National Records of Scotland

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Population and Migrations Committee

11 November 2015 Meeting

Sub-National Population Projections Review: Update

Progress Overview

- Several processes have been coded with others in the process of being coded:
  - The outputs, births, deaths, and cohort-component processes have been coded in SAS,
  - The international migration process has been coded in R,
  - We are currently coding the constraining process,
  - We still have to code within Scotland and Rest of UK migration, and special populations.
  - The controlling process still needs to be coded.

Proposed Outputs

- The new methodology allows for more detailed outputs.
- The ‘Outputs Phase’ will produce over 58,000 tables in 960 workbooks.
- We are in discussions with our web-team on the best way to disseminate these tables.
- The tables will consist of the following:

The Details

- Overall there are:
  - The principal and 6 variant projections.
  - 15 components;
  - 52 areas;
  - 25 years;
  - 2 groupings.

Components

- Population (by single year of age and sex),
- Births (by sex and age of mother),
- Deaths (by single year of age and sex),
- International Migration*,
- Rest of UK Migration*,
- Within Scotland Migration*,
- Total Migration*.

* Migration will be published by flow (in, out, net) as well as by single year of age and sex.

Geographical areas to be projected.

- We have examined data from the 2001 and 2011 censuses.
- Final decision still needs to be made.
- Current plans:
  - Project 30 council areas and four council area parts (Fife and Stirling will be split into part areas).
  - Geo-convert seven councils into the remaining council area parts.
  - Aggregate council area parts to Strategic Development Plan (SDP) area and National Park area.

Within Scotland and Rest of UK Migration

- We have made preliminary examinations on four different approaches to the model:
  - Using static rates with an adjustment,
  - Using static rates without an adjustment,
  - Using changing rates with an adjustment,
  - Using changing rates without an adjustment.

- The adjustment
  - This is the Statistics Canada adjustment.

Static & Changing Rates Explained

- Static rates:
  - Where the migration rates are created using an average of the population and previous migration from the five years prior to the base year.
- Changing rates:
  - Where the migration rates are created using an average of the population and previous migration from the five years prior to the year being projected.

International Migration

- International migration will be projected by performing time series analysis on historic totals to project future totals.
- A 5-year average of international migration estimates will be constrained to the projected totals to create age and sex distributions.
- The age and sex distributions will be constrained to the international migration for Scotland.

Time Series Analysis Methods

- We are using Auto-Regressive Integrated Moving Average (ARIMA) time series modelling.
- The ARIMA methodology has been coded in the statistical software R.
- Total international migration, by sex, into and out of an area is projected.
- A projection for each of the run-in years will be created.
- The long-term trend will be the projection for the year following the run-in period.

How the System Works

- Historical data is loaded into R and plotted.
- The components are chosen based on criteria derived from the data.
- Up to 8 variations on the components are modelled and the best model is selected.
- The users model is compared with the model that the R software would automatically pick, as well as simple moving averages and a final model is selected.
- A statistical test is performed to determine whether there is any significance in the residuals.
- If there is nothing amiss then the model projects the migration.
- This process is repeated for each total to be projected.

Implications for the Consultation

- Modelling international migration and constraining to the national totals means:
  - The projected migration is more detailed and data driven than previous projections.
  - If we make changes as a result of the consultation then it will be to review the final model selected, not to adjust the numbers.
  - This is because any changes suggested by a council have a knock-on effect for all other councils.

Implications of the MYE Error

- The error in the mid-year estimates (MYE) affects the age and sex distributions of the population.
- The National Projections have used the unrevised MYE.
- The Sub-National Projections have the option to use the revised MYE.
- Constraining revised derived data to unrevised derived data may produce unusual results.
- Further work needs to be done to identify the implications for constraining the sub-national projections.

Timescales

- Completion of the new system by the end of January 2016.
- Comparison paper of new and old system using 2012 data by the end of February 2016.
- Subgroup meeting in February/March 2016.
- Consultation on international migration in February/March 2016.
- Publish new sub-national projections in June 2016.