

Methods, models and projections abstracts

Strand organiser: Professor Ludi Simpson

Household projections in England.

Jane Hinton, Communities & Local Government

National Statistics on household projections in England are commissioned by the Department for Communities and Local Government (CLG) every two years in line with the sub national population projections published by the ONS. CLG has undertaken work to assess user needs for the projections, including potential improvement to the methodology and the presentation of the main outputs. In light of this CLG undertook a technical consultation during spring 2010 on a number of proposed changes to the projections. These include new household types with better information on household size particularly numbers of dependent children, and a modified projection method for the household representative rates including greater weighting to Labour Force Survey data.

This paper will set out the methodology review work, the consultation responses and the consequent changes to the methodology for the next set of household projections along with estimates of the likely impacts these changes will have. Plans for the release of the 2008-based household projections will also be presented.

Email: jane.hinton@communities.gsi.gov.uk

A microsimulation of Scotland's household composition using SCOTSIM.

Ashley McCormick, University of Liverpool & GRO-Scotland

Currently the General Register Office for Scotland uses a cohort component model to project households. As part of an ESRC and Scottish Government funded project a recently constructed dynamic microsimulation model (SCOTSIM) has been constructed to aid official projections. A synthetic population has been constructed (from various sources) to simulate annual individual, family and household compositional change in Scotland, until 2030. SCOTSIM's core processes incorporate key demographic dynamics including fertility, mortality, migration, household formation and household dissolution.

Mimicking household change has been achieved by modelling relationship formation and dissolution, and migration. Experiences of these demographic events have been further disaggregated by key socio-demographic factors - health, socio-economic status and education.

Since the microsimulation complements current General Register Office for Scotland projections, age-sex counts of individuals and household compositions have been constrained to official projection figures. Additionally, projections have been scaled to local authority area level, such as Glasgow City and Edinburgh. Both local authority areas will be used as illustrative examples, highlighting differences in experiences of household change via personal characteristics, including age, gender, socio-economic status to name but a few.

Email: ashmc@liv.ac.uk

Using small area demographic forecasts to support planning and policy development in local communities

Peter Boden, University of Leeds & Edge Analytics Ltd; Ludi Simpson, University of Manchester

The estimation and projection of small area populations has become increasingly important as components of demographic change have fluctuated since 2001. Local Authorities need better evidence to understand the speed and scale of change, to plan services and to develop appropriate policies for increasingly diverse local populations. POPGROUP is established as a robust and flexible tool for the production of population and household projections and forecasts.

In the UK, the economic recession, political change, the withdrawal of Regional Spatial Strategy and its housing targets, do not reduce the need for local demographic projections but make their context and the resources for them more uncertain. The availability of administrative data sets provide an opportunity to test population estimates between censuses that is useful but adds new uncertainty in the interpretation of results.

This paper provides some insights into the use of POPGROUP to produce forecasts of both population and households at a variety of spatial scales and identifies some of the issues that have arisen. Our approach allows forecasts anchored on the recent past population dynamics for any set of local areas, by estimating detailed local migration schedules from successive published population estimates.

In addition the paper discusses the use of administrative data to fill some of the gaps and to respond to some of the doubts about intercensal demographic estimates. We report on the use of alternative housing and vacancy estimates, and the use of Council Tax and patient registrations to supplement population estimates, for small areas in three parts of England and Wales. The paper will also report on the latest developments in the POPGROUP suite of products.

Email: p.boden@leeds.ac.uk

What happens when international migrants settle? Ethnic group population trends and projections for UK local areas

Phil Rees, Paul Norman, Pia Wohland & Peter Boden

The ethnic make-up of the UK's population is changing significantly. Groups outside the White British majority are increasing in size and share, not only in the areas of initial immigration but throughout the country. This growth is driven by all the demographic components: immigration less emigration, differences among ethnic groups in fertility levels and varying mortality experiences. We describe the national results for a set of four projections, all of which result in significant increases in ethnic minority population sizes and shares, which show population ageing for all groups but at different stages. There is also substantial spatial redistribution which we discuss in detail.

Ethnic minorities will shift out of the most deprived local authorities and will move into the least deprived local authorities. The distribution of ethnic minority populations shifts favourably over the projection horizon, while that of Whites remains stable. The percentage of the Mixed group population in the most deprived quintile of LAs reduces from 26% to 19%, while the percentage in the least deprived quintile increases from 22% to 29%. The corresponding shifts for Asian groups are from 25 to 18% for the most deprived quintile and from 9% to 20% for the least deprived quintile. For Black groups the most deprived quintile sees a decrease from 54% to 39% while the least deprived quintile sees an increase from 7% to 19%.

There are *significant shifts to LAs with lower ethnic minority concentrations* by Mixed, Asian and Black populations from LAs with high ethnic concentrations, while the White and Chinese and Other group distributions remain in 2051 as they were in 2001.

Ethnic groups will be significantly less segregated from the rest of the population, measured across local authorities, in 2051 than in 2001. The Indexes of Dissimilarity between each group and the rest of the population fall by a third over the projection period.

The UK in 2051 will be a more diverse society than in 2001 and this diversity will have spread to many more part of the country beyond the big cities where ethnic minorities are concentrated.

Email: p.h.rees@leeds.ac.uk

Does education matter? Population projection of Pakistan at provincial level by educational attainment.

Wazir M. Asif, IIASA; Anne Goujon, Vienna Institute of Demography & IIASA

Pakistan faces high levels of population growth entailing a large population of schooling age, and low levels of economic development, with increasing spread of poverty and unemployment over the past few decades. While the role of education has been emphasized by the government and international development agencies in playing a vital role for the successful development of Pakistan, progress realized at all levels have been inadequate and this for two main reasons: The investments in education have been too low and the schooling age population has been growing too fast. With 39 percent of its population below age 15 in 2005; Pakistan was one of only 12 world countries that spent less than 2percent of its GDP on education. Consequently the average Pakistani boy received only five years of schooling and the average girl two and a half years (World Bank 2004). In 2006, 54 percent of adults (15+) were literate with literacy reaching only 40 percent among women (UNESCO).

Still there is ground for optimism: Pakistan is experiencing a decline in birth rates and population growth is beginning to level off as part of the demographic transition. In this context, human capital will be central to the realization of the window of opportunity which could allow under certain conditions for rapid economic growth and further investments in education and infrastructure. However, this demographic bonus could transform into demographic distress and social unrest if the decision makers either fail to improve education levels or to develop the economy to provide work opportunities for the coming generation of more educated male and female Pakistani. The paper will analyze the results of population projections by levels of education, and the impact of different assumptions regarding especially changes in levels of educational attainment and in fertility, both at national and provincial levels. The objectives of the paper are as follows:

- To emphasize human capital development in Pakistan at provincial levels and changes in levels of educational attainment, especially for women's and its impact on the demographic transition.
- It will assess the potential for the achievement of the Millennium Development Goals (MDGs) provincial level, especially universal primary education and gender equality and how realistic are national goals on educational attainment. Will Pakistan achieve these goals?
- To infer the potential for the exploitation of the demographic window of opportunity. How Pakistan will utilize the demographic bonus, when it get the maximum with compare to educational demographic windows of opportunities.

Email: wazir@iiasa.ac.at

MAPE-R: A rescaled Measure of Accuracy for Cross-Sectional Forecasts.

David A. Swanson, University of California Riverside; Jeff Tayman, University of California San Diego; TM Bryan, McKibben Demographic Research

Accurately measuring a population and its attributes at past, present, and future points in time has been of great interest to demographers. Within discussions of forecast accuracy, demographers have often been criticized for their inaccurate prognostications of the future. Discussions of methods and data are usually at the center of these criticisms, along with suggestions for providing an idea of forecast uncertainty. The measures used to evaluate the accuracy of forecasts also have received attention and while accuracy is not the only criteria advocated for evaluating demographic forecasts, it is generally acknowledged to be the most important. In this paper, we continue the discussion of measures of forecast accuracy by concentrating on a rescaled version of the measure that is arguably the one used most often, Mean Absolute Percent Error (MAPE). The rescaled version, MAPE-R, has not had the benefit of a major empirical test, which is the central focus of this paper. We do this by comparing 10- year population forecasts for U.S. counties to 2000 census counts. We find that the MAPE-R offers a significantly more meaningful representation of average error than MAPE in the presence of outlying errors and provide guidelines for its implementation.

Email: david.swanson@ucr.edu

A comparison of official population projections with time series forecasts for England and Wales.

Guy J. Abel, Jakub Bijak and James Raymer University of Southampton

In this presentation, we compare official population projections with Bayesian time series forecasts for England and Wales. The Bayesian approach allows the integration of uncertainty in the data, models and model parameters in a coherent and consistent manner. Bayesian methodology for time-series forecasting is introduced, including autoregressive (AR) and stochastic volatility (SV) models. These models are then fitted to a historical time series of data from 1841 to 2007 and used to predict future population totals to 2033. These results are compared to the most recent projections produced by the Office for National Statistics. Additionally, in-sample forecasts are compared with actual population and previous official projections.

Email: g.j.abel@soton.ac.uk

IPF and the ecological fallacy.

Maja Zaloznik, University of Liverpool

Iterative Proportional Fitting (IPF) is an iterative procedure used to adjust or fit contingency table cells to a set of constraints and its classical applications include updating tables to new margins, combining population and sample data, and estimating cell frequencies based on incomplete information. It is a general data analysis methodology, applicable to any and every type of categorical data; geographical data being no exception. IPF is particularly useful in census data analysis where it allows the estimation of small area individual data based on the released aggregate tables. These estimates do however suffer from errors due to the unavailability of data that would allow a realistic estimation of geographic variation. The question of how grave this error from insufficiency of constraints is has not yet been explored systematically.

This paper will present the results of a series of three-dimensional computer simulations using microdata from the 2001 UK Census Individual Sample of Anonymised Records. By using

complete tables with known geographic variation, various scenarios can be created to simulate different levels of data availability conditions and compare the IPF estimates with known tables. This allows the systematic evaluation of the procedure's efficiency for small area census data estimation. The IPF estimation procedure is demonstrated with the use of mosaic plots that allow the visualisation of geographical variation at different spatial levels, demonstrate the extent to which IPF picks up on it, and can offer a far more intuitive understanding of what the ecological fallacy is.

Email: m.zaloznik@liverpool.ac.uk;

Modelling small-area mortality: how many (and which) parameters?

Michael Grayer, Queen Mary University of London

Life expectancy statistics for small geographical units representing "neighbourhoods" are data that are highly in demand, particularly for policy-making institutions. However, because there is so much random variation in the mortality data used to calculate life expectancy, simplistic methods have a tendency to produce spurious results. A Bayesian approach is suggested to estimate age-specific mortality rates (ASMRs - the components required to calculate life expectancy) for London electoral wards. Such an approach allows for direct estimates of uncertainty (enabling confidence intervals to be easily estimated), and treats each ward population as part of the whole London population rather than as separate entities.

Previous Bayesian approaches have modelled the "average" level of mortality by age group, and then used a single parameter to model the differences in the level of mortality between areas. It is argued in this paper that this is not enough. A two-parameter system based on the relational model proposed by Brass (1971) is suggested here. Maps of preliminary estimates of life expectancy by electoral ward in London from this method are presented.

Email: m.p.grayer@qmul.ac.uk
