Microsimulation and agent-based modeling in demography

Proposal for an IUSSP Scientific Panel.

October 2014

Background

Populations change because people change. Fertility rates decline as a result of couples having fewer children. Ageing is an outcome of smaller families and longer lives. Microsimulation approaches population dynamics as the outcome of actions of individuals. Longitudinal microsimulation derives population dynamics as the outcome of sequences of actions or changing lives. Individual actions are outcomes of behavioural processes that involve individual decisions (agency) and interactions with the social and institutional environment (structure). Microsimulation models that incorporate agency and structure are generally referred to as agent-based models (ABM).

More specifically, agent-based models describe how populations evolve, patterns (e.g. social networks) emerge, and collective features (e.g. norms) are established as outcomes of actions and interactions at the micro-level. Simple heuristics or rules govern the actions and interactions. Agents may be humans, institutions or organizations. They have attributes, capacities and resources (time and capital: physical, financial, human, social and cultural capital). Agents are autonomous - they determine their own actions -; they are connected - they interact with each other and with the environment -; and they are adaptive – they change their behaviour in response to changes in their own characteristics, in that of other agents or in the environment. Feedback mechanisms, learning processes, assortative mixing processes and diffusion processes are key components of agent-based models.

Microsimulation and agent-based models are extensions of traditional demographic models that describe processes at the population level (e.g. the cohort-component model for population projection). Since the individual is the unit of analysis, population heterogeneity can be accommodated easily. In addition, individual decision making, social influences and social grouping can be incorporated. In multilevel microsimulation models, social groups and institutions are agents with agency and life paths. Agents at different levels interact and produce the patterns of demographic change we observe.

Microsimulation has a long history in demography (e.g. SOCSIM, CANSIM). ABMs are more recent. The workshop on agent-based computational demography, organized in 2001 at the Max Planck Institute for Demographic Research (MPIDR), triggered an interest in agent-based modeling in demography (Billari and Prskawetz, 2003). Recent initiatives include the Workshop on Agent-based Modeling at the University of Leuven in September 2014 and the Agent-based Modeling and Simulation course organized by the MPIDR from November 2013 to January 2014 and a second course in October 2014. The second course was organized by three partners: the Vienna Institute of Demography, the University of Southampton and the MPIDR.

Proposed programme of activities:

The aim of the panel is to further the integration of microsimulation and ABM in the study of population. Both research and training are envisaged. Three types of activities are proposed in the lifetime of the panel:

    a. Two workshops, one in a developed country (e.g. Canada) and one in a developing country or country in transition (e.g. Senegal, South Africa, India or China).

    b. Two short courses, under the auspices of the IUSSP panel. One course may be organized in conjunction with a workshop.

    c. A short online course on agent-based modeling in demography. The course is an introduction to ABM and access is free.

Billari, F. and A. Prskawetz, Eds. (2003). *Agent-based computational demography. Using simulation to improve our understanding of demographic behaviour*. Contributions to Economics, Physica-Verlag.