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Demography Abandons Its Core

A key staff member at NICHD recently said: “Formal demography is in a coma. Perhaps we should just let it die a natural death.” This view is not limited to funders; it pervades the NIH study section and perhaps the field. This short essay addresses the topic. It was initially presented as part of a Panel on Micro-Macro Issues at the annual meetings of the Population Association of America in 2001.

Demography is Changing: Less Macro, More Micro

Demography is changing in profound ways, in its methods and topics of research, and in its training. There is less aggregate level (macro) analysis and more individual level (micro) analysis. There is less emphasis on process and dynamics, and more emphasis on individual decisions about demographic behavior. There is less formal demography, and more data analysis. There is much less funding of aggregate demography and formal demography, and much more funding of micro level empirical studies.

Formal demography is not the same thing as aggregate or macro demography. There is also micro level formal demography, and much formal demography integrates micro and macro approaches. But for the most part, when I refer to formal demography, I will have in mind either macro level or integrative formal demography.

A funder at NICHD said “Formal demography is in a coma. Perhaps we should just let it die a natural death.” This view is not limited to funders; it pervades the NIH study section that reviews research proposals in population, and that study section is a non-random selection of leading researchers in certain areas of demography.

Why Micro Demography Has Risen

For several decades, macro and formal demography have been declining, and micro demography has been on the rise. There are a number of reasons. When I was a graduate student, almost all data were aggregate level data, which came from official national statistical agencies, and which were published in printed cross tabulations. Demographers analyzed and interpreted these data. Formal demography was an important tool in this process, and aided in the process of careful analytic description. When micro level data were available, complicated statistical modeling was rarely possible, because calculations had to be done by hand on mechanical calculators which whirred and clanked and then eventually spat out a result. Computers were just beginning to come into use, but data analysis consisted mainly of carefully chosen cross tabulations.

The growing availability of survey data has helped to change all that. In the 1940s the Indianapolis fertility survey established a new approach, which was consolidated and extended in subsequent national fertility surveys, and then in the World Fertility Surveys and Demographic and Health Surveys, which continue today. But this is only one line of

development, and wonderfully rich survey data have become available through the efforts of demographers and others, in many areas of demography and related fields.

Along with the growth in availability of survey data has come a corresponding growth in statistical and econometric methods for analyzing such data, taking advantage of the frequent longitudinal designs, respecting the discrete nature of outcome measures, permitting complex error structures, and attempting with varying success to cope with problems of unobserved heterogeneity, truncation, selection and censoring. Particular attention has been devoted to the problems of drawing causal inferences in the context of non-experimental data.

Neither the survey data nor the new methods of analysis would have taken-off as they did were it not for a parallel development of computing power and data storage and retrieval capability. The simultaneous advance in these three areas created a powerful force encouraging and facilitating micro level analysis.

Over what was more or less the same period, there was an infusion of micro-level theory from Economics, as work by Gary Becker and his colleagues entered the field. Although Becker and Mincer wrote seminal articles on the economics of fertility and female labor supply in the 1960s, it was really after a special session at the PAA meetings in 1972 or so, in which Heckman, Willis and others presented their work, that this elegant and powerful approach was brought home to demographers. It was first received with great skepticism, if not resentment and disdain, but over the decades since then it has come to dominate the thinking and approach of demographers. The key theoretical perspective was individual rational choice. This provided a theory and program to guide empirical research, focusing attention on the micro level, and away from societal and aggregate processes.

There have also been institutional factors influencing the development of demography over this period. In the United States, academic demography has been located not in separate departments of demography, but rather in other departments, mostly Sociology but to some degree also in Economics, Public Health and Public Policy. This has been good for demography in many ways, keeping its agenda broad, and enriching its theoretical and methodological perspectives. However, it has meant that recognition and promotion for demographers has depended on their ability to communicate with and impress non-demographers, and this, in turn, has created pressures to be like ones non-demographer colleagues, using similar methods, theories, and formalisms. For this reason, there is a powerful centrifugal force pulling demographers away from the core of demography, and out toward the periphery. We are becoming a doughnut of a field, without a center. The center should contain formal demography as a major part, closely linked to analytic description, another major part. Institutional arrangements discourage even the *maintenance* of this center, let alone the energy needed for its development. Indeed the center is dying. But is it dying a natural and deserved death, or is it dying for reasons that are largely incidental to its intellectual and practical importance?

But Key Issues Are Macro Demographic

Some of the most important demographic questions, indeed some of the most important questions facing policy makers around the world, are essentially macro-demographic, and are concerned with the consequences of population change. For concreteness, let me mention a few of these. Population growth and economic development is one.

Demographers have spent decades, particularly in the half century following World War II, trying to determine whether rapid population growth impedes economic development. This effort continues, and despite considerable consensus, plenty of controversy remains. There has been a great deal of valuable research at the micro level on various aspects of this question. Nonetheless, this is essentially a macro issue, and it cannot be answered by micro level investigations. Is the failure to resolve the issue through 50 years and more of research an indication that macro research is impossible? Not at all. One could say the same of most social science research, certainly including micro level fertility research. We research, we learn, we gain insights and understanding, but very seldom do we truly resolve a big question.

The consequences of population size, structure, distribution and growth for the environment forms another important and difficult research problem. Some people think this is the most important issue facing humanity. Again, there has been some excellent research done at the micro level, but this is fundamentally a macro problem, in my view, and the basic questions must be addressed at this level.

Assessing the consequences of immigration for the receiving population and the sending population is another pressing research topic. For example, do immigrant workers depress the earnings of natives, or impose higher tax burdens on them? This is a macro question, which works through markets that involve aggregates of participants, and through governmental institutions, which are also macro in scale.

The consequences of population aging pose another pressing research question which, like the others, is of global concern. There is very important research on closely related individual behavior, such as retirement decisions, saving behavior, or bequests. Yet the fundamental question is population aging, and this must be addressed at the level of the population.

How to make population forecasts is not a substantive question, but a methodological one; nonetheless, it is a central question for Demography. Unfortunately, it receives very little serious attention from demographers these days, who tend to regard it as a mechanical exercise with little or no intellectual content. I have read dozens of research proposals for micro level projects which justify their request for funding based on insights to be gained for population projection, but in truth the promise is almost never fulfilled. It is an invocation that has very little meaning.

Formal Demography Links Micro to Macro, Individuals to Aggregates

A population is not an individual. A population is a collection of individuals. The study of population is the study of these collections, and of the processes of recruitment and

attrition that shape the structure, distribution and growth of the collection. In this study, individual level analyses can be very helpful, and often have great value in their own right, but these studies in themselves cannot answer questions about the collection, the population. These populations need not be of the usual sort. They could be enrolled students, prisoners, books in a library, elephants, capital stock, labor force, immigrants, married people, and so on.

Formal demography provides the analytic link between individuals at the micro level and populations at the macro level. Sometimes a simulation can serve the same purpose, with less effort, but the proper design and validation of a simulation also requires formal demography. While simulations definitely have a useful place in research and analysis, their shortcomings are well known, most notably that they do not provide insight. Without formal analysis, we don't know why the outcome is what it is, and we do not develop understanding of what drives the results.

Formal demography both provides a link between the macro and micro levels, and is the formal expression and vehicle for macro theorizing. Imagine Sociology with no society and no social processes, with nothing but individual behavior. Imagine Economics with no macroeconomics, with no growth theory, with no study of economic development. This will give you an idea of where Demography is rapidly heading. It is impossible to imagine that sociology could be created by summing and simulating individuals, and it is impossible to imagine growth theory or macroeconomics emerging from the summing or simulation of individuals. First, there must be provision for their interactions in markets or other forums, and second, the insights from macro theory would be lost. Could micro-theory guide fiscal and monetary policy?

Examples of Formal Linkage

I will give some examples of the kinds of formal analysis and micro-macro integration that I have in mind. First, surely, is the classic renewal equation of demography, stating the connection between individual level fertility, mortality and migration on the one hand, and the population structure and growth on the other. Stable population theory is just one very specialized use of this renewal equation. These days, uses of the renewal equation to explore transitional situations is more important. Feed back can also be built into the renewal equation, for example to reflect density dependence or wage dependence of the relevant flows.

Formal demography is also important in fertility analysis. One old topic which enjoys renewed attention in recent years is the quantum-tempo problem in demography. The Total Fertility Rate for industrial populations is now 1.4 on average. But is this aggregate measure of fertility behavior accurately reflecting the goals and plans of individual women, or is it distorted downwards by changes in the age of child bearing? For that matter, what pattern of change in the TFR should we expect if the fertility goals of individuals are changing over time? Formal analysis shows that a peak in the TFR may substantially precede a peak in desired completed fertility. There are also formal models of fertility which view it not simply as a matter of individual choice, but which rather reflect the interaction of individuals. Many believe that fertility is socially mediated, and

not simply a matter of individual choice. Models of diffusion and social interaction are aggregate level models with micro underpinnings. Social network theory is another example of formal analysis that involves the interactions of individuals.

The tragedy of the commons occurs when rational optimizing individual choice does not lead to a social optimum, because of a divergence between the costs and benefits of an action accruing to the individual, and accruing to society. One important example is a divergence between the private and social costs of childbearing, which is a fundamental aspect of the population-environment problem. Analysis of these problems requires an integrated analysis of micro and macro levels.

Evolution itself is manifested as a change of gene frequencies in a population as the result of differential reproductive success, which in turn comes from interactions and competition of individuals with different genetic endowments. This also is a micro-macro integration leading to a powerful theory. Bio-demography has a macro and a micro aspect, and when it deals with evolutionary theories of fertility and mortality, it works through the integration of micro and macro processes.

Heterogeneity at the individual level, for example in frailty, influences aggregate level patterns of mortality rates by age, or in fecundity influences the duration pattern of conception in the open birth interval. This is yet another example of the power and utility of using formal analysis to integrate the two levels.

Intergenerational transfers can be fruitfully studied at the individual level, for example bequests, old-age support, care-giving, support for education, or inter vivos gifts. Are these motivated by altruism or by the expectation of repayment? But many of the key questions about these transfers are aggregate level questions. Transfer wealth at the aggregate level is a substitute for physical wealth, which is to say capital stock, for example, so patterns of transfers have implications for the macroeconomy.

Marriage markets are another example. We can formulate a theory of the motivations driving the search for partners and the choice of a long-term mate. We will have only a small part of the picture, however, if we do not go on to consider the interaction of these individuals in a marriage market that imposes certain constraints, assigns certain values to the characteristics of the participants, and somehow brings into balance the choices of men and of women, and reconciles the conflicting desires of the participants.

A final example is the analysis of saving behavior. One can study this at the micro level, and derive a theoretical or empirical result for the effect of an additional birth on a family's saving behavior and cumulative assets, by age of parent. However, without an appropriate macro-level analysis, one can easily reach a misleading conclusion, as has sometimes happened in the literature. A change in fertility does indeed change the number of children in a typical family. However, it also changes the relative numbers of families by age of parent, since it affects the population age distribution. The aggregate saving rate, which is typically the focus of interest, depends both on the effect within individual families, and the macro re-weighting of families by age. A full analysis must

take both into account, and should indeed then consider feedbacks arising from changing capital per worker and therefore changing wages and interest rates, and the resulting equilibrium.

Economics is Learning from Demography

Nowadays, when I go to an economics meeting where empirical research is presented, I see more and more careful, analytic, descriptive work that looks to me like demographic analysis. There is some degree of disenchantment with highly structured micro-empirical analysis in which the estimation procedure depends on accepting strong, and often patently false, assumptions of various sorts, or using instrumental variable techniques with poor and arbitrary instruments. Demographic-style analysis often suffers from its own problems, including fuzziness about what is endogenous and what is exogenous, heterogeneity and selection effects, and so on. Yet if one proceeds with caution and awareness of these problems, it provides an excellent, and perhaps essential, starting place. To a demographer, some of these efforts at analytic description sometimes seem clumsy and unsophisticated; we are good at this kind of thing, and have much to contribute here.

Economists have also shown increasing interest in basing macro theory on micro foundations, often aggregating individuals using models with overlapping generations. These aggregated individuals then interact through markets or social structures, which harmonize their actions through market mechanisms or political mechanisms. Becker himself, with collaborators, has effectively taken this approach from the start, for example in the theory of marriage, but particularly so in recent years. This kind of work is a good conceptual model for Demography. However, the overlapping generations model of economists is just an exceptionally primitive demographic model, with two age groups and everyone surviving until the end of the second age group. We demographers know how to do better than this, much better than this.

Demographers have sought to emulate the methods and research style of economists in recent decades. It would be ironic if Demography abandoned its strengths in these core areas, to exclusively pursue micro analyses, at a time when Economics was turning toward an appreciation and practice of these approaches.

Danger: Demography is Losing Its Core

I am an economic-demographer, a hyphenated demographer. Most of us are hyphenated demographers: social-demographers, economic-demographers, health-demographers, anthropological-demographers, statistical-demographers. That is not bad, it is good, and it is healthy. Our field needs, and thrives on, infusions from other disciplines. That is what keeps it from being merely arithmetic, merely accounting identities. But our training of demographers must include enough core demography so that future demographers *know* demography. Most demographers are now conducting micro level research, fitting equations to survey data, with demographic dependent or explanatory variables, and using fairly sophisticated econometric techniques, guided by some sort of micro theory. This kind of work is good, and is valuable. However, it must not crowd out the analytic core of demography itself.