THE USE OF SIMULATION TECHNIQUES TO STUDY THE CHANGING ECONOMIC SITUATION OF THE AGED

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Introduction

Due to inability or neglect, a great many people in the United States have failed in recent years to prepare, through individual or group action, for an ever growing number of retirement years. This has resulted in the plight of today's poverty-stricken retired aged population. Enough reliable statistical information has now been accumulated to substantiate clearly the existence of a relatively low income status for all but a very small minority of the current retired aged in the United States. Using the Social Security Administration's highly stringent definition of poverty, for example, three out of every ten people 65 and older -- in contrast to one in nine younger people -- were living below the poverty line in 1966. Another one-tenth of the aged population was on the border of poverty.

Recently the U.S. Senate's Special Committee on Aging undertook a year-long investigation of the economic problems of the aged. A working paper [1] prepared for the Committee by a Task Force of persons specializing in research in this area made the following major points concerning the current situation:

1. Americans living in retirement are suffering from an income gap in relation to younger people. And as the gap widens, low income continues to be the number one problem facing most of our 20 million persons 65 years or older, as well as other millions just a few years younger.

2. More Americans are spending more years in retirement periods of indeterminate length and uncertain needs, causing a mounting strain on resources they had when they began retirement. For an ever-rising proportion of women -- most of them widows -- the problem is especially severe.

3. Today's inadequacies in retirement income -- and the policies and trends that perpetuate them -- should be of direct concern not only to our population of aged and aging Americans, but also to those in middle age or younger. Most parents today face a common problem: How can they allocate earnings to meet current obligations to their family and still have something left over for retirement?

4. Projections and various studies indicate that Social Security, private pensions, and other forms of retirement income are not improving fast enough to reverse or significantly counter present economic trends.

5. Facing what must be recognized as a worsening retirement income crisis, the Nation must take positive, comprehensive actions going far beyond those taken within recent years. The Nation faces these basic policy issues:
   a) What is an adequate level of income for retired persons?
   b) What part in attaining this level should be played by government programs, by voluntary group action, and by individual effort?
   c) Is the economic problem of aging a temporary problem that requires a different solution or a different "mix" of solutions for today's aged than for those reaching old age in the future?

Whether or not one agrees with the previous summary of the current situation, it seems clear that there is a need for research which focuses on the unique economic problems of the rapidly growing group of retired aged families -- families distinguished not just by the older age of their members but also by the fact that none of their members, including the head, contributes to the family's support by working in the labor force.

For most families, the income problem in old age grows out of the cessation of earnings of one or more family members and the failure of private savings and/or private and public pen-

sions to replace a sufficiently large proportion of these earnings. For a significant number of retirees, however, very low incomes were a problem throughout worklife; some form of income maintenance was in order even before they became too old to work.

Income-maintenance issues as they relate specifically to the elderly require further research into (a) questions of the present and future income and wealth levels in old age; (b) the relationship of these levels both to pre-retirement income levels, to general budgetary requirements of the elderly, and to the income-needs gap of particular aged groups; (c) the transitional period into retirement and the decision-making process involved; and (d) considerations of the adequacy of current income maintenance institutions and the costs of alternative financing arrangements for these institutions.[2]

Simulations of the Aging Process

In order to investigate various aspects of these issues, a "life process" simulation model has been constructed to permit those activities of individuals to be simulated which have an important influence on their economic situation in retirement.* These activities can be divided into the following four categories:

a) Demographic.
b) Work force and earnings.
c) Pension status.
d) Asset accumulation.

A large sample of 33,280 persons in the U.S. population, who were, in general, between the ages of 45 and 60 in 1960, is aged 20 years, using the simulation process. The basic data used are from the "one-in-a-thousand sample," a set of tapes produced by the U.S. Bureau of Census which contains separate records (including demographic, work force, and income information) of a 0.1 percent sample of the U.S. population as recorded in the 1960 census.

At the end of 20 years, these people are age 65 or over and represent the aged population in 1980. Naturally not everyone in 1960 between 45 and 60 can be expected to live at least 20 years. Hence the first life process activity considered in the simulation model is death. A probability of death for each particular year is specified for individuals based on their sex, race, and age. A random drawing from the associated probability distribution is used to determine whether an individual will die or live that year. Similarly, probabilities are specified for other possible occurrences built into the model -- labor force exit and entry, job change, pension coverage, vesting, periods of unemployment, etc.

Each possible "occurrence" specified in the model is treated in a manner similar to the live-die occurrence -- each person being considered in turn. By sequential handling of the various occurrences it is possible to make the consideration of any one occurence dependent on occurrences which had been handled before it. Once one year's simulation is completed, the individual, if he has survived, is aged another year and the process immediately repeated. This continues until the year 1980 is reached (i.e., completion of 20 "passes" in the computer). After all individuals have been processed, the resulting sample population represents the major part of the future aged population, since the surviving individuals are now 65 to 85 years of age.

During the simulation, work income, pension coverage, and asset histories are kept for each individual. Social security benefits for those persons retired and no longer in the work force (and eligible) can be calculated by applying the average "creditable" wage income generated by the simulation to a social security benefit formula. Where applicable, private pension benefits and government pensions can be estimated based on the wages and/or years of service of employees.

Having calculated private and public pension benefits, a "census" is

* A detailed explanation of the simulation model and assumptions are contained in [3].

taken of the retired population at the end of the simulation run, and various distributions of pension income and assets for couples and unrelated persons can be derived.

Previous Findings

The results of the initial simulation study (which have been reported elsewhere) were definitely not encouraging with regard to the future economic situation of the retired U.S. population in 1980. The study [3] concluded that if pension systems are to be used to eliminate poverty among retired families and individuals in the United States and also to improve the relative economic status of the retired population, significant changes in present U.S. pension systems must take place.

Table 1 contrasts the resulting pension income distributions for couples, for example, using two different assumptions regarding the trend of social security benefits. Estimate I assumes a 4 percent annual increase in social security benefits, a 3 percent annual increase in private pension benefits, and periodic increases in "maximum creditable earnings" for social security purposes.

Estimate II simulates a situation in which Congress and the President in, say, 1970 attempt to improve the position of the retired aged relative to that of the working population by increasing benefits 50 percent in that year. Thereafter benefit levels are increased by 2 percent annually to take account of general price increases.

There is a substantial upward shift in the income distribution for Estimate II. The proportion of couples with pension income over $5,000, for example, increases from 12 to 20 percent. The estimate, however, also shows the difficulty of improving the income situation of low-income couples by across-the-board percentage increases in social security benefits. Despite the very large pension increase assumed for Estimate II, almost two-fifths (39 percent) of the retired couples are projected as having total pension income of less than $3,000 in 1980.

Another simulation study which I have conducted [4] measured for the first time the "adequacy" of U.S. pension systems by comparing projected pension income with average earnings of retired persons for the 1, 5, and 10 year period prior to each individual's time of retirement. This simulation study projected pension-earnings ratios for persons retiring in the United States between 1960 and 1980. The projections indicated that U.S. pension systems as they are presently developing are failing to generate for large numbers of aged persons retirement income sufficient to meet generally accepted international and national standards regarding the relationship which pension income should bear to preretirement earnings.

Comparative Study of Social Security Systems -- West Germany and the U.S.

In recent years we have seen developed and implemented in various industrialized countries a number of highly innovated social security systems. These new systems were in large part motivated by dissatisfaction with the existing programs of old age income maintenance in each country. Innovative public pension developments in West Germany, Austria, and Sweden, for example, have been watched by social security researchers and policy-makers with increasing interest.

Given the continuing interest of countries in evaluating and improving their pension systems, study of alternative pension systems is a necessary part of the information required to formulate public policy in this area.

A comparative simulation study of the U.S. and West German social security systems is currently underway. The West German system is being evaluated with regard to the desirability and feasibility for adopting a somewhat similar system in the U.S. For this study, the West German system has been programmed for computer simulation analysis and its major provisions have been adopted to be compatible with the basic provisions of the existing social security retirement system in the United States. Using U.S. data on persons approaching retirement,

Table 1. Projected pension income distribution for retired couples, assuming different social security benefit increases, 1980. (Percentage distribution)

Pension income	Social security income[2] I 4% annual social security increase	Social security income[2] II 6% annual social security increase	Total pension income[1] I 4% annual social security increase	Total pension income[1] II 6% annual social security increase
Total percent	100	100	100	100
Under $1,000	4	0	5[3]	1
$1,000-1,999	21	16	16	12
$2,000-2,999	43	39	28	26
$3,000-3,999	30	27	25	23
$4,000-4,999	2	16	14	18
$5,000 and over	0	2	12	20

1. Pension income includes benefits from social security, private pensions (including State and local government plans), and Federal retirement programs.
2. Social security recipients only.
3. Includes couples with no pension income.

Source: Simulation study. Table reproduced from The Economic Status of The Retired Aged in 1980, Research Report No.24, Social Security Administration (1968).

estimates of aggregate pension income, pension income distributions, program costs, and the effects on poverty groups are being made. These estimates can then be compared with alternative estimates which assume that the current U.S. system does not change radically in the future.

A major principle upon which the current West German social insurance system is based is that the worker should receive a pension which will enable him to achieve a retirement standard of living similar to the living standard maintained during his working life. The retirement pension is related, however, not just to prior earnings of the worker himself (as in the U.S.) but also to the average earnings of all workers at the time a particular worker retires.

The result of these provisions is to provide substantial pensions to workers with long years of service -- substantial in the sense that the pension is a high proportion of average preretirement earnings. Currently a West German worker who has 40 years of service in the program would receive a pension which was equal to 60 percent of his average preretirement earnings. If he has 50 years of service, he would receive 75 percent.

In order to simulate the effect of such a system on pension incomes in the United States, a number of working rules are specified. These are the following:

1. Only persons over age 61 are eligible for a pension.

2. If the female member of a family is not eligible for a pension in her own right, she receives no pension (i.e., no wife benefits are awarded).

3. Pensions are based upon average earnings for a 10-year period prior to retirement (rather than as in the German system -- lifetime average earnings).

4. Workers eligible for social security pensions are assumed to enter the work force at age 20.

5. Pensions are increased 2.5 percent each year after retirement to adjust for general price level increases.

Table 2. Projected total pension income distribution for U.S. retired couples, 1980.
(Percentage distribution)

Total pension income[1]	U.S. system 6% annual increase	German system with 0.111 constant
Total percent	100	100
Under $2,000[2]	13	16
$2,000-2,999	26	10
$3,000-3,999	23	14
$4,000-4,999	18	12
$5,000-5,999	18	37
$6,000 and over	2	11

1. Pension income includes benefits from social security, private pensions (including State and local government plans), and Federal retirement programs.
2. Includes couples with no pension income.

Source: Simulation Projection.

Table 2 presents the first findings from the study described above. The U.S. system projections are the same as those cited in Table 1; they assume a 4 percent annual social security increase. Table 2 shows a dramatic improvement in the projected pension income distribution when the West German system is substituted for the U.S. one. Almost two-thirds of the couples are projected as having pensions of $5,000 or more.

To some, the pension incomes indicated by the West German system projections may seem, at first glance, to be unrealistically high. However, one should remember, first, that the German social security system is designed to produce pensions which are a high proportion of preretirement earnings and, second, that average gross earnings in U.S. manufacturing currently are about $6,000 a year and growing over time. Thus, Tables 1 and 2 demonstrate a basic fact: the present U.S. social security system, unless changed in a very substantial way, will not (together with private pensions) produce incomes which would permit U.S. workers to maintain their standard of living as they move into the retirement period. Serious consideration should be given to alternative systems which do.

References

[1] U.S. Senate Special Committee on Aging, Economics of Aging: Toward a Full Share in Abundance, 91st Congress, 1st session, U.S. Government Printing Office, Washington D.C., 1969.

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[4] Schulz, James H., "Aged Retirement Income Adequacy -- Simulation Projections of Pension-Earnings Ratios," in U.S. Joint Economic Committee, Old Age Income Assurance, Part II, U.S. Government Printing Office, Washington D.C., 1968.