# II. INTRODUCTION TO THE MATH STEWARD MODEL

## A. JUSTIFICATION FOR USING MICROSIMULATION

Microsimulation involves the use of a micro-level database on households or individuals to simulate how changes in public policies or economic conditions are likely to affect outcomes. The assumptions governing the simulation are typically included in a set of computer programs that can imitate the behavior of program caseworkers as well as the behavior of individuals applying for public assistance. By simulating program eligibility and behavior on the household level and then aggregating outcomes across households, it is possible to assess the overall consequences of changes in program parameters. By altering the values of variables capturing economic conditions, it is possible to assess how changes in the economic environment may affect program caseloads and costs. Because it can distinguish effects due to policy changes from effects due to economic changes, microsimulation is an especially valuable tool for evaluating the contributions of economic growth and of welfare reform to recent changes in food stamp caseloads and costs. Microsimulation can also be useful for anticipating caseloads and costs when welfare and food stamp policies remain the same, but economic conditions change (during a recession, for example).

MATH STEWARD is a dynamic policy microsimulation model first developed from 1996 through 1998 with funding from the Smith Richardson Foundation, the Food and Nutrition Service of the U.S. Department of Agriculture, and the Administration for Children and Families of the U.S. Department of Health and Human Services. Further model development has occurred since 1998 with funding from the Economic Research Service of the U. S. Department of Agriculture, as well as the Food and Nutrition Service. The model is designed to enable states, federal agencies, and other users to simulate responses over time to changes in welfare, food stamp, and childcare policies. Such a policy simulation capability is especially relevant for assessing how changing unemployment rates affect the FSP caseloads and costs.

In the sections that follow, we describe several main features of the MATH STEWARD model, including the model database, the behavioral equations in the model, and the tabulation of model output. We then present our plans for using MATH STEWARD to simulate the consequences of economic change for the FSP.

## B. MODEL DATABASE

The MATH STEWARD model database consists of records on households in the 1992 panel of the Survey of Income and Program Participation (SIPP). A sample of 15,469 households (and associated reference persons) was selected to represent all U.S. households during the late 1990s. The database contains information on the demographic characteristics and income of all individuals in each reference person's household at any point during a three-year period. The sample includes reported information from January 1992 through December 1994, but was reweighted to match 1996 population totals from the Current Population Survey (CPS) and the Food Stamp Program Quality Control (FSP-QC) database.

To enable MATH STEWARD to generate simulation outcomes for individual states, the developers of the model created a set of 51 state-specific weights (including the District of Columbia) for each household in the model database at the start of the three-year period. If state-specific simulations are restricted to the SIPP observations that actually resided in a particular state, the size of the sample would frequently be too small to generate useful simulation estimates. By using state-specific weights, the entire SIPP sample is included in each state-specific simulation and is assigned a weight reflecting the prevalence of that type of household in the state in question. The state-specific weights produce, for each state, a population of households with an identical set of demographic characteristics as that state's sample in the March 1996 CPS, and a population of recent food stamp recipients with an identical set of demographic characteristics as that state's sample in the Fiscal Year 1996 FSP-QC database.

## C. BEHAVIORAL EQUATIONS

MATH STEWARD contains a set of behavioral equations to simulate the following outcomes, every three months over a three-year period:

- The employment status and earnings of each household reference person and spouse
- AFDC/TANF participation for members of each reference person's household
- Participation of each female reference person or spouse in AFDC/TANF-related employment/training (E/T) programs
- Participation of eligible children in each reference person's family in state child care subsidy programs, the subsidy amounts, out-of-pocket child care costs, and choice of providers implied by such participation
- Food stamp participation for members of each reference person's household

The model assumes that each household's reference person and spouse have the choice of no work, part-time work, or full-time work. The model also assumes that the household as a whole can choose to have eligible members participate in AFDC/TANF and food stamps, food stamps only, or neither program.[1] The household's choice of a particular work or program participation option depends on implied levels of disposable income, as well as household-specific preferences for part-time work, full-time work, participation in both AFDC/TANF and food stamps, and

[1] About 90 percent of the households that receive AFDC/TANF benefits also receive food stamps. Version 1996.41 of the model, the source of the estimates in the body of this report, does not allow households to participate in AFDC/TANF only, although versions 1996.70 and 1996.80 allow this option.

participation in food stamps only. The state unemployment rate affects potential earnings, preferences for work, and preferences for participation in AFDC/TANF and food stamps. The wage, labor supply, and program participation equations differ according to the version of the model; the equations for Version 1996.41 are the same as for Version 1996.30, described in Jacobson et al. (1998), while the equations for Versions 1996.70 and 1996.80 are documented in Appendix B. The Version 1996.41 equations were used for the simulation estimates in the body of this report; Appendix A provides evidence of the validity of the simulation estimates obtained using different versions of the model.

## D. SIMULATION SOFTWARE

The MATH STEWARD model consists of several software modules that perform simulations of program eligibility and household behavior. These simulations rely on user-specified parameters governing AFDC/TANF, food stamp, childcare subsidy, and federal tax policies. A supervisor module controls the flow of individuals and households through the other modules and imputes potential earnings for the household reference person and spouse. Policy modules determine potential AFDC/TANF benefits, childcare utilization and costs, and food stamp benefits under each of the household's labor supply/program participation options. After calculating the household's disposable income under each of the alternatives, the model assigns the household to its preferred choice and keeps track of outcomes such as employment tenure or cumulative time on AFDC/TANF. An output table program tallies aggregate results and displays them for the user.

The MATH STEWARD output tables display aggregate outcomes indicating participation and costs in the AFDC/TANF, child care, and food stamp programs, as well as the work-related characteristics of AFDC/TANF recipients and the number of households hitting a TANF time limit. The tables compare monthly outcomes under a set of "reform" conditions with the corresponding outcomes under a previously defined "baseline" simulation, which is stored on file. Because the conditions governing the baseline and reform simulations are identical *except* for the policy or economic changes specified by the user, any difference between a baseline outcome and a reform outcome is due entirely to the simulated effects of the changes.

## E. USING THE MODEL TO SIMULATE THE CONSEQUENCES OF ECONOMIC CHANGE FOR THE FSP

MATH STEWARD, primarily through the state unemployment rate, captures economic change. To simulate the consequences of economic change for the FSP, we ran four sets of state-specific simulations:

The first set of simulations used state unemployment rates at their 1990 to 1992 levels, and state AFDC and child care policies at their pre-PRWORA levels (corresponding with the years 1992 to 1994 for AFDC, and 1994 for state child care subsidies). We call this simulation the "AFDC92" simulation, since it used AFDC rules and, for Year 3 of the simulation, 1992 unemployment rates.

- The second set of simulations lowered state unemployment rates to their 1996 to 1998 levels, but kept all other policies unchanged. This simulation predicted what food stamp caseloads and costs would be, if the economic boom of the 1990s had taken place, but welfare reform had not occurred. We refer to this simulation as the "AFDC98" simulation, because it used AFDC rules and 1998 unemployment rates.
- The third set of simulations lowered state unemployment rates to their 1996 to 1998 levels, and also introduced 1998 state TANF and child care policies in place of the old AFDC policies. We refer to this simulation as the "TANF98" simulation.

- The fourth set of simulations raised state unemployment rates to their 1990 to 1992 levels, but retained 1998 state TANF and child care policies in place of the old AFDC policies. We refer to this simulation as the "TANF92" simulation.

For every set of simulations, we kept FSP parameters at their 1996 to 1998 levels.[2]

To simulate the contribution of welfare reform to changes in FSP outcomes during the late 1990s, we created the following ratio:

***100* (TANF98 outcome - AFDC98 outcome) / (AFDC 98 outcome)***

This ratio indicates the percentage change in outcomes arising from welfare reform, assuming the economy is held constant at its 1996 to 1998 levels.

To simulate the contribution of economic change to changes in FSP outcomes arising from both economic change and state welfare reform from the early 1990s through the late 1990s, we created the following ratio:

***100* (AFDC98 outcome - AFDC92 outcome) /***

***[(AFDC98 outcome - AFDC92 outcome) +***

***(TANF98 outcome - AFDC98 outcome)***]

The numerator in this ratio is the change arising from different unemployment rates, and the denominator is the sum of the changes arising from different unemployment rates and from welfare reform. The ratio may be simplified to equal:

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[2] We did not include restrictions on FSP benefits for Able-Bodied Adults without Dependents (ABAWDs) in our simulations described in the body of this report, although they were included with state welfare reform policies in some alternative simulations described in Appendix A.

***100* (AFDC98 outcome - AFDC92 outcome) /***

***(TANF98 outcome - AFDC92 outcome)***

To simulate the likely effect of an economic recession on FSP outcomes under welfare reform, we created the following ratio:

***100* (TANF92 outcome - TANF98 outcome) / (TANF 98 outcome)***

This ratio indicates the percentage change in outcomes arising when unemployment rates return to their 1990-1992 levels from their 1996-1998 levels, assuming that welfare reform remains in place.

For more detailed information on how we simulated state TANF programs as differing from the older AFDC programs and how we simulate state child care programs as differing between the late 1990s and the early 1990s, we refer the reader to an earlier report by Jacobson and Puffer (April 1999).