

# Software for local authority users

Theory and practice of population and  
household projections – GRO(S),  
Edinburgh 9<sup>th</sup> November 2005

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# Why do it?

- LARIA 1984 review
- BSPS conference 1992(?) survey and review
- Service planning – age/sex related
- Resource allocation – land, housing, jobs, electors
- Assessing the robustness of government plans and allocations
  - Finance; housing land
- Derived forecasts
  - Disability, waste disposal, recruitment targets, care homes, library usage, ...

# How to do it?

- Councils and large sub-populations
  - Cohort component projection: detailed age-sex
  - Proportion at each age-sex who head households of each type
  - Numbers of dwellings
- Smaller areas
  - Average household size, migrating households
  - Total population
  - Types of dwellings, site-specific, limits of housing

# Who does it?

- In-house
  - Wishart, Cockhead, Fearnley, Dewhurst, Rutherford, Perkins, Pope, Hollis: treatment of migration is the key difference in approach, dependent on scale and source of migration
  - Simpson: Bradford (Fortran); Calderdale (Smart); Bradford (Lotus)
- POPGROUP
  - Excel, Do-It-Yourself data entry, see it working
- CHELMER
  - Own-format, standard datasets, ready packaged
- Various overseas packages

# What do you want from a forecasting software package?

- Input of relevant standard data
- Input of your own local data
  
- Interrogation of results
- Making intelligent alternative assumptions
- Compare different forecasts
- Keeping track of what you have done
  
- So clear that there is no need for technical support
- Technical support and training when you do need it

# POPGROUP development

Initially funded by Bradford, Derbyshire, Staffordshire, Buckinghamshire, Shropshire, Worcestershire

- Version 1                      1999              Population of n groups
- HOUSEGROUP              2001              Household forecasts
- Version 2                      2002              Housing-led options
- LABGROUP                      2002              Labour force
- Version 2.1                      2003              Jobs-led options

Transferred to University of Manchester 2003

- Version 3                      2005              Improved interfaces
  
- Currently 48 organisations (6 in Scotland), 42 local authorities (5 in Scotland). Cairngorms National Park.

# POPGROUP design

## Principles and practice

- Excel input files
- Excel output files
- Macros do work of structuring files, validating data, projections and most interrogation
- Easy start, then develop
  - the future is not what it used to be

# POPGROUP Population Estimates and Forecast

## Model Set-up Information

POPGROUP version 3.0

When complete, click this **SET-UP** button  
to save the skeleton input workbooks

# Setting up POPGROUP

File Header:

Base Year of population data:

Maximum number of years to be forecast:

Directory in which to save the skeleton input workbooks:

Directory in which to save data workbooks:

Directory in which to save output workbooks:

### Labels for the total of all population groups.

Short Label (Up to 8 characters)	Long Label
Derbyshire	Derbyshire County Total (geographic)

Number of Population Groups:

The order given will be used on the input and output files, and printed reports

No.	Short Label (Up to 8 characters)	Long Label
1	AmberVal	Amber Valley
2	Bolsover	Bolsover
3	Chesterf	Chesterfield
4	DerbDale	Derbyshire Dales
5	Derby	Derby
6	Erewash	Erewash
7	HighPeak	High Peak
8	NEDerbys	North East Derbyshire
9	SDerbys	South Derbyshire

Note: The short label is used for naming sheets in the input, model and output workbooks. It is also used for column headings throughout the system.

The long label is used for headings in workbooks and reports.

Folders for  
Skeletons  
Input  
Output

Labels for  
each area



# Labels transferred to all files

Microsoft Excel - fert1.xls

File Edit View Insert Format Tools Data Window Help

Type a question for help

Arial 10 B I U

C5 Year beginning July 1

**Population Estimates and Forecasts** *Derbyshire*

*Annual Assumptions*

**Fertility**

Go to Births Go to Differentials Go to TFRs

Options wizard -----shortcuts-----

VALIDATE

**Population Group: Amber Valley**

**BIRTHS**

Year beginning July 1

**Options**

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Provide total births	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
Trend total births															
Provide births by sex											✓	✓			

Double click any option you wish to select (or de-select) for a year and then fill in the relevant data below

**Data**

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total	1,328	1,286	1,315	1,296	1,273	1,327	1,274	1,300	1,255	1,191					
Males											603	581			
Females											550	574			

**FERTILITY DIFFERENTIALS (by which to multiply the single age schedule)**

Year beginning July 1

Sched / Notes / Derbyshire / AmberVal / Bolsover / Chesterf / DerbDale / Derby / Erewash / HighPeak / NEDerbys / SDerbys /

# Each component of population change is one input file

$$P_{t+1} = P_t + \frac{B - D}{\text{Natural change}} + \frac{I_{UK} - O_{UK} + I_{OV} - O_{OV}}{\text{Migration}}$$

Future  
popul-  
ation

Base  
popul-  
ation

Natural  
change

Migration

Seven input files, plus:

*Constraints* : population, housing and employment

*Special populations* (students, armed forces)

*Dwellings* (vacancy, second homes, sharing households)

*Jobs* (commuting, unemployment)

# Each input file represents a collection of assumptions for one component

Name	Size	Type	Date Modified
oldhamCons1.xls	798 KB	Microsoft Excel Wor...	15/04/2005 13:58
oldhamCons1-ONS503.xls	783 KB	Microsoft Excel Wor...	15/04/2005 13:56
oldhamfert1.xls	588 KB	Microsoft Excel Wor...	16/04/2005 18:46
oldhamfert1-ONS503.xls	588 KB	Microsoft Excel Wor...	19/04/2005 18:43
oldhamMig_INOV1.xls	599 KB	Microsoft Excel Wor...	15/04/2005 13:29
oldhamMig_INOV2.xls	612 KB	Microsoft Excel Wor...	19/04/2005 14:57
oldhamMig_INOV2-ONS503.xls	609 KB	Microsoft Excel Wor...	19/04/2005 18:44
oldhamMig_INOV3.xls	612 KB	Microsoft Excel Wor...	17/05/2005 10:45
oldhamMig_INOV3-ONS503.xls	609 KB	Microsoft Excel Wor...	17/05/2005 10:46
oldhamMig_INUK1.xls	601 KB	Microsoft Excel Wor...	19/04/2005 08:16
oldhamMig_INUK1-ONS503.xls	601 KB	Microsoft Excel Wor...	19/04/2005 18:45
oldhamMig_OUTOV1.xls	567 KB	Microsoft Excel Wor...	15/04/2005 13:49
oldhamMig_OUTOV2.xls	582 KB	Microsoft Excel Wor...	19/04/2005 15:00
oldhamMig_OUTOV2-ONS503.xls	570 KB	Microsoft Excel Wor...	19/04/2005 18:47
oldhamMig_OUTUK1.xls	577 KB	Microsoft Excel Wor...	19/04/2005 08:19
oldhamMig_OUTUK1-ONS503.xls	575 KB	Microsoft Excel Wor...	19/04/2005 18:48
oldhammort1.xls	591 KB	Microsoft Excel Wor...	15/04/2005 10:46
oldhammort1-ONS503.xls	582 KB	Microsoft Excel Wor...	19/04/2005 18:50
oldhampopbase.xls	138 KB	Microsoft Excel Wor...	15/04/2005 13:08
scenario_o1.xls	271 KB	Microsoft Excel Wor...	19/04/2005 08:19
scenario_o1c.xls	271 KB	Microsoft Excel Wor...	19/04/2005 08:25
scenario_o2.xls	280 KB	Microsoft Excel Wor...	19/04/2005 08:32
scenario_o2c.xls	274 KB	Microsoft Excel Wor...	19/04/2005 08:36
scenario_o3.xls	280 KB	Microsoft Excel Wor...	19/04/2005 14:39
scenario_o3c.xls	282 KB	Microsoft Excel Wor...	19/04/2005 15:00
scenario_o3c-ONS503.xls	282 KB	Microsoft Excel Wor...	19/04/2005 20:04
scenario_o4c.xls	282 KB	Microsoft Excel Wor...	19/05/2005 07:55
scenario_o4c-ONS503.xls	282 KB	Microsoft Excel Wor...	20/05/2005 12:06

# Running the model: specify the component files (scenario)

Double click to browse for directory or workbook names

Default Directory for the input workbooks: T:\CMUDATA\LudiConsultancy\ProjectsCurrent\OldRoch\PopProj\Oldham1\_inp\

Directory for the output workbooks: T:\CMUDATA\LudiConsultancy\ProjectsCurrent\OldRoch\PopProj\Oldham1\_out\

## **Input workbook names** (you do not need to give the .xls suffix for any workbook names)

Base population	oldhampopbase.xls
Births & fertility	oldhamfert1-ONS03.xls
Deaths & Mortality	oldhammort1-ONS03.xls
In-migration from the UK (optional)	oldhamMig_INUK1-ONS03.xls
Out-migration to the UK (optional)	oldhamMig_OUTUK1-ONS03.xls
In-migration from Overseas (optional)	oldhamMig_INOV2.xls
Out-migration to Overseas (optional)	oldhamMig_OUTOV2.xls
Special Groups (optional)	

## **Output workbooks (named automatically from the scenario identifier)**

Detailed population forecasts fore\_o3c-ONS03  
Components summary comp\_o3c-ONS03  
Summary forecasts report summ\_o3c-ONS03  
Forecast reports book fore\_o3c-ONS03-reports

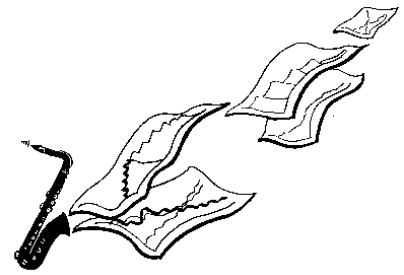
This scenario saved as: scenario\_o3c-ONS03

last run on: **19/04/2005 at 20:04:47**

## **Notes for this scenario to be placed on the output files**

This third forecast uses census data for estimates of fertility, and migration adjusted to meet the 2001 population, with constraint to population estimates after 1991.  
It is also constrained in all its components and results to the ONS 2003-projection for Oldham Borough as a whole.

# POPGROUP operations



## STAGE 1 - SETTING UP THE MODEL BASICS

You specify: groups, special populations, furthest forecasts, 2 migration areas.  
The model creates skeleton input files.

## STAGE 2 - PREPARING THE ASSUMPTIONS

You specify: options, data, and documentation  
The model validates your data.

## STAGE 3 - FORECASTS

You specify: scenario  $\equiv$  file locations; the model calculates the forecast

## STAGE 4 - USING THE OUTPUT

Chart the results; extract summaries.

# Data input options - migration file example

Microsoft Excel - mig\_INUK1.xls

File Edit View Insert Format Tools Data Window Help

Arial 10 B I U

C5 fx

## Population Estimates and Forecasts Derbyshire

Annual Assumptions

Migration

Options wizard

Go to Migrants Go to Differentials Go to SMRs

~~~~~shortcuts~~~~~

VALIDATE

Population Group: Amber Valley

Migrants

Options

Year beginning July 1

|                        | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Provide total migrants |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Trend total migrants   |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Provide age-sex mgt    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    | ✓    |

NOTE Double click any option you wish to select (or de-select) for a year and then fill in the relevant data below

| Data | Total |     |     |     |     |     |     |     |     |     |     |     |     |  |
|------|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| Sex  | Age   |     |     |     |     |     |     |     |     |     |     |     |     |  |
| male | 0-4   | 219 | 219 | 219 | 219 | 219 | 219 | 228 | 213 | 233 | 193 | 229 | 195 |  |
| male | 5-9   | 179 | 179 | 179 | 179 | 179 | 179 | 163 | 177 | 188 | 172 | 194 | 163 |  |
| male | 10-14 | 143 | 143 | 143 | 143 | 143 | 143 | 130 | 128 | 145 | 160 | 152 | 132 |  |
| male | 15-19 | 107 | 107 | 107 | 107 | 107 | 107 | 94  | 107 | 109 | 92  | 131 | 106 |  |
| male | 20-24 | 239 | 239 | 239 | 239 | 239 | 239 | 271 | 233 | 202 | 234 | 254 | 245 |  |
| male | 25-29 | 312 | 312 | 312 | 312 | 312 | 312 | 334 | 334 | 315 | 287 | 290 | 298 |  |
| male | 30-34 | 331 | 331 | 331 | 331 | 331 | 331 | 339 | 320 | 354 | 308 | 334 | 348 |  |
| male | 35-39 | 252 | 252 | 252 | 252 | 252 | 252 | 221 | 256 | 259 | 227 | 297 | 265 |  |
| male | 40-44 | 177 | 177 | 177 | 177 | 177 | 177 | 147 | 169 | 197 | 183 | 187 | 179 |  |
| male | 45-49 | 130 | 130 | 130 | 130 | 130 | 130 | 137 | 119 | 131 | 125 | 138 | 150 |  |
| male | 50-54 | 123 | 123 | 123 | 123 | 123 | 123 | 119 | 117 | 118 | 138 | 123 | 104 |  |
| male | 55-59 | 77  | 77  | 77  | 77  | 77  | 77  | 80  | 60  | 84  | 76  | 84  | 104 |  |
| male | 60-64 | 52  | 52  | 52  | 52  | 52  | 52  | 54  | 54  | 60  | 42  | 51  | 63  |  |

Sched Notes Derbyshire AmberVal Bolsover Chesterf DerbyDale Derby Erewasl

Draw AutoShapes

# Data input options for each of migration, fertility, mortality

| Sheet                                        | age    | sex | area | year |
|----------------------------------------------|--------|-----|------|------|
| <b>Rates: these make an initial forecast</b> |        |     |      |      |
| <b>Schedule</b>                              | single | x   | x    |      |
| <b>Each area</b> differential from schedule  | five   | x   | x    | x    |
| <b>Each area</b> TFR/SMR/SMigR               |        |     | x    | x    |
| <b>Counts: these are constraints</b>         |        |     |      |      |
| <b>All areas</b>                             | five   | x   |      | x    |
| <b>Each area</b>                             | five   | x   | x    | x    |

**Extras:** Rates on all-areas sheet applies to all areas

Fertility: sex-ratio at birth; matrix of mother's to child's group

In-Migration: age-sex profile can replace 'rates'

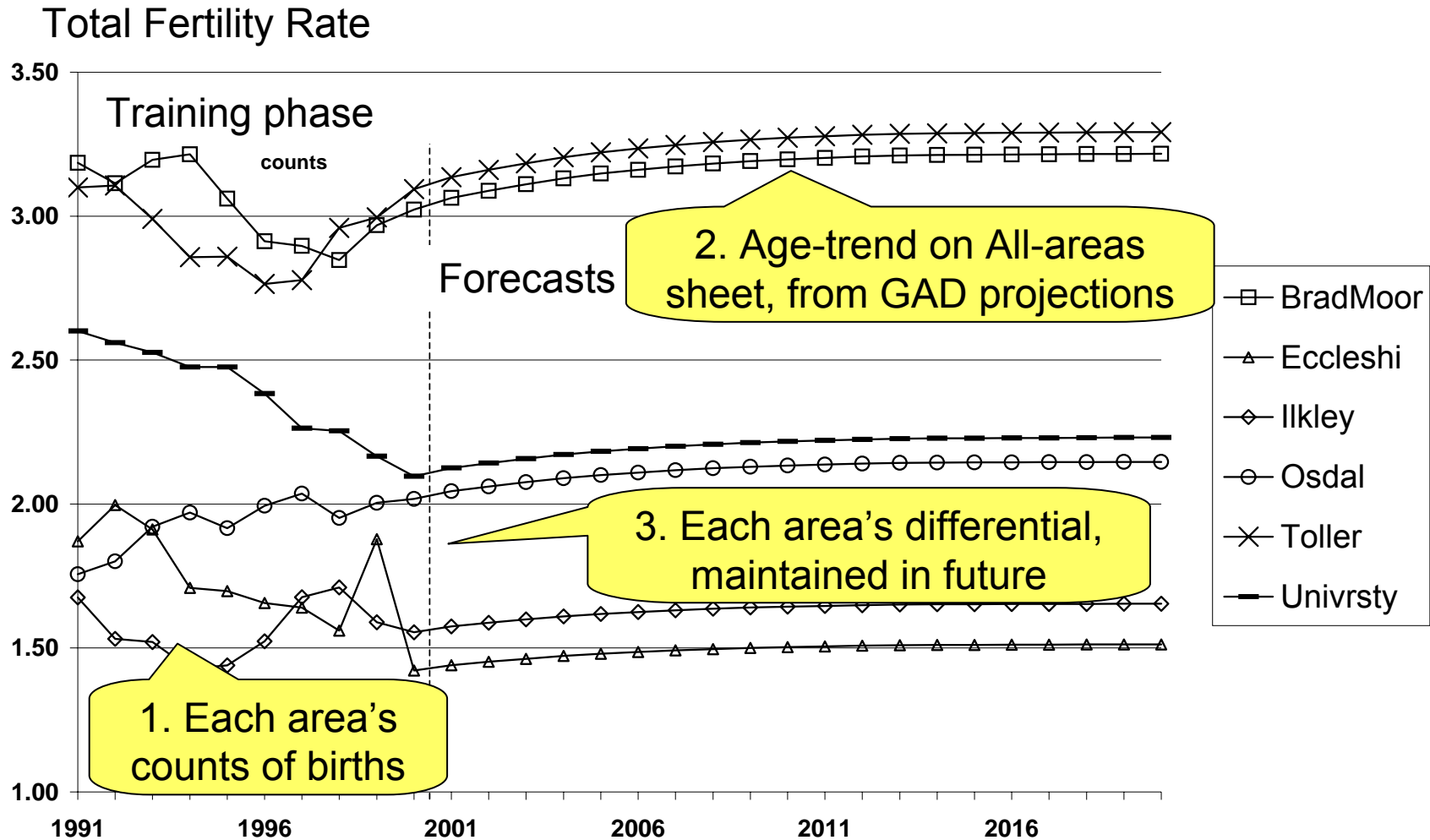
Further constraints of population, housing or employment: these adjust migration

# Government data for input

- GAD projections
  - Single age fertility and mortality rates
- Census
  - Single age migration rates
- ONS POPGROUP datasets
  - Population estimates and components of change, migration, projections. All unrounded

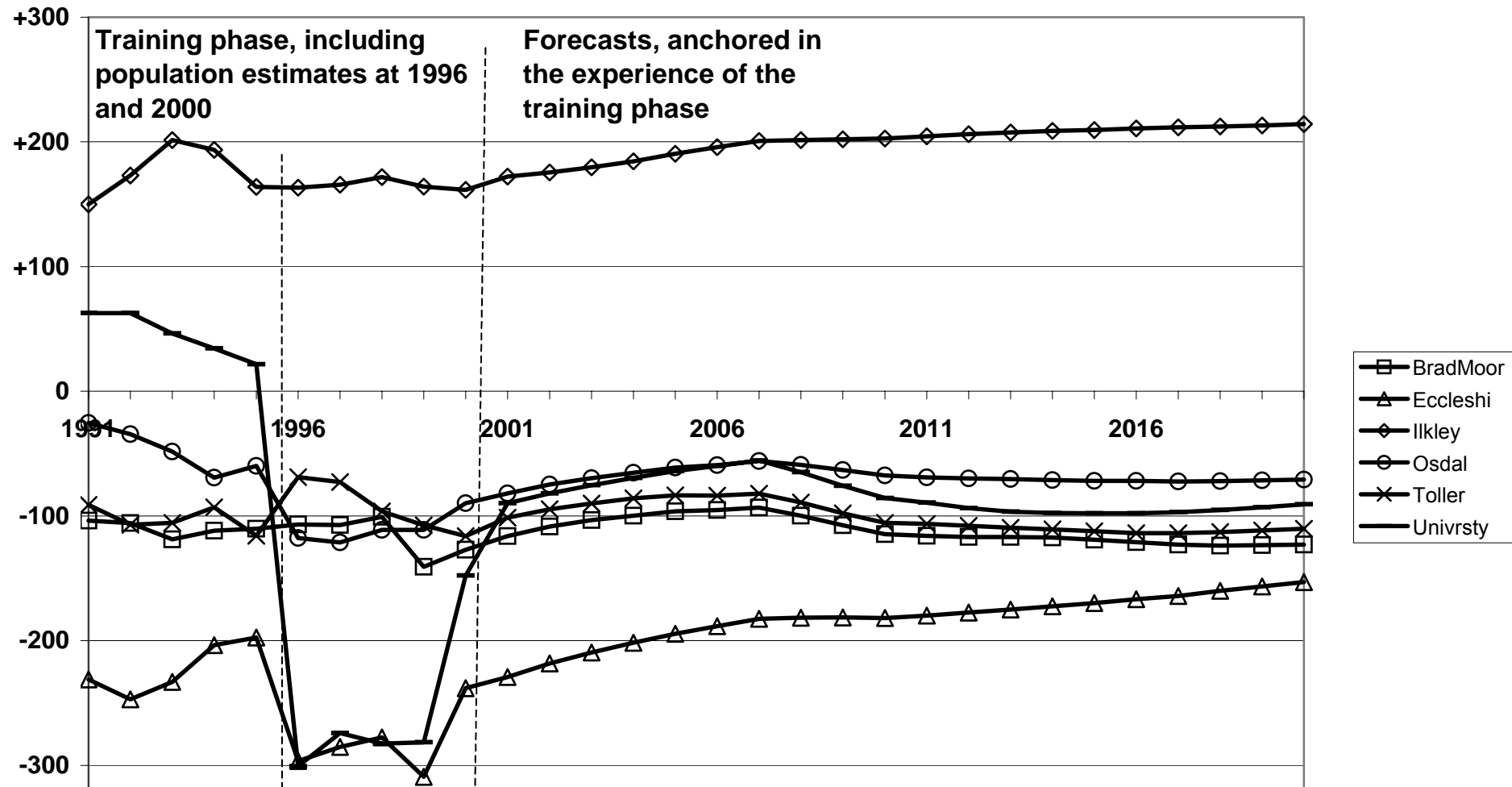


# Example of the impact of fertility file options on the Total Fertility Rate



# Example of the impact of migration file and constraint options on migration

Net migration in year after June 30th



# Output files and facilities

- Detailed forecasts: each year, single age
- Components, Summary, Dump files
- Reporter – charts and tables

## *Special effects*

- *Components of change summary*
- *Comparison of forecasts*
- *Output for database/statistical analysis*
- *Flying pyramids*

# Outputs

- Output files allow, for example
  - Charter - pyramids
  - Flying pyramid
  - Comparison of forecasts

# Household forecasting model set-up

## HOUSEGROUP - Household Forecasts

### *Model set-up: chosen age groups and household types*

*This is the set of age groups and household types for which the model will require data. It will also be the lowest level available for reporting on household forecasts, and associated output.*

#### Age groups

15-19  
20-24  
25-29  
30-34  
35-39  
40-44  
45-49  
50-54  
55-59  
60-64  
65-69  
70-74  
75-79  
80-84  
85+

#### Household types

2 adult no children  
2+ adult with children  
3+ adult no children  
Lone parent  
One person

Concealed family types  
Concealed married couple  
Concealed cohabiting couple  
Concealed lone parent

#### Created from

<<Married couple>  
<<Cohabiting couple>  
<<Other multi-person>  
<<Lone parent>  
<<One person>

*If these groupings of age and household type are what you intended, click the button to generate the skeleton input workbooks.*

Generate skeleton workbooks

*This set-up workbook will be saved as:* hhset-up\_2

# HOUSEGROUP

## Input and Output files

- Population forecast
  - Optionally, a POPGROUP output file
- Population in households
  - Number or %; default for areas; and for years
- Headship rates
  - ODPM definition; or GRO(S); or your own
- Detailed rates and numbers of households
  - Area, age, sex, household type, and year
- Reporter

# Housegroup outputs

| <b><i>Blinkforth</i></b>      |               |               |               |               |               |               |               |
|-------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| <b><i>Household Types</i></b> | <b>1991</b>   | <b>1996</b>   | <b>2001</b>   | <b>2006</b>   | <b>2011</b>   | <b>2016</b>   | <b>2021</b>   |
| Married couple                | 23,600        | 22,750        | 21,700        | 20,850        | 20,200        | 19,750        | 19,350        |
| Cohabiting couple             | 2,550         | 3,100         | 3,650         | 4,100         | 4,500         | 4,700         | 4,700         |
| Lone parent                   | 1,800         | 2,050         | 2,050         | 2,050         | 1,950         | 1,900         | 1,850         |
| Other multi-person            | 2,300         | 2,500         | 2,600         | 2,650         | 2,700         | 2,750         | 2,700         |
| One person                    | 10,000        | 11,350        | 12,350        | 13,200        | 14,050        | 14,950        | 15,700        |
| <b>All Households</b>         | <b>40,250</b> | <b>41,750</b> | <b>42,350</b> | <b>42,850</b> | <b>43,450</b> | <b>44,000</b> | <b>44,300</b> |
| Private household population  | 100,150       | 100,500       | 99,450        | 98,250        | 97,250        | 96,650        | 96,100        |
| Average household size        | 2.49          | 2.41          | 2.35          | 2.29          | 2.24          | 2.20          | 2.17          |
| Concealed married couple      | 50            | 50            | 50            | 0             | 0             | 0             | 0             |
| Concealed cohabiting couple   | 50            | 50            | 50            | 100           | 100           | 100           | 100           |
| Concealed lone parent         | 200           | 200           | 150           | 200           | 200           | 200           | 200           |
| <i>All concealed families</i> | 250           | 250           | 250           | 300           | 300           | 300           | 300           |

## Decomposition of Household Change

|                   | <b>2001-2021</b>  |                 |               |
|-------------------|-------------------|-----------------|---------------|
|                   | <i>Population</i> | <i>Headship</i> |               |
|                   | <i>Effect</i>     | <i>Effect</i>   | <i>Change</i> |
| <b>All groups</b> | 6,500             | 1,350           | 7,900         |
| Abbafield         | 4,700             | 1,150           | 5,900         |
| Blinkforth        | 1,800             | 200             | 2,000         |

Plus: Charts, time series, headship age schedules

Each figure has been independently rounded to the nearest 50

# Housing plans and implications within POPGROUP output

|              |                |                |                |                |                |
|--------------|----------------|----------------|----------------|----------------|----------------|
| 60/65 -74    | 21,274         | 21,361         | 21,484         | 21,554         | 21,183         |
| 75-84        | 9,484          | 9,363          | 9,155          | 8,951          | 9,187          |
| 85+          | 2,611          | 2,751          | 2,892          | 2,926          | 3,039          |
| <b>Total</b> | <b>196,269</b> | <b>196,970</b> | <b>197,610</b> | <b>197,886</b> | <b>198,029</b> |

**What's the impact on population of planned housing developments?**

## Population impact of constraint

|                   |  |     |     |      |      |
|-------------------|--|-----|-----|------|------|
| Number of persons |  | +56 | +38 | -267 | -351 |
|-------------------|--|-----|-----|------|------|

## Housing

|                           |        |        |        |        |        |
|---------------------------|--------|--------|--------|--------|--------|
| Number of households      | 76,554 | 77,240 | 77,958 | 78,479 | 79,067 |
| Change over previous year |        | +686   | +718   | +521   | +588   |
| Concealed families        | 800    | 786    | 771    | 754    | 737    |

**What's the change in number of households and dwellings each year?**



# In practice: the forecasting process

## Population and housing forecasts

- Set up: program and data: 1 month
- Develop and sensitivity test: 3 months
- First reports: 2 months
- Review: on demand
  
- But : research is also a piece of string

# Support and user group

- [www.ccsr.ac.uk/popgroup](http://www.ccsr.ac.uk/popgroup)
- Training: Manchester two-day courses
- Email discussion list
- User group: chair, Janine Edwards, Conwy
- Steering group
- Administration
  - CCSR/Margaret Martin/Barbara Ackrill
- £1,000 POPGROUP, £500 each HOUSEGROUP and LABGROUP