimates prior to projection

Not yet provided.

Summary of changes since last round of official projections

The WG used POPGROUP version 4 in the 2014-based round of SNPP, rather than version 3 as in the previous 2011-based round.

4.2. Households

Data was last updated for the WG 2014-based SNHP in the WG2014HH Data Module. Documentation of the WG method is available [here](#).

Detailed data are available from WG on request.

Derivation in the Data Module

The Data Module reproduces the contents of Derived Forecast files provided by WG, without any additional processing for data relating to forecast years.

Estimates prior to projection

The projection includes years 2001-2013, calculated as follows:

	Derivation in the Data Module
Population	Mid-Year Estimates provided by ONS.
Population not in households	As in WG, this is the population in Communal Establishments at each age: absolute numbers for age-sex groups up to 74 and percentage of population for ages 75 and older. It is linearly interpolated between 2001 and 2011 Census values, then held constant as in the WG projection.
Household membership rates	<p>The Data Module interpolates membership rates for years between 2001 and 2011, using the two point exponential model used by WG for its projection. The membership rates estimated in this way for each area, age and household type and year 2002-2010 are scaled to add to 1 across household types.</p> <p>Membership rates for 2011, 2012 and 2013 are taken from the WG 2011-based projections. The WG projection of rates did not change</p>

	between the 2011- and 2014-based rounds.
Factors	Average household size for household types of 5+ people linearly interpolated between 2001 and 2011 census values, then held constant as in the WG projection.
Constraint	No DF constraint file is used.
Other comments	

Variants

Four variants provided by WG are based on the four population variants. The Data Module provides these variant population input files, and scenarios, as provided by WG.

Summary of changes since last round of official projections

The WG used the Derived Forecast model in the 2014-based round of SNHP, rather than the HOUSEGROUP model as in the previous 2011-based round.