

## *WORKSHOP ON PROBABILISTIC PROJECTION AND MICRO-SIMULATION METHODOLOGIES FOR DEMOGRAPHIC, FAMILY AND RELATED ISSUES*

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The somewhat imposing title of this workshop (held on 6–8 December 2004 at Waikato University) may cause some readers to turn very quickly to the next item in this journal. To be fair, some of the sessions were indeed quite technical. However, the focus of the workshop and the fundamental themes of the research discussed embraced the basic knowledge upon which much social policy is founded – namely, the size of the New Zealand population, its composition in terms of age, gender and geographical distribution, and how these are likely to change in the near and distant future.

I suspect these data are amongst the key parameters that underpin our understanding of the implications of social policy changes in many sectors (e.g. education, labour market, health). In addition, projections of population sizes are used at different phases of social policy development, helping to set social policy objectives, providing inputs into planning for services and interventions, and providing benchmarks for monitoring and evaluation purposes. So it seems hard to argue that the development of exciting new methodologies in this area does not warrant some attention.

This workshop was an opportunity for many of the leading exponents in these fields to get together and expose these new ideas to key senior policy analysts in New Zealand, and discuss the implications of the new methodologies for New Zealand's population projections.

Key speakers included Dr Heather Booth (Australia National University), Dr John Bryant (Mahidol University Thailand), Professor Nico Keilman (University of Oslo), Dr Michael Rendall (RAND Corporation, United States, and Office of National Statistics, United Kingdom), Professor Shripad Tuljapurkar (Stanford University), Professor Frans Willekens (Netherlands Interdisciplinary Demographic Institute) and Dr Tom Wilson (University of Queensland). In addition, there were panel discussions featuring senior officials from Statistics New Zealand, the Treasury, the Ministry of Social Development, Te Puni Kōkiri and the Ministry of Economic Development.

It is my intention in this review to provide my own “stumbling novice's” introduction to two of the central topics that were discussed, in the hope that these few paragraphs might provide readers with enough of a taste of the work for them to venture forth and

read the experts' papers prepared for the workshop when they appear in the *New Zealand Population Review* in the near future.

The first broad topic is population projections and, specifically, probabilistic projections.

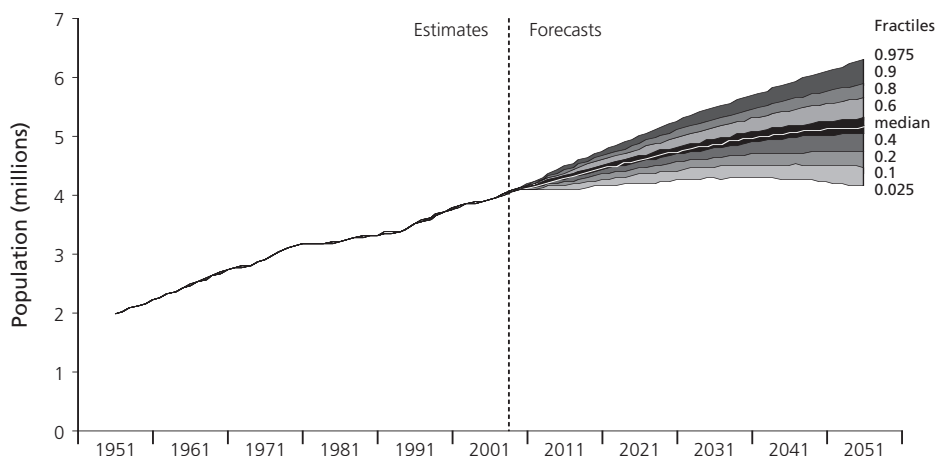
Typically, estimates of the population into the future are produced regularly by official statistical agencies. These are usually founded on population census data and combined with some detailed historical knowledge of patterns of changes in fertility, mortality and migration. To project forward into the future, a number of assumptions need to be made about these parameters. Rather than focus on a particular choice of assumptions, a number of different sets of assumptions are made and the results for each set are presented to enable people to choose for themselves which assumptions they feel most comfortable with (or better still to allow them to test out their ideas under a number of different population scenarios).

Probabilistic population modelling works by making distributional assumptions about the main parameters, which define the median, spread and inter-period correlation for each of the main inputs (fertility rate, mortality rate and migration). Given these distributional assumptions, time series models are then used to project the population forward in time. The methods do not relieve us of having to make and rely on assumptions about the parameters, but the models will produce population trajectories that behave far more realistically (i.e. they vary more and do not move forward in strictly linear fashion) and, most importantly, enable us to measure the uncertainty in the estimates produced.

The contrast between the methods is illustrated in Figure 1 extracted from Dr Tom Wilson's paper. I felt this was a key paper at the conference because it took the methods we were talking about and applied them directly to New Zealand data. The middle line in the graph provides the results of the "middle series" from Statistics New Zealand projections, and the error bands represent the results of Dr Wilson's probabilistic simulations.

The key outcome is that there is considerable uncertainty about where New Zealand's population will be in the longer term and that this uncertainty is not apparent when considering the results based on conventional demographic methods. For New Zealand, the variation in the key input factors (fertility, mortality and migration), in relation to our small population size, means that there is more uncertainty as to the size and composition of our population in comparison to many countries with which we traditionally compare ourselves.

Figure 1 New Zealand Population Forecasts



Dr Shripad Tuljapurkar from Stanford University also gave an excellent paper dealing with uncertainty – “Stochastic models for planning public pensions and fiscal expenditures”. It highlighted just how much uncertainty is present when we consider the projections of some quite basic population characteristics. An example is the elderly dependency ratio – the ratio of people aged 65 or over to the population aged 15–64. In many countries this currently sits at a bit below 20%, but probabilistic modelling in some countries has the uncertainty surrounding projections of this producing upper bounds of over 70% by 2050. The implications of this for the development of policy around funding care for the elderly are indeed sobering. However, although it is somewhat disquieting to know that policy must be formed in such a state of uncertainty, it is at least a step forward to be aware of just how uncertain the basic population data is. More helpful is the fact that most models produce narrower bounds for the elderly dependency ratio, which are above the current values, and so we have a good deal of certainty that the ratio will rise.

In the discussions of these and other papers on probabilistic projection methods our attention was drawn to the simplicity of the conventional methods and how this often meant the results could be easily communicated to a very wide audience. As with most things, I am sure a judicious use of both methods in producing demographic projections and communicating them to the wider public would be the ideal strategy.

The second key topic discussed at the workshop was micro-simulation. At its simplest, micro-simulation is about taking a representative data set of individuals, modelling the impact of some change on each person, and then aggregating the results to make some conclusion about the effect of the change on the population as a whole. A New Zealand example is the Treasury’s TAXMOD system, based on the Household

Economic Survey data, which can simulate the effect of changes in income tax rules. The key benefit from such analysis is to help us get a handle on the distributional effects of policy changes. So instead of making policy decisions (such as moving to a flatter tax rate) based on the impacts on a “typical” household, a micro-simulation model allows us to estimate policy impacts across a variety of household types, and gain an understanding of the variety of impacts a policy change may have across different parts of the population.

Of course simple static models such as TAXMOD are not the beginning and end of the story of micro-simulation. Dr Michael Rendall (from the Office of National Statistics in the United Kingdom and the Rand Corporation in the United States) gave a fascinating account of some of the developments in a dynamic micro-simulation model called POLISIM. Having had a bit to do with very simple micro-simulation models, it was great to hear the experiences of someone with first-hand experience of (what I would guess is) one of the most complex models around.

A key question asked by New Zealand practitioners was whether it would be feasible and worthwhile to develop such a large project in this country. It seems to me that we need to proceed with a lot of caution because dynamic micro-simulation models become extremely complex very quickly and often the quality of the input data may not stand up to such intricate and detailed micro-level analysis. On a more positive note, the longitudinal data from the SoFIE (Survey of Family, Income and Employment) project, will provide much of the high-quality input data required for this sort of modelling work for New Zealand in the near future.

In conclusion I would say that the workshop represented a great opportunity to hear directly from many of the world’s experts in these areas and to hear them discuss their new methods in the context of New Zealand’s population and social policy issues. What I have briefly summarised here is only a taste of the content of the programme and I would encourage readers to delve further once the full set of papers is published.

The international Workshop on Probabilistic Projection and Micro-Simulation Methodologies for Demographic, Family and Related Issues was partially funded by SPEaR, the interdepartmental government committee for social policy, evaluation and research. The conference organiser was Professor Ian Pool. The full programme is available on the website of the Population Studies Centre website: [www.waikato.ac.nz/wfass/populationstudiescentre](http://www.waikato.ac.nz/wfass/populationstudiescentre) and the papers from the workshop will be published in the *New Zealand Population Review*.