Microsimulation models for social welfare programs: An evaluation

by Constance F. Citro and Eric A. Hanushek

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A scene in Washington, D.C.—It is mid-1988. In the quarters of the Congressional Budget Office (CBO) at the foot of Capitol Hill, exhausted analysts are working overtime to prepare final estimates of the budgetary and programmatic effects of what will become the Family Support Act (FSA) of 1988. . . . [In] the process of developing the final form of the FSA . . . CBO analysts have prepared cost estimates for half a dozen major bills, each of which contains as many as 50 separate provisions. They have also prepared estimates of which population groups would be affected by the various bills and whether those groups would gain or lose under each proposal, in comparison with alternative proposals and with current law. . . . To prepare their estimates for the FSA, the CBO analysts have called on a wide variety of data sources and data processing tools [including] microsimulation models that process large, nationally representative samples of families as if they were applying to the local welfare office for benefits.

This vignette, from the report of the Committee on National Statistics Panel to Evaluate Microsimulation Models for Social Welfare Programs,[1] could be used, with very few wording changes, to characterize the flurry of activity throughout much of 1993 on the Clinton administration's health care reform initiative. Executive and congressional analysts were working overtime to estimate the costs and likely effects on population subgroups of a variety of proposals, and they were using many different data sources and processing tools, including large, complex microsimulation models. As the administration gears up for an initiative to reform the welfare system, beyond the provisions of the Family Support Act, executive and congressional analysts will similarly be engaged in round-the-clock analysis with the support of several types of policy models. Clearly, a vital concern—but one that is frequently overlooked in the heat of the policy debate—is the quality of these models and the quality of the estimates that they produce.

The use of large-scale models in the policy process is both a relatively recent and a heavily entrenched phenomenon. Since the inception of the U.S. federal system in 1789, decision makers in the executive and legislative branches have sought information to help make choices among alternative public policies. Throughout most of the nation's history, however, the supply of policy information has been limited and the demand for it sporadic and ad hoc in nature.

Beginning in the 1960s, quantum improvements in data sources, socioeconomic research, and computing technology made it possible to supply information of much greater depth and breadth to the policy process. In turn, the activist posture of the federal government during that period both stimulated the production of policy research and analysis and drew on its results. At one end of the process, policy research helped identify problems and move them onto the federal agenda; at the other end, it contributed to an understanding of the successes and failures of enacted programs. At the middle stage of the process in which legislative initiatives are debated, the role of information about the costs and benefits of alternative proposals became institutionalized.

Today, the policy community in Washington takes it for granted that neither the administration nor Congress will consider legislation to alter any of the nation's expenditure programs or the tax code without looking closely at "the numbers." Often, these numbers are the product of team efforts to apply formal computerized modeling techniques and large-scale databases to the task of estimating the impact of alternative policies. The kinds of formal models that are used for policy analysis, defined as the production of estimates of the budget and population impacts of proposed program changes, vary widely. They include large-scale macroeconomic models, single-equation time-series models, cell-based models of population groups, econometric models of individual behavior, and large-scale microsimulation models (see discussion of these model types below, pp. 15–17). Of course these approaches are frequently supplemented, or sometimes supplanted, by a range of less formal means of developing policy estimates.

Despite the widespread use of formal models to provide information to the legislative debate, neither the utility of the models as tools for policy analysis nor the accuracy of the estimates they produce has been subject to much explicit evaluation. Several years ago, the Office of the Assistant Secretary for Planning and Evaluation (ASPE) in the U.S. Department of Health and Human Services and the Food and Nutrition Service (FNS) in the U.S. Department of Agriculture asked the Committee on National Statistics at the National Research Council to convene a panel of experts. They asked that the panel evaluate microsimulation-based policy models, such as TRIM2 (Transfer Income Model 2) and MATH (Micro Analysis of Transfers to Households). ASPE, FNS, and other agencies have used micro-simulation models for many years to estimate the impacts of proposed changes in social welfare programs—including programs for income support for the poor, retirement income support, and provision of health care—and also in tax laws. Models of this class were first developed for policy analysis in the late 1960s but have not been the focus of a major evaluation since a study by the General Accounting Office in 1977.

The panel concluded that, conceptually, micro-simulation models are an invaluable component of the tool kit that policymakers have at their disposal for assessing the effects of different policy alternatives. For the analysis of certain types of policy effects, micro-simulation modeling is unquestionably the best tool to use and has undeniable advantages over alternative methods. The panel found, however, that the existing microsimulation models are far from fulfilling their potential and suffer from problems that deserve much greater attention and resources than have been devoted to them to date. Perhaps the best example is the woeful lack of validation activities and the consequent dire need not only for additional activity in this direction but for systematic validation to be made an ongoing part of the use of microsimulation models.

The panel also concluded that many, if not most, of the considerations involved in assessing the relative strengths of the microsimulation approach and in assessing the defects of existing applications of that approach apply more broadly to other forms of policy analysis. This is not surprising, for microsimulation modeling is just one of many means by which information is provided and used in the policy process. As a result, the panel also made recommendations regarding improvements in the use of information in the policy process in general.

In what follows, we first summarize the panel's findings on this more general theme. We then discuss in more detail the major findings of the panel vis-à-vis microsimulation models.[2]

Improving the tools of policy analysis: Investment priorities

The panel identified two primary deficiencies that demand attention if policy models, of whatever type, are to provide cost-effective information to the legislative debates of the future. The first problem—one of long standing—is the lack of regular and systematic model validation. Ingrained patterns of behavior on the part of decision makers and policy analysts have led to persistent underinvestment in the validation task. The second problem—of more recent origin—is underinvestment and consequent deterioration in the scope and quality of needed input data for policy models.

Given the importance of estimates of the costs and population effects of proposed policy changes, it is essential that the legislative debate have available, in addition to the estimates themselves, an assessment of their quality. Any estimate, whether coming from a rough back-of-the-envelope calculation or produced by one or another type of formal model, will inevitably contain errors and be subject to uncertainty—from sources such as sampling variability, errors in the input data, and errors in the specification of model components. Despite this need, it is rare that questions about the quality of policy estimates are asked by policymakers or that information about quality is provided to the policy debate by others. This state of affairs is no doubt a result of the very difficult problems in determining quality objectively, as well as a result of the time pressures of policy debates. Nevertheless, the panel concluded that it is essential for users and producers of policy information to elevate validation to a priority task. Failure to do so will only lead to a continuation of the wild swings in perceptions of policy successes and failures that come on the heels of expectations falsely based on highly uncertain predictions of their effects. Heads of policy analysis agencies are the logical actors to begin the process of ensuring that information on uncertainty becomes available as a matter of course for the estimates their agencies provide.

Much of the error that arises from policy estimates can be traced to data of poor quality. A disturbing feature of the 1980s was declining federal investment in the production of high-quality, relevant data in many areas of ongoing policy concern. Budget and staff cutbacks, reductions in sample sizes of many surveys, reductions in the publication of tabulations from existing data collections, delays in the revision of key concepts and measurements, and a deterioration in mechanisms for interagency coordination have all occurred. This decline in data availability and quality reduces the value of estimates from microsimulation models and other analysis tools in ways that no statistical technique can correct. The panel therefore urged that this trend be reversed and that progress on improving data quality in the United States be reestablished.

The value of microsimulation as a policy analysis tool

Microsimulation models have played a prominent role in the production of estimates for proposed changes to social welfare and tax programs for over 20 years.[3] The use of microsimulation techniques for tax policy analysis has its origins in work at the Brookings Institution and the Treasury Department in the early 1960s. Today, the microsimulation model maintained by the Office of Tax Analysis is used routinely and extensively to estimate the revenue effects of proposed changes to the tax code. The first operational social welfare policy model—Reforms in Income Maintenance—was developed for the President's Commission on Income Maintenance in 1968. RIM, which built on the pioneering microsimulation work of Guy Orcutt, was used extensively over the next few years to model alternative welfare reform proposals. ASPE supported the development of a successor to RIM, and this model—TRIM (now in its second generation, TRIM2)—has continued to be used for a wide range of welfare program analyses.

By the mid-1970s, the Congress as well as the executive branch was growing accustomed to requesting and receiving detailed estimates of the budgetary impact and also the anticipated social impact of legislation. In particular, Congress sought information on which groups—the elderly, children, the middle class—would benefit and which would be adversely affected by a program change. The Food Stamp Reform Act of 1977 was a milestone in this regard. Over a two-year span, FNS used the MATH microsimulation model to produce cost and distributional estimates for at least 200 variations of the proposed legislation under consideration by Congress. Subsequently, microsimulation models have played important roles in many key policy debates, including those preceding legislation to change the social security system in the early 1980s and the enactment of the Family Support Act of 1988.

Defined very simply, the microsimulation approach to evaluating alternative legislative proposals involves modeling the impact of government programs at the level at which they are intended to operate. That is, instead of modeling the impact of program changes on aggregates, such as the national economy or demographic subgroups of the population, microsimulation looks at the impact on individual decision units, which may be families in the case of income support programs, hospitals and doctors in the case of health care cost reimbursement programs, or corporations in the case of changes to corporate-based taxes. This modeling approach has two key advantages that are not generally found in other policy analysis methods. First, it permits direct analysis of the complicated programmatic and behavioral interactions that abound in social programs. Second, it permits detailed and flexible analyses of the distributional impacts of policies.

Given the diversity of the populations served by the government programs that are modeled, the complexity of most of those programs, and all of the factors that need to be taken into account in developing an appropriate microlevel comparison of current policy with one or more hypothetical alternatives, microsimulation models inevitably entail a large number of steps. A schematic description of the steps involved is roughly as follows. To begin at the very beginning, a series of operations required to generate either a household survey or an administrative database must be carried out, usually by a separate agency. For example, the Census Bureau collects household survey data and makes a series of adjustments, such as imputations and weighting, which have an impact on the quality and utility of the data for microsimulation purposes. Next, the database is adjusted further by the model developers, who, among other activities, restructure the data in a way more convenient and appropriate for the model at hand and define units appropriately (e.g., define tax and transfer filing units according to program definitions, which may differ from survey definitions of households or families). The data may also need to be "aged," that is, updated to the current or future years.

Following this, a "baseline" data file is created to represent current program rules, which involves adjusting or "calibrating" one or more aspects of the simulation so that the simulated values agree as closely as possible with available control totals—a process that is critical to the simulation model and involves considerable judgment on the modeler's part. Next, one or more program alternatives must be simulated, such as a change that requires simply resetting a model parameter, or replacing a benefit algorithm with an entirely new one, or inserting a brand-new program into the simulation. If the model takes account of behavioral responses to program changes, the simulation of such responses would then follow. In practice, however, because the complexities of simulating first-round and second-round behavioral responses are an order of magnitude greater than the previous steps, these capabilities are infrequently or only very crudely implemented in today's microsimulation models.

The final step involves tabulating the output for the baseline program and the various simulated alternatives. Typically, the output shows not only the effects on costs and caseloads as a whole, but also "gainers" and "losers" under each alternative compared with the baseline. The latter information is a key element of the output, for a major purpose of microsimulation models is to produce distributional impacts of program changes for subgroups of the population.

After reviewing the history of the uses of these models for policy analysis over the last twenty years, the panel made its first major finding: *The microsimulation modeling approach to estimating the impact of proposed changes in government programs offers important conceptual and operational benefits to the policy process.* Because microsimulation models operate at the level of the individual decision unit—obtaining input from microlevel databases of individual records, mimicking how government programs apply to the individuals described in those records, and maintaining the outputs of simulated variables for current and alternative programs on each of the individual records—they have the capability to respond to important information needs of the policy process:

- First, microsimulation models can simulate the effects of very fine-grained as well as broader policy changes. For example, a microsimulation tax model can estimate the effects of a proposed change to the tax code that applies only to taxpayers with certain kinds or levels of income or expenses, as well as a proposed increase or decrease in tax rates across-the-board.
- Second, microsimulation models can simulate the impact of proposed changes that involve complicated interactions among more than one government program. For example, a microsimulation model of income support programs can simulate the net effect of a proposed change to AFDC that also alters the calculation of food stamp benefits.
- Third, microsimulation models can simulate the effects of proposed changes on subgroups of the population, in addition to aggregate estimates of program costs and caseloads. For example, a microsimulation model of physicians' services can simulate the effects of changes in Medicare fee schedules on different types of medical specialties and geographic areas; or a microsimulation model of health insurance programs can provide detailed distributional information about the effect of changes in insurance coverage and benefits on specific types of families.

Besides offering flexibility in examining alternative programs, microsimulation models—in common with many other modeling techniques—provide a framework that ensures consistency of estimates across a wide range of proposals. In addition, the orientation of microsimulation models to the individual decision unit is conceptually attractive, since it is the individual who makes decisions regarding AFDC participation, labor market search, tax itemization, and so on. The panel concluded that no other type of model can match microsimulation in its potential for flexible, fine-grained analysis of proposed policy changes.

Drawbacks of other types of models for policy analysis

Large-scale macroeconomic models, which are designed to estimate the aggregate effects of policy and program changes, such as the implications of a President's proposed budget for the deficit and for national economic growth, rival microsimulation models in size and complexity. However, these models use entirely different data and modeling techniques, and their outputs are for aggregates alone—they are in no way able to estimate the impact of changes in particular programs on particular groups, such as the effects on the working poor from mandating the AFDC unemployed-parent program in all states.

Simpler macrolevel models, which estimate a single equation on the basis of a few aggregate time series, are often applicable to analyses of particular programs. For example, such a model might estimate growth in AFDC costs and caseloads on the basis of changes in unemployment, inflation, and the average benefit level. However, single-equation time-series models are very limited in scope and do not provide any real capability for analyzing complex program alternatives or for sorting out the detailed effects of program changes.

Cell-based models, which develop estimates for subgroups or "cells" that make up the population of interest (for example, an AFDC model might comprise cells for case type by state), can provide more detailed information on policy effects than macroeconomic models, but they, too, are limited in comparison with micro-simulation models. Cell-based models, whether they contain only a handful or several thousand cells, make the critical assumption that all elements within a subgroup will behave in the same way. Should a policy change affect members within cells in different ways, or should policymakers want information on different groups, a cell-based model must be rebuilt.

Microeconometric multiple-regression models, which produce estimates of the impact of a set of variables on some aspect of individual economic behavior, resemble microsimulation models in their use of microlevel data and their ability to provide disaggregated as well as aggregated results. For example, regression models of welfare program participation—which might include explanatory variables for family size and type; family income and expected benefit level; age, race, and sex of family head; and other characteristics—can be run on a microlevel database to produce participation probabilities for individual families. In turn, these probabilities can be aggregated for subgroups or for the total population. However, the key variable for analyzing the impact of a proposed program change with such a model, namely, expected benefit level, must be supplied by some other means. Indeed, some microsimulation models use a regression-based approach to determine program participation after they have calculated program eligibility and expected benefits by applying the detailed program operating rules to each family's record.

Barriers to progress in microsimulation modeling

Despite the great value of microsimulation for the evaluation of many policy alternatives, the panel found many barriers to further progress in microsimulation and many deficiencies in the current state of microsimulation modeling. The panel identified six major problem areas: (1) the failure to identify when the gains from additional complexity are outweighed by the cost; (2) the failure to adequately conduct model validation and to quantify uncertainty; (3) serious inadequacies in the databases used in microsimulation models; (4) fundamental deficiencies in the research knowledge base upon which the models are built; (5) questionable adequacy of the computer technology being used; and (6) the costly structure of the microsimulation modeling community.

1. *The capability for additional detailed analysis provided by microsimulation models comes at a price that is rarely calculated.* Although the panel expressed support for the use of microsimulation models for policy analysis, it is important to recognize that the complex nature of such models entails costs. Microsimulation models are highly complex for a number of reasons: they typically require large amounts of data, they must model many complex features of government programs, and they are pressed to provide more and more elaborately detailed information.

Because of their complexity, microsimulation models can be resource-intensive to develop and apply and difficult to understand and evaluate. Moreover, because microsimulation models must usually meld together a variety of data and research results of varying degrees of quality and, in the process, make many unsupported assumptions, there are potentially serious implications for the quality of the resulting estimates. And there are likely to be compounding effects of the errors introduced at each of the many steps in the simulation process.

Indeed, the panel became gravely concerned that the history of microsimulation model development to date has witnessed too many instances in which costs have proved disproportionately large in comparison with benefits. In the panel's view, the tendency to pile complexity upon complexity has all too often led to a situation in which the modeling task (whether it be for development or application) incurs added time and cost; in which it is difficult for the analyst, let alone the decision maker, to evaluate the quality of the output; and in which the model, instead of providing a capability for timely, flexible response to changing policy needs, becomes sluggish and inflexible in operation.

A typical response in the past to the problems posed by the complexity of microsimulation models has been to pare back the capabilities of the model, or to focus new development on the model's "accounting" functions that mimic program rules and leave aside other, more difficult aspects, such as modeling behavioral response. However understandable, these kinds of choices limit the usefulness of the models for policy analysis.

In its review, the panel accorded high priority to identifying strategies with the potential to improve the quality, flexibility, accessibility, and overall cost-effectiveness of the next generation of microsimulation models without compromising their ability to provide the fine-grained policy information that is their prime reason for being. The panel believes that such strategies exist: for example, new computer technologies are very promising in this regard. An important implication of the panel's recommendations is that policy analysis agencies must be willing, over the next few years, to allocate a higher percentage of available resources to investment in improving microsimulation models rather than to applying them to current policy debates (unless, of course, overall budgets can be increased). As we discuss further below, the panel recommended urgent investments in data, research, and computational inputs to models. Investment is even more urgently needed to evaluate the quality of model outputs and to build capabilities into models that will facilitate systematic validation in the future.

2. *The overall uncertainty of the estimates produced by existing microsimulation models is virtually unknown at this time.* Although in theory the microsimulation models in use today provide better estimates of distributional impacts and at least as good estimates of overall costs and caseloads as other kinds of models, it is not known if this theory is true in fact. There is very little evidence with which to assess the validity of microsimulation model results, that is, how well they compare with actual policy outcomes. In addition, there are almost no measures available of the degree of uncertainty (variability) in the estimates or the major sources of variation. It seems likely, however, that the level of uncertainty, given the large number and varying quality of microsimulation model inputs, is high.

The panel believes that analysts and policymakers can have considerable confidence in the quality of the computer models per se, that is, in the accuracy with which the computer code replicates the model specifications. Microsimulation modelers have long made a practice of devoting time and resources to computer model verification. Another check against egregious errors in the computer code is the long-standing practice of analysts from various agencies, in both Congress and the executive branch, to get together periodically over the course of developing major legislation to compare models' outputs and to search vigorously for explanations of discrepancies.

However, very little systematic study has been conducted of the quality of the estimates produced by microsimulation models during their 20-year history of use in the policy process. The dearth of analysis extends to external validation studies, which compare model output with actual responses to program changes; internal validation studies, which assess the sensitivity of model results to the input data, the specifications for individual modules and their interactions, and other components of the simulation process; and studies that assess the variance of model estimates due to sampling error in the primary database and other sources.

Microsimulation models are not alone in lacking systematic validation of their outputs. As noted above, information about the uncertainty in estimates of the effects of proposed policy changes is largely absent from the policy debate, regardless of what type of modeling tool has been used. The conditional nature of almost all policy analyses makes the task of validation difficult. Most analyses consider a range of policy choices, *none* of which may ultimately be adopted. Therefore, data on actual outcomes are difficult to link directly to the analysts' estimates. The many different factors involved in most policy analyses are also a hindrance to validation, as is the resistance of decision makers to dealing with analytical uncertainties. Given the highly complex nature of microsimulation models, it is perhaps not surprising that the validation literature for their outputs is so scant. Yet the panel believes strongly that the impediments to model evaluation can and must be overcome. Otherwise, policymakers will continue to make decisions based on numbers that may be quite inaccurate, and the agencies that provide support to decision makers will lack information on the most cost-effective ways to invest in improved microsimulation models for the future. Given the high costs of microsimulation model development, it is particularly important to have good information on which to base investment decisions.

As part of its work, the panel undertook an experiment in validating aspects of the TRIM2 model. A 1983 TRIM2 database was used to simulate the AFDC program provisions in 1987; hence, administrative caseload data could be used as measures of truth against which to assess the model's "projections." The experiment also involved a sensitivity analysis: the 1987 caseload projections were made using different aging routines, different routines for allocating yearly data to months, and different input databases (in one instance the standard TRIM2 database from the March Current Population Survey and in another instance a database with adjustments for undercoverage of such population groups as minorities and low-income families). The results of the experiment, which was performed for the panel by staff of the Urban Institute, demonstrated that such a validation exercise is feasible and that much can be learned that is helpful for pinpointing model components that need improvement.

3. *There are serious questions about the adequacy of the data sources used to construct microsimulation model databases.* Much of the computer code and sizable fractions of staff resources for current micro-simulation models are devoted to reprocessing and manipulating available input data, not only to produce databases that are more efficient to process, but also to

try to compensate for deficiencies in data content and quality. Examples of important deficiencies for modeling income support programs include underreporting of income receipt and undercoverage of population subgroups, particularly low-income minorities, in household surveys such as the March Current Population Survey. The Survey of Income and Program Participation (SIPP) was designed to address some of these problems, but it does not currently have a sufficient sample size and is not yet timely enough to be a satisfactory substitute.[4] For data on health care, there are serious gaps, difficulties in linking available data sources together, and problems with timeliness. For data on retirement income and tax policy, impediments to linking survey and administrative data cause serious problems for models. In the panel's view, improvements in data quality, together with a shift in the data production function to place more responsibility for producing useful databases on the originating agencies, rather than the agencies that operate the models, represent high priorities that promise substantial dividends in terms of reduced cost and improved relevance and quality of model estimates. Again, while we here emphasize the linkage of data quality and microsimulation modeling, we should note that all analytical approaches to the development of policy estimates rise and fall with the quality of the data.

4. *There are serious questions about the underlying base of research knowledge that supports the modeling of individual behavior and other model capabilities.* Although predicated on the desirability of simulating individual decisions as they are affected by and affect government programs, current microsimulation models are very limited in this regard. This statement applies not only to models that are avowedly "benefit calculators," such as the administrative records–based models of AFDC and food stamp recipients, but also to models that simulate program effects for the broad population. Except for the basic decision of whether to participate in a new or modified program, the models rarely simulate other behavioral responses, such as the response of income support beneficiaries to work incentives. They also rarely simulate second-round effects of a policy change, such as the impact of raising or lowering health care benefits on consumption of medical services and, consequently, on employment in the health care sector in relation to the rest of the economy.

An important factor in this paucity of behavioral responses in microsimulation models in addition to high cost and complexity is the weakness of the underlying research knowledge base. There are no generally agreed-upon estimates of key behavioral relationships, and the form of the available parameter estimates is often not readily suited to implementation in a microsimulation context. We do not anticipate rapid progress in ameliorating this situation, given constrained budgets for research and aspects of academic research incentives that do not encourage the kinds of research necessary. However, the panel offered a number of recommendations for the agencies to spur the production of policy-relevant research. The panel also recommended practices for model design and development that appear to be most cost-effective for incorporating new research knowledge.

5. *The adequacy of the computer hardware and software technologies used to implement current microsimulation models is questionable.* The major social welfare policy microsimulation models that are widely used today are designed for mainframe, batch-oriented computing environments that represent yesterday's technology and limit the models in important ways. Computing costs for a single simulation run are much lower for today's models than for the models of the 1960s and 1970s. However, other costs, such as the combined staff and computer costs of rewriting portions of the model code (often needed to simulate innovative policy proposals) remain high. The current computing environment for microsimulation modeling discourages experimentation, either substantively or for validation purposes, and puts barriers in the way of direct access by analysts to the models.

Some model developers have explored the potential of microcomputer technology to support more flexible and accessible models with promising results. Other hardware configurations, such as some combination of linked micro and mainframe computers, may also provide improved capabilities. New developments in software, such as graphical user interfaces (characterized by icons, windows, and the use of "point and click" tools that enable users to work more effectively and easily with complex models and data) and computer-assisted tools for design of software, are also very promising. The panel strongly recommended that agencies position themselves to build the next generation of micro-simulation models around new computer hardware and software technologies that can enhance the cost-effectiveness of this important class of policy analysis tools.

6. *The current structure of the microsimulation modeling community is costly.* Several aspects of the interrelationships among the policy analysis agencies that use microsimulation models, their modeling contractors, and academic researchers are troubling. One set of problems stems from the highly decentralized and fragmented nature of policy analysis in the federal government. While having positive features, the involvement of many different agencies frequently imposes costs of duplication of effort and often isolates groups of analysts who could benefit from more communication and exchange of ideas and viewpoints. The panel's suggestions of useful ways to enhance interagency cooperation are oriented to microsimulation, although problems in this area also affect policy analysis based on other types of modeling tools.

Another set of problems stems from the very circumscribed nature of the community that is actively involved in developing and applying microsimulation models. As in the past, there are today a handful of private firms that operate the major microsimulation models for social welfare programs on behalf of their federal agency clients. The agencies, which typically have only a few or no staff who are able to use the models themselves, are very dependent on their contractors for support. In the panel's observation, these firms have performed responsibly and capably in responding to agencies' needs. Nonetheless, the panel believes that it would be beneficial to expand access to and use of the models by agency analysts. It would also be useful to expand access to and use of the models by academic researchers, who in most disciplines have played a relatively minor role heretofore in applying, refining, and evaluating this class of models. Having more people who are knowledgeable about microsimulation models and adept in using them can only help the development of improved models and the vital process of validating model results.

Future directions

In sum, the panel expressed the belief that microsimulation models are important to the policy process and anticipated that the need for the kinds of detailed estimates that they can best generate will only grow in future years. However, because of the lack of evidence to assess the performance of the current models and the limitations of available databases and research knowledge, the panel could not responsibly advocate substantial investments that would expand the capabilities of existing models in any specific direction. The panel strongly supported allocating sufficient resources to the current models to evaluate their capabilities, maintain them, and improve them as appropriate and cost-effective. The validation and maintenance functions, together with incremental improvement, are critical to the ultimate objective of developing a new generation of microsimulation models after investments in data, research, and computing technology have borne fruit. Maintaining a cadre of knowledgeable and experienced users and producers of the current models will enable new models to be built much more expeditiously and efficiently. The panel urged the relevant agencies to make the investments that are required to ensure that a new generation of models is developed in a timely manner to meet the policy needs of the future.

Postscript

Since the panel's report was released in 1991, there have been some encouraging developments. Budgetary constraints have limited the speed and scope of the response to the panel's recommendations on the part of government agencies, but some steps forward have been taken nonetheless. To cite just a few examples, a number of agencies and also academic researchers are moving such models as TRIM2 and MATH to a workstation or personal computer environment.[5] The newly developed health care policy models within the Department of Health and Human Services have been built from the beginning in a personal computer environment. While little progress has been made on the vital issue of developing estimates of uncertainty for outputs from the models, both ASPE and FNS have supported efforts to evaluate and improve the performance of specific model components (e.g., the routines in TRIM2 and MATH that model program participation decisions and that allocate the yearly income amounts in the Current Population Survey to months).

Perhaps most heartening have been initiatives to broaden the community of analysts and researchers who work with microsimulation techniques. The past three meetings of the American Statistical Association have featured sessions devoted to microsimulation, in contrast to a virtual absence of papers on microsimulation modeling in the prior decade. The Washington-based Society of Government Economists held a conference on microsimulation techniques and applications in November 1992 that drew a record attendance of public- and private-sector analysts. The importance of models to the current health care policy debate has not escaped notice, and several forums over the past year have featured reviews of existing health care policy models. ASPE staff held a conference in May 1993 to review recent developments in microsimulation modeling more broadly, and the Australian Bureau of Statistics held a major international conference on microsimulation models in December 1993.

The panel concluded in its report that the policy analysis world needs a "second revolution." The "first revolution" of the past two decades institutionalized the use of detailed estimates of cost and population effects of alternative proposals as part of the legislative process and contributed to the development and widespread application of large computerized models as estimation tools. The second revolution requires significant investments in data, research knowledge, and computing to improve the quality of these models and the estimates they produce. Even more important, the second revolution requires a commitment to model validation. The developments just cited may be straws in the wind that the second revolution is under way. ■

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[1]Copies of the panel's two-volume report, *Improving Information for Social Policy Decisions: The Uses of Microsimulation Modeling*, ed. Constance F. Citro and Eric A. Hanushek (1991), are available from the National Academy Press, 2101 Constitution Ave., N.W., Box 285, Washington, D.C. 20055. Volume I, *Review and Recommendations*, is $35.00; Volume II, *Technical Papers*, is $39.00.

In addition to the chairman, Eric Hanushek, panel members were David M. Betson, University of Notre Dame; Lynne Billard, University of Georgia; Sheldon Danziger, University of Michigan; Eugene P. Ericksen, Temple University; Thomas J. Espenshade, Princeton University; Harvey Galper, KPMG Peat Marwick, Washington, D.C.; Louis Gordon, University of Southern California; Kevin M. Hollenbeck, W. E. Upjohn Institute for Employment Research, Kalamazoo, Mich.; Gordon H. Lewis, Carnegie Mellon University; Robert Moffitt, Brown University; Gail R. Wilensky, Project Hope, Washington, D.C. (served January 1989–January 1990); and Michael C. Wolfson, Statistics Canada.

[2]An earlier version of this summary of the panel's report, by Robert Moffitt, Eric Hanushek, and Constance Citro, appeared in the 1991 *Proceedings of the Social Statistics Section*, American Statistical Association, Alexandria, Va.

[3]To narrow its focus, the panel concentrated on the evaluation of several specific microsimulation models that have been used in policy debates: (1) TRIM2 (Transfer Income Model 2), MATH (Micro Analysis of Transfers to Households), and HITSM (Household Income and Tax Simulation Model), all of which are static models of income support and tax programs; (2) DYNASIM2 (Dynamic Simulation of Income Model 2) and PRISM (Pension and Retirement Income Simulation Model), which are dynamic models of retirement income programs; (3) a submodel added to PRISM to simulate alternatives for financing long-term care of the elderly; (4) the tax policy model maintained by the Office of Tax Analysis; and (5) MRPIS (Multi-Regional Policy Impact Simulation), which is a hybrid income support and tax policy model that uses microsimulation, input-output, and cell-based techniques.

[4]For a discussion of the problems faced by SIPP users, see Constance F. Citro and Graham Kalton, "The Future of the Survey of Income and Program Participation," *Focus* 15:2 (Summer and Fall 1993), pp. 13–20.

[5]IRP researcher John Karl Scholz, for example, is developing a microsimulation model which runs on a personal computer with an interface. It models not only AFDC, SSI, and the Food Stamp program but also the federal income tax and state income taxes.

D. Lee Bawden
1934–1993

D. Lee Bawden, who died August 18, 1993, devoted much of his professional life to the study of poverty and welfare programs. At the time of his death he was director of the Human Resources Policy Center at the Urban Institute.

He was an affiliate of the Institute for Research on Poverty from 1970 to 1977, during his tenure at the University of Wisconsin in both the Agricultural Economics Department and the Economics Department. While at the Institute, he, along with William S. Harrar, carried out the Rural Income Maintenance Experiment, a major social experiment testing the behavioral consequences of a universal, income-conditioned cash transfer program—a negative income tax. Like the New Jersey Income Maintenance Experiment, which preceded it, the Rural Income Maintenance Experiment looked at possible work disincentive effects of a number of guaranteed minimum incomes and tax rates. It focused, however, on farmers and those in towns of fewer than 2500 people, where, at the time, over one-third of the nation's poor resided.

Altogether Bawden wrote more than 70 papers and books evaluating social programs. His most recent include two he edited: *Rethinking Employment Policy*, with Felicity Skidmore (Washington, D.C.: Urban Institute Press, 1989) and *The Social Contract Revisited: Aims and Outcome of President Reagan's Welfare Policy* (Washington, D.C.: Urban Institute Press, 1984).