Institution: University of Southampton

Unit of Assessment: 22 Social Work and Social Policy

Title of case study: 22-03 A Numbers Game: Revamping Official Statistics on Migration and Population

1. Summary of the impact

In the UK and the rest of Europe, public bodies and policymakers have struggled to quantify migration and make accurate population forecasts because of inconsistent data from a variety of disparate sources. The University of Southampton has demonstrated how, via the use of statistical modelling, conceptual frameworks and migration modelling, policymakers can radically improve the information they glean from the data sources at their disposal. The team successfully guided the Office for National Statistics (ONS) in overhauling their methodologies, finally making them compliant with European Union (EU) regulations. The wider impact of accurate numbers is significant for public service provision, planning, and the UK economy. Furthermore, ONS data feeds into numerous areas of public policy, hence the provision of accurate estimates by Southampton researchers has significant reach and impact on such policies.

2. Underpinning research

Accurate information about the size and movements of populations is essential for policymakers and government bodies, from the local to the international level. Whether used to inform decisions on funding for infrastructure and amenities, or for economic forecasting, accurate population data is crucial. But in the European Union, the study of international migration, which is so important to the understanding of population change, has been hindered by problems with data availability, quality and consistency. A study by Poulain et al. in 2006 showed that harmonisation of data collection processes and the data they generate was not even close to being realised.

The University of Southampton's Statistical Sciences Research Institute and the Economic and Social Research Council's Centre for Population Change forged a collaboration to tackle this problem. A team led by James Raymer, Professor of Demography (2004 to present), Jakub Bijak, Lecturer in Demography (2009 to present), and Peter W. F. Smith, Professor of Social Statistics (1990 to present), have researched the accuracy and analysis of migration data and worked with government bodies to improve their understanding of population dynamics. During the REF impact period, they have used that knowledge to work directly with those government bodies to significantly improve their use and understanding of the statistics available to them.

Raymer and Bijak completed a three-year Migration Modelling for Statistical Analyses ('MIMOSA') project on estimating international migration flows and stocks in Europe in 2009 **[G1]**. The MIMOSA project was funded by Eurostat, the statistical office of the European Union, which was unable to reconcile migration data provided by member states. Bijak joined Southampton for the last year of the project but was involved in it from the beginning at CEFMR, Warsaw.

The team developed a modelling approach to estimate international migration flows between countries in Europe. For the first time, a methodology was developed for obtaining reliable and consistent estimates of international migration between European countries, and to estimate the missing data. In particular, a categorical data analysis approach **[3.1, 3.2]** was applied to the structures in the migration flow tables, representing the gross flows of immigration and emigration and the associations between countries. The work has been subsequently extended in a project on Integrated Modelling of European Migration ('IMEM') **[G2]**, which uses the Bayesian statistical approach to analyse the uncertainty of the migration estimates, while accounting for the many differences in definitions, quality and sources of available migration data. In parallel, innovative methodologies for migration forecasting have been developed **[3.3]**.

The MIMOSA estimates **[3.4]** provided valuable insights into the overall picture of population movements, as well as suggesting areas for further improvement in the modelling

approach. EU regulations state that a breakdown of 'scientifically based' statistics on migration must be submitted to Eurostat by each member state. Failure to meet the requirements has the potential to result in a hefty fine. The Southampton team advised the UK's Office of National Statistics on how to improve their methodology and suggested methodological improvements to be implemented by the ONS, like pooling data and estimating age distributions over time. The ONS subsequently commissioned the Southampton team to work on five projects. In the first one Bijak has performed an independent review of methods for distributing international immigration estimates to sub-national regions. In the second project Raymer and other co-authors delivered recommendations for how the ONS could improve the migration statistics sent to Eurostat to fulfil its legal obligation of quality data reporting. The third project, by Smith, Raymer and Bijak, assessed uncertainty in the ONS mid-year population estimates. The fourth one, by Raymer and co-authors, put together the first ever conceptual framework for UK population and migration statistics. Recently, Bijak was also commissioned by the ONS to overhaul the methodology behind the international migration assumptions in population projections.

3. References to the research

Main Research Publications (in chronological order)

[3.1] Raymer J, Abel G, and Smith PWF (2007) Combining census and registration data to estimate detailed elderly migration flows in England and Wales. *Journal of the Royal Statistical Society Series A (Statistics in Society)* 170(4): 891–908.

[3.2] Raymer J and Rogers A (2007) Using age and spatial flow structures in the indirect estimation of migration streams. *Demography* 44(2): 199–223.

[3.3] Bijak J (2010) *Forecasting international migration in Europe: A Bayesian view*. Springer Series on Demographic Methods and Population Analysis, vol. 24. Dordrecht: Springer.

[3.4] Raymer J, de Beer J and van der Erf R (2011) Putting the pieces of the puzzle together: Age and sex-specific estimates of migration amongst countries in the EU / EFTA, 2002-2007. *European Journal of Population* 27(2): 185–215.

Main Project Grants and Contracts

[G1] Raymer J (for Southampton). European Commission / Eurostat tender n° 2006/S100 106607 (OJ 27/05/2006), Lot 2: *Modelling of statistical data on migration and migrant populations (MIMOSA)*, coordinated by the Netherlands Interdisciplinary Demographic Institute, The Hague (€562,500, €94,700 for Southampton), January 2007 – December 2009.

[G2] Raymer J, Forster JJ, Smith PWF, Bijak J, and van der Erf R (Netherlands Interdisciplinary Demographic Institute), Keilman N (University of Oslo). *IMEM: Integrated Modelling of European Migration*. NORFACE (€535,504), November 2009 – April 2012.

4. Details of the impact

The University of Southampton's research on statistical modelling for migration, and on producing accurate population estimates and projections, has improved the daily working methods of public bodies that rely on population statistics in their forecasts and decision-making, ultimately affecting the users of public services all across the UK. The team has shown how data limitations can be overcome by using statistical modelling to produce more reliable and detailed migration estimates and forecasts, with associated measures of uncertainty. They demonstrated, for example, how administrative sources like student registers, NHS registers and National Insurance data, can be used to supplement traditional survey data used by the ONS.

In the UK, this work has become an integral part of ONS operations. The final report of the *Migration Statistics Improvement Programme* (ONS 2012a **[5.1]**) mentions **four areas of improvement** which resulted directly from the team's work and recommendations:

- Demographic models for migration and population estimates;
- Long-term international immigration estimates;
- Measures of uncertainty in population statistics (reported in detail in ONS 2012b **[5.2]**); and
- Conceptual frameworks.

These methodological changes are of **national significance** and increase the **national capability** to accurately estimate population at a variety of geographic levels. The work on measuring uncertainty in population estimates has fed into professional guidelines of the ONS and its customers, providing the users of public statistics "*with better information regarding the uncertainty associated with the local authority mid-year estimates*" (ONS 2012b **[5.2]**, p.1). Here, the reach and significance of the research impact go far beyond the methodology of official statistics, indirectly affecting the **national economy and public sphere**. Good quality population estimates and projections are crucial for transparent and fair **allocation of public funds** in such areas as social services, education, police, fire and rescue, highway maintenance, or environment and culture, where they are explicitly used in many of the allocation formulae (CLG 2013 **[5.3]**). The ONS estimates also serve as benchmarks for calculating standardised mortality rates, used in allocating funds to Clinical Commissioning Groups of the National Health Service (NHS 2013 **[5.4]**).

To quote the ONS in regard to the conceptual framework developed by Southampton's researchers, *"[it has benefited] users of population statistics, including analysts, statisticians, researchers as well as policy and decision makers), […] data providers to understand the context and uses to which their data are put, [and] producers of population statistics to provide a basis on which to prioritise future developments in population statistics, and communicate latest data and put data in proper context*" (ONS 2012a **[5.1]**, p. 6). The framework gives details of the component parts of the population statistics model, together with the data sources used to estimate these parts. In particular, it examines how individual sources such as the Census, surveys and administrative data differ in terms of quality and coverage.

The ONS states that, in relation to Southampton's guidelines and recommendations which were implemented to change the current practice in order to meet the Eurostat requirements for statistics on international migration, following the MIMOSA project, "*for the first time since the regulation was introduced, the UK was considered compliant with the requirements under Article 3 of Regulation 862/2007*." **[U1]** This meant that the UK could fulfil its statistical requirements under EU law, avoiding a potentially significant fine.

Southampton's current work on future migration assumptions has also been found "…*important to ensure the ongoing relevance and accuracy of the projections which are used widely across government for* ***planning and policy making***" **[U2]** in areas such as fiscal sustainability, pensions, health and education. The wider societal impact is significant, even notwithstanding the issue of direct allocation of government funds. Population projections form the base of forecasts for the economy and public finance prepared by the Office for Budgetary Responsibility, analyses of future workforce and pension provision by the Department for Work and Pensions, actuarial analysis for the public sector carried out by the Government Actuary's Department, or various types of macroeconomic studies by the Bank of England.

The ONS has described its collaboration with the University of Southampton as having made an invaluable contribution to the development of more accurate population and migration estimates **[U3]**. The Southampton team has put the ONS "…*in an excellent position to think about the gaps and the priorities for the future*." **[U4]** As part of a *Beyond 2011* programme, the ONS is working on alternatives to the national Census, including dropping it altogether in favour of Southampton's modelling approach to the various data streams to which they have access.

Southampton's research was already highlighted in a 2009 UK Statistics Authority report entitled *'Migration Statistics: The way ahead?'* In Part 2 of the report, it stated: "*There is a strong case for constructing synthetic estimates of migration statistics […] Raymer and colleagues at the University of Southampton have been applying the methods to current UK and European migration data. A shared official and academic programme of such synthetic estimates should be considered*." (UK Statistics Authority 2009 **[5.5]**, p. 105). The current case study presents selected outcomes of the implementation of this programme in practice within the REF impact period.

Currently, the Southampton team is looking into impacts of their work on modelling migration in Europe, carried out in 2009–2012 in the IMEM project. In terms of impact, the research is directly targeted at the EU-level public statistics (Eurostat) and decision-making (European Commission), fulfilling the requirements for harmonised migration statistics stipulated by recent EU law. During the latest meeting of the Eurostat Working Group on Migration Statistics in 2012, it was explicitly stated that:

> *" the research project 'Integrated Modelling of European Migration' (IMEM) by the University of Southampton could be used as a starting point to develop a model of intra-EU migration. This might provide a useful benchmark to assess the accuracy of reported migration flows. Eurostat reported that it was following this project with interest, noting that some aspects of the IMEM project built upon the earlier MIMOSA project that was funded by Eurostat."* (Eurostat 2012 **[5.6]**, p. 3)

5. Sources to corroborate the impact

[5.1] Office for National Statistics (2012a) Migration Statistics Improvement Programme Final Report. http://www.ons.gov.uk/ons/guide-method/method-quality/imps/latest-news/msip-final-report/migration-statistics-improvement-programme-final-report---download-file.pdf

[5.2] Office for National Statistics (2012b) Uncertainty in local authority mid-year population estimates. http://www.ons.gov.uk/ons/guide-method/method-quality/imps/latest-news/uncertainty-in-la-mypes/uncertainty-in-local-authority-mid-year-population-estimates---download-file.pdf

[5.3] CLG (2013) Calculation of 2013-14 Formula Funding. London: Department for Communities and Local Government. http://www.local.communities.gov.uk/finance/1314/CalcFFs.pdf

[5.4] NHS (2013) Everyone Counts: Planning for Patients 2013/14. Technical Definitions. National Health Service for England Commissioning Board. http://www.england.nhs.uk/wp-content/uploads/2013/04/ec-tech-def.pdf

[5.5] UK Statistics Authority (2009) Migration Statistics: The Way Ahead? Report by the UK Statistics Authority. http://www.statisticsauthority.gov.uk/reports---correspondence/reports/authority-report-4--migration-statistics-the-way-ahead.pdf

[5.6] Eurostat (2012) Working Group on Migration Statistics, Luxembourg, 25-26 April 2012, Draft minutes. http://circa.europa.eu/Public/irc/dsis/migrationasylum1/home

Direct Users / Beneficiaries at the ONS (corroborating statement available on request)

[U1] Statistician, Migration Statistics Unit, ONS

[U2] Head of Population Projections Unit, ONS

[U3] Head of Demographic Methods Centre, ONS

[U4] Statistician, Population and Demography Division, ONS