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EVALUATION OF FOOD CONSUMPTION PROGRAMS: A NEW APPROACH

by

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ABSTRACT

"Evaluation of Food Consumption Programs: A New Appraoch"
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Microsimulation modeling allows the effects of food programs and changing socioeconomic and demographic characteristics on household food consumption to be estimated for future time periods. The paper presents the methodology, data base, and specifications needed to develop a framework for assessment of current and proposed food and nutrition programs.

BIOGRAPHICAL SKETCHES

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EVALUATION OF FOOD CONSUMPTION PROGRAMS: A NEW APPROACH

The 1970's witnessed rapid growth in federally supported food consumption programs. The objectives of the majority of these programs are compatible with the Food and Nutrition Board's goal of assuring a supply of diverse, safe and attractive foods meeting the poulation's nutritional requirements at reasonable cost (Claffey). The individual programs vary widely, however, in the size and characteristics of the target populations they serve and in the type and amount of benefits they provide. As evidence, the program for women, infants and children (WIC) serves a specialized audience with selected foods. The food stamp program (FSP) increases the food-purchasing ability of a large segment of low income households while the national school lunch program (NSLP) and the dissemination of information on dietary goals are targeted toward the public at large.

As federal budgets become increasingly restrictive, penetrating questions are being asked as to which programs are most cost-effective in attaining the common nutritional objectives. For answers, one turns initially to the many credible studies that have been conducted in the past. These studies have tended to focus on individual programs and to rely on historical data.[1/] They provide useful information for administrators in situations where target audiences and program guidelines have changed little over time. But their results are less relevant for decision-makers who face changing program regulations, shifting target audiences and budget allocations which will not maintain all programs at current levels.

In this latter context, researchers and program evaluators face a new challenge. Expanded analytical models, data bases and methodologies are needed to develop frameworks in which the relative contributions of various programs

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1. The number of such studies is becoming more extensive. Selected examples are Madden and Yoder; Lane; Price, et. al.; and Hoagland.

toward nutritional objectives can be assessed. A critical fact of this need is the capability to estimate program effects at the household level so that distributional impacts of various programs among specific target audiences can be traced. From a planning point of view, the most desired feature is the ability to simulate the household socioeconomic and demographic environment in which anticipated or proposed programs would operate in some future time period. Such a feature would permit estimation of program benefits and costs in advance of implementation.

This paper describes the development of an approach, termed the Distributional Impacts Model, (DIM), which is designed to incorporate features described above. The approach is an adaptation of microsimulation modeling. This modeling has extensive empirical capacity and is coming into wider use for policy and program planning purposes. Specific models such as the transfer income model (TRIM) or the microanalysis of transfers to households (MATH) have been used successfully to cost out anticipated changes in the food stamp and other transfer programs (Haveman and Hollenbeck).

The microsimulation technique involves the creation of computer models designed to simulate effects of proposed policy or program changes at the levels of disaggregation such as individuals, households and regions. Data requirements are extensive so in many applications data bases are formed through the merger of separate data sets. When properly formulated and supported by adequate data, microsimulation models enable policy and program decision-makers to examine the differential impacts of combinations of policies and programs on various target groups. In our approach, DIM will be used to generate estimates of food consumed (used) at home, and its nutritive value, for disaggregated groups of households. Such estimates should permit the effects of various food and nutrition programs on food use and nutritive value to be projected for future time periods.

The Distributional Impacts Model (DIM) Adopted to Analysis of Food Programs

Operationally microsimulation involves a sequence of tasks which, after problem definition and the application of appropriate theory, can be categorized as follows:

- development of a micro data base combining relevant program and control variables along with household characteristics needed to identify distributional effects;
- formation of a set of adjustment procedures which simulate changes in distributions of households with specific socioeconomic and demographic characteristics over some future time period, i.e., routines which "age" these data;
- comparison of distributions generated through the microsimulation process with those predicted by independent macroprojections, with any subsequent needed refinement of the simulation process; and
- generation of estimates of policy and program impacts and other desired projections from the simulated data file.

The adaptation of the microsimulation process to assessment of food and nutrition policies and programs requires the following steps:

- the (prior) recognition and development of the theoretical framework in which the program variables are expected to impact household food use and nutritive values, and
- the specification and estimation of food and nutritive value relationships derived from the theortetical framework using base data.

Development of the theoretical framework for analysis of food programs logically precedes the choice of the microsimulation modeling technique. However, interrelationships exist in that both theory and method must recognize the household as the unit of analysis and incorporate variables which link the type and amount of food used to socioeconomic, demographic, policy and program characteristics. The second step serves a dual role. Initially, parameters of specified relationships between food used and the variables which influence it are estimated using base data. These parameter estimates are then available to project program effects in a future time period by using them in combination with values from the "aged" socioeconomic and demographic data, constant or proposed prices, and values reflecting anticipated or proposed policies and programs.

The combined sequence of steps in the microsimulation approach is shown in Figure 1. The theoretical base used to address the problem of food and nutrition program effects is that of household consumption adapted to incorporate food program participation. This theoretical base has been developed extensively in earlier studies (Madden and Yoder, Mittelhammer and West, Lane). In general, it postulates that household food consumption is responsive to household size; income; location; the age, sex, education, and employment of household members and various other socioeconomic and demographic characteristics. Benefits from food program participation have been recognized in the form of direct food subsidies and increased ability to purchase food.

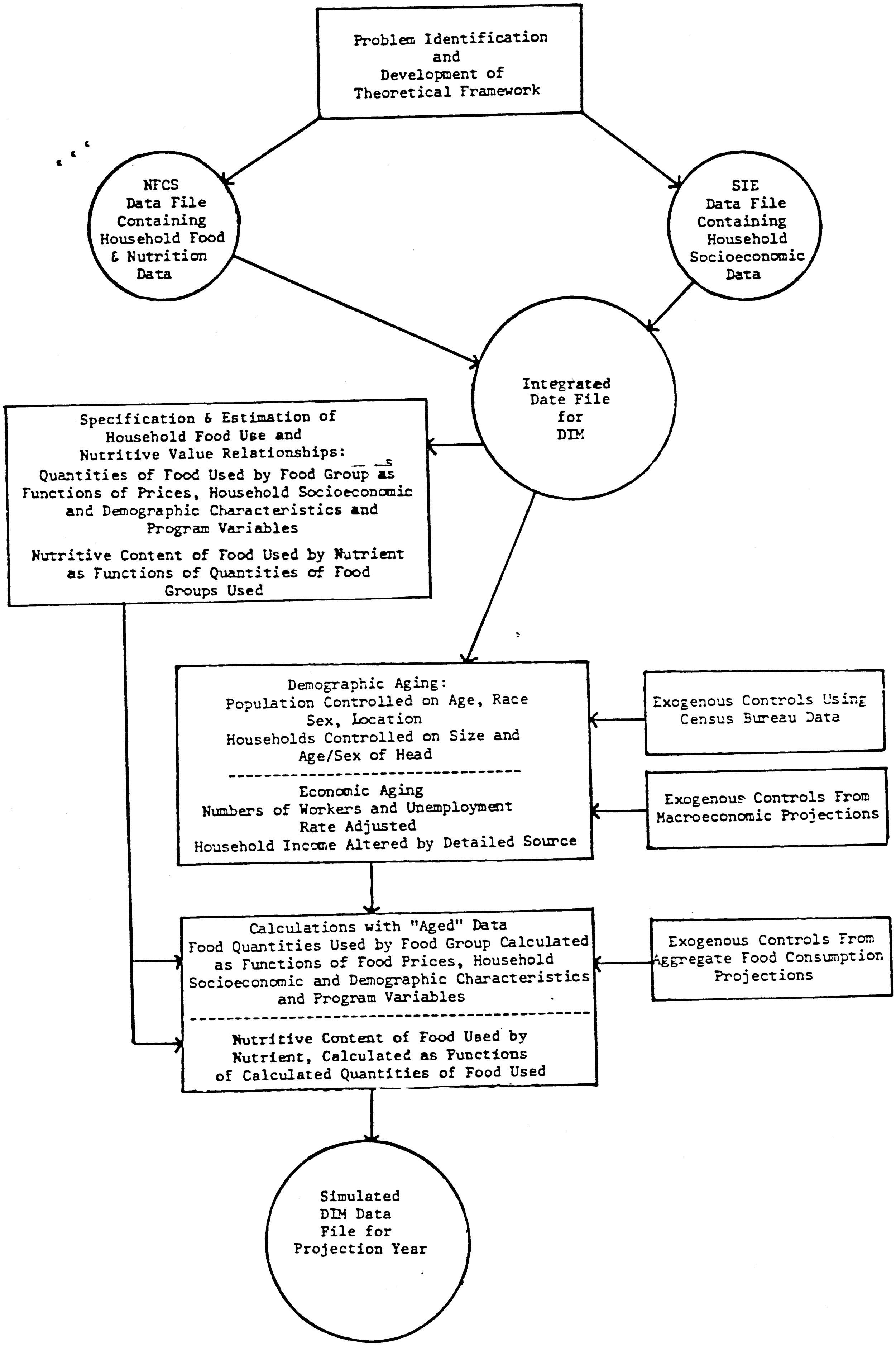
Data Requirements

The selection of data is critical for the microsimulation approach. The data base must contain measures for as many relevant variables as possible. Additionally, it must be sufficiently large so that cell numbers for specific sub-populations are adequate for estimating distributional effects, especially among target audiences for particular programs. Consequently, two or more data sets are frequently combined to meet these requirements.

For this study, data from the 1977-78 Nationwide Food Consumption Survey (NFCS) and from the 1976 Survey of Income and Employment (SIE) are being matched statistically to form an integrated data base as shown in Figure 1. [2]

2. A statistical match of these two surveys is being implemented to provide the microdata base for the study. See U.S. Department of Commerce, Statistical Policy Working Paper 5 for an expanded discussion of this method.

FIGURE 1: STEPS IN ADOPTING THE DISTRIBUTIONAL IMPACT MODEL (DIM) TO ANALYSIS OF FOOD AND NUTRITION PROGRAMS



The SIE was selected to serve as a "host file" because of its size (approximately 150,000 observations), reliability and previous adaptation to microsimulation analysis. The SIE contains information from a national sample on an rich assortment of household socioeconomic and demographic characteristics. It is recognized for providing statistically reliable estimates of these characteristics.

The NFCS complements the SIE by providing extensive recent data on household food use and nutritive value of foods consumed. It also contains an adequate amount of socioeconomic and demographic information needed to "align" this data file with the SIE for statistical matching. The NFCS collected information from a basic sample of approximately 15,000 households and is supplemented by additional smaller sample surveys of elderly and low income households.

Data on the quantities of food items used at home, their monetary value and their nutritive content were collected in the 1977-78 NFC surveys. Cost of food and number of meals eaten away from home are included along with household characteristics believed to be related to food consumption. Food program information collected includes participation in the program for women, infants and children (WIC), meal service for senior citizens, the food stamp program (FSP) and school lunch and breakfast programs. One of the supplemental low income surveys also collected information on participation in the expanded food and nutrition education program (EFNEP).

Merging of the SIE and NFCS is being accomplished through statistical matching of households on the two data files. Household characteristics are used to align the files; i.e., to determine which (groups of) households on the NFCS file are matched to (groups of) households on the SIE file. The characteristics used include household size, income, housing tenure, number of adults and employed persons, and age, race and sex of household head. In the matching process, distribution of household characteristics are compared and checks are performed to guard against introducing bias. Once properly matched, DIM data base permits the analyses which draw on the respective strengths of the NFCS and the SIE.

Estimating Food Consumption Relationships From Base Data

Relationships between household food use and the characteristics and program variables which influence it must be estimated carefully from the base data since these estimates are used later for projections. Specification of these relationships and estimation of their parameters can take place prior to the simulation process as shown in Figure 1. It is important that dependent variables representing food consumption be related to the household characteristics which are aged in the simulation process.

Specification of these relationships involves a two-part process and several assumptions. Household food consumption is represented as quantities of food items, aggregated into food groups, used from the household supply during a week.[3/] The nutritive value of these food quantities, adjusted for the number of meals consumed at home and age-sex composition of the household, is assumed to be a reasonable indicator of the nutritional value of the household's diet. With these assumptions, the first part of the process is specified as follows:

$$QF_{ij} = F(P_i, SE_j, D_j, PR) \qquad (1)$$

where QF_{ij} is the quantity of the i^{th} food group used by the j^{th} household,

P_i is a vector of composite prices containing the price for the i^{th} food group and any close substitutes,

SE_j is a vector of economic characteristics for the j^{th} household,

D_j is a vector of demographic characteristics for the j^{th} household, and

PR is a vector of food and nutrition program variables affecting households.

Drawing on the rationale from earlier studies, the price of the i^{th} food group is expected to be inversely related to quantities purchased while prices of close substitutes are directly related. Socioeconomic characteristics such as income, housing tenure, employment, and food purchased for consumption outside the

3/ Some of the food group categories and concepts presented here have been developed by the Consumer Nutrition Center (CNC) of SEA/HN, USDA.

home are expected to influence the amount of food used at home. It is anticipated that demographic characteristics such as family size, age-sex composition and location will affect home food requirements. Food and nutrition programs providing access to food, purchasing power or nutritional knowledge are expected to influence the types and amounts of foods used.

Empirical specifications of equation (1) will be estimated for each of the food groups. While the price vector will change with food groups, the household socioeconomic, demographic and program variables will be constant or similar over all specifications.

The second step in the process is to specify the nutritive values of foods used at home as a function of food quantities used as follows:

$$NV_k = f(QF_1, QF_2, \ldots QF_i) \qquad (2)$$

where NV_k is the value of the k^{th} nutrient, and

QF_i are the quantities of foods used from the food groups.

This specification recognizes that the nutritive values for individual food items have been calculated for individual food items in the NFCS data, using procedures established at the Consumer Nutrition Center.[4/] Estimation of the relationship in (2) is necessary, however, because the food items have been grouped. Data are available for estimating relationships for each of 15 nutrients.

Demographic and Economic Aging

A unique characteristic of microsimulation models is the process through which estimates of conditions in some future time period are generated. This is accomplished through an aging of the socioeconomic and demographic characteristics of households in the microdata base file. The specific model selected for this study, TRIM, uses a comparative static microsimulation technique which modifies the data from the base to the simulation year without recording intervening steps.[5/] This technique adjusts the base data to reflect economic and demographic characteristics of the population in the simulation year.

4/ For more detail on procedures, see Merrill, et. al.

5/ For a full description, see Beebout and Bonina.

The aging is accomplished in a two-step procedure. The first step applies a set of demographic multipliers to base year sample weights. Once applied, a given observation represents a new number of households consistent with the projected population estimates for that household (group) in the simulation period. Demographic factors used in aging include household size and the age, race and sex of members. The population control totals to which the simulated data are aligned are obtained from Census Bureau projections. This latter process provides a control or check on the reasonableness of the simulated data.

The second step ages the economic characteristics of households in the data base to reflect projected changes in household income arising from changes in productivity, employment, transfer payments, prices and other variables. Multipliers for specific income sources, derived through extrapolation from recent trends or estimated through regression analysis, are applied to the demographically aged data. The simulated economic data are then aggregated and checked for consistency with macroeconomic projections.[6/]

Deriving Food Quantity and Nutritive Value Projections

Once the economic and demographic data have been aged, the next step is to use them together with previously estimated parameters to project household food use and its nutritive value for the simulation year. It is at this point that the full capability of the microsimulation process can be brought to bear on food program questions. With the aged economic and demographic data both contributing to the projections and acting as control variables,a number of alternatives can be analyzed.

First, real prices can be assumed constant with program variables held at base year levels to project food use using parameter estimates from equation (1).

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6. Previous applications have used macroeconomic projections from the Wharton, Chase and Data Resources, Inc. econometric models.

Alternatively, food prices projected by an independent method could be entered to calculate household food use under that set of conditions. Results obtained from these alternatives can then be summed across households and the totals compared to aggregate food consumption projections from another source as shown in Figure 1. This step will provide a check on the estimated quantities of food used that is similar to those imposed on the aged demographic and economic data. Once the food use quantities have been aligned, parameter estimates from equation (2) can be used to project nutritive values.

An alternate analysis, important to program decision-making, is to enter expected prices and household characteristics and then vary characteristics and benefit levels for programs represented in equation (1). This alternative would generate food use and nutritive value projections which show effects of different program alternatives under conditions expected to prevail in the simulation period. While the programs that can be analyzed in this way must necessarily operate through variables contained in base period relationships, considerable flexibility does exist. Different levels and combinations of programs could be represented.

Through all of the projection alternatives, the DIM approach can be used to advantage. Using data aged to the projection year, distributional impacts of various price and program alternatives can be identified for subgroups of households classified by their socioeconomic and demographic characteristics. This feature may be especially important for projecting program effects for a specific target population.

Concluding Remarks

The DIM approach to assessment of food and nutrition policies and programs provides a framework for assessing household level impacts and comparing alternatives. It is an adaptation of microsimulation modeling developed and used successfully in other policy areas. The sheer magnitude of implementing such a system at the household level may occassionally require the use of various assumptions and techniques that can eventually be improved. However, methods are available for checking the consistency of projections with those from exogenous sources thus keeping results from exceeding reasonable bounds.

The persuasive argument for adopting the DIM approach is its ability to represent household level conditions under which programs may operate in some future time period. Properly implemented, this approach can have considerable value in the policy area. Decisions improving program effectiveness which are made in advance of implementation are much more cost effective than those which attempt to remedy an unwanted situation.

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