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Abstract

Public policymakers and program administrators often face decisions that impact the retirement incomes of individuals. An important question that these decision-makers may wish to address concerns the distributional impacts of the programmatic changes under consideration. Who (what population groups) would gain income and how much? Who would be unaffected? Who would lose and by how much? The question that this paper investigates is the extent to which computer models and associated policy analysis capability are available to provide decisionmakers with this kind of information.

Specifically, the paper reviews a class of models that may be designated as retirement income policy models. The review is limited to existing models of programs within the U.S. retirement income system. The paper presents a general discussion of the components of such models. It describes features of models that are in the current portfolio and assesses components of those models. It furthermore presents examples of how the existing models might analyze two policy initiatives—changing the "bend points" of the Social Security old-age and survivors insurance benefits and increasing the maximum allowable contributions to IRAs.

The paper finds that the current capacity is not great, nor is it fully utilized. However, a foundation exists to be able to examine distributional impacts of retirement policy changes. Three concerns that need to be addressed now to assure that this foundation will be useful in the future are (1) assessing whether the existing modeling capacity is substantive enough and flexible enough to gear up in a short amount of time, (2) assessing whether decisionmakers will have adequate resources to support the necessary development and refinement of models, and (3) assuring that appropriate recent data sources are available to support the models.

An Evaluation of Retirement Income Policy Models

Employees with defined contribution pension plans may be allowed to designate annually a percentage of their gross salary as a tax-deferred supplement to their plans. This is an important choice for individuals as they plan their retirement incomes. Some factors that they may consider in making this choice include their desired retirement income goals, their ages and potential remaining work years, other financial assets (e.g., savings accounts, IRAs, life insurance, other pension assets) and home equity, current expenditure plans, marginal federal and state tax rates, opinions about future Social Security benefits, and options for health insurance security.

If these employees wanted to investigate the impacts of this voluntary supplementation or other decisions that may affect their retirement incomes, they could purchase advice from a financial planner. Such a planner would likely have a computer model to analyze portfolios and to forecast future income streams. Presumably this model would be parameterized to generate a range of forecasts under various scenarios.

Public policymakers and program administrators often face decisions that impact the retirement incomes of individuals. An important question that these decision-makers may wish to address is the distributional impacts of the programmatic changes under consideration. Who (what population groups) would gain income and how much? Who would be unaffected? Who would lose and by how much? The question that this paper investigates is the extent to which computer models and associated policy analysis capability are available to provide decisionmakers with this kind of information.

The specific types of computer models that are being investigated are designated, here, as **retirement income policy models**. This term is derived from terminology used in a report written by the U.S. General Accounting Office (1986) that reviewed retirement forecasting models. That study distinguished three types of forecasting models: Retirement Program Cost Models, Retirement Behavior Models, and Retirement Income Models. According to the GAO, retirement program cost models forecast the future aggregate liabilities and assets of specific retirement income programs. Retirement behavior models predict or explain the decision of workers to retire. *Retirement income models* are designed for making long-range forecasts of the levels or distribution of retirement. GAO identified several dozen models that fit in each of the first two categories, but only four retirement income models.

I have added the term **policy** to the GAO terminology because a major focus of this study is on public policy analysis. To be included in this investigation, a model must be capable of mapping changes in public policy to its impacts on the retirement income of individuals[1]. Of

[1]The short-range and long-range forecasting models used by the Office of the Actuary, Social Security Administration, to analyze trust fund adequacy were categorized and assessed by GAO as program cost models. Nevertheless, I have included them in this study because they are often used to benchmark other models and because they have a major impact on Social Security policy. But these models do not readily analyze policy changes nor are they capable of examining

course, the models may be used for other purposes, such as forecasting the retirement income of a subgroup of the population assuming **no** changes to current public policy or examining the impacts of alternative demographic or macroeconomic trends on retirement incomes. However, I assume that these types of model uses are driven by policy interest—to scan future scenarios to determine whether policy intervention is warranted.

The emphasis of the paper is on current "capacity," that is, models that have been used. In effect, I hope to answer the question of whether policymakers could use **existing** models to get systematically generated, valid information about the distributional impacts of particular policy initiatives that might be under consideration. In the process of conducting this study, I learned of a few modeling efforts that were under development. These were excluded from consideration in this paper.[2]

The paper limits its investigation to models of the U.S. retirement income system. Considerable activity has been and is being undertaken in other countries (e.g., Germany, Denmark, Canada, Australia) and it would be advisable for the retirement income modeling community and decisionmakers to monitor this activity. Information sharing across national boundaries undoubtedly will benefit all communities. For example, all modelers must address software and platform choices in a technological environment that is constantly changing. Similarly, all modelers must address validation and means for identifying and bounding uncertainty. These are just a few specific concerns among many general issues that must be addressed by models from all nations.

The next section of the paper presents a discussion of the components of a retirement income policy model. Following is a section that describes some of the features of the models that are in the current modeling portfolio and assesses components of those models. The information used in this assessment comes, for the most part, directly from individuals who are "keepers" of the models. The fourth section presents two examples of policy initiatives and describes how models might simulate their impacts. The fifth section summarizes and concludes.

THE COMPONENTS OF A RETIREMENT INCOME POLICY MODEL

Retirement income policy models are complex. The complexity stems from many sources. For example, retirement income is received toward the end of one's life, so the economic decisions that individuals make as they age, which are influenced by a myriad of economic and political events throughout their lifetimes, affect the levels and sources of their retirement income. For example, many sources of retirement income are conditioned by the labor market choices that are made throughout a lifetime; but these choices are influenced by the interactions of many individuals with many employers under many different economic conditions. A further

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income distributions.

[2]For the example, the model described in Wolf (1994) was excluded from review because it is under development.

complicating factor is that uncertainty pervades individuals' decisionmaking. Almost all saving, expenditure, labor force, and other economic choices are made with imperfect information about the future.

Also complicating retirement income policy modeling is the potential endogeneity of policies, behaviors, and decisions. For example, the labor market and savings decisions of individuals are based, in part, upon the tax and pension plan provisions that affect the individuals. But tax and pension provisions are determined partially by forecasted behavioral responses. Any representation of the retirement income system must address this simultaneity.

Perhaps the most fundamental aspect of any model is its unit of analysis. All of the models under consideration in this paper are forecast models.[3] In particular, the models are employed to forecast the impact of a policy on an economic unit. That unit may be a **micro (or disaggregate)** unit, e.g., an individual, a household, an establishment, or a firm; or the unit may be a **macro (or aggregate)** unit, e.g., a cohort of individuals, a geographic area, an industrial sector, or the entire U.S. **Microsimulation** models use micro units of analysis. The DYNASIM2, PRISM, and CORSIM models that are discussed below are microsimulation models that use individuals as the unit of analysis. The data bases for these models contain actual survey observations of individuals. **Cell-based models** use cohorts of individuals as their units of analysis. The MDM, SIR, and Office of the Actuary's long- and short-range forecasting models are cell-based models, in which population aggregates by age and sex are the units of analysis.

Perhaps the primary point that this paper argues is that microsimulation models are the only type of models that can forecast the impact of policy on the **distribution** of retirement income, and therefore they are the only retirement income policy models in existence. Policymakers should look to microsimulation models only for forecasts of the distributional impacts of policies or regulations. However, some cell-based models examine some distributional issues,[4] so the paper discusses them as well. An advantage that the cell-based models have over microsimulation models, to date, is that they have developed forecasts of trust fund or pension fund balances.

The factors that make retirement income policy modeling so complex have been addressed to some extent by the developers of existing models. One purpose of this paper is to dissect these models and to explain how they make their forecasts in light of all of the complexities. The list of model components of models in Figure 1 is the framework that is used to describe the existing (microsimulation) retirement income policy models. This list was developed by reviewing the

[3]Models are an abstraction or simplification of reality. They may be used to explain or understand events or they may be used to forecast events. The models under consideration in this paper are used for forecasting, in particular, projecting the impacts of policy changes.

[4]At a minimum, the cell-based models examine the distribution of policy impacts on the cells that comprise the model.

Figure 1
Major Components of a Retirement Income Policy Model

Initial year population representation
Year(s) of analysis
Operating characteristics for demographics
Operating characteristics for pre-retirement labor force characteristics
Retirement decisionmaking
Components of (retirement) income
- Work-related sources of income
- Means-tested transfers
- Income from assets
- Other

Savings/dissavings or wealth accumulation/ decumulation
- Pensions (including IRAs)
- Financial assets
- Home equity

Tax operating characteristics
Uses of retirement income
- Health care

Linkages to macroeconomy
Policy parameters

literature concerning retirement income issues and documents describing model capabilities. I will review each major model component in turn. It should be noted that the figure describes the content of a retirement income policy model, but excludes implementation features. In this paper, I address tangentially, but do not attempt to describe or assess, features such as computer platform, coding language, computational performance, output reporting, or documentation.

Base Year Population Representation

Whether the model's approach is cell-based or microsimulation, the model must establish initial conditions. These conditions include a base year and universe (or target population). The model may attempt to include all individuals or it may limit itself to a particular set of individuals. For example, the model may only operate on individuals born in a certain year(s) (e.g., Baby Boomers), or it may represent the entire population. Furthermore, the model must specify a base year.

The decisions about base year and target population are constrained by data availability. Furthermore, the concept of a base year is not necessarily straightforward for a microsimulation model. The survey that generates the model's underlying data observations may have been conducted in one year, and then the data may have been "aged," that is systematically adjusted to conform to known control totals, to a different base year. To distinguish between these two time periods, I call one the **survey year** and the other the **base year**.

It is often the case that the survey year will precede the base year by a significant number of years. For example, the two most recent exact matches of the CPS with Social Security earnings histories occurred in 1973 and 1978. The microsimulation models discussed below may use one or the other of these data sets because they have precise earnings records. Critics suggest that the models are out of date because the underlying data come from the '70s. The model builders are sensitive to this point and would prefer much more recent data, but they do make the argument that there is at least one advantage to having the survey year precede the base year by a significant length of time. They suggest that it allows them to validate and "fine tune" the aging operating characteristics in the model and to validate simulations of the effects of structural changes that occurred between the survey year and the base year.[5] Of course, the models do not "adjust" or validate the entire covariance structure in the data, which suggests to me that the criticism is valid absent any evidence that the underlying covariation remained stable.

[5]Another advantage of an older survey year that one of the modelers pointed out was that the sampling population may be more appropriate. In particular, the Current Population Survey included institutionalized individuals in the 1970s, but has since excluded them from its sampling frame. Obviously, a number of retirement income recipients are institutionalized.

Years of Analysis

The year or years of analysis are choices that the modeler must make. Typically, we think of forecast periods in which the **analysis years** represent a future time period; that is, the analysis year(s) exceed the base year. However, this need not be the case. Some models and some analyses may be conducted through a comparative static framework, in which the underlying population is not aged and policy impacts are modeled as if the policies were imposed on the base year population in the base year. The benefit to such an approach is that it avoids errors or inconsistencies that might occur due to the operating characteristics used to "age" the data to the analysis. The disadvantage is that it does not allow analyses of the time path of policy impacts and it imposes the assumption that cohort and trend effects are unimportant.

If a forecast is undertaken, then the model must account for dynamic changes to the underlying population. This is commonly referred to as "aging" the data. In particular, cohort and trend effects in demographic characteristics must be modeled, which is the next component to be discussed. If comparative static analyses are conducted, then such aging is not present.

Operating Characteristics for Demographics

Orcutt et al. (1976) coined the notion that (microsimulation) forecasting models are comprised of **operating characteristics** that are applied to a data base. Operating characteristics are mathematical expressions that are used to forecast changes in the levels of variables over time or over variations in policy. The major demographic events that models may forecast are aging, mortality, marital status changes, fertility, household formation, education, and mobility.

The way that these events get projected varies considerably across models. Typically, a stochastic process is invoked to calculate the probability that a change in status occurs (mortality, marital status change, fertility, etc.), a random variate is drawn to determine whether or not the event is simulated to occur, and the demographic characteristics of the observation are altered if the event "occurs." The stochastic process may range from a simple Markovian process that uses observed transition probabilities to a structural model that is estimated using several covariates and possibly exogenous policy parameters. A "simple" stochastic process for the mortality operating characteristic would involve extrapolating trends in death rates rate by age and sex and applying those rates to the data base. A "structural model" approach would be based on a model of the probability of death based on variables such as age, race, sex, marital status, disability and health status, region, etc.

Most demographic operating characteristics use aggregative controls to adjust the results. If "too many" or "not enough" events occur, then the models systematically override the simulation process and alter the underlying data until the aggregates conform to the controls. Model "keepers" and the literature seem to conclude that estimated probability models of demographic events are considered superior to simple Markovian transition probability approaches and that adjusted results are considered superior to unadjusted results.

Operating Characteristics for Pre-retirement Labor Force Characteristics

The labor force characteristics that may be considered by models include number and industry/occupation of all jobs in all forecast years, annual hours and earnings in each job, and job characteristics such as union status and pension coverage. I discuss the latter (i.e., pension coverage) below. Labor force operating characteristics are similar to the procedures described above for demographics. Stochastic processes that may or may not be based on structural models are simulated to determine status changes for discrete characteristics such as in or out of the labor force.

Continuous variables such as annual hours or earnings are handled in one of two ways. They may be altered stochastically by categorizing them into discrete classes and using a stochastic process to determine transitions between cells or they may be predicted using an econometric model (with or without a stochastic error term). Again, the predictions and data changes at the individual level may be adjusted to conform to control totals.

There is a significant difference between microsimulation models and cell-based models in their stylization of earnings histories. The former models (microsimulation) have the capability of tracking earnings and employment characteristics on an annual basis. They can therefore create and alter work and earnings histories. So, for example, some observations would be simulated to enter the labor force in any given year; others would leave it. Some observations would show an increase in hours of work; others might show no change in annual hours. In all of these cases, the model would maintain the observation's earnings and work history. This feature allows microsimulation models to simulate retirement income benefits such as Social Security or private pension benefits. Cell-based models, on the other hand, do not maintain individual histories. In these models, retirement benefits are calculated by determining coverage and participation rates by cell and multiplying them by average payments per cell.

Retirement Decisionmaking

Obviously important to an analysis of the impacts of policy changes on retirement income is the retirement operating characteristic. Conceptually, this operating characteristic should be consistent with, and perhaps integrated into, the labor force operating characteristics. There are two approaches. First, a retirement decision model predicts whether or not an individual decides to "retire" and then the model would compute annual hours (and other employment-related characteristics) **conditional** on retirement status. This approach would allow policy parameters and covariates to affect the retirement decision that are separate from the determinants of hours of work. The second approach would be to simply model annual hours of work and define retirement to be a movement from full-time hours to zero hours or part-time hours in a different job in combination with age. The extant models use the second approach and do not have explicit retirement decisions.

Components of (retirement) income

Earnings is the largest source of income for most individuals and it is determined within the labor force operating characteristics of these models. Other sources of income include work-related sources of unearned income (Social Security benefits, pension benefits, unemployment compensation, workers' compensation), means-tested transfers (SSI, Food Stamps, AFDC), income from assets (rent, interest, dividends), and other sources.

For most income sources, there are two approaches to modeling income levels by year. The first approach is to predict, on an income source-by-income source basis, the likelihood of receiving the source and to then simulate levels of receipt. This approach is done in two steps. The first step would be an equation to predict the probability of receiving the source and the second step would be a prediction of the level conditional on receipt.

The second approach, which is possible for some sources of income, is to simulate program rules. I entitle this approach as using a **benefit calculator**. Most of the models reviewed use the calculator approach for some of the sources of income, which has the significant advantage of allowing a number of policy parameters. Predictions from estimating equations would be limited to observed policy variation.

The richness of the various models' labor force operating characteristics determines the sophistication with which they can use benefit calculators for work-related nonearned income sources. If a model generates work histories that have an appropriate number of quarters and that have earnings associated with them, then Social Security benefits can be calculated, for example. Similarly, pension benefits can be simulated using a calculator approach if sufficient detail concerning plan participation and plan characteristics is included in the model. Unemployment compensation and workers' compensation are not important sources of income for the retired population, but they, too, may be computed using a calculator approach as long as appropriate labor force and work-related injury status variables are present in the model.

Means-tested transfers, such as SSI or Food Stamps, can also be included in a model through prediction equations (that may or may not include participation models) or through benefit calculators. Of course, SSI disability benefits would require health status information and the asset test provisions of means-tested transfer programs require data on asset holdings. As with the work-related nonearned income sources, there are other means-tested transfers that could be included in a model—AFDC, General Assistance, Housing Assistance, Veterans' benefits—but these are a negligible share of income for retirees.

Rent, interest, and dividends are the major types of income flows from asset holdings. These income sources can be predicted econometrically, or they can be calculated in a fashion that is analogous to benefit calculators if the model contains household financial holdings. If data on asset holdings, by type of asset, were in the model, then income flows could be calculated by assuming particular rates of return.

Other income sources (except for decumulations of wealth, or dissaving, which is discussed below) are relatively negligible in the aggregate and may be handled as a residual or may be ignored in retirement income models.

A particular strength of microsimulation models is the income detail that they contain. These models use data bases that are derived from household surveys; and most of these surveys collect detailed information on income. Survey income data are known to be subject to reporting errors, but most microsimulation models make adjustments for them. Cell-based models, if they include income at all, characterize individuals in their cell by mean household income. Presumably, these models could assign receipt rates for the various sources of income and assign mean levels as well. However, no cell-based models do so.

Savings/Dissavings or Wealth Accumulation/Decumulation

It is inappropriate to analyze the income distributional impacts of policies on the retirement population without considering personal wealth. First of all, various forms of wealth accumulation during one's lifetime (including pension accruals) help to determine income during retirement. Second, abstracting from liquidity and risk arguments, the annuitized returns from total wealth holdings may significantly exceed monetary income flows from asset holdings for some individuals. Examples include appreciation in home equity, changes in the value of equity holdings, or accrued interest on financial instruments that is not received.

Types of assets that would be particularly useful in a retirement income policy model include pension and other retirement income plan accruals, financial assets (i.e., savings accounts, money market accounts, CDs, stocks, bonds, life insurance cash values, etc.), and home equity. Because these assets help to determine retirement income, models should forecast asset holdings by (forecast) year(s).

Despite the importance of wealth holdings in determining the economic well-being of individuals, microsimulation models typically do not include many components of wealth. Some models have rudimentary operating characteristics for some types of wealth, but, in general, the lack of data on surveys that are used for analysis of income and population have precluded sophisticated development of wealth holdings in the models.

Taxes and Disposable Income

The treatment of taxes in a retirement income policy model is important for two reasons. First and most importantly, tax regulations may be significant determinants of labor force and saving behavior and, as discussed above, these behaviors are important determinants of retirement income. Second, decisionmakers may wish to understand the policy impacts on the disposable income of individuals, rather than the gross incomes.

Individual federal and state income and payroll taxes are typically computed by a calculator approach in the retirement income models. The payroll tax calculators are rather straightforward given annual gross earnings by job. The income tax calculators, on the other hand, have many simplifications. They typically have personal exemptions and tax rates, but cannot calculate explicitly deductions. Instead they rely on econometric predictions of deductions.

Other types of taxes that may be important indirect determinants of saving or disposable income but that require incidence assumptions or that require data that are unlikely to be available are usually not included in models. These would include sales and excise taxes, property taxes, corporate or employer-paid taxes, local income taxes, inheritance taxes, and others.

Uses of Disposable Income—Health Expenditures

Much of the work that has been conducted on retirement income models in recent years has been in the area of health expenditures and health status. Because of the interest in health policy reforms, policymakers have invested resources in model development that can inform the debate. Obviously, the distributional impacts are key outcomes of interest. For purposes of this review, however, I treat health expenditures as a use of individuals' disposable income and do not get into an assessment of the recent model developments.

Linkages to Macroeconomy

The state of the macroeconomy impacts the incomes of individuals mainly through the labor market and earned income. In addition, interest rates and inflation rates influence income from assets and income sources that may be tied to the cost of living. The linkages between macroeconomic growth and retirement income models may be more or less developed. At a minimum, retirement models will use economic forecasts to control or adjust aggregate hours of employment and aggregate annual earnings. In addition, models may use aggregates as control variables or exogenous predictors in various operating characteristics. Finally, some cell-based models move toward simultaneity of the individual actions in the labor market and the performance of the macroeconomy.

Policy Parameters

The last component of a retirement income policy model that I want to address here is the number and accessibility of policy parameters that may be included in it. Essentially, policy changes may be entered into a model in three ways. First of all, an analyst may attempt to predict **outside of the model** how a policy change affects an exogenous factor within the model. For example, a model may project annual hours of employment and earnings of individuals, but it does not model explicitly the impact of a particular tax rate on labor force participation. If an analyst were interested in using this model to analyze the impacts of changing that tax rate, the analyst would need to determine the impact of the tax rate on the exogenous factors that drive the hours and earnings projections and then invoke the model.

A second way that policy levers may be used in a model is directly **in an operating characteristic prediction equation**. For example, the annual hours operating characteristic of a model may include a person's federal income marginal tax rate as one of the independent variables. Policy initiatives that include changes to that rate can be simulated by recomputing predicted values with the new marginal rates.

The final way that policy parameters are employed in a model is **within the benefit or tax calculators**. The calculators attempt to simulate program rules and so changes to those program rules are easily examined as long as the changes of interest are parameterized in the model.

AN ASSESSMENT OF CURRENT MODELS

The review of retirement income policy models by the GAO (1986) identified four models. Two of them used a microsimulation approach—DYNASIM and PRISM, and two of them were cell-based models—MDM and the AARP Age-Income Model. In my investigation of these models, I have discovered that the latter model has not been used for many years, and so I eliminated it from consideration here. The other three models, however, have been used in recent years and should be considered within the current portfolio of models. In addition to these models, another model that uses a microsimulation approach is currently in use and has been used to examine retirement income issues—CORSIM. Staff at AARP have developed and used a cell-based model, which they have entitled SIR, to examine Social Security policy. The final model that I detail to some extent is the short- and long-range forecasting model that is used by the Social Security Administration's Office of the Actuary.

The level of documentation of the models that were reviewed varies considerably. Some of the models have considerable technical documentation available and others have almost none. Time and resources precluded a thorough assessment of the existing documentation for all models. Thus the approach that I used was to review recent literature and to interview individuals that I identified as model "keepers." The objectives of my review were to try to understand the major features of the model and the policies that it could analyze. The information that I gathered came mainly from the developers or "keepers" of the models, either from written documents or telephone conversations. Thus my assessment should not be construed as an independent verification of model capabilities, but rather as an objective reporting of these capabilities.

The models that I have investigated and the model "keepers" include the following:

Model	Contact Individual
	MICROSIMULATION MODELS
DYNASIM 2	Sheila Zedlewski, The Urban Institute
PRISM	David Kennell, Lewin VHI
CORSIM	Steve Caldwell, Cornell University

CELL-BASED MODELS

MDM	Joe Anderson, Capital Research Associates
SIR	Lee Cohen, AARP Public Policy Institute
Short- and long-range forecasting models	Office of the Actuary, Social Security Administration[6]

I conducted a formal telephone survey of each of the model "keepers," to structure my exploration of each model's capabilities. The survey that I administered to these individuals comprises the appendix to this paper.

The following paragraphs summarize each of these models. I have separated the discussions of microsimulation and cell-based models. But the order of presentation within each section is arbitrary and does not represent any sort of assessment or ranking.

Microsimulation Models

As stated previously, microsimulation models are the only models that policymakers can rely upon to derive distributional analyses of retirement income policies. I have excluded from this review a number of static microsimulation models that are used routinely to analyze the distributional impacts of tax and income transfer policies.[7] This set of models includes MATH (Beebout, 1980 and 1986), TRIM2 (Webb et al., 1982 and 1986), STATS (Wixon, Bridges, and Pattison, 1987), the Treasury (Department) Individual Income Tax Simulation Model (Cilke and Wyscarver, 1990), and HITSM (Lewin/ICF, Inc., 1988). Citro and Ross (1991) present a review of MATH, TRIM2, and HITSM. The reason that I have excluded them is that they have not been typically used for retirement income policy analysis, and they were reviewed extensively by a previous Committee on National Statistics panel (see Citro and Hanushek, 1991). Also, these models have traditionally been used to generate very short-range forecasts. The models do not maintain histories on individuals, which would be helpful to examine Social Security or private pension benefits. Nevertheless, it should be recognized that these models could be modified and used for retirement income issues. The extent of modifications required is not clear, although I would submit that the resources required to make such modifications

[6]I tried numerous times to contact the "keeper" of the long-range forecasting model to ask questions about the SSA models. I was told by another staff person that this person "doesn't ever return phone calls." Therefore all of the information in this paper is derived from Section H, "Assumptions and Methods Underlying the Actuarial Estimates," of the *1995 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Disability Insurance Trust Funds.*

[7]Microsimulation models are classified as static if the "aging" that is done to demographic variables, most especially population, is accomplished by adjusting the survey sampling weights rather than simulating demographic events such as mortality, fertility, and household formation or dissolution and then creating, deleting, or altering actual data records. Microsimulation models that use operating characteristics to accomplish the latter approach are classified as dynamic.

would not exceed the resources required to update some of the models that are included in this study. In fact, some efforts have already moved in that direction. Wixon and Vaughan (1991) propose a SIPP-based microsimulation model and Jacobson and Czajka (1994) discuss using panel data (also SIPP) in a static, microsimulation model.

DYNASIM 2. DYNASIM 2 is a direct descendant of DYNASIM, which was the original dynamic microsimulation model. Guy Orcutt is generally acknowledged to be the inventor of microsimulation, and he led a team of social scientists and computer programmers in the development of DYNASIM (see Orcutt, et al., 1976). A major purpose of DYNASIM was to promote basic research about the impacts of demographic and economic forces on the population of the future. Instead of partial equilibrium-type forecasts generated just by demographic models or just by economic models, Orcutt understood the simultaneity of demographic, labor market, and macroeconomic forces.

Policy analysis using DYNASIM came after its initial development when analysts understood that the model could generate population representations that had family formation and work history dynamics. The Social Security Administration Office of Research and Statistics had a version of DYNASIM in-house that it used extensively for analyses of Social Security policy in the late 1970's. The Urban Institute developed a Social Security calculator that operated on an exact match of the 1973 March CPS with Social Security earnings records.

This model has not been used much lately, and one of the reasons for this is that the model keeper is concerned about the labor market operating characteristics.[8] During the course of her interview, Zedlewski indicated that she felt that significant structural changes have occurred in the labor market in the last decade that have significant implications for retirement income in the future. She noted that these changes are not captured in the labor force operating characteristics in DYNASIM 2, which have not been updated with models estimated from recent data. Thus Zedlewski felt that even though DYNASIM 2 was operational, credible policy analysis would have to wait until the Urban Institute had the resources and opportunity to update the operating characteristics of the model. Zedlewski furthermore maintained that there is not enough consensus in the theoretical or empirical literature yet to build reasonable operating characteristics that can support long-range simulations.

What the Urban Institute has been working on with DYNASIM 2 is model operating efficiency. The staff has been working on developing modules that can be easily ported to other models and operated on a PC platform.

The putative strength of DYNASIM 2 is the extent to which it relies on structural models for operating characteristics as opposed to adjustment of data using simple extrapolative techniques such as applying nonparameterized transition probabilities. Zedlewski emphasized

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[8]The two most recent applications of DYNASIM 2 are documented in Zedlewski and McBride (1992) and Zedlewski et al. (1990).

strongly the need to validate constantly the operating characteristics with the most recent data. As I went through the model components, she referred to them by the year for which she felt they were valid. For example, she thought the demographics were okay through about 1984, whereas the health status characteristics were valid through 1989 or later.

PRISM. This model is also a dynamic microsimulation model. It was developed in the early 1980's, mainly funded by the President's Commission on Pension Policy. Kennell, at the firm ICF at the time, had done considerable work in the area of pension policy, and was commissioned to develop a model that could analyze distributional impacts. Thus the impetus of PRISM was strictly for policy analysis purposes and was aimed at pension issues. Whereas the basic approach of PRISM was comparable to the basic approach of DYNASIM, the following design goals of PRISM indicate its differences from that model (or DYNASIM 2, its derivative):

- a detailed pension model that relied on Form 5500 data on plan characteristics
- a model that was computationally efficient
- use of the 1978 exact match of the CPS to Social Security Earnings Records

To achieve computational efficiency and still allow a large, detailed pension model, PRISM relied on transition probability-type operating characteristics.

Over the last four to five years, the major development and use of PRISM has been to supplement it with a long-term health care financing model. It has been used a number of times, but mainly in the context of constructing an "aged" database for the long-term health care model. The health model is fully parameterized and operates on a PC platform.

In terms of areas for model improvement, Kennell indicated that the model's labor force operating characteristics were not sophisticated. He added that he had attempted to validate longitudinal work and earnings histories a few years ago, and that he was satisfied that these histories were reasonable at that time. He echoed Zedlewski's concern that recent structural changes in the labor market have not been captured in the earnings histories, and he plans to use HRS data to improve them.

Kennell also indicated that the pension model needed to be updated with more recent data. PRISM operates by assigning a specific pension plan to individuals on the database. The plans come from a public use database of actual plans and the assignment is done based on industry, unionization, and worker characteristics. The current version of PRISM uses a 1983 pension plan database.

CORSIM. The CORSIM model is a direct descendant of DYNASIM. Caldwell was a member of the Urban Institute team who worked on DYNASIM and then developed his own version of the model when he left for Cornell. A major funding source for Caldwell during the 1980's was the National Institute for Dental Research, and so considerable effort went into adding operating characteristics that predicted the dental health of the population. But in addition to the dental health model, Caldwell reprogrammed the model into a different language and ported CORSIM to a PC platform and developed a group of faculty members and students to work on various aspects of the model. Of all of the models, CORSIM has the most well-developed modeling infrastructure. It is computationally efficient since it is can be completely operated on a PC and it has a team of professionals and computer staff supporting its further development. Caldwell and his staff have recently developed extensive documentation of CORSIM (Caldwell, 1995; Caldwell, et al., 1995).

CORSIM is currently being used in a number of projects. Most germane to this paper is the development of a detailed household wealth model that will include several categories of assets and liabilities and will ultimately be aligned to the Flow of Funds data. Secondly, the Canadian government undertook an exhaustive design and procurement process to develop a Canadian retirement income policy model and Caldwell won this competition. He and his colleagues are developing the Canadian model within the CORSIM framework. Finally, a state-to-state mobility operating characteristic is being added to CORSIM (U.S. model). Note that none of the other models in this review attempt to model interstate mobility.

CORSIM is capable of forecasting into the future, but Caldwell indicated that 90 percent of CORSIM's runs cover the period 1965 to 1990. This allows validation and alignment to known control totals. Caldwell rates the labor market operating characteristics highly because they are based on recent empirical work by Alice and Masao Nakamura. He feels that the operating characteristics capture well the dynamics of the labor market.

Cell-based Models

Three cell-based models are described. As with my descriptions of the microsimulation models, the order of presentation does not represent any ranking.

MDM. A cell-based model, MDM was developed to integrate a detailed household representation into a macroeconometric growth model. Anderson developed this model at ICF in the early 1980's, and it was initially used to align the PRISM model to the macroeconomy. The model operates by using a population forecast as exogenous to a four-sector neoclassical growth model and a disaggregated labor market representation. The growth model and the labor market model are solved simultaneously through an iterative procedure to produce a cell-based data set that represents the population's labor force characteristics. This data set then is used in models of family wealth and income.

In the late 1980's, the MDM model was supported by the National Institute on Aging to develop a full macroeconometric model of health care and consumer expenditures. (See NIA, 1988). After that effort, Anderson left ICF and added an Individual Retirement Account model and did some work on aligning the model's household financial asset models to U.S. Flow of Funds data. The latter work was supported by Merrill Lynch in order to obtain distributional detail on asset holdings in the U.S. In 1991, MDM was used in a project for the Commonwealth Fund to examine the impacts of expanded labor force participation by the elderly.

An advantage of this model over the microsimulation-approach models is that it has a model of trust fund balances and can analyze the impacts of policies on those balances in addition to examining the distributional impacts.

The SIR Model. A cell-based model, the Solvency and Individual Return (SIR) Model differs from the preceding models because it is limited to analyses of a single program—Social Security. The model has two major capabilities and purposes. First of all, it calculates trust fund balances (as does MDM), and second, it calculates "money's worth" to individuals, i.e., the ratio of taxes paid to benefits received. The cells that this model uses as units of analysis are individual birth cohorts, by sex. In calculating individuals' returns, the cells are disaggregated by marital status and into minimum wage earners, average wage earners, and maximum taxable wage earners.

This model is highly benchmarked to Alternative II of the Office of the Actuary's long-range forecasts. The population projections and macroeconomic forecast parameters come from that source. The model is used to analyze the impacts of changes to Social Security benefits or financing on trust fund solvency and on (married and single) minimum wage, average wage, and high wage earners. It is a PC-based model that can be run in a short time frame as long as the policy changes of interest are built into the model, such as tax rates, bend points, PIA percents, and so forth.

Future enhancements of this model include adding disability information to be able to analyze the distributional impacts of Social Security disability benefits and potentially hooking up the model to CORSIM and/or to a very long-range macroeconomic forecasting model (from Lawrence Meyer & Associates).

The Short- and Long-range Forecasting Models of the Social Security Administration Office of the Actuary. The basic approach of the actuarial estimates is to forecast, on an annual basis, revenues from payroll taxes, interest earnings on trust funds balances, and income from taxation of benefits and disbursements as benefits paid, administration, and miscellaneous transfers. Payroll tax receipts are calculated by estimating total taxable earnings of the population of taxpayers and multiplying by the appropriate tax rates. Benefits are estimated by forecasting the number of recipients of various types and multiplying by an average benefit per recipient (of that type). In the lexicon of this paper, the short-range estimates are derived through a cell-based approach.

The steps involved in forecasting annual payroll tax revenues are as follows:

- Estimate total population, by age, sex, and marital status
- Estimate labor force participation, by age and sex

- Estimate employment, by age and sex
- Estimate the covered employment, by age and sex
- Estimate average annual wages and annual self-employment net income
- Estimate average taxable earnings (wages and self-employment net income)
- Estimate taxes collected

The starting point for the total population estimates is Census Bureau data on the U.S. population by age, sex, and marital status. These data are adjusted for census undercount, U.S. citizens living abroad, and for populations in geographic areas covered by OASDI, but not included in U.S. population. Projections are made by applying average fertility rates and average mortality rates, by sex. Three alternative fertility and mortality rate assumptions are made. The "low cost" scenario has the highest fertility rate assumption and smallest decline in mortality rates (highest death rates). Conversely, the "high cost" scenario has the lowest fertility rates and death rates. These assumptions bracket the assumptions used in the "intermediate" scenario. Net immigration is then added to the projected population, with three assumptions made about the levels of immigration. Marriage and divorce rates are applied to the population as well, although it appears as if these rates are assumed to remain constant over time.[9]

Labor force participation, by age and sex, is determined by multiplying the total population by age and sex by an age- and sex-specific labor force participation rate. Three alternative participation rates are used in the forecasts. Total employment is calculated by multiplying the projected labor force by an age-sex-adjusted employment rate. Finally, covered employment is determined by multiplying coverage rates times total employment. Three unemployment rate and coverage rate assumptions are used.

Average annual wages earned and average annual self-employment net income are projected by forecasting annual percentage increases using macroeconomic forecasts of the change in the CPI and GDP implicit price deflator.[10] The document does not mention allocating wages

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[9]The *1995 Report* does not give any more information than the following statement, "Because eligibility for many types of OASDI benefits depends on marital status, the population was projected by marital status, as well as by age and sex. Marriage and divorce rates were based on recent data from the National Center for Health Statistics." (p. 164).

[10]The percentage increase in earnings is equal to the sum of the percentage change in real earnings and the percentage change in the CPI. The percentage change in real earnings, in turn, is equal to the sum of the percentage change in productivity and the percentage change in "linkages." "Linkages" refer to the difference in productivity and real wage growth and are attributed to changes in "average number of hours worked per year, labor's share of total output, the proportion of employee compensation paid as wages, and price adjustment reflecting the ratio of the GDP implicit price deflator to the CPI." The percentage changes in linkages are assumed to equal the percentage change in average hours worked per year plus the percentage change in wages paid as a share of compensation. Putting these factors all together, we get the following equation:

$$\%\Delta W = \%\Delta AVEHOURS + \%\Delta SHARE + \%\Delta PROD + \%\Delta CPI,$$

where, W = average annual wages (net self-employment income) in nominal terms
AVEHOURS = average hours worked per year
SHARE = wage share of compensation
PROD = labor productivity

and net self-employment earnings by age and sex group, so I assume that the baseline annual wages and self-employment income are averaged over all covered, employed individuals in a cell. Then total covered wages for an age-sex group an total net self-employment income for the group would equal covered employment for the group times average wages and average self-employment income. Taxable payroll is then estimated by using a ratio of taxable earnings to coveree earnings. In the short-range forecasts, the same ratio is used in all scenarios, but in the long-range forecasts, variation is introduced in this ratio. Finally, tax revenues are calculated by applying the appropriate employee, employer, and self-employed persons rates.[11]

The steps involved in forecasting annual benefit payments are as follows:

- Estimate fully insured population, by age, sex, and marital status
- Estimate disability insured population by age and sex
- Estimate OASI beneficiaries, by type, sex of insured worker, and age
- Estimate DI beneficiaries, by type, sex of insured worker, and age
- Estimate average monthly benefits, by type
- Calculate annual benefit payments

The percentage of the population that is fully insured is projected by age and sex based on historical data, projected coverage rates, and amount of earnings required for quarters of coverage. Three sets of projections of the fully insured population are used, but little variance is introduced in the alternatives. In all three, the percentage of the population that is aged 62 and over that is fully insured is projected to increase from about 78 percent in 1994 to about 91 percent in 2070. This increase comprises a small decrease for men and a large increase for women. Similarly, projections of the percentage of the population that is fully insured and disability insured are made based on historical data and projected coverage rates. Apparently, all three scenarios use the same rates. The fully insured population and the population that is fully insured and disability insured is calculated by using the population forecasts and multiplying by the projected coverages. The fully insured population by age and sex is divided further by marital status.

Old-Age and Survivors Insurance (OASI) provides income replacement for individuals who retire and for dependents of insured individuals who die. Several types of beneficiaries are entitled to payments—retired workers, spouses, dependent children/grandchildren, widow(er)s, and surviving mothers/fathers. Both the short-range and long-range actuarial projections develop forecasts of each type of beneficiary. The methods used to project the numbers of OASI beneficiaries by type differ substantially across types of beneficiaries and across the two models.

CPI = Consumer Price Index

Three assumptions are made about the levels of each of the components in the equation. In each of the alternative forecasts, a single percentage is used for all age and sex groups and for both wages ans self-employment income.

[11]Note that the document mentions that lags in tax collection are considered.

For example, for retired workers in the short-range model, award rates for new beneficiaries and termination rates for existing beneficiaries are modeled. Then the number of beneficiaries in a year is equal to last year's beneficiaries less terminated cases plus new awards. In the long-range forecast of retired workers, rates of recipiency from the "exposed" population are extrapolated from past data. In other cases, rates of recipiency are forecast using regression equations. In still other cases, levels of beneficiaries are extrapolated from historical data. At any rate, annual forecasts of the number OASI beneficiaries of each type are derived. There is apparently no variation in the assumptions about rates of recipiency by type in this part of the model; however, because three alternative population forecasts are made, there are three alternative forecasts of beneficiaries.

The Disability Insurance (DI) program operates in conjunction with OASI and insures workers and their spouses and dependents against income loss due to disability. Again the actuarial models project beneficiaries by type, but the approach is less eclectic than that for OASI. The number of disabled-worker beneficiaries is determined by estimating annual terminations and new entitlements. Termination rates by reason—death, recovery, or all others—are projected by age and sex, and duration of entitlement (in the long-range model). Three alternative projections of death rates and recovery rates are used for the low-cost, intermediate, and high-cost scenarios. Disability incidence rates are also projected, with variation, to determine new entitlements. The number of child and spouse beneficiaries are projected based on the number of new disability awards.

Total benefit payments are calculated by multiplying beneficiaries by type times average benefit by type. The *1995 Report* states: "Average benefits were projected by type of benefit based on recent historical averages, projected average Primary Insurance Amounts (PIAs), and projected ratios of average benefits to average PIAs. Average PIAs were calculated from projected distributions of beneficiaries by duration from year of award, average awarded PIAs, and increases thereto since the year of award, reflecting automatic benefit increases, recomputations to reflect additional covered earnings, and other factors. Average awarded PIAs were calculated from projected earnings histories, which were developed from the actual earnings histories associated with a sample of awards." (p. 165).

MODEL APPLICATIONS

To give the reader a sense of how microsimulation and cell-based models might project the impact of retirement policies on the distribution of income, I discuss here analyses of two policies that might be considered. In particular, I assume that policymakers would like to analyze the distributional impacts, in the year 2020, of changing the "bend points" in the computation of OASI benefits, and I further assume that policymakers would like to analyze the distributional impacts of increasing the maximum allowable contributions to IRAs starting in 1995 on retirement incomes in the year 2020.

A microsimulation model might analyze the two policies by using a data base that comprises a random sample of 10,000 observations (appropriately reweighted) from the exact match of the March 1978 CPS with earnings records. Both applications require "aging" the data to the year 2020. In the lexicography of microsimulation, two types of aging would be done. Demographic aging would alter characteristics such as age, marital status, and family composition. Economic aging would alter employment and income variables. In the particular applications that are being considered, both types of aging would be accomplished in two steps. First, the data base would be "aged" to a base year, say 1994. In this step, adjustments to both the demographic and economic data could be benchmarked to actual data. When the modelers were satisfied with the data base's representation of the base year, then simulations to the year 2020 would begin.

Demographically aging the data from 1994 to 2020 might be done, a year at a time, by incrementing the age variable of each observation, by exposing each observation to a probability of death and simulating mortality, by simulating marital dissolution among married individuals, by simulating marriage and household formation among marriageable individuals, and by simulating fertility among childbearing-aged females. If any of the demographic events are simulated to occur—mortality, divorce, marriage, or birth—then the data are altered appropriately. Records will be deleted for deaths; household records will be formed for marriages or dissolved for divorces; individual records will be created for births. Note that the size of the data base changes each year. At the end of each "forecast year," the population characteristics will be totaled and the data may be adjusted to control forecasts. The next year's demographic aging would then take place after economic aging and program simulations are run for that forecast year to project employment, income, and wealth. A more fully developed model might include education attainment, net immigration, and interstate migration among its demographic operating characteristics.

After the population is projected for a given forecast year through demographic aging, the microsimulation model would invoke its labor market operating characteristics. Labor force participation would be simulated for each record that is in the appropriate age range, followed by forecasts of annual hours of employment. The model may assign characteristics such as industry or occupation as well. Finally, wage and earnings equations would be used to extrapolate earned income for the year for labor force participants. The annual earnings would be accumulated into the record's earnings history. The employment and earnings projections are usually "bench-marked" or derived from macroeconomic forecasts of unemployment and aggregate income.

Tax liabilities and assets are not on the CPS data file, so they would have to be added to the model's data base. For the change in the Social Security benefit formula, it would not be necessary to impute taxes or assets; however, the change to the tax code to increase IRA deductions has obvious implications for both federal income taxes and asset accumulations. Therefore the microsimulation model would execute its tax calculator(s) for each forecast year and it would have a savings module that would simulate saving decisions and asset accumulations for each forecast year. The savings module would have a parameter for the maximum allowable

IRA deduction, and hopefully, would be able to capture the changes in other types of saving that would result from additional savings into IRAs.

Thus the steps in this microsimulation exercise would be to (1) demographically and economically "age" the data from its survey year in 1978 to a base year of 1994; (2) benchmark the 1994 database to known population and economic control data; (3) demographically age the data to 1995; (4) perform labor market and earnings characteristics for 1995; (5) calculate tax liabilities in 1995; (6) calculate savings decisions (including IRA contributions) for 1995; (7) repeats steps (3) - (6) for each forecast year to 2020; and (8) simulate Social Security benefits under the new formula in the year 2020. After all of these steps, the model would have produced a data base that has (simulated) observations of the entire population in the year 2020. This data base can then be tabulated by any of the variables that are maintained on it, including income.

How would a cell-based model examine these two policies? First of all, it should be recognized that neither the SIR model nor the Office of the Actuary's models could be used to analyze the impacts of the changes to the rules concerning IRA contributions. Furthermore, the cell-based models do not maintain income distributional data, so they are unable to address impacts of policy on income. The models do have excellent Social Security benefit calculators, so that they could easily calculate benefits in 2020 if they are given an earnings history. Furthermore the SIR model maintains a representation of a minimum wage (full year) worker, an average wage worker, and a maximum payroll tax worker and calculates the tax payments into the system for each and benefits to be received for each. It thus has a rough distributional calculation of "money's worth." Presumably, the Actuary's long-range forecasting model would estimate the impact of changing the "bend points" by looking at a sample of earnings histories (outside of the model) and recalculating benefits under the revised formula. It would then calculate new average benefits by type of benefit and use those to project fund balances.

A major advantage of the cell-based models is that they are developed to track the trust fund balances. So they would be limited in examining distributional impacts of a change to Social Security policies, but they would be able to estimate the impacts of those policies on trust fund balances. To date, microsimulation models have not calculated or reported trust fund balance projections.

SUMMARY AND CONCLUSIONS

The existing retirement income policy modeling capacity is slight. It consists of three microsimulation models—DYNASIM 2, PRISM, and CORSIM—and two of these models are outdated for most policy simulation projections according to the model "keepers." In addition to the microsimulation models, there are a few cell-based models that forecast aspects of retirement income. If we include cell-based models with microsimulation models, a decisionmaker interested in an analysis of the distributional impacts of a particular public policy on the retirement incomes of individuals could go to at least five organizations with models that have been used previously in analyzing similar issues. The key question, of course, is the credibility of any analyses that these models would provide. What advice would I offer to policymakers? My assessment of their choices is as follows:

DYNASIM 2 (Organization: The Urban Institute)

The advantages to DYNASIM 2 are that it is directly descended from the first dynamic microsimulation model, DYNASIM, and is housed in the same organization that developed the precursor. It is well-documented and the modeling philosophy has been to develop operating characteristics that are theoretically as well as empirically sound. The model's Social Security benefits calculator has been extensively used and is probably better developed than its private pension capabilities. The Urban Institute is in Washington, which is arguably an advantage in conducting analyses for federal policymakers.

On the negative side, the model "keeper" has suggested that the model is currently not credible for conducting long-term simulations. Recent dramatic changes in the labor market, savings behavior, wage structure, and pension characteristics are not captured in the model. The model has been ported to a PC platform, so it is possible to run the model to generate forecasts relatively quickly and inexpensively (in computer costs). But the Urban Institute staff would prefer to develop more refined and more up-to-date labor market, savings, and retirement operating characteristics before exercising the model in serious, long-term projections.

PRISM (Organization: Lewin VHI)

PRISM's main advantage is its analytical capability for private pensions, although the underlying data are a decade old and need to be updated. Another potential advantage to this model is the detailed health care model that has been added to it. Of course, the health care model is invoked after PRISM is run and there are no feedbacks from it to PRISM. Lewin VHI is also located in the Washington area. It has readily available analysis and programming staffs who have most recently performed considerable work in the area of health care modeling.

A potential disadvantage of PRISM is that its modeling philosophy relies on extrapolation of transition probabilities for many of its labor market and demographic operating characteristics. Changes over time are extrapolated into the future with very little attention to underlying models of behavior. Thus PRISM misses structural changes that may occur in the labor market. Furthermore, documentation of the model is sketchy.

CORSIM (Organization: Cornell University)

An advantage that policymakers would realize by using CORSIM would be its modeling infrastructure/capacity. Cornell has several ongoing projects with CORSIM and has a cadre of project staff that includes several faculty members and students and runs a model that operates on advanced computing facilities. Concomitantly, Cornell is the furthest along of any of the microsimulation models in computing functionality and portability and in validation efforts. Finally, Cornell has recently added wealth and asset operating characteristics.

Some disadvantages to CORSIM are that it is not Washington-based, which may inhibit policy analyses. Furthermore, the model builders have not developed a private pension operating characteristic.

MDM (Organization: Capital Research Associates)

The unique feature of this cell-based model is its integration into a macroeconomic forecasting model. In all of the other models, household earnings and income are only loosely benchmarked to macroeconomic forecasts; whereas MDM has consistency explicitly built in. In many ways, MDM belongs in the class of models known as computable general equilibrium (CGE) models. Advantages to using the MDM model include its "after-model" allocations of household spending, health care utilization and expenditure, and wealth accumulation. Capital Research Associates is also located in the Washington area.

Because it is a cell-based model, MDM cannot perform analyses of income distributional impacts of policies. Furthermore, MDM does not have many policy parameters in it. It relies on an approach of determining the effects of policies on its exogenous parameters "outside of the model," and then performing its forecasts once those changes have been estimated. Finally, the organization is a very small business just attempting to get off the ground, so there is a limited number of staff persons devoted to the model.

SIR (Organization: AARP Public Policy Institute)

The cell-based SIR model has been developed to analyze Social Security benefits exclusively. It has many program features parameterized into it, so that it can be used to analyze a wide range of Social Security policy alternatives. Furthermore, it has two features--calculation of "money's worth" and calculation of trust fund balances, which answer the primary questions that get asked about Social Security policy changes.

However, the model does not include other income sources or other retirement income policies. Whereas it has a good characterization of Social Security, it cannot be used to examine retirement income policy.

CONCLUSION

The current retirement income policy modeling capacity is scant. I conjecture that the reason for this is that there is little policymaker concern, at this time, about the overall income (or poverty) of the senior population. That is, there is little **demand** for models. The major federal program is Social Security. Income replacement rates and integration with other sources of income are certainly issues of some concern to that agency, but the main issue that they are faced with is trust fund adequacy. Of course, as proposals are put forward to better insure future trust fund adequacy, policymakers will have to confront the issue of gainers and losers from these proposals.

The pension income "system" is totally decentralized and only modestly regulated at the federal level. It, too, is not demanding analyses of distributional impacts. The regulatory concern is not focussed on income replacement, but rather on whether benefits will be paid or, in other words, on the funding status of pension plans.

The major policy analyses and modeling innovations that have occurred over the last couple of years have to do with health status and health care utilization and expenditures. This is because of the prominence of health care reform in the policy arena. Note that with the consideration of reform policies, resources were devoted to modeling distributional impacts.

In short, although the capacity is not great and is not being fully utilized, a foundation exists to be able to examine distributional impacts of retirement if, and when, decisionmakers decide that these impacts are of major concern. Three concerns that should be considered **now** are (1) whether the existing modeling capacity is substantive enough and flexible enough to gear up in a short amount of time should that be necessary, (2) whether decisionmakers will have adequate resources to support further development and refinement of models, and (3) whether appropriate, recent data sources are available to support the models.

Appendix

Status of Current Retirement Income Policy Models

1. What is the status of the model? When was it used most recently?

2. Are you planning any significant upgrades, modifications, enhancements to software or documentation? If so, what are they and why? If not, why?

3. If an agency wanted you or your organization to perform some policy simulations, how quickly and easily could you deploy the resources (programmers, analysts, hardware resources, etc.)?

4. On a scale of 1 - 10 (10 is fully satisfied), how satisfied are you with the model's capabilities to do the following (I recognize that resources and data availability may have been constraints, so I'm really asking in what areas do you think you have done well given the constraints and in what areas would you like to improve):

Capability	Comments
Demographics	______
Mortality	
Family behavior	
marriage/dissolution	
fertility	
emancipation	
Education	
Mobility	
Employment and Earnings	______
Annual hours	
Wage rates	
Industry/occupation	
Union status	
Other Income (besides earnings)	
Social Security benefits	______
Pension benefits	______
SSI	______
Tax-deferred financial assets (IRAs, etc.)	______
Other financial assets/debts	______
Home equity	______
Health Status and Financial Concerns	
Health status/disability	______
Medicare benefits	______
Health insurance premia and benefits	______
Health expenditures	______
Longitudinal Nature of Earnings/ Work Histories	______
Longitudinal Nature of Kinships	______

Linkages to Macroeconomic forecasts ______

Parameterized Policy Levers ______

Consistency of Interactions of
Operating Characteristics ______

5. On a scale of 1 to 10 (where 10 is very easy), how easily could you analyze the following policies for the indicated outcomes:

1. ______ Accelerate the 1983 reforms to Social Security by increas-ing the retirement age in monthly increments and by increasing the delayed retirement credits.

Outcomes:
-Household income distribution in year 2050
-Distribution of Social Security benefits in 2050
-Trust fund balance in years 1995 - 2050
-Lifetime contribution to benefits ratio for various population subgroups

2. ______ Decrease the Social Security spousal benefits.

Outcomes:
-Household income distribution in year 2030
-Distribution of Social Security benefits in 2030
-Trust fund balance in years 1995-2030

3. ______ Means-test Medicare benefits.

Outcomes:
-Individual health status distribution in year 2020
-Distribution of Medicare benefits in 2020
-Medicare trust fund balance in 2020

4. ______ Incorporate SSI into a state block grant for public assistance purposes. This will manifest itself into state-by-state benefit levels and eligibility rules.

Outcomes:
-Household income distribution in 2020 (percent in poverty)
-SSI payments distribution in 2020

5. ______ Increase stringency of rules determining deferrals of federal income tax on retirement savings. Decrease annual maximums and impose differential levels by income.

Outcomes:
-Household income distribution in 2035

6. ______ Impose regulations on the extent to which defined benefit pension plans can be backloaded. Simultaneously decrease the COLA provisions of public (Civil Service) pensions.

Outcomes:
-Household income distribution in 2035
-Percent of private pensions with substantial unfunded liabilities

7. ______ Increase funding of Older Worker federal training programs, which will result in a significant increase in the labor force participation rate of individuals 55 and over.

Outcomes:
-Household income distribution in 2020.
-Social Security benefit distribution in 2020.
-Social Security trust fund balances, 1995-2020.

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