POPGROUP v.4

User Guide 1

How to Get Started with Population Projections

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Note: This guide supersedes the version first published in May 2015. This updated edition is for use with Data Modules that include historical births, deaths, migration and population as well as the official projection:

ONS 2014-based projections for districts in England

Users with Data Modules that do not include past data will find the earlier edition of this Guide published in 2015 more appropriate:

WG 2014-based projections for districts in Wales

NRS 2014-based projections for districts in Scotland

Contents

Introduction

Providing services that people need is all about planning for the future. Whether the focus is the number of pupils entering school next year, or the adult and health services needed five years ahead, or looking forward strategically over one or two decades, demographic projections of the future size and composition of the population are a key input to planning policy and investment.

This Guide describes how to get started with local population projections in England, Wales and Scotland, using POPGROUP software. The Guide assumes that the reader has access to the Data Modules of official projections that are regularly produced for POPGROUP users.

This Guide describes how to view and analyse the official projection for a set of local authority areas chosen by the user, how to make alternative scenarios, and how to compare their results.

1.1. How much time do I need?

An existing user of POPGROUP will be able to complete Sections 2-4 to install a new official projection, view and analyse it all within ten minutes. A complete novice will want to put aside half a day. Each of the alternative scenarios in Section 5 takes only a few minutes to complete and run, as does the comparison of different scenarios in Section 6. Again, the novice will want to put aside more time to consider the new skills that are being learned. Section 7 involves alternative source data: finding and managing these data outside the software does take time, but your organisation may already do this.

1.2. What else will I need to know?

This Guide is intended for those getting started with the software, by providing step-by-step support for specific common tasks. It assumes no prior knowledge. The POPGROUP v.4 reference manual remains the comprehensive guide that should also be consulted to learn how the software operates and its full range of functionality.

However, the POPGROUP suite of software (POPGROUP, Derived Forecasts, and their Data Modules) is not intended to be a 'black box'. When making projections, the user is responsible for the assumptions made about future population change. The user must understand something about how births, deaths and migration combine to create a developing population, and will get that understanding from other texts and from courses.

POPGROUP is a very flexible engine for producing demographic forecasts and scenarios. To use it to its full, the user will consult its other Guides (listed on page 50). All documentation for POPGROUP is available by emailing **popgroup@edgeanalytics.co.uk**.

1.3. About this guide

In this document, the names of Excel workbooks are written in bold grey font (e.g. `POPGROUP_Scenario`). Sheets within workbooks are written in bold grey italics surrounded by single quotation marks (e.g. `'Sched'`).

Folder names are written in uppercase, surrounded by single quotations (e.g. '…POPULATION\OUTPUT'). Users may name folders and workbooks using both lower and upper case, depending on preference.

References to cells within worksheets, or to buttons/options within the workbooks are in blue italics surrounded by single quotations, for example, *'Validate'*.

Two types of text box are used in this document:

ⓘ	**Information**

!	**Warning**

ⓘ	**Local authority areas**
This Guide refers to local authority areas in England, Wales and Scotland that are variously named Unitary Authorities, Districts, Boroughs or Council Areas. For shorthand the Guide often refers to 'areas'.	

Record results for your area

The Guide asks you to choose one or more areas, and follow instructions to replicate the official projection and make alternative scenarios.

You can manually record results for your area on page 48, to keep track of your progress.

Instructions and advice

Much of this Guide is structured as tables with instructions for an 'Action' accompanied by images of the 'POPGROUP view' that you will see.

Text outside the tables provides further advice and explanation.

POPGROUP is a 'model-maker'

POPGROUP makes a model for the local authority area(s) you specify, starting in the 'base year' of the projection. Sections 2–4 of this Guide help you use POPGROUP to replicate the official government projection. It is just one projection that can be made with this model.

Sections 5–7 of this Guide show you how to develop a variety of other projections for your local authority area(s). Each projection uses the same model for your area(s).

After using this Guide, you may also make projections which start from a different year or have different areas. These will be different models made with POPGROUP, held in separate folders.

2 Install POPGROUP

This Guide does not repeat the installation instructions in the POPGROUP Reference Manual. But here are some tips:

ⓘ	**Location of POPGROUP on your computer**

When installing the software, usually from a disc or a Dropbox address, the default location for the software is on your hard drive at 'C:\FORECAST\'. POPGROUP documentation and software will assume that this is its location.

However, many organisations will prefer a different location and POPGROUP will work with any path that does **not** begin with a back slash '\'. You can specify your path during the installation. If for any reason you need help, contact **popgroup@edgeanalytics.co.uk**.

!	**Macros must be enabled when using POPGROUP**

POPGROUP works in Excel by using programs known as 'macros'. After installation you must follow the instructions in the manual to enable macros and trust access to Visual Basic. Otherwise, POPGROUP cannot work and you will receive error messages.

ⓘ	**Multiple copies of POPGROUP**

You may install the software on more than one computer within the organisation as specified on your licence. You may **not** pass the software to third parties. If the software is installed on a networked server, a single installation will serve all users connected to that server.

3 Install the Latest Official Population Projection

Each official population projection for England, Wales and Scotland has been replicated in POPGROUP, and is supplied to users either:

(a) as completed data files for selected local authority areas. In this case, install them as instructed, and continue with Section 4 to explore the results; or

(b) as a Data Module which is installed and used to select local authority areas. Most local authorities receive the Data Module. In this case, follow the notes in the rest of this Section.

3.1. Install the Data Module

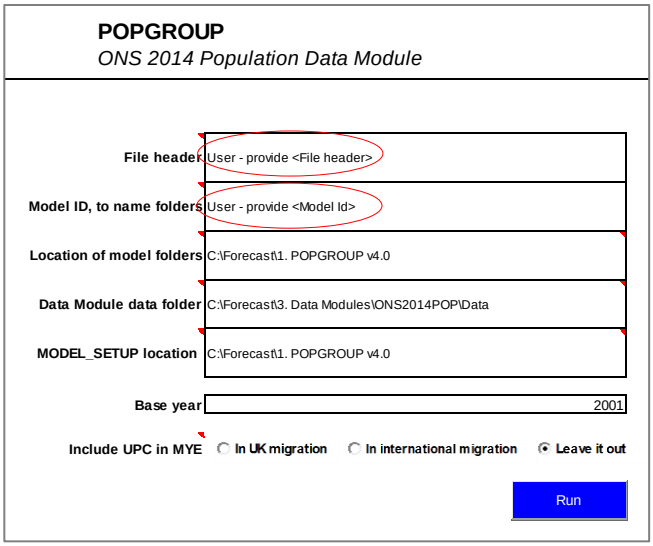
Follow the instructions in the Data Module's manual (supplied with the Data Module). Installation is simply a matter of clicking on the Data Module provided, specifying the folder to contain the Data Module if it is not the default provided, and allowing files to be copied.

!	**Wales and Scotland projections; England projections other than 2014-based**
This Guide has been developed using ONS 2014-based population projections for five areas in England. It includes the births, deaths and population from 2001 onwards. These give useful context to the projections. If you are working with areas of Wales or Scotland, or with a projection from a different base year, the same instructions will apply but names may differ. Occasionally, notes appear in this Guide to indicate differences that might be expected in Wales or Scotland.	

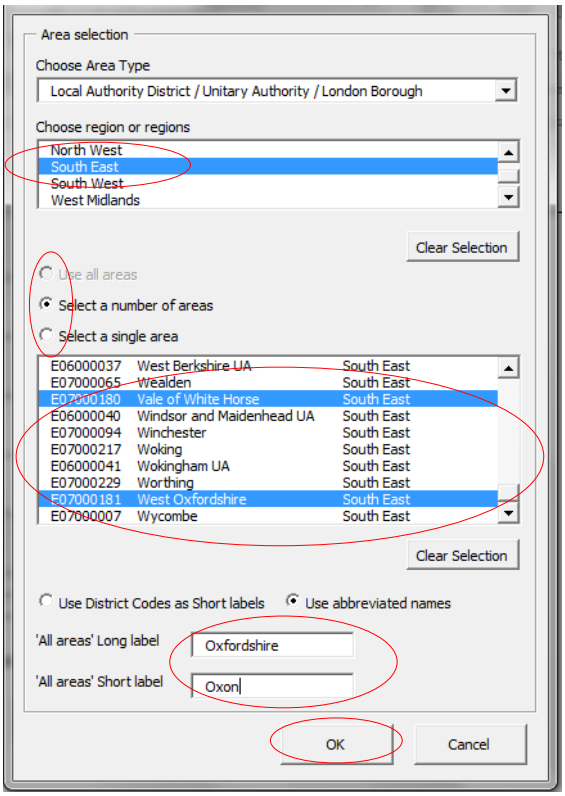
3.2. Produce the official projection

ⓘ	**Which areas will you make a model for?**
Before starting, decide which areas you wish to model. Up to 40 can be chosen, but usually you will choose either a single area or a group of neighbouring areas, for example all the districts within one county.	

Further information is available in the Data Module's manual, which is supplied with the Data Module (also available from **popgroup@edgeanalytics.co.uk**).

Action	POPGROUP view
When opening the Data Module, e.g. `DM_ONS2014POP_Setup.xls`, two entries are required on this screen: 1. The *'File header'* will be repeated on all input and output files and is for information only. You may make it a blank space, or put a meaningful name like 'Districts'. 2. The *'Model ID'* will be used to name folders containing the model's files. Use it to remind you of the areas and the start year of the model, e.g. 'Manchester2014' or 'Essexdistricts2014' After completing this screen, click *'Run'*.	

By default, POPGROUP will fill the input files with births, death and Migration back to 2001, and will leave out UPC (Unattributable Population Change during 2001-2011). For details, see Appendix 1.

Action	POPGROUP view
A further screen appears where you choose the Region(s) containing your area(s), and then choose your area(s). You may be provided a restricted choice of areas. If you need more areas than are offered, contact **popgroup@edgeanalytics.co.uk** If you chose more than one area, type a long and short label for the collection of 'All areas', e.g. 'Essex'. **! Wales and Scotland** Regions are not a choice on your screen. **! Selecting a single area** If you choose to select a single area, you will not be asked to complete labels for 'All areas'. When this screen is complete, click *'OK'*.	

The model is then created. Input files are filled with the official projection assumptions. The projection outputs are created and saved. The model setup is saved in the POPGROUP folder, so that you can refer to it later.

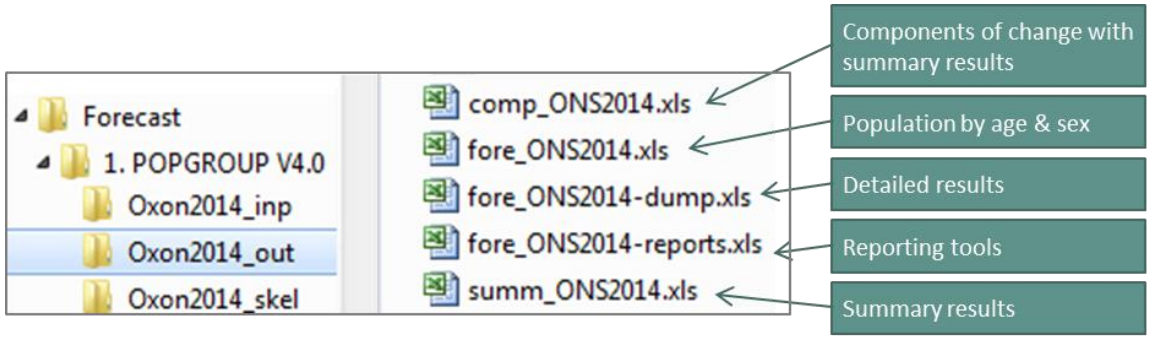
The next Section explores the results of the official projection in some detail. You will learn how to use POPGROUP, and how its files are structured.

!	The production of a model and running its official projection may take some time
On a fast machine a model for one area will take less than 3 minutes. However, the time taken can be significantly longer for several areas, for a slower machine or using a connection to a server. With a combination of these things it has been known to take more than an hour. Be patient. Progress is indicated on the screen.	

4 Summarise the Results

4.1. Find the output files

Whether you have been supplied with the official projection in POPGROUP files, or have produced it using a Data Module, the results will be saved in an output folder, for example:

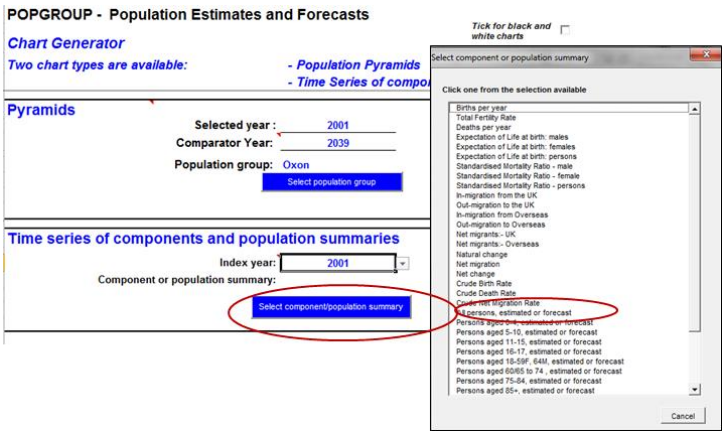
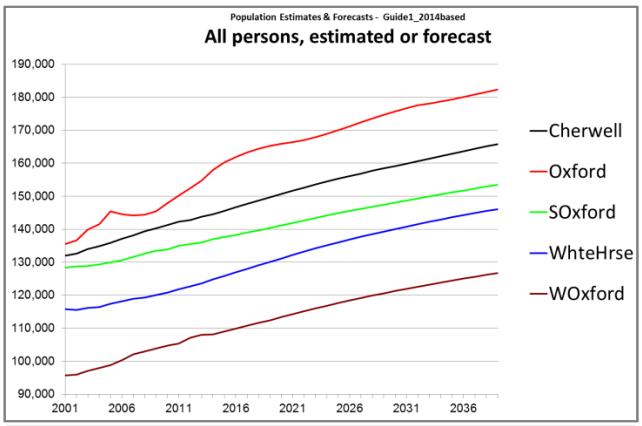
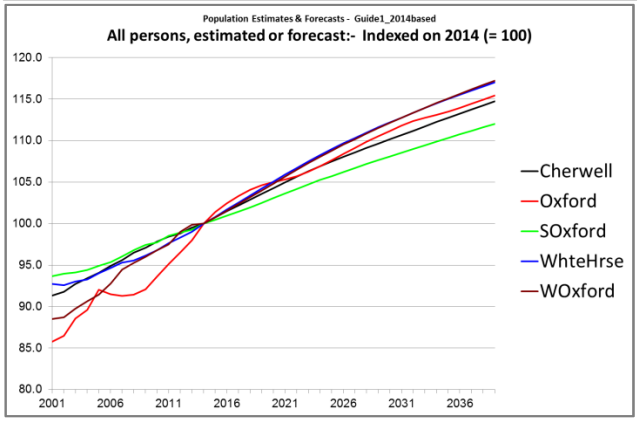


Check that the five files listed above are there. Open each of them to see that they contain the results described.

We will mostly use the `-reports` file and the `comp` file in this Guide, but all contain useful information, and are described in more detail in the POPGROUP reference manual.

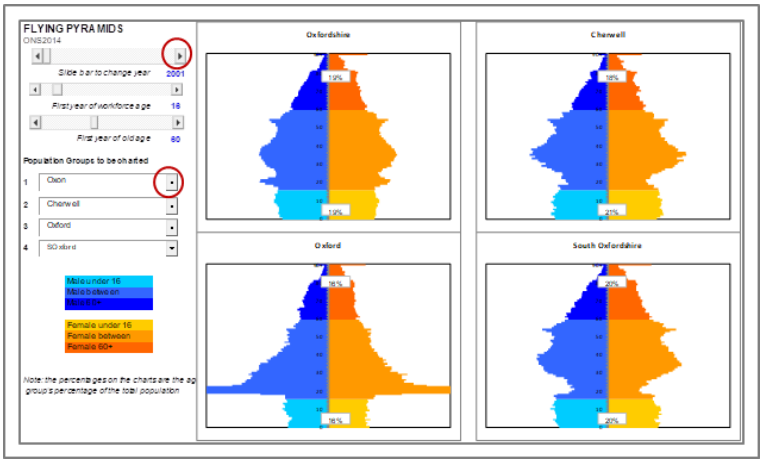
If it is not already open, open the `-reports` file now.

4.2. View population change 2014–2039

Action	POPGROUP view
In the `-reports` file, make sure you are in the *'Charter'* sheet. Click: Select component/population summary A box will open. Click *'All persons estimated or forecast'*. Click: Produce the charts	 See the projected change in population. Move the mouse over the line to see the values at any year.
Return to the *'Charter'* sheet and click: Save the charts just produced Enter any appropriate name for the saved charts, e.g. 'Pop'. There are two charts. One shows the number of people; the other is indexed to show the percentage change over time. The index year can be changed by the user, on the *'Charter'* sheet.	 

Now that they have been saved, the charts are not protected and can be edited like any Excel chart. For example, you can change the font sizes, format the axes, and reorder the areas to be suitable for a report.

4.3. View the evolving population pyramid

Action	POPGROUP view
Go back to the *'Charter'* sheet. Try other options. Click: Run the flying pyramids program Choose the area from the drop down lists of Population Groups. Click or drag the top slider to see how the population changes over time.	
How fast is the area ageing?	The % aged 60 and over is given on the chart.

The `FlyingPyramid` file is automatically saved into the output folder for later use, or can be recreated from the `-reports` file later.

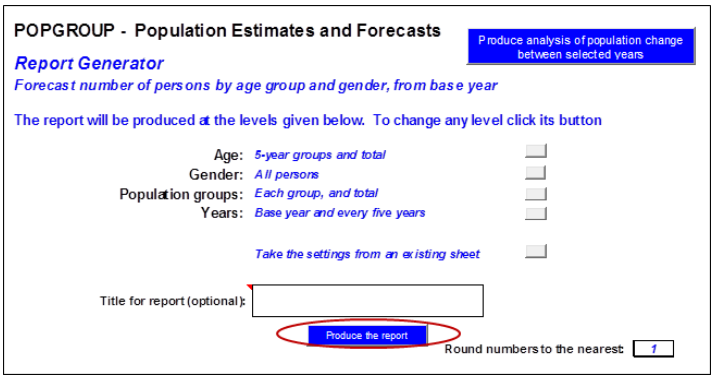
4.4. Tabulate the population age structure

Page 48 of this Guide provides a table headed 'Your answers', where you can manually record some key results to keep track of the total population and the percentage aged 85 and older. This will help you to compare the results of the official projection with the scenarios that you will make in the next part of the Guide.

<table>
<tr><th>Action</th><th>POPGROUP view</th></tr>
<tr><td>Still in the -reports file, go to the 'Reporter' sheet.

Make the default report by clicking:

Produce the report

The report will be saved on a new sheet. Give the sheet a name, e.g. 'Default' or '5-yrs'.</td><td> 

How useful would this report be to you?</td></tr>
<tr><td>Return to the 'Reporter' sheet. Try different options by clicking the grey boxes which allow any age groups and years to be reported.

Numbers can be rounded suitable for publication:
Round numbers to the nearest: 1
Change the '1' to '50' or whatever you feel is appropriate.

Or choose the option to:

Produce analysis of population change between selected years</td><td>An example with user-specified age groups and years, males and females separately, a title, and rounded to 50 persons.

Young age groups 2001-2014 and projection

<table>
<tr><th></th><th></th><th></th><th>2001</th><th>2014</th><th>2019</th><th>2024</th></tr>
<tr><td>Oxfordshire</td><td>Males</td><td>0-4</td><td>18,200</td><td>21,450</td><td>21,000</td><td>21,250</td></tr>
<tr><td></td><td></td><td>5-10</td><td>23,150</td><td>23,950</td><td>26,300</td><td>25,800</td></tr>
<tr><td></td><td></td><td>11-15</td><td>19,500</td><td>18,650</td><td>20,500</td><td>22,650</td></tr>
<tr><td></td><td></td><td>16-24</td><td>38,900</td><td>43,700</td><td>42,150</td><td>42,600</td></tr>
<tr><td></td><td></td><td>Total</td><td>99,750</td><td>107,700</td><td>109,900</td><td>112,350</td></tr>
<tr><td></td><td>Females</td><td>0-4</td><td>17,650</td><td>20,100</td><td>19,950</td><td>20,200</td></tr>
<tr><td></td><td></td><td>5-10</td><td>22,100</td><td>23,450</td><td>24,650</td><td>24,200</td></tr>
<tr><td></td><td></td><td>11-15</td><td>17,700</td><td>18,000</td><td>19,800</td><td>21,100</td></tr>
<tr><td></td><td></td><td>16-24</td><td>36,400</td><td>39,700</td><td>37,800</td><td>38,450</td></tr>
<tr><td></td><td></td><td>Total</td><td>93,850</td><td>101,250</td><td>102,200</td><td>104,000</td></tr>
<tr><td></td><td>Persons</td><td>0-4</td><td>35,850</td><td>41,550</td><td>40,950</td><td>41,500</td></tr>
<tr><td></td><td></td><td>5-10</td><td>45,250</td><td>47,400</td><td>50,900</td><td>50,000</td></tr>
<tr><td></td><td></td><td>11-15</td><td>37,200</td><td>36,650</td><td>40,300</td><td>43,750</td></tr>
<tr><td></td><td></td><td>16-24</td><td>75,250</td><td>83,350</td><td>79,950</td><td>81,100</td></tr>
<tr><td></td><td></td><td>Total</td><td>193,600</td><td>208,950</td><td>212,100</td><td>216,350</td></tr>
</table></td></tr>
<tr><td>Use the results to record the total population, the number and percentage aged 85 and older, at the start and at the end of the official projection, e.g. 2014 and 2039.</td><td>The report does not calculate percentages for you. Use your Excel skills to do that.</td></tr>
</table>

The reports can be edited like any Excel worksheet, before use in a report or other work.

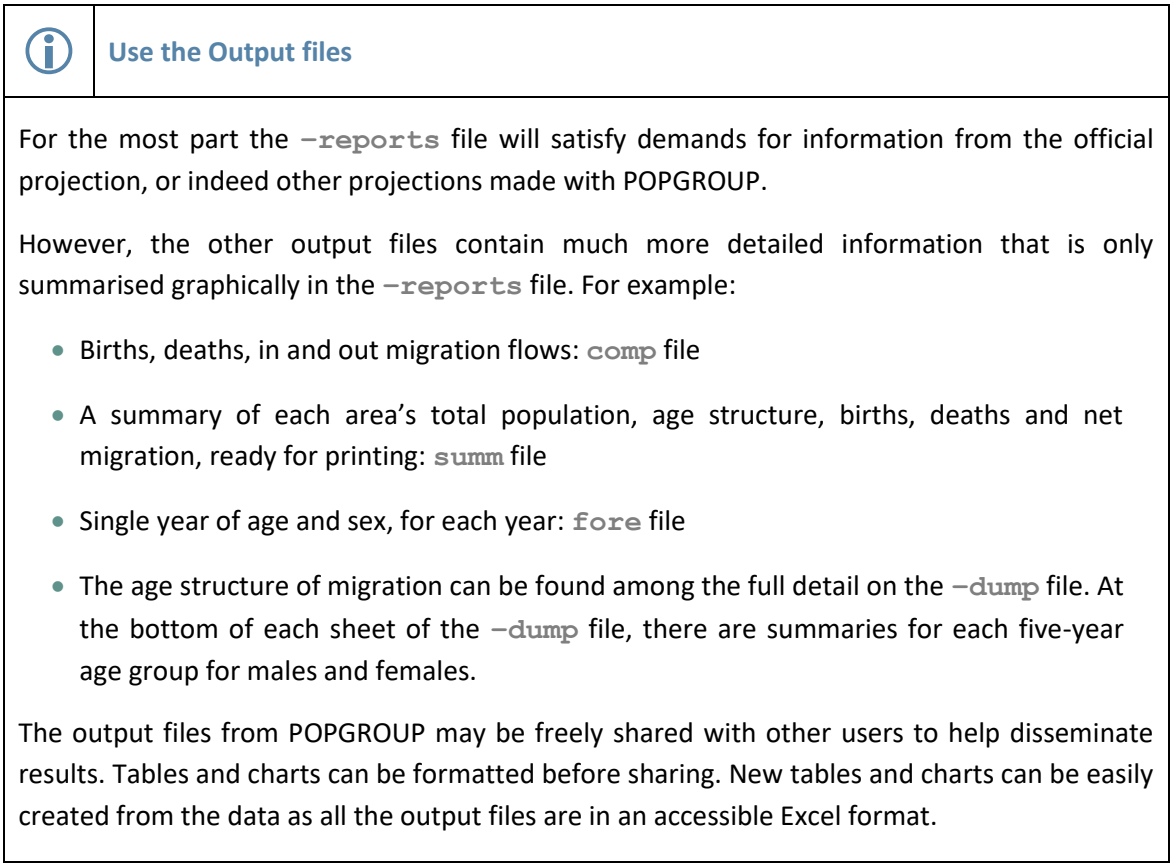
4.5. Plan with the official population projection

The official government projection can be used to foresee future demand for services, and how it may change in the short, medium and long term. The evolving size of the various age groups will lead to calculations that can help derive the demand for each service. For example:

- Change in a health service use due to increased number of elderly, or the number of women reaching age 50.
- Changing demands on recruitment due to a shift in the proportion of young adults among the population of working age.
- A change in social or other services as a consequence of the increasing number of deaths.

Use the `–reports` file to find these results for your area(s).

Demographic results such as these are fundamental ingredients of forward planning. Demographic changes often make the case for a shift of priorities, or help to explore the implications of new policies.



Use the Output files

For the most part the `–reports` file will satisfy demands for information from the official projection, or indeed other projections made with POPGROUP.

However, the other output files contain much more detailed information that is only summarised graphically in the `–reports` file. For example:

- Births, deaths, in and out migration flows: `comp` file
- A summary of each area's total population, age structure, births, deaths and net migration, ready for printing: `summ` file
- Single year of age and sex, for each year: `fore` file
- The age structure of migration can be found among the full detail on the `–dump` file. At the bottom of each sheet of the `–dump` file, there are summaries for each five-year age group for males and females.

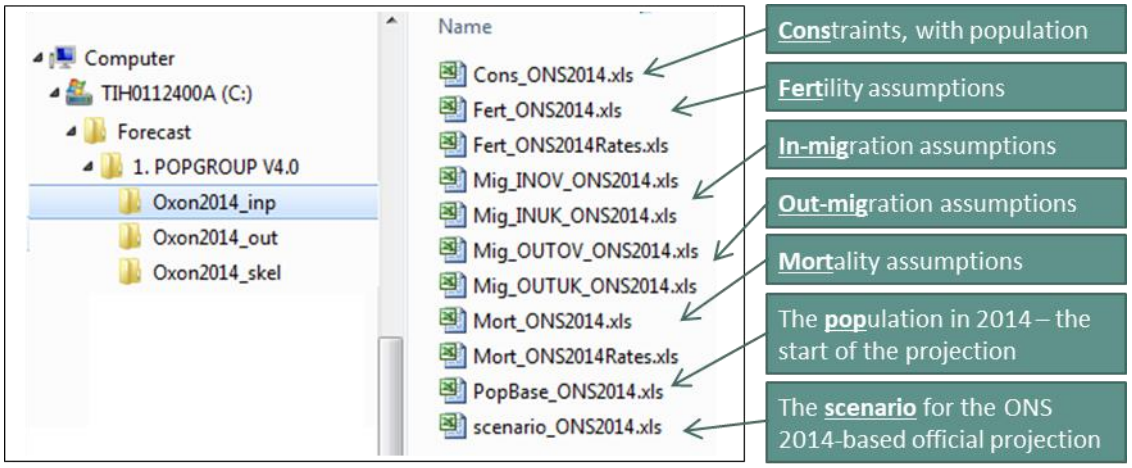
The output files from POPGROUP may be freely shared with other users to help disseminate results. Tables and charts can be formatted before sharing. New tables and charts can be easily created from the data as all the output files are in an accessible Excel format.

4.6. Understand how POPGROUP replicated the official population projection

This section explains how POPGROUP holds the assumptions (inputs) in its files, as well as the results of the projections (outputs) that the previous section explored.

Find the Input files

The input files contain the assumptions made by official projections. The folder containing them will look something like this, with your Model ID used to name the folder. The files are named according to their contents:



Note: In Wales and Scotland, different numbers of files represent variations on the assumptions included.

For example, the file beginning `Cons` holds a 'Constraint', in this case the population estimates up to 2014 and the projections after that year.

The files beginning `Fert` hold assumptions about fertility and births. There is more than one `Fert` file, each holding a different set of assumptions about fertility and births.

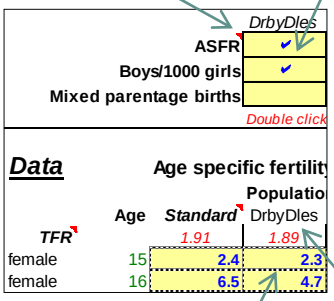
4.6.1. Structure of the POPGROUP input files

Action	POPGROUP view
Open some of the input files, and notice their **structure**. Most POPGROUP input files have several sheets: • A *'Sched'* sheet, with the schedule of rates that are specific to each individual year of age (fertility rates, mortality rates, and migration rates). • A *'Notes'* sheet, that documents where the data came from. • A sheet with assumptions that apply to all areas. • A sheet for each area.	The sheets on a POPGROUP input file:  The Constraints (*'Cons'*) and Population Base (*'PopBase'*) input files do not have a *'Sched'* sheet, because they do not deal with *rates* of population change. The `scenario` input file is unique. It lists the input files for a particular projection. It does not contain data.

4.6.2. POPGROUP inputs: age-specific rates, differentials and counts

The examples below explain the relationships between different parts of the data. The examples are for fertility; follow them on your file.

In summary, 'Age specific rates' for fertility, mortality and migration are on the schedule (`'Sched'`) sheet. They can be altered during the projection using 'Differentials' on the other sheets. However, 'Counts' take precedence over rates and differentials.

Action	POPGROUP view
Open `Fert_ONS2014` or your equivalent. Notice: On the `'Sched'` sheet you will see *'Age-Specific Rates'*, in this case of Fertility. The data can be input for single years of age in this sheet, and gives a starting point for the probability of giving birth at each age. Areas which don't have their own age profile in the schedule will use the 'Standard' schedule. The mortality and migration files also have a `'Sched'` sheet to identity the age profile of mortality and migration rates in each area. If there are entries you want to know more about, refer to the POPGROUP reference manual.	Hover over a red triangle for more information (in this case it spells out Age Specific Fertility Rate). Try one of the other red information points. The tick indicates that the Option has been chosen to enter ASFRs for this area. You can turn this on or off by double clicking in the box. If the box is unticked, you can't enter data below, and any data which has already been entered in the cells below will be greyed out, and won't be used in the projection.  Data entry areas are shaded yellow. In Derbyshire Dales, it is projected that there will be 4.7 live births per 1000 women aged 16 during the year. The red values are not data entry; they are calculated by POPGROUP from the data entry.

Action	POPGROUP view
Click on an area sheet, scroll down a little to *'Differentials'*. They are used to multiply the values on the `'Sched'` sheet so that fertility rates can change over time. • A differential more than 1 increases the fertility rate. • A differential of less than 1 decreases the fertility rate. • A differential of 1 means the same fertility rate as on the `'Sched'` sheet.	Option chosen to enter age-specific differentials: **FERTILITY DIFFERENTIALS** (by which to multiply the single age *Options* Provide total Trend total Provide age values ✔ Trend age values 2013-14 2014-15 2015-16 2016-17 2017-18 2018-19 *Data* — *Total* / *Age* female 15-19: 1.04 1.00 1.00 0.98 0.98 female 20-24: 1.03 1.00 0.97 0.95 0.95 female 25-29: 1.00 1.00 1.00 1.01 1.02 female 30-34: 1.01 1.00 0.99 1.00 1.00 In Oxford, it is assumed that teenage fertility will increase. The Schedule refers to 2015–16, so the differential for that year is 1.00.
At the top of the area sheet, notice the counts of *Births*. When a count of births is given, it overrides anything the fertility rates may indicate.	Option chosen to enter counts of boys and girls born: **BIRTHS** *Year beginning July 1* *Options* 2012-13 2013-14 2014-15 Provide total births Trend total births Provide births by sex ✔ ✔ ✔ *Double click any option you wish to s* *Data* *Total* *Males* 289 287 289 *Females* 275 273 275 ONS projects this many births each year.
The `'Notes'` sheet explains what is on the file and where it came from. You should edit this whenever you change the assumptions. An accurate and comprehensively completed notes sheet is a very useful reminder of how you created your projection, so it is well worth taking the time to keep it up-to-date.	**Documentation of the set of Fertility parameters contained in** Area counts of births by sex for years 2001-02 - 2013-14 from ONS Area fertility schedules taken from ONS subnational 2014-based pr Area fertility differentials each year computed to approximately repr Area SNPP counts of births each year taken from ONS subnational If alternative assumptions are made in a scenario not intended to re

Now look at other input files, to get a feel for the structure of the input sheets. It is worth taking the time to do this before the next Sections where you will create your own scenarios.

5 Create Alternative Scenarios

For many purposes, you will want to create your own projections. For example:

- to understand how each of the official assumptions affects the projection results
- to see how sensitive the official projections are to alternative assumptions
- to update the projections with more recent estimates of population change
- to estimate how plans for housing or jobs might affect the population

This Section and Section 7 guides you through making common alternative projections, so that you understand how POPGROUP's input files can be changed and how these changes affect the projection. Projections led by plans for housing or jobs are discussed in User Guides 4 and 5 (see page 50).

Before attempting to create alternative scenarios you should have worked through Section 4, and in particular made sure that you understand the input files as described in Section 4.6.

5.1. Remove counts from the official projection

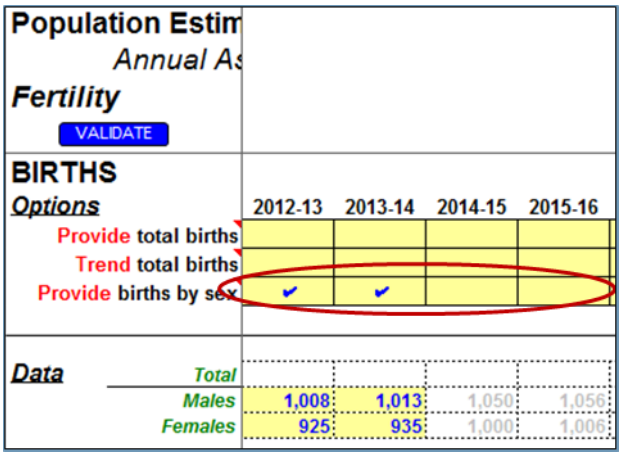
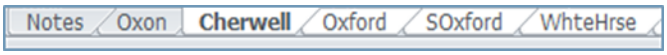
When replicating the official projection, POPGROUP's assumptions include counts from the results to exactly reproduce the number of projected births, deaths, migrants and the projected population each year. There are also the schedules of rates and differentials that on their own closely approximate the official projection. There are more inputs than needed, to make sure of exact replication.

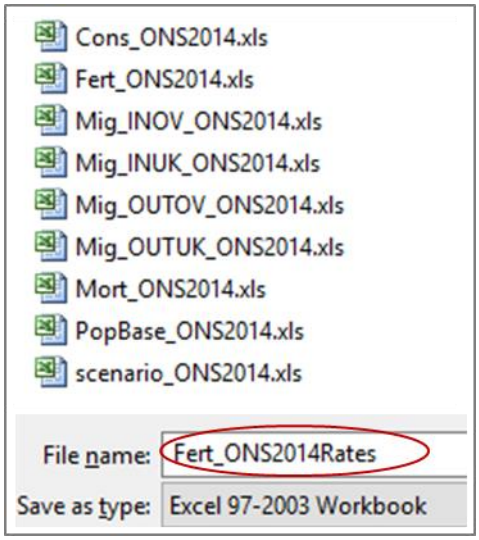
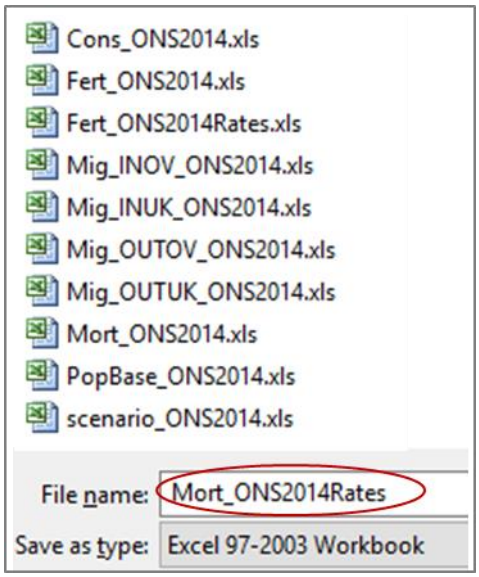
Before you produce your own projections with different assumptions, you must remove the constraining counts so that, for example, a changed assumption about the future number of migrants will properly affect the future numbers of births, deaths and population.

In this Section you will reproduce the official forecasts with future fertility and mortality rates, not with counts of future births and deaths, and note the insignificant differences in the results.

You will then create your own different scenarios in the Sections 5.2 and 5.3.

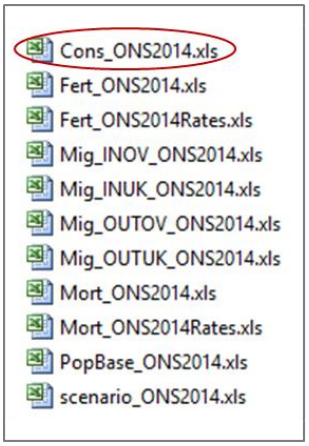
	**England projections with constraints removed**
The ONS2014 Data Module already produces the files `Fert_ONS2014Rates.xls` and `Mort_ONS2014Rates.xls` with counts removed. You can skip Action 5.1a below, and continue with Actions 5.1b, 5.1c and 5.1d if you are using files from the Data Module. Scotland and Wales users will have to create these files without birth or death counts now, using the instructions for Action 5.1a and then continuing with 5.1b and 5.1c.	

Action 5.1a: Remove birth and death counts	**POPGROUP view**
From the input folder, open the `Fert` (fertility) file of the official projection. On each area's sheet, turn off all the ticks in the *'Provide births by sex'* row from 2014-15, by either double clicking the cell, or highlighting the cell and pressing delete. The option will be deselected and the data will change to grey to indicate that they will not be used. Make sure you delete all the ticks on this row from 2014-15, but not those before for 2001 to 2014.	 **Tip:** if you have more than one area, select all of the area sheets together (by holding down the Ctrl key and clicking each tab in turn) before deleting the *'Provide births by sex'* options. The selected sheets will appear white:  When you make the deletion on one sheet, it will be then repeated on all the sheets. Click on one of the unselected sheets to remove the grouping of multiple sheets.

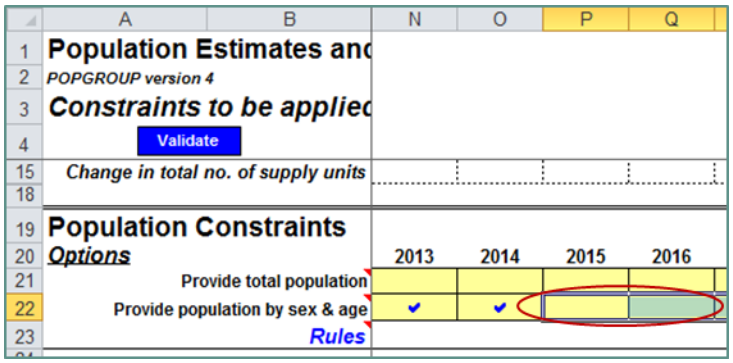
On the *'Notes'* sheet, add to the documentation to record that the options to use counts of Births have been removed. Click: VALIDATE If you have deselected all the births, validation will be successful and a chart of fertility rates will appear. The *'Validate'* button is seen on most input files, and checks that all expected data has been provided. Save the new file, adding 'Rates' to the file name.	
Repeat the process with deaths: • Open the mortality (Mort) file • Delete the ticks in the options for counts of deaths • Add a comment to the *'Notes'* page • Validate • Save the file with a new name, adding 'Rates'.	

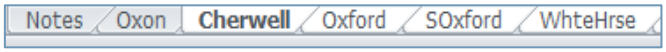
<table>
<tr><th>Action 5.1b: Delete the forecast results from the input file 'Cons'</th><th>POPGROUP view</th></tr>
<tr><td>From your input folder, open the constraints file <code>cons_ONS2014.xls</code>

This POPGROUP constraints file contains the population of each area from 2002 to 2014, and the results of the official projection from 2015 onwards. Find them, in rows 71 and below.

We will delete the options to constrain to the projected population, from 2015 onwards.</td><td> 
</td></tr>
<tr><td>On each area's sheet, turn off all the ticks in the 'Provide population by sex and age' row, by highlighting the cells and pressing delete.

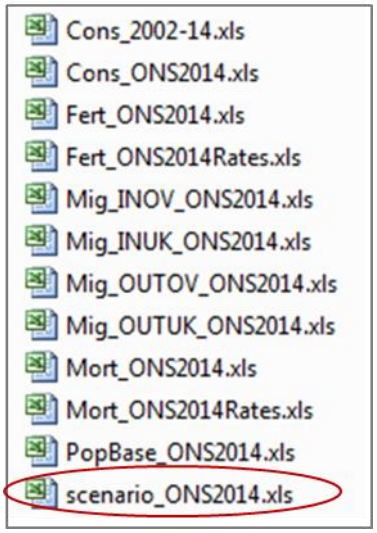
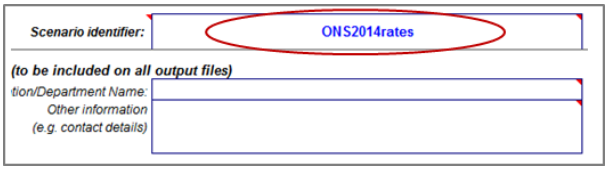
The options will be deselected and the data below will change to grey to indicate that they will not be used.

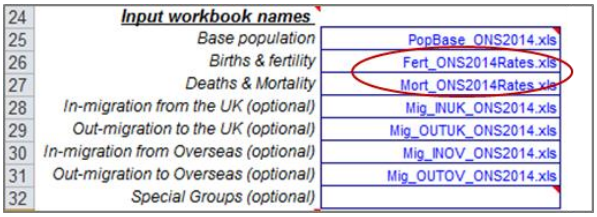
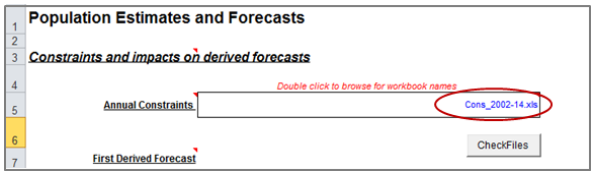
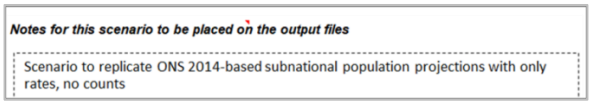
Make sure you delete all the ticks on this row from 2015 to the end, but not those before for 2002–2014.</td><td> 

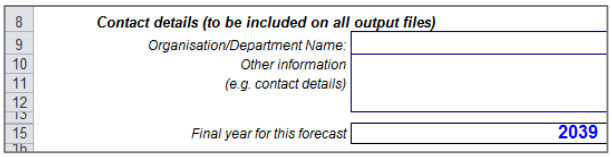
Tip: if you have more than one area, select all of the area sheets together (by holding down the Ctrl key and clicking each tab in turn) before deleting the 'population by sex and age' options. The selected sheets will appear white:
 

When you make the deletion on one sheet, it will be then repeated on all the sheets. Click on one of the unselected sheets to remove the grouping of multiple sheets.</td></tr>
<tr><td>Amend Notes to remove reference to ONS projection, 'Validate', and Save as with a new file name.</td><td>If there are errors on validation, correct them.
Save the file with a new file name, for example <code>Cons_2002-14.xls</code> to indicate the years that will be constrained.</td></tr>
</table>

Now that you have input files with fertility and mortality rates rather than fixed numbers of births and deaths, and you have a constraint that does not include the projected future population, use these new input files in a projection as follows.

Action 5.1c: Prepare the official projection without counts	POPGROUP view
From your input folder, open the official scenario `scenario_ONS2014.xls` A POPGROUP scenario lists the files that contain assumptions for a projection. You may have more than one fertility file, each with different assumptions. A scenario will list only the fertility file to be used for its projection.	
On the *'Run_Details'* worksheet, amend the *'Scenario identifier'*, adding 'rates' to the name (e.g. **ONS2014rates**). The identifier will name all the output files from this projection. A scenario workbook will be saved with this name when the scenario is run. **! Warning** If you do not alter the scenario identifier, your official projection will be over-written.	

Change the *'Births & fertility'* and the *'Deaths & Mortality'* files to those not containing counts, prepared in Action 5.1a. You can edit the name by typing (ensure that the '.xls' file identifier is included), or double-click to find the file. Leave the four file names referring to migration unchanged.	 24 Input workbook names 25 Base population — PopBase_ONS2014.xls 26 Births & fertility — Fert_ONS2014Rates.xls 27 Deaths & Mortality — Mort_ONS2014Rates.xls 28 In-migration from the UK (optional) — Mig_INUK_ONS2014.xls 29 Out-migration to the UK (optional) — Mig_OUTUK_ONS2014.xls 30 In-migration from Overseas (optional) — Mig_INOV_ONS2014.xls 31 Out-migration to Overseas (optional) — Mig_OUTOV_ONS2014.xls 32 Special Groups (optional) If you double-click to find the file, the filename when it is pasted here will include its full path.
On the **'Constraints_and_impacts'** sheet, delete the file name from the *'Annual constraints'* and replace with the **Cons_2002-14.xls** . Constraints are used to force the population forecast to agree with figures you provide for one or more years, which may be the population, or a plan for housing or jobs. By using the **Cons_2002-14.xls** file the population is constrained up to 2014, forecasting population change thereafter.	 Run_Details Constraints_and_impacts  Population Estimates and Forecasts Constraints and impacts on derived forecasts Double click to browse for workbook names Annual Constraints Cons_2002-14.xls CheckFiles First Derived Forecast
Return to the **'Run_Details'** sheet and change the *'Notes'* section to document this new projection.	 Notes for this scenario to be placed on the output files Scenario to replicate ONS 2014-based subnational population projections with only rates, no counts

You can include contact details to be repeated on the output files. Here you could also change the final year of the forecast, but do not do so because we want to compare the result for the final year with the official forecast.	 8 **Contact details (to be included on all output files)** 9 Organisation/Department Name: 10 Other information 11 (e.g. contact details) 12 15 Final year for this forecast 2039

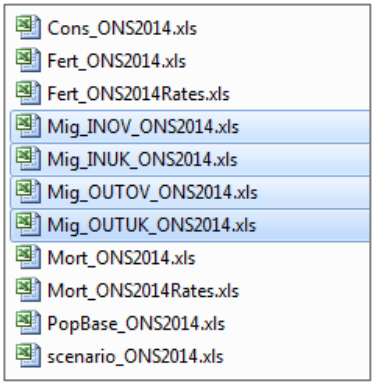
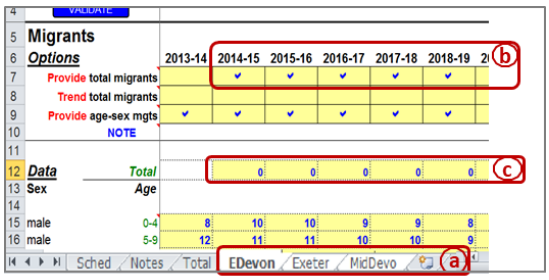
Action 5.1d: Run the official projection without counts	POPGROUP view
When *all* the changes have been made as above, click at the top of the sheet: 	You may be warned that: • All other Excel files that are open will be closed without saving (Click *'Cancel'* and save those files if this is a problem). • You will be overwriting output files. In this case, cancel and check that you have given your scenario a new identifier as in Action 5.1b before clicking 'OK'. The forecast will be run, with a note that: • The forecasts have been successful and the results saved in your output folder. ***If this is your first forecast in POPGROUP, congratulations!***
Note the total population at the end of the projection.	After the forecast has run, the -`reports` output file will be left active. Use it to note the total population. The total may be different by a few dozen from the official projection that you noted in Section 4.4 above. This is not a problem. It is a measure of the small cost of not being able to use exactly the same forecasting model as the official statistics agency ONS or NRS (WG used POPGROUP v4 for their forecasts from 2014).

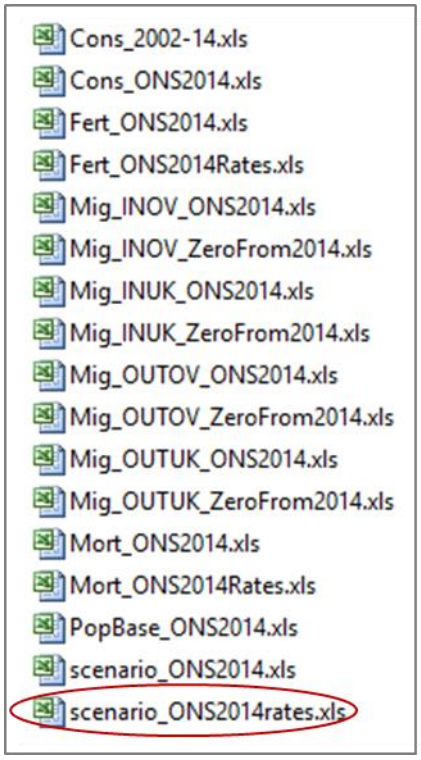
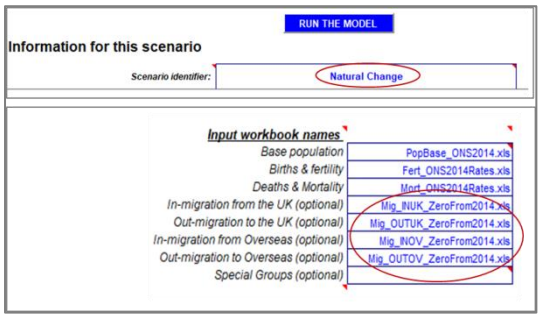
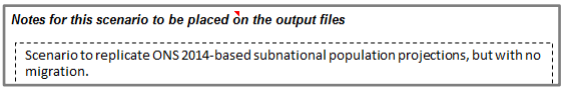
When running a forecast, its scenario is saved automatically. This 'rates' scenario, without birth and death counts and without the constraint of the results of the official projection, will be the basis for all alternative scenarios.

5.2. Scenario: natural change, i.e. no migration during the projection

A 'Natural Change' scenario will help you to answer the following questions: How much of the population change is due to migration? How much would the population have changed without any migration?

First you will amend the migration files so that they include zero migration from 2014 onwards. You will save each of these amended files with new names and use them in a new scenario.

Action: Amend migration input files to state zero migration after 2014	POPGROUP view
From the input folder open the four migration files, and "*Save as…*" each one in turn, replacing **ONS2014** by **ZeroFrom2014**. This avoids accidentally over-writing the files with ONS assumptions.	
For each new migration file in turn, specify that migration will total 0 from 2014: a. Select the District sheet(s), but not the All-Areas sheet b. On one of them, from 2014-15 to 2038-39 double-click to choose the option to 'Provide total migrants' c. Enter 0 in each of those years See the diagram on the right for what is already there and what you do in steps a, b, and c.	 Note the red triangle help comments **! Warning** Use copy and paste, but never drag: it can permanently mess with POPGROUP's formatting in ways that you will regret!
Complete each new migration file in turn: a. Document on the Notes sheet b. Validate c. Save	The Notes sheet already has documentation. Add to it, eg. 'From 2014, migration forced to be zero instead of the ONS projected flows.'

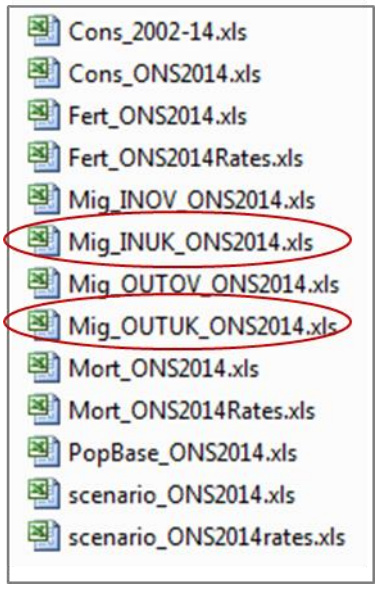
Action: Use the new migration files in the scenario	POPGROUP view
From your input folder, open the official scenario without counts (i.e. the '**ONS2014rates**' scenario), which you prepared in the previous Section.	
Amend the *'Scenario identifier'*, using '**NaturalChange**'. The identifier will be used to name all the output files from this projection, and to save a POPGROUP scenario workbook with this name. Double click the space for the four migration files to identify the new files. You have specified new assumptions.	 **! Warning** If you do not alter the scenario identifier, your official projection will be over-written.
Change the *'Notes'* section to document this new projection.	

Action: Run the natural change scenario and note the results	POPGROUP view
When *all* the changes have been made as above, click at the top of the sheet: RUN THE MODEL	You will be warned that: • Other Excel files will be closed without saving (cancel and save those files if this is a problem). The forecast will be run, with a note that: • The forecasts have been successful and the results saved in your output folder.
Note the total population and the percentage aged 85 or older at the end of the projection.	After the forecast, the `comp` output file will be left active. Use it to check that the migration is zero after 2014. Record the total population at the end of the projection, and the number aged 85 or older. Calculate the % aged 85 and over. Did migration add to or decrease the population? Did migration add to or decrease the ageing of the population?

5.3. Scenario: zero net total migration

It is useful to know whether the profile of migration between your area(s) and the rest of the UK (i.e. 'internal' migration) is tending to make the population older or younger. If in- and out-migration balanced each other in total but kept their age structure, how would the population change? Young adult migrants are more likely to have children and so their impact on the population is inflated, while older migrants are more likely to die during the projection period and their impact is thus lessened. This scenario is therefore not the same as the 'Natural Change' scenario which projects no migration at all. It is often the case that migration to rural areas accelerates ageing of the population, while migration to city areas maintains a more 'youthful' population profile.

In this scenario, you will make the UK migration flows match in total (thereby ensuring zero net internal migration as the two flows will balance). The same approach could be taken to international (i.e. overseas) migration, but in this scenario we will leave it out.

Action: Make total in-migrants from the rest of the UK equal to total out-migrants to the rest of the UK	POPGROUP view
From your input folder, open the official assumptions about migrants from and to the rest of the UK, labeled `INUK` and `OUTUK`.	
Save the `IN` file with a different file name: for example replace '**Mig_INUK_ONS2014**' with '**Mig_INUK_TotalEqualToOutUK**'.	Saving the new file now, avoids accidentally overwriting the original file.

For your area(s), you will:

1. Enable the option to *'Provide total migrants'* on the **IN** file, for each year for each year 2014-15 to 2038-39. Either double click in each box, or copy and paste as values the ticks in row 9. See the next step for an image of how the **IN** file will look.
2. Copy the entries for total migrants from the **OUT** file year 2014-15 to 2038-39. These are calculated in row 54 below the male and female entries.
3. Paste as values those entries into the Data area on the **IN** file. See the next step for an image of how the **IN** file will look.

If you like to use formulae, you can do so instead of copying.

Section 4.4.4 of the POPGROUP v.4 reference manual has rules and tips on data entry, copying and pasting and using formulae.

Each area's sheet will look like this before you make the changes. The data are the official projection:

Mig_INUK file:

5	**Migrants**						
6	***Options***		2013-14	2014-15	2015-16	2016-17	2017-18
7	Provide total migrants						
8	Trend total migrants						
9	Provide age-sex mgts		✔	✔	✔	✔	✔
10	NOTE						
11							
12	***Data***	*Total*					
13	Sex	*Age*					
14							
15	male	0-4	260	262	261	259	260
16	male	5-9	161	145	149	152	153
17	male	10-14	101	110	112	115	119

1 3

Mig_OUTUK file:

47	female	55-59	104	113	118	123	127
48	female	60-64	124	101	101	102	105
49	female	65-69	89	76	78	76	74
50	female	70-74	51	43	44	47	50
51	female	75+	146	138	141	144	148
52		*All Females*	3,836	3,615	3,622	3,620	3,634
53							
54		*All Persons*	7,668	7,059	7,081	7,096	7,1
55							

2

If you have more than one area, do this for each area. Remember, you are copying totals from the **OUT** file to the **IN** file.

Document on the *'Notes'* page, validate and save the new input file for **IN** migration:

- Document: on the Notes sheet, add something such as 'Total UK in-migrants set to equal the total UK out-migrants'.
- Validate: if there are no errors, the schedules of migration rates will be shown. If there are any errors, revise your work.
- Save the new **IN** file before using it.

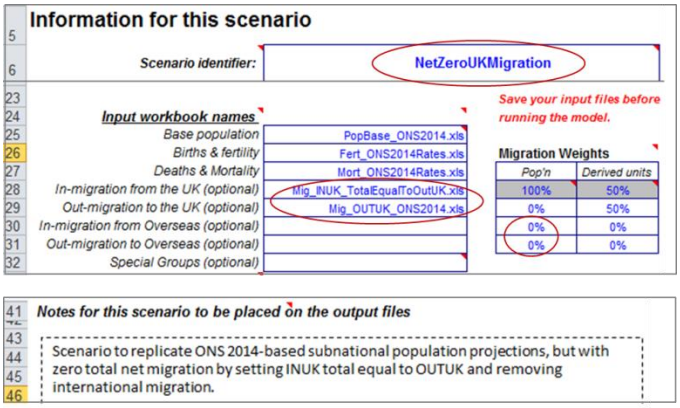
After the previous step, the revised **INUK** migration file will look like this:

5	**Migrants**					
6	***Options***		2014-15	2015-16	2016-17	2017-18
7	Provide total migrants		✔	✔	✔	✔
8	Trend total migrants					
9	Provide age-sex mgts		✔	✔	✔	✔
10	NOTE					
11						
12	***Data***	*Total*	7,059	7,081	7,096	7,117
13	Sex	*Age*				
14						
15	male	0-4	262	261	259	260
16	male	5-9	145	149	152	153
17	male	10-14	110	112	115	119

What POPGROUP does when the assumptions provide total and age-sex group migrants

This exercise has provided a new total number of in-migrants that will be different from the sum of the age-sex counts of in-migrants on the same sheet.

POPGROUP treats the age-sex counts as a 'migration profile'. When running a projection with this file, in each year it will scale the age-sex counts to sum to the total provided.

Action: Run and record results	POPGROUP view
From your input folder, open the **ONS2014rates** scenario created in 5.1 above. Make these changes: • Amend the '*Scenario identifier*'. • Change the file for `INUK` migration to the new one you have just prepared. • Delete the two overseas migration files. • Leave the file for `OUTUK` migration (the official projection). • Change two of the '*Migration Weights*' as shown to 0%. • Amend the notes.	 The '*Migration Weights*' are needed for a constraint but must be zero for migration that is not specified. Details are in the manual.
Click: **RUN THE MODEL** Open the `comp` output file. Note that net migration each year is zero: the in and out flows are the same. Record the total and elderly population aged 85+.	Look at the results that you have recorded on page 48. Why are the results of this projection different from the natural change projection? Both have net total migration equal to zero each year. • If this projection with 'zero net total migration' is lower than the 'natural change' projection, it will be because this area's in-migrants are older than out-migrants; the difference tends to make the population older and reduce the population total through extra deaths. • If this projection is higher than the 'natural change' projection, it will be because this area's in-migrants are younger than out-migrants; the difference tends to increase the population through extra births.

The impact of the age structure of migration

This investigation of the impact of the age structure of migration helps to understand the impact of migration on your area's population.

The official population includes this impact, and the impacts of the different totals of in- and out-flows, and of international migration.

Direct information about the age structure of in- and out-migration is contained on the `Mig` input files and the `-dump` output file.

6 Compare Scenarios

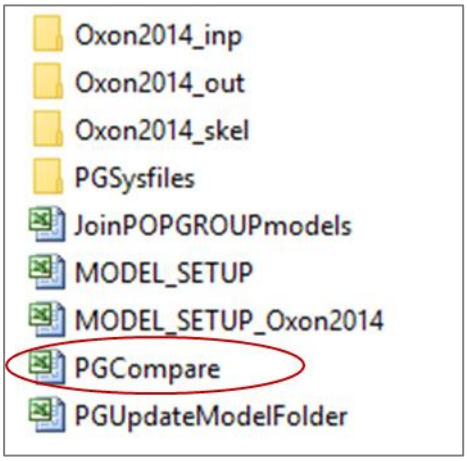
This Section uses POPGROUP's `PGCompare` file to compare the results from different projections.

When you have completed any part of Section 5, you will have created a new projection. Each projection has a scenario file with its identifier. The identifier is used to name the output files from that projection. The output files from all the projections are collected in the output folder. Only when you create a new model for other areas or with a different base year will there be a different folder to collect output files.

The `PGCompare` file is intuitive to use. The steps below get you started by answering two specific questions:

- How do the projections differ in their total population?
- How do the projections differ in their net migration within the UK?

Once you get to know `PGCompare`, use it to investigate other characteristics of the projections – age groups, fertility and births, mortality and deaths.

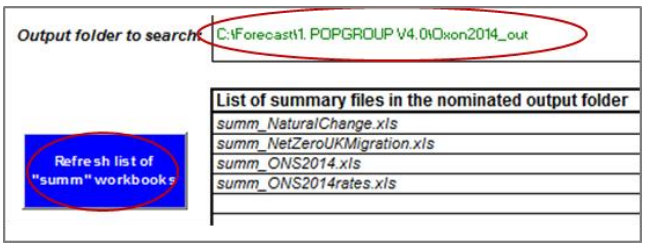
Action: Load selected projections into PGCompare and analyse the results	POPGROUP view
Go to the folder '1. POPGROUP v4.0'. It will probably contain sub-folders and files like those pictured (but your folders will carry the name you gave as your model ID). Open `PGCompare`	

There will be no summary files listed.

- Double click the cell next to *'Output folder to search'*, go to the output folder of your model, click *'OK'*.
- Click:

Refresh list of "summ" workbooks

Delete any projections you do not want to compare on this occasion.



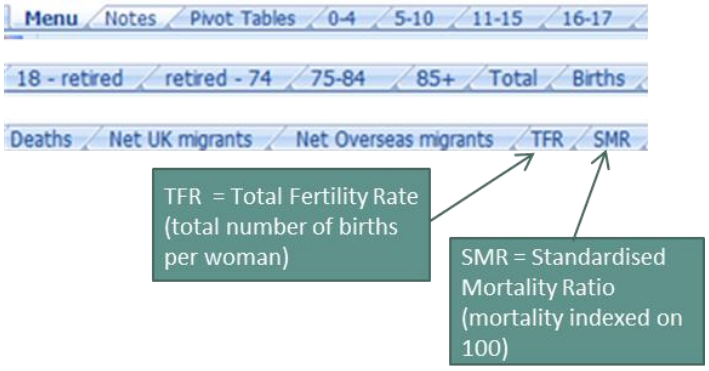
Notice that POPGROUP finds all the `summ` output files. `PGCompare` extracts the summary output from those files.

Click:

Get summary workbooks and make charts

POPGROUP will collect all the results, and sheets will appear on `PGCompare` for:

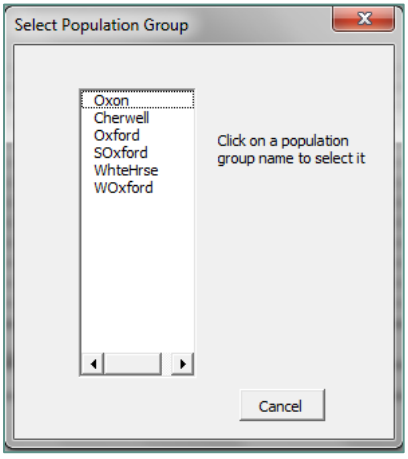
- documentation (`'Notes'`)
- results (`'Pivot Tables'` – do not change these)
- a chart for each summary age group, total, and component of change



Still on the `'Menu'` sheet, click on:

Select population group for tables and charts

If you have more than one area, choose the area to show by default on all the charts.

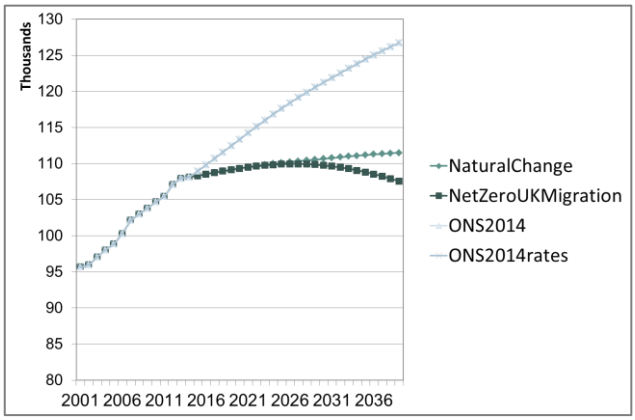


Move to the *'Total'* sheet and check that the different projections make sense to you.

In the example opposite for West Oxford district, the natural change projection (i.e. with no migration), is much less than the ONS forecast. Migration increases W Oxford's population and without it the district population growth would be very slight.

The forecast with in- and out-migration matching, 'net zero UK migration', shows a decrease. From this, we can infer that the in-migration is of relativley older people who are less likely to have children and more likely to die during the projection period, and the out-migration is of relatively younger people who have their children elsewhere.

Chart of projected total population: West Oxford:



Excel draws each line on top of the next, so in this case the official forecast and the version using rates which approximates its results very closely are seen as one line (see Section 5.1).

The chart has been edited to increase the size of the labels before copying to this Guide.

All POPGROUP output files are unprotected so that they can be edited.

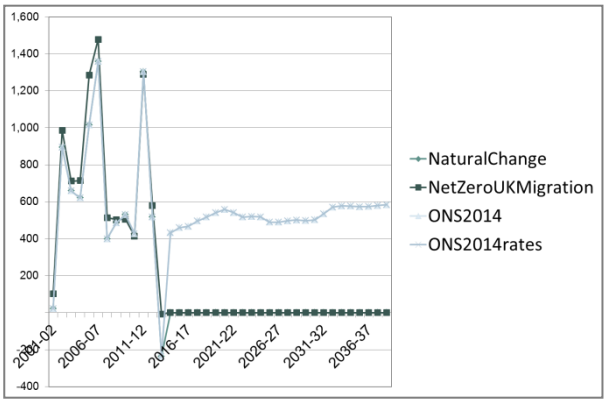
Move to the *'Net UK migrants'* sheet and check that the different projections make sense to you.

In the example opposite, there are only two lines visible. At the bottom, hugging the line for zero from 2014 onwards, are the **Natural Change** and **Net Zero UK Migration** projections.

The other forecasts have the same net migration as in the official forecast. In the example it is positive, net in-migration, which has been volatile in the past and is projected to increase slightly over time.

How and why is the chart for your area(s) different from this one?

Chart of projected net UK migration, West Oxford:



Excel draws each line on top of the next, so only the last-drawn line is visible when the results of two forecasts are the same.

Now look at the charts for each age group, and at the other components of population change.

Think through why the lines are as they are. This will help you to:

- understand more about the population dynamics in your area(s).
- explain the official projection and its reliabiilty to other people.

Further comparisons of forecasts

- The `PGCompare` utility compares only data from each projection's `summ` output file. If this is not sufficient detail, you can use your own Excel skills to compare other data from the projections. Other age groups, gross migration flows, and their age structure are available on the `comp` and `–dump` output files.
- POPGROUP's functions that produce 'flat files' and collect results from more than one projection may also be useful. Flat files are suitable for statistical and database software, and are described in the POPGROUP v.4 reference manual (Section 8.1.6).

7 Create Alternative Scenarios with Other Data

With this Guide so far you have created projections using the data provided with POPGROUP Data Modules, and have become familiar with many of the POPGROUP input and output files. This final Section shows how to use other data available throughout Britain to make further scenarios for population forecasts. Then you will then be able to develop further work on your own.

The official 'trend' projections show what the population will become if fertility, mortality and migration continue as they have in the recent past. They are 'business as usual' projections, based mostly on the past five years' data for each area. The scenarios in this Section help to show how sensitive the projected population is, if the recent past is interpreted slightly differently. It will help to show how much uncertainty planners should expect in the official projections.

The scenarios in this Section show the projected population if:

- The future number of migrants continues at its average from the past five or past ten years.
- Future fertility is higher or lower according to the high and low variants of the National Population Projections.
- Future mortality is higher or lower according to the high and low variants of the National Population Projections.

In each case, you will need data that are not available within the sub-national population projections. Your organisation may already obtain these data; it would be good practice for those making population projections to do so. The Guide describes the data but is not intended as a full guide to them, because they do vary between countries and over time.

!	**Scotland and Wales**
The NRS and the Welsh Government have provided some of these scenarios for all their local authority areas. This will make your life easier! You will learn POPGROUP skills and gain experience with the software by following these Sections to replicate their work. You may find you get slightly different results from them due to the use of different detailed data or models.	

7.1. Scenario: future migration within the UK based on the past five or ten years

The official Sub-National Population Projections continue migration rates or numbers taken from the recent past. The methods are different for **England**, **Wales** or **Scotland** (the links are the most recent documents at the time of writing). They are usually based on the migration experienced over the five years previous to the projection's base year. In England a multi-regional approach uses rates of out-migration from each area, and a distribution of the out-migrants to each receiving area; the result is not a simple average of the past five years of migration, as it is in Wales.

In some places the past five years may be considered not typical and unlikely to be repeated. However, it is as difficult to prove that a period is not typical as it is to prove that it is typical. It is worth knowing how different the projection would be if based on a set of years that could be argued to more typical than the recent past. It is for this reason that the Welsh Government, for example, was persuaded to provide a variant based on the average of the past ten years, as part of its 2011-based and 2014-based population projections.

To implement these scenarios, you will use the data for past migration that was included in the input files by POPGROUP's Data Module. You will use formulae to set future years' migration equal to the average of past years' migration.

The steps in the boxes below show what is needed to implement an alternative migration assumption on the POPGROUP files, setting the future count of migrants to a value based on the average of previous years. It is suggested that you implement the following scenarios, one at a time:

- The counts of in-migrants and of out-migrants by age-group and sex remain constant at their average during the 5 years before the official base year (e.g. mid-2009 to mid-2014 for a 2014-based projection).
- The same but averaged for the previous 10 years.
- The counts of in-migrants and out-migrants remain constant based on the most recent period which you feel is most justified as typical experience to be expected in future years.

ONS uses a multiregional model led by rates of out-migration

The official projection by ONS for England areas uses out-migration rates from each district, and distributes the total out-migrants to destinations by past trends. Thus the first scenario suggested in this guide, a simple average of the past five years' counts, will not produce the same results as the ONS projection. It is useful to see how the two approaches to using the last five years' experience are similar or differ. To fully understand the differences, you will need to read the ONS methodology; follow the link given in the first paragraph of this Section.

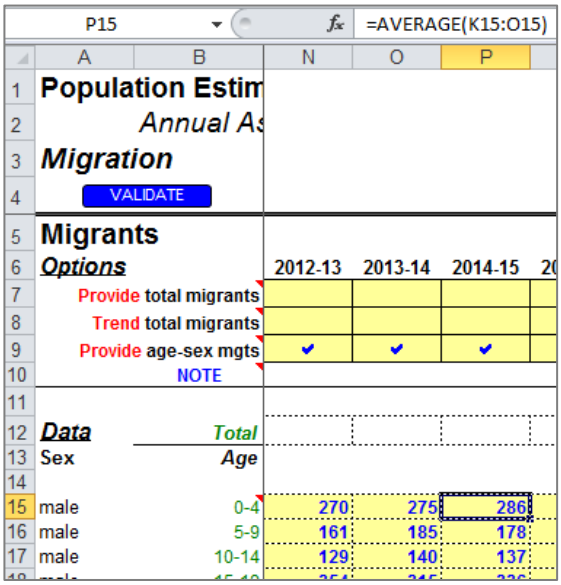
Rates and counts in POPGROUP

In this Section, counts of migrants by five-year age-group and sex are used as the assumption for each alternative projection. Rates are also held on the Schedule sheet of each input file, but they only affect the distribution of the counts of migrants to single years of age, for example the distribution of 15–19 year old males to each year 15, 16, 17, 18 and 19. Strictly speaking, the Schedule should also be changed to reflect the past period which is considered most indicative of the future. But it will not affect the results much if you leave in place POPGROUP's representation of the official Schedule.

On the other hand, some authorities feel that rates are what should be used in a projection, so that as the population changes size, so does the size of each migration flow. In that case, calculation of the Schedule is important. There is no 'right answer' to the choice between using rates only or fixed counts, and experienced projectionists differ in their opinion on this. All say that it depends on the local circumstances, which is not very helpful for any particular researcher seeking guidance!

<table>
<tr><th>Action: Calculate and add an alternative migration assumption</th><th>POPGROUP view</th></tr>
<tr><td colspan="2">Open the official projection's POPGROUP migration files (the four files prefixed Mig).

Save the files each with a new name to reflect the data you will put in them, e.g. 'Mig_INUK_5yrAv.xls'.

For each file:</td></tr>
<tr><td>Use formulae for the migration flows for your alternative assumption, replacing the migrant assumptions in the official projection.
For example, a five year average in 2014-15 based on the five years 2009-2014 would be calculated with a formula in cell P15:
=AVERAGE(K15:O15)
Your assumption of the number of migrants will be the same in each future year, an average of past years as proposed above. Either copy the value for 2014-15 and paste in future years, or use a formula for future years that copies the previous year.</td><td> 

The official projection (before you replace it with your formulae) may not have the same number of migrants in each future year. This is partly because of aligning to national totals, and partly because the ONS model is more complex than POPGROUP.</td></tr>
<tr><td colspan="2">Document, Validate, and Save each of the four migration files with a file name that indicates the alternative assumption.</td></tr>
<tr><td colspan="2">Open the 'ONS2014rates' scenario file (made in Section 5.1) and amend the 'Scenario ID' to reflect the migration assumptions and run it as in previous Sections.</td></tr>
</table>

After running new scenarios, use `PGCompare` to compare their results with the official projection, as in Section 6. Record and understand the differences. They tell you how much the official projections are dependent on the particular migration assumptions that have been made.

Are your assumptions better, or simply indicate some uncertainty in the future? Which would you recommend to your Council planners?

7.2. Scenario: high and low fertility variants

This section shows how to provide a range for the future number of births, acknowledging that the official projection is uncertain. The official projection can be taken as the most likely outcome according to government research. The high and low variants of fertility are not better than the official projection, but provide "plausible alternatives" according to the report of the 2014-based National Population Projections. The variants show how the uncertainty is greater the further ahead is the projection.

The projected future number of births is the product of two things:

- The future number of women of each age between 15 and 49. This is estimated in the projection.
- The likelihood of those women giving birth. This is the fertility rate at each age (the age-specific fertility rate). The Schedule of rates and the differentials for each year and each age group of women are held on the POPGROUP input file named `Fert`. These reflect the official assumptions for your area(s).

Demonstrating the scale of uncertainty recently, there was an unpredicted increase in fertility in most areas of Britain of over 15% during the 2000s, after holding steady or decreasing for the previous two decades. An under-forecast of births can put serious pressure on schools within a short space of time, and an over-forecast can lead to wasted expenditure. That is why variants, giving a plausible range of future numbers of births, allow planners to consider how to mitigate the uncertainty in the forecast population.

In POPGROUP, an easy way of applying alternative future fertility assumptions is to add a differential to the fertility file, which will alter the Total Fertility Rate (TFR). Differentials were described in Section 0.

Below are two methods of calculating overall differentials for high and low fertility. These are not the only methods, nor is there a 'best' method. However, the first method is straightforward and can be applied to all areas in a country. You should follow it for the exercise below. If the variants will be used to determine how resources are allocated, it would be wise to also investigate and understand the results from other methods.

a) The national 'high variant projection' TFR divided by the national 'principal' TFR.

- Similarly a low variant by dividing the national low and principal TFR, for each year.
- These differentials are calculated from the **detailed ONS data**, and are available to POPGROUP users in a file available from **popgroup@edgeanalytics.co.uk**
- The differential is calculated for each year separately, as the distance between variant and principal fertility widens over the course of the projection. See the 'POPGROUP view' below for an example of the calculation.
- The same differential applies to all areas because it is calculated from national data.

b) The second-highest local TFR in the past ten years divided by the average in the past ten years

- This differential indicates a feasible variation already experienced locally.
- Similarly a low variant, by dividing the second-lowest local TFR by the average.
- The local TFR is already recorded in the output file of your scenario of the official forecast: `comp_ONS2014.xls`. It is also available from the statistics agencies, for **England and Wales** and for **Scotland**.
- The differential can be used for each year of the variant, or trended from 1 to reach its value after, say, five years.
- The differential could be calculated separately for each area.

Action: Calculate and make high and low fertility variant projections	**POPGROUP view**
Find or construct differentials for each area to represent high fertility. The example on the right shows a calculation to derive the differentials for fertility for England, from the file available from **popgroup@edgeanalytics.co.uk**, using ONS open data from the 2014-based National Population Projections.	

Population projections by the Office for National Statistics

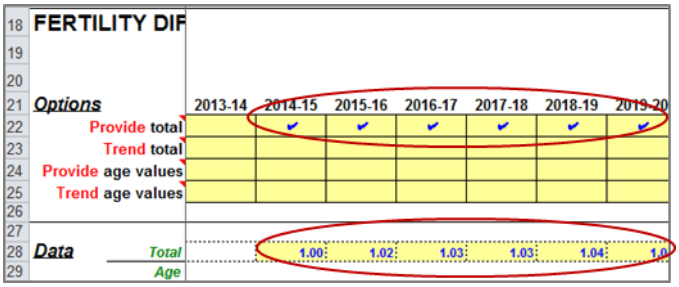
England				
Total Fertility Rate TFR	2014	2015	2016	2017
	-2015	-2016	-2017	-2018
From ONS website:				
Principal projection	1.82	1.83	1.84	1.85
High fertility	1.82	1.87	1.89	1.91
Low fertility	1.82	1.79	1.77	1.75
For entry into POPGROUP:				
High differential (=High/Principal)	1.00	1.02	1.03	1.03
Low differential (=Low/Principal)	1.00	0.98	0.96	0.95

<table>
<tr>
<td>Open the official Fert input file with rates (you used this in Section 5.1)

Save with a new name, e.g. adding ‘High’ to the existing file name, Fert_ONS2014ratesHigh.xls.

On the All-areas sheet (‘Oxon’ in this guide’s example, it will be the first sheet after ‘Notes’ in your file):
• Double click the option for ‘Provide total’, each year.
• Type or paste the differentials into the data area.

If you have more than one area, do the above actions only on the ‘All Areas’ sheet (it will have the name you gave it on creating the model in Section 3.2). The differentials on the ‘All Areas’ sheet are applied to every area.</td>
<td>The Fertility file’s All-areas sheet, after including differentials to represent the high fertility variant:

If there are already age differentials, this is fine: both differentials will apply. The age differentials are part of the official projection, and the total differentials provide the extra variant from the official projection.

If there are already total differentials, you will need to multiply them by your extra differentials, so that the combined differentials apply.</td>
</tr>
<tr>
<td colspan="2">Document, Validate, and Save.</td>
</tr>
<tr>
<td>Open the official scenario with rates (‘ONS2014rates’) made in Section 5.1.

Amend the scenario:
• Change the Scenario identifier, e.g. change ‘ONS2014rates’ to ‘ONS2014HighFert’
• Change the fertility file to use the ‘High’ variant
• Documentation

Run the model.</td>
<td>After running the model, view the comp output file for this projection. Record the total population and those aged 85+.

The differences with the official projection will be small in total – and not affect the elderly at all.

The comp output file also gives the population of school age. This will be significantly affected by the alternative scenario of fertility.</td>
</tr>
<tr>
<td colspan="2">Repeat with the low fertility variant.</td>
</tr>
</table>

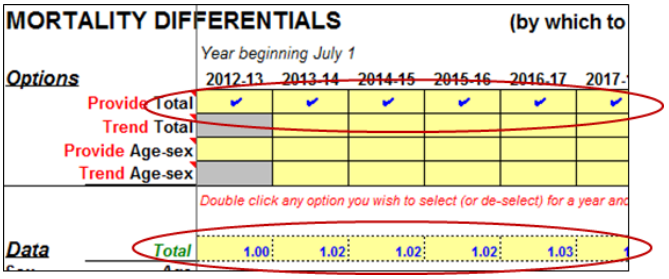
7.3. Scenario: high and low mortality variants

High and low variants of mortality provide acknowledgement and measurement of uncertainty in the official forecasts, this time affecting above all the size of the elderly population. As for fertility, the most straightforward way of representing variants of mortality is through a differential entered on the mortality input file. See Section 4.6.2 for explanation of differentials in POPGROUP.

There is not a convenient summary of mortality that can be used to represent the variants in National Population Projections (as the TFR was used for fertility in the previous Section). The suggestion here is to use the average of age-specific mortality rates of both males and females:

- The national 'high variant projection' mortality rates averaged, divided by the national principal average mortality. Average the rates for ages 0, 1, … , 89 and 90+ for males and females – an average of 182 numbers from the 'male' and 'female' data sheets.
- Similarly a low variant by dividing the national low and principal average mortality, for each year.
- These differentials are calculated from the **detailed ONS data**, and are available to POPGROUP users in a file available from **popgroup@edgeanalytics.co.uk**
- The differential should be calculated for each year separately, as the distance between variant and principal mortality widens over the course of the projection.
- The same differential applies to all areas because it is calculated from national data.

The variant differentials should now be entered on POPGROUP mortality input files, and a new projection scenario prepared and run, as for fertility in the previous Section.

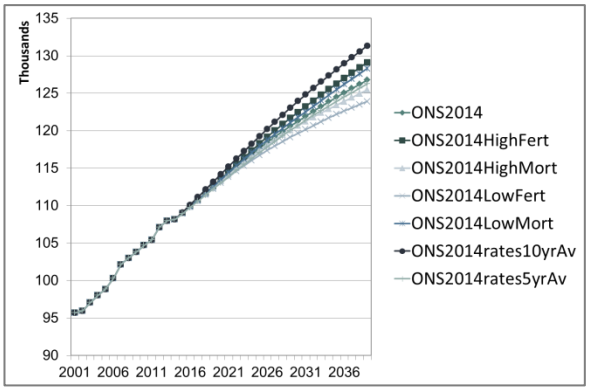
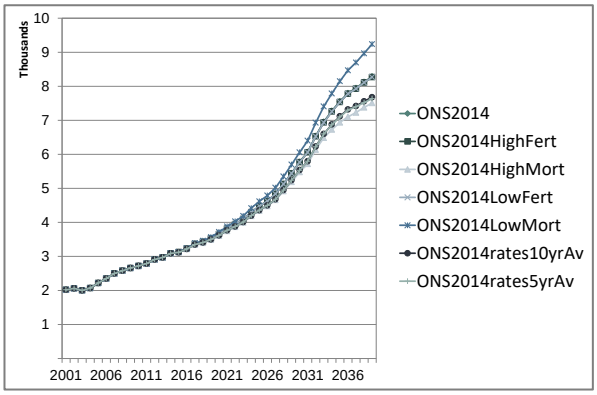
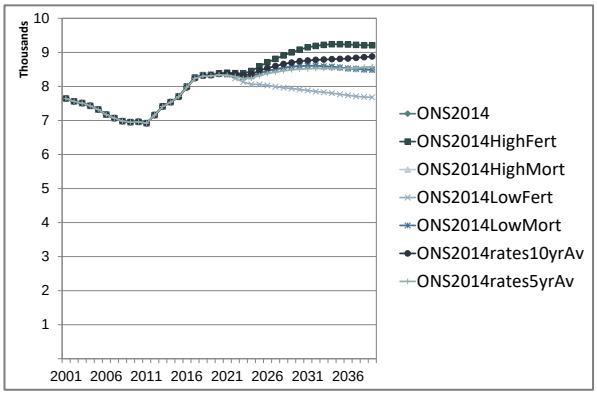
Action: Calculate and make high and low mortality variant projections	POPGROUP view
Construct differentials for each area to represent high mortality. The example on the right shows a calculation to derive the differentials for fertility for England, from the file available from popgroup@edgeanalytics.co.uk, using ONS open data from the 2014-based National Population Projections.	**Population projections by the Office for National Statistics** **England** 2014-based **Average rates of mortality ASMRs** 2014 2015 2016 20 (m, f, newborn to 90, per 100,000) -2015 -2016 -2017 -20 **From ONS website:** Principal projection 1692 1556 1520 1 High mortality (low life expectancy) 1692 1588 1553 1 Low mortality (high life expectancy) 1692 1523 1486 1 **For entry into POPGROUP:** **High differential (=High/Principal) 1.00 1.02 1.02 1** **Low differential (=Low/Principal) 1.00 0.98 0.98 0**
Open the official `Mort` input file with rates (you created and used this in Section 5.1). Save with a new name, e.g. adding 'High' to the existing file name, e.g. `Mort_ONS2014ratesHigh`. On the All-areas sheet ('Oxon' in this guide's example, it will be the first sheet after 'Notes' in your file): • Double click the option for 'Provide total', each year. • Type or paste the differentials into the data area. If you have more than one area, do the above actions only on the *'All Areas'* sheet (it will have the name you gave it on creating the model in Section 3.2). The differentials on the *'All Areas'* sheet are applied to every area.	 If there are already age differentials, this is fine: both differentials will apply. The age differentials are part of the official projection, and the total differentials provide the extra variant from the official projection. If there are already total differentials, you will need to multiply them by your extra differentials, so that the combined differentials apply.
Document, Validate, and Save.	

Open the official scenario with rates (‘**ONS2014rates**’) made in Section 5.1. Amend the scenario: • Change the *Scenario identifier*, e.g. change ‘**ONS2014rates**’ to ‘**ONS2014HighMort**’ • Change the mortality file to use the ‘High’ variant • Documentation Run the model	After running the model, view the `comp` output file for this projection. Record the total population and those aged 85+.
Repeat with the low mortality variant.	

The differences from the official projection will be small in total, but the changes to mortality will particularly affect the size of the projected elderly population.

7.4. Compare scenarios

As in Section 6, use the file `PGCompare` to evaluate the various scenarios you have made (see next page).

Action: Load selected projections into PGCompare and analyse the results	POPGROUP view
Follow the instructions of Section 6 to open `PGCompare.xls` and to compare the forecasts you have made. In the example on the right for West Oxford: • None of the variants change the main story of continuing significant growth in population. • The fertility variants have slightly more impact in the long term than the mortality variants. • The fertility and mortality variants have less impact compared to using 10 years' past migration data. The extra years had relatively high in-migration. • For the population aged 85 and older, the variants showing plausible alternative mortality scenarios have more impact than the other variants. • For the population aged 85 and over, *all* these scenarios show a rapid increase, doubling the population within 20 years. The mortality variants provide the widest uncertainty. • For the primary school ages 5-10, the impact of varying fertility assumptions makes a significant impact within ten years.	West Oxford, scenarios of population projection. **Total population**:  West Oxford, scenarios of population projection. **Population aged 85 and older**:  West Oxford, scenarios of population projection. **Population aged 5-10**: 

8 Your Answers

Use this section to record answers for each of your area(s). Write the area names in the column headings.

Section	Area 1	Area 2	Area 3	Area 4
4.4 Official projection: first year				
Total population				
Number aged 85+				
% aged 85+				
4.4 Official projection: last year				
Total population				
Number aged 85+				
% aged 85+				
5.1 Official projection using fertility and mortality rates: last year				
Total population				
Number aged 85+				
% aged 85+				
5.2 Natural change: last year				
Total population				
Number aged 85+				
% aged 85+				
5.3 Zero net total migration: last year				
Total population				
Number aged 85+				
% aged 85+				
7.1 Migration based on last 10 years: last year				
Total population				
Number aged 85+				
% aged 85+				
7.2 High fertility: last year				
Total population				
Number aged 85+				
% aged 85+				
7.2 Low fertility: last year				
Total population				
Number aged 85+				
% aged 85+				
7.3 High mortality: last year				
Total population				
Number aged 85+				
% aged 85+				
7.3 Low mortality: last year				
Total population				
Number aged 85+				
% aged 85+				

9 Common Problems

!	**Message 'Cannot run the Macro' or similar**

POPGROUP works in Excel by using programs known as 'macros'. After installation you must follow the instructions in the manual to enable macros and trust access to Visual Basic. Otherwise, POPGROUP cannot work and you will receive error messages.

If you do not have the manual, contact **popgroup@edgeanalytics.co.uk**.

!	**My scenario gives the same result as the official forecast**

Have you deleted the constraints file from the scenario? If not, whatever your assumptions the forecast will be forced to be the same as the official forecast results which are written on the constraints file. See Section 5.1.

!	**I get a Windows error**

Occasionally there will be a Windows error. Usually it is unclear why it has happened. Coming out of Excel and starting the task again will usually solve the problem. Occasionally after an error, you will be left with a window with program code. Again, close that window and Excel, and try again. These occasional errors are inevitable with a complex program working on many different operating environments, and are not unique to POPGROUP.

If an error occurs more than once, note what happened (take a screen shot if you can), and email details to **popgroup@edgeanalytics.co.uk**.

10 Next Steps

POPGROUP is a versatile tool for analysis of population dynamics. The next 'How to…' Guides in this series are:

2. How to get started with household projections
3. How to get started with labour force projections
4. How to create population projections led by a plan for house-building
5. How to create population projections led by an economic plan for jobs
6. How to integrate population, housing and labour force projections

During the lifetime of a population projection, the statistical agencies provide updates of the mid-year population, births and deaths. POPGROUP provides a Data Module called MYEandChange to help users add those data to their existing models, avoiding a lot of copying and pasting from official sources.

Some users make forecasts for areas other than local authorities, for example for electoral wards or for service areas. Methods developed for small areas are documented and available from **popgroup@edgeanalytics.co.uk**. The NRS has its own **advice and guide** for small areas in Scotland.

Appendix: Unattributable Population Change

The Data Module for official population projections includes past data from 2001, and allows you to include Unattributable Population Change (UPC) when writing migration for years between 2001 and 2011 to input files. The default is to leave it out, but you have the choice to include it with internal migration or to include it with international migration when filling in the Data Module Setup options (see Section 3.2 in this Guide).

The choice makes no difference to the past population or to projections. It simply allows you to have the historical series for migration in your input files which either includes the UPC, or not. The decision is a local one, dependent on your view of the local cause of UPC. The explanation below is intended to give some background and to help you understand how POPGROUP will use the information.

	**Information Box**
Even if the UPC is not included in migration, POPGROUP will nonetheless ensure that its calculations add up to the official mid-year population estimate (MYE) each year 2002 to 2011 which are written into the constraints file. As POPGROUP's reference manual explains, POPGROUP adjusts the migration on its outputs to make up any discrepancy found in the inputs and the constraint, the MYE. Therefore for years 2001–2011, POPGROUP's output of migration is best understood as 'Migration and unattributed population change'.	

UPC has been identified by ONS in each local authority district in England and Wales to close the gap between the population estimated for 2011 after the census of that year and estimates of the 2001 population, and of births, deaths and migration each year between 2001 and 2011. ONS believe their estimates are the best possible, but acknowledge that extra change did occur which it is unable to attribute to a specific cause. ONS provides the amount of this extra change in its population accounts for 2001 to 2011. It is not an issue in Scotland where the discrepancy was smaller.

There has been debate about whether the UPC should be used locally in estimates of population change and whether it should be extended within population projections as part of future migration, even though it is not known whether it is due to mis-estimates of the internal migration, overseas migration, or census populations. ONS decided not to include it when calculating recent levels and patterns of migration as inputs to their sub-national projections. In effect they chose the 'leave it out' option.

The size of UPC is significant in some local authorities. Evidence may exist for an area that suggests that the UPC is likely to be due to a particular source of population change. Some POPGROUP users have therefore wished to include the UPC with the official estimates of that population change, usually in either internal migration or overseas migration.

For this reason the Data Module allows the choice of including the UPC in your input files.