REVIEW • FORUM
Reflections on reviews by Courgeau, Preston, and Swanson[1]

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It is a privilege and a pleasure to have *Model-Based Demography* reviewed by three eminent demographers, all the more so because they represent different academic backgrounds and different intellectual traditions within demography. I value their expressions of appreciation for the book, but also their questions and criticisms, which will help others and me better understand the issues at hand.

Samuel Preston says that I have "a lover's quarrel with demography." I would emphasize the *lover* part. My quarrel is with those who would identify demography with "human bookkeeping," or view it simply as a branch of statistics. I prefer to think of demography as a complete and autonomous science, and a much better discipline than we sometimes recognize. But we must drop our logical positivist blinders and view our discipline from a different perspective. In my opinion, the semantic or model-based school of philosophy of science provides a fruitful perspective. I would say of demography what Ronald Giere has said of science in general: "The problem is not with current scientific theories of the world, but with current theories…of what it is to acquire good scientific theories of the world" (1999: 3). Demographers know much more about human population than we give ourselves credit for. Again, quoting Giere, "our collective self-knowledge lags behind our collective knowledge of the world" (1999: 3). But the totality of demographic knowledge has not been adequately codified and unified. This is less true of the technical/formal side of demography, and truer of the behavioural and theoretical side.

David Swanson quotes my ten principles for teaching demography "because they provide an insight into the monograph as a whole." In this context, I would take the opportunity to add two more:

11. In judging the worth of a model or theory, a central consideration is the purpose for which it is being used. A good model for one purpose may be a bad model for another. The life table stationary population model is good for many purposes. But many years ago, the use of a series of stationary populations to study population aging led to a partially wrong conclusion: declining mortality invariably was associated with population aging—that is, a larger proportion of the population over age 65 in the stationary population. Overlooked was the fact that stationarity in the face of declining mortality implies declining fertility. A good model was used for the wrong job.

12. It follows that there may be many useful models of the same phenomenon, and that there is no perfect model that excludes all others (Teller 2001).

And so, I agree with Preston when he notes that I have discussed only a few of the many excellent models in demography. But the models included are simply examples, chosen to illustrate a specific methodological or pedagogical argument. An inventory and synthesis of all or the most worthwhile demographic models would be a different and much larger task, perhaps a task beyond the ability of a single researcher. Such a compendium would include micro-behavioural models, such as Lee's model of migration decision making, but also microeconomic models of fertility, marriage, divorce, and migration. It would include macro-models, such as various demographic transition theories, or gravity models of migration or Stouffer's model of intervening opportunities, as well as mathematical models of age schedules of fertility, mortality, migration, etc. It would include models of the consequences of demographic change, such as Coale-Hoover on fertility decline and economic growth and other models of the "demographic dividends" of lowered fertility, and models of the labour force impact of population aging. It would include qualitative as well as quantitative models, and visual and conceptual models. Preston rightly cites the influential work of John Caldwell, much of which was non-quantitative. The possibilities seem almost endless and a bit overwhelming.

Nevertheless, it is to be hoped that someday there will be a volume—more likely, volumes—that codify *all* demographic models, formal and behavioural, as well as Preston and his colleagues have done for formal demographic models (Preston et al. 2001).

Daniel Courgeau disagrees with my view on the role of statistics in demography: "He rejects the heavy reliance on statistical models in usual demography." Presumably, something I wrote has given him this impression, but that is not quite my view. What I object to is *overreliance* on statistical models—especially multivariate models of census or survey data—to the neglect of other kinds of modelling, notably mathematical and computer simulation models of theory and systems. Demography will always rely heavily on statistics to describe demographic dynamics, to discover relationships that require further explanation, for putting error bounds on population forecasts, and for entirely new uses that are now coming into play—for example, statistical *meta-models* for understanding the inner workings of complex agent-based computer models (Grow and Van Bavel 2017: passim and esp. ch. 4). But ABM and other computer modelling approaches will focus more on modelling real-world systems rather than incomplete datasets relating to the real world. These will be more theoretical than empirical models, but often they will incorporate empirical data and relationships. Michael Wolfson has recently used the apt term *quasi-theoretical* to describe computer models of theory that are firmly anchored in empirical data (see Grow and Van Bavel 2017: 489–90).

In Courgeau's view, the semantic or model-based approach to science does not encompass mechanistic models. This is not my understanding. Giere, for example, explicitly lists a wide variety of models—physical, visual, large, small, mathematical, conceptual, and so forth (1999). The model-based approach takes an extremely broad view of what constitutes a model. That view certainly can include causal or mechanistic or functional models. Another member of the semantic school, Nancy Cartwright, attributes the behaviour of some part of reality to its "nature" (1999). To me, this comes close to Robert Francke's notion of a functional structure inferred from the behaviour of some system, although I may miss some of the subtleties in the formulations of Francke and Courgeau. And while it may be true, as Courgeau asserts, that "for the semantic approach a theory is a formal system empty of any content," this is true only of a model or theory as such. As soon as it is used for some specific scientific or practical purpose, it must be linked to empirical observations, to verify that it fits some portion of the real world closely enough for the purpose at hand, to paraphrase Giere. I would never argue that in demography as an empirical science there is a role for theoretical models that are totally untethered from observation.

Courgeau also objects to my reference to agent-based modelling as a new paradigm in demography. It may well be that I have use the word *paradigm* too loosely. All I wish to say is that ABM is a major new tool to relate behaviour at the micro level to macro-level demographic trends. And it does so in a way that subjects hypothetical individual actors to social norms and rules, and to pressures resulting from their positions in social networks, rather than only to random draws from probability distributions, as has been the case in earlier micro-simulations. This strikes me as a major advance in demographic analysis, even if it does not constitute a new paradigm in Courgeau's preferred meaning of the word.

Swanson ends his review with the suggestion that demographers reading the book may find that their "level of comfort with how the field is currently conceptualized, studied, and taught will be disturbed and, possibly, forever altered." That, of course, has been my aim all along. It is a modest aim and not original with me. Looking to the future, I'm only saying that demography, like any other empirical science, must make greater use of mathematical modelling and of the many kinds of modelling made possible by computers if it is to realize its full potential as a science. Looking to the past and present, I suggest—paradoxically, perhaps—that demography already has a wealth of good scientific models, including theoretical models, many of which we tend to devalue and ignore. We know more than we know.

References

Cartwright, N. 1999. *The Dappled World: A Study of the Boundaries of Science*. Cambridge (UK): Cambridge University Press.

Giere, R. 1999. *Science without Laws*. Chicago: University of Chicago Press.

Grow, A., and J. Van Bavel (eds.). 2017. *Agent-Based Modelling in Population Studies: Concepts, Methods, and Applications*. The Springer Series on Demographic Methods and Population Analysis 41. Dordrecht: Springer International Publishing.

Preston, S., P. Heuveline, and M. Guillot. 2001. *Demography: Measuring and Modeling Population Processes*. Ill. edn. Malden, MA: Blackwell Publishers.

Teller, P. 2001. Twilight of the perfect model model. *Erkenntnis* 55(3):393–415.