

PhD on incorporating social trends into national and sub-national household projections

Ashley McCormick is a PhD student based at Liverpool University. His PhD involves using dynamic microsimulation to improve the household projections for Scotland. He is jointly funded by the Economic and Social Research Council (ESRC) and the Scottish Government (SG) and spends one month per year (September) working alongside members of the household estimates and projections branch, in GROS. He is currently in the second year of his PhD.

Ashley has written the attached paper to give an introduction to his PhD. **He would welcome any comments or questions about it, from HARG members.**

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Projecting Scotland's Households

*Introducing one of the Joint Economic and Social Research Council and
Scottish Government PhD Projects*

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Main objectives of the PhD

The following document provides an introduction to a joint PhD project funded by the Scottish Government (SG) and the Economic and Social Research Council (ESRC). There are more than a dozen of such projects, with the number increasing annually. In this particular project there are four joint partners; the previously mentioned SG and ESRC and the General Register for Scotland (GROS) as well as Liverpool University.

In short, the project aims to use an alternative method to project Scotland's households into the future. By explicitly incorporating social trends, such as social class, into household projections, this method can complement the current GROS projection method. The aim of this document is to introduce the current system of projecting Scotland's households. Following this, the alternative method is introduced, including an explanation of how it can add value to the current method.

GROS Household Projections

The project aims to improve the accuracy and data richness of current GROS household projections. Currently, GROS use a standard approach to produce their projections by age, gender, household composition and local authority area known as the headship rates method. An example of household composition is a one adult-one child household or a household with two adults and no children. The first step of the projection process is to remove the number of people living in communal establishments, such as care homes and hospitals, from the total population to derive the estimated number of people living in private households. The proportion of people who head

particular household types within any particular age group and local authority area is known as the 'headship rate'. These are calculated using information on household composition from the 1991 and 2001 Censuses and projected forward. These calculated rates are then multiplied by the number of people in private households in each age group, to produce figures for the number of households of each type, for each year of the projection period. Minor adjustments are made to ensure local authority figures add up to the total for Scotland. GROS projections are produced every two years covering a 25 year period.

Household projection data is used by local and national government to inform the planning and budgeting process for the building of new houses. Using an alternative method of projection, the current system can hopefully be complemented by more accurate figures, which incorporate more directly the social forces underpinning changes in household formation. To create such data, the project uses a technique known as ‘dynamic microsimulation’.

Dynamic Microsimulation to Household Projections

Dynamic microsimulation projects at the individual level, so each person in the projection can be given their own individual characteristics. For this project it simply means that at the start of the projection there is an anonymous record, synthetically derived for each individual, family and household. Included in the record are attributes for each person, such as age, gender, education, social class. These households are then subjected to a series of simulated demographic events (births, deaths, marriages, etc) using empirically derived rates. For example, all women of child bearing age are subjected, each model year, to an age specific probability of giving birth. The bonus of dynamic microsimulation is that it captures the age/gender change of the GROS model *and* individual, family and household change.

Three stages of a full dynamic microsimulation of Scotland’s Households

The project has been broken down into three stages:

(1a) Build a dynamic microsimulation package – SCOTSIM, which is short for Scottish Simulation, and collect data for the projection model.

(1b) Using SCOTSIM, produce national household projections for Scotland.

(2a) Investigate the potential to create alternative ‘headship’ rates, as explained below.

(2b) Apply the newly created national level headship rates at local authority level (such as Fife) to the outputs of SCOTSIM.

(3) Attempt to produce sub-local authority level projections.

The rest of this leaflet provides a summary account of these three stages.

Stage 1

In stages 1(a) and 1(b) SCOTSIM will be ‘built’ as a work in progress. Whilst SCOTSIM is being built, data collection and research will be carried out. One major issue for dynamic microsimulation is its data requirements. SCOTSIM needs a large sample of individual, family and household level data. Since the Census provides the only close to 100% coverage of Scotland’s population, there are difficulties gaining data between Censuses. Therefore the most appropriate datasets will be identified and those with the largest sample will be selected. Examples of datasets that will be considered include the Labour Force Survey, Scottish Longitudinal Study and British Household Panel Survey. When reviewing datasets one critical aspect is to identify whether the necessary data will be available at sub-national level.

Whilst data is being collected, current literature and statistics on household change will be reviewed, to help identify *which* attributes have the most influence on household change. There are a limited number of variables which SCOTSIM can include. Therefore not all factors

influencing household change can be included, only those variables which have the largest impact. Variables which may influence household change will be analysed to identify which are likely to have the largest impact on household change, then included in the SCOTSIM model. Examples include social class, education, economic activity and household tenure, to name but a few.

Stage 1(b) aims to produce national projections of Scotland's population and households. The age, gender, fertility, mortality and migration data, (as well as future assumptions), are derived from the same sources as the GROS population projections (www.gad.gov.uk see Demography section). Once SCOTSIM is fully built, the chosen variables will be projected for each individual up until 2035. These variables will include the previously mentioned variables from stage 1(a), which are yet to be chosen, and the variables shown below:

- Household ID Number
- Family ID Number
- Individual ID Number
- Age
- Gender
- Partnership Status

SCOTSIM will project forward a representative sample of around 5% of Scotland's population. Using sample data, the probabilities of households changing through demographic events to predict future change. The probabilities of life events of births, deaths and migration will be simulated as part of SCOTSIM.

Analysis To Check the Accuracy and Quality of SCOTSIM

Once the microsimulation is working, analysis of the results will take place. The analysis which will take place depends on how the project develops. A likely choice of analysis includes measurements of

mortality by socio-economic status as they are heavily linked to different ages of death for individuals in Scotland. It may also be possible to produce variant projections such as high and low birth rates.

Stage 2

As mentioned in the introduction, the headship rate is crucial for household projections. The number of household heads adds up to the number of households projected forward. The project will investigate the potential to create alternative headship rates, which may help to project future household change more accurately. Currently, the 'head' of household is calculated using Census data. The Census form asks for details of each member of the household and the first person on the list is assumed to be the 'head' of household. The approach is understandable, as it is robust and the necessary data are available. However other definitions may (or may not) help supply more accurate headship rates. It will also be important to identify whether the necessary data will be available to produce alternative headship rates.

One definition to be explored, that may be more realistic than the current 'first person on the list' could be the 'oldest female on the list'. When a married or cohabiting couple with children end their relationship, the children tend to live with the female rather than the male, who tends to move out of the household. It is possible that this definition may provide improved rates to the current rates. However, there are problems with all definitions including this one. There are households which contain single male parents with daughters; in this definition the oldest daughter would be the head of household which is likely to be incorrect.

Once the alternative headship rates have been derived, they will be applied to the national level household and age/sex structure of outputs of SCOTSIM. Which will produce projections of local authority household numbers and types.

Stage 3

The final stage will attempt to provide a microsimulation of smaller areas, built upon some of the foundations provided by stages 1 and 2. Using data from the previous two stages may allow sub-local authority area projections to be produced.

Where stage 3 differs from the previous two stages is quite simple. One of the disadvantages of the current approach of projections (the group-approach) is that it produces averages for each local authority area. However, there could be large differences *within* a local authority area.

One major problem is the reliability of projections below local authority area level. For a realistic set of below local authority area projections it seems that a

creative approach is needed. One approach for doing this is known as 'borrowing strength'. This involves combining data from areas that have similar social and demographic trends, but are not physically connected. Stage 3 of the project will investigate whether this approach may enable the production of projections below local authority level.

About the PhD Student – Ashley McCormick

I am based at the University of Liverpool, and throughout this the duration of the research project I work at the General Register Office for Scotland (GROS) each September. One purpose of the placement is to share work practices and for both parties to gain an understanding of the needs of each other.

For any enquiries please email me at ashmc@liv.ac.uk or check my website at www.liv.ac.uk/geography/staff/ashmc.htm

This document (and other Research Findings and Reports) and information about social research in the Scottish Government may be viewed on the Internet at:

<http://www.scotland.gov.uk/socialresearch>

The site carries up-to-date information about social and policy research commissioned and published on behalf of the Scottish Government. Subjects covered include transport, housing, social inclusion, rural affairs, children and young people, education, social work, community care, local government, civil justice, crime and criminal justice, regeneration, planning and women's issues. The site also allows access to information about the Scottish Household Survey.

GROS household estimates and projections can be found at:

<http://www.gro-scotland.gov.uk/statistics/household-estimates-projections/index.html>