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Book Review of: MAZZUCO S. and KEILMAN N. (eds.), 2020, Developments in demographic forecasting (The Springer Series on Demographic Methods and Population Analysis, vol. 49), Cham, Springer Nature Switzerland, viii + 258 pages

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MAZZUCO S. and KEILMAN N. (eds.), 2020, *Developments in demographic forecasting* (The Springer Series on Demographic Methods and Population Analysis, vol. 49), Cham, Springer Nature Switzerland AG, viii + 258 pages.

While Bryant and Zhang (2019)⁽¹⁾ take a clear position in favour of Bayesian demographic estimates and projections, this book presents and discusses frequentist and probabilistic projections more generally.

The first chapter, authored by the editors, offers a clear presentation of the differences between the various types of models, along with the main criticisms of each.

First, in the cohort-component approach, a population is followed over time while varying the three components of demographic change: fertility, mortality, and migration. This variation is based on hypotheses about each component and each year of projection. Mazzuco and Keilman say this approach was first developed in 1895 by Edwin Cannan.⁽²⁾ But already in 1760, the mathematician Leonhard Euler⁽³⁾ presented hypotheses that allow the answer to the question ‘How many men will die in a year?’ to be calculated using his concepts of stationary and stable populations. These concepts, as well Bourgeois-Pichat’s (1994)⁽⁴⁾ concepts of semi-stable and quasi-stable populations, provide a clearer basis for this method.

Many statistical institutes have applied this method over time. Chapter 4 (Castiglioni, Dalla-Zuanna, and Tanturri, ‘Post-transitional Demography and Convergence: What Can We Learn from Half a Century of World Population Prospects’) and Chapter 9 (Keilman and Kristofferson, ‘European Mortality Forecasts: Are the Targets Still Moving?’) discuss certain aspects of the approach. However, it has been criticized as overly mechanical, in particular because of its neglect of feedback mechanisms; increasing population density may have an effect on fertility, mortality, and migration that cannot be taken into account using this approach.

The second point is the distinction between deterministic scenarios and probabilistic methods. This contrast emerged in the early 1960s, and some countries’ statistical offices began to publish their projections in probabilistic form from the late 1990s: the Netherlands from 1998, New Zealand from 2011, and Italy from 2018. The United Nations Population Division has also been publishing its projections for all countries of the world in probabilistic form since 2014. Chapter 3 (Dion, Galbraith, and Sirag, ‘Using Expert Elicitation to Build Long-term Projection Assumptions’) indicates that Canada will soon be

(1) Bryant J., Zhang J. L., 2019, *Bayesian demographic estimation and forecasting*, Boca Raton, CRC Press.

(2) Cannan E., 1895, The probability of a cessation of the growth of population in England and Wales during the next century, *Economic Journal*, 5(20), 505–515.

(3) Euler L., 1760, Recherches générales sur la mortalité et la multiplication du genre humain. *Histoire de l’Académie royale des sciences et des belles lettres de Berlin*, 16, 144–164.

(4) Bourgeois-Pichat J., 1994, *La dynamique des populations. Populations stables, semi-stables, quasi-stables*, Paris, INED.

using a probabilistic approach, and Chapter 12 (Scherbov and Sanderson, ‘New Approaches to the Conceptualization and Measurement of Age and Ageing’) applies the same method to elderly populations. The authors argue that this approach will not provide more accurate estimates of future trends than deterministic scenarios, but will offer a more complete view of the uncertainties in these forecasts. They are thus subject to the same criticisms mentioned above.

The third point in the introduction is a welcome exploration of the distinction between Bayesian and frequentist approaches. But it would have been useful to more precisely define the bases of these different approaches—which have been axiomatized—and explain their very different objectives (Courgeau, 2012⁽⁵⁾). The authors also do not draw the distinction between subjectivist and logicist Bayesian methods, which could shed more light on the choice either to use expert opinions (subjective) or only observed data (logicist). Consequently, the authors have trouble showing how the Bayesian approach provides something more than (or different from) the frequentist approach. Only Chapter 2 (Graziani, ‘Stochastic Population Forecasting: A Bayesian Approach Based on Evaluation by Experts’), Chapter 5 (Aliverti, Durante, and Scarpa, ‘Projecting Proportionate Age-specific Fertility Rates via Bayesian Skewed Processes’), and Chapter 10 (Zhang J. L., ‘Bayesian Disaggregated Forecasts: Internal Migration in Iceland’) could enlighten us on this point. As we will see below, however, their objective of presenting a specific subject prevents them from providing a more general view of their approach.

Finally, the editors address the important problem of verifying the validity of these projections. Once the time range covered by a projection has passed, the projected values can be compared with the actually observed values. The methods for doing this are now well developed, but few tests have been performed thus far. Of course, to make these tests possible, a probabilistic approach is required. Two of the chapters present results of such tests: Chapter 10, presented above, and Chapter 11 (Raimer, Bai, and Smith, ‘Forecasting Origin-Destination-Age-Sex Migration Flow Tables with Multiplicative Components’).

I have already briefly presented most of the 11 other chapters above, which provide recent results obtained using these different approaches. They are of great interest to the specialist reader, but many offer only a very precise and technical presentation of their approach. This may obscure other important points that, if treated in more detail, would be helpful to less informed readers.

Chapter 10, on internal migration in Iceland, offers a clearer presentation of its Bayesian methods. This chapter complements Chapter 15 of Bryant and Zhang (2019), on internal migration between eight regions of Iceland from 2000 to 2014, by 5-year age group, projected to 2020. It complements the earlier chapter, among other points, by comparing estimated flows for 2009–2018 (based on observed flows from 1999–2008) with observed flows. Without going into detail

(5) Courgeau D., 2012, *Probability and social science*, Dordrecht, Heidelberg, London, and New York, Springer.

on the estimated Bayesian models, it shows that the best of these models provided highly satisfactory predictions. But this chapter cannot go into full detail on this Bayesian approach and its merits, which extend far beyond this particular case. For this, readers must consult the authors' 2019 book.

After these chapters presenting various new results on different projections, a chapter of general conclusions offering an overall synthesis would have been very welcome.

Apart from a few points that would have made it more accessible to non-specialist readers, then, this book offers a good synthesis of the main recent improvements in this area. Statistical offices often try to predict the population at the end of the century. It seems more prudent to limit ourselves to projections over the next 10 or 20 years, given the great uncertainty that they are subject to at longer time, as highlighted by the verifications presented in this book.

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