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The Adequacy of Savings

Central to the formulation of public policy towards social security and private pensions is the question: How adequately do people save for their old age? The widely accepted life cycle and permanent income hypotheses of savings presume that individuals plan their consumption path over their lifetimes in a way that maximizes their satisfaction. Public policy regarding the financing of old age consumption is based on a very different view. The essential premise underlying the social security system, as well as government tax breaks for private pensions, is that left to their own devices, large numbers of people would fail to save adequately and find themselves destitute in their old age. While our social security and private pension systems perform a number of functions in the area of income redistribution and insurance, their primary function is to force individuals to save for their old age. This has the potentially important virtue of avoiding their turning to general welfare for assistance, as well as preventing personal suffering.

To date, very little empirical work has directly addressed the question of the adequacy of accumulation. In the first systematic study of this problem, Peter Diamond (1977) concluded that in the absence of Social Security, a substantial fraction of the population would be inadequately prepared for retirement. The Interim Report of the President's Commission on Pension Policy (1979) reached a similar conclusion.

This paper uses newly available data from the Social Security Retirement History Survey to examine the adequacy of saving. This data source is particularly rich; survey data for respondents covering the years 1969, 1971, and 1973 have been matched with social security earnings records covering the years dating back to 1951. In addition to information on the path of lifetime earnings, the survey contains extensive data on individual asset holdings. The evidence indicates that surprisingly few couples currently suffer significant reductions in their standard of living in their old age. This appears due, in large part, to our compulsory savings institutions, the Social Security and Private Pension Systems. These institutions have succeeded in redistributing the lifetime consumption of private individuals from their youth to their old age. The current scale of these programs, however, appears appropriate. The evidence does not warrant a substantial increase in the scale of these programs.

The next section examines potential causes of undersaving and considers the potential scope for public policies. The data and the methods of analysis used are described in Section II. Section III discusses the results regarding the current adequacy of retirement savings. The fourth section analyzes the reasons for differences in the adequacy of individual preparation for retirement. The fifth and final section of the paper presents conclusions and discusses some implications for future research.

I. Undersaving and Public Policy

Market economies traditionally respect consumer sovereignty. Economists typically do not attempt to examine the wisdom of consumers' choices between good x and good y, work and leisure, or risk and return. Nor do public policies typically seek to affect these decisions. Why then should choices regarding the intertemporal allocation of consumption be subject to special scrutiny?

There are several possible rationales for public intervention in private savings decisions. Paternalism may be appropriate in this context even if not in other static situations. Decisions about retirement savings are unique in their irreversibility. An individual cannot retrospectively enjoy his wealth nor can he undo his previous consumption. This problem of irreversibility is heightened by the likelihood of changing tastes. The saver may well have very different goals, tastes and desires when he retires than at the time the savings decision is made.

Costs of information processing and decision making provide a second possible justification for paternalistic policies. Individuals may find it difficult or unpleasant to confront the possibility of forced early retirement or disability. If these contingencies are sufficiently unlikely or remote, utility maximization recognizing the costs of choice may call for ignoring the possibility of their occurence. Welfare might then be increased by public planning for these contingencies. A third element of

the case for paternalism emphasizes the difficulty of "rational" decision making. Because of the long lag between actions and consequences, and the large number of uncertainties involving low probability events, intertemporal consumption decisions are likely to be particularly difficult.

Even if paternalistic arguments are rejected out of hand, there is a second potential justification for forced savings. By requiring individuals to save, we avoid the negative "externality" that they might otherwise generate by not saving for themselves. A precondition for this argument is obviously interdependent utility. With this assumption, forcing individuals to save protects the remainder of the population from the welfare burden they might otherwise be forced to take on. This argument which is widely used to justify compulsory private pension plans in some settings undoubtedly has some force in the social security context.

Even if it is granted that a rationale exists for government intervention to overturn private savings decisions, there remains the question of whether it can succeed. This depends on the nature of the problem in individual decision making and the existence of capital market constraints.

First, consider the length of the savings horizon in the presence of perfect capital markets. If individuals have lifelong, or because of a concern for the welfare of their descendents, infinitely long savings horizons, they will consider future resources in determining current and future consumption. After consulting their current intertemporal consumption preferences,

some or many non-myopic individuals could plan to consume at a significantly higher level during their youth than during their old age. Other individuals, in general, and public officials, in particular, may, from the perspective of their own preferences, view this intertemporal choice decision as "perverse" if not stupid. They may suspect that it will be regretted subsequently. Indeed, policymakers may be sufficiently disturbed to attempt to force these "irrational, but non-myopic" undersavers to save more for their old age. If this attempt to require additional savings takes the form of our current social security system, i.e., of forced contributions when young in return for retirement benefits when old, public policy will fail to achieve its desired goal. This is simply because of the existence of perfect capital markets. In the presence of perfect capital markets, private "irrational, but non-myopic" savers will undo a forced government savings plan of the social security variety by reducing their own savings out of disposable income and maintaining the original intertemporal consumption allocation plan. Note that if social security forced tax contributions are sufficiently large, these "irrational, but non-myopic" savers will borrow against their future social security benefits. Borrowing against future social security benefits would occur, however, only after the individual's private net worth was depleted.

Myopic savers, in contrast to "irrational, but non-myopic" savers, may simply not think about the future in deciding how much to consume today. In the extreme they may consume all their disposable income as well as inherited assets in each

period that they receive these streams. A less severe form of myopia might entail a rule of thumb method of determining how much to consume and how much to save, such as "save 5 percent of all received flows." In this case of myopia, a forced social security savings program can indeed change the intertemporal allocation of consumption. Since myopic individuals do not foresee future social security benefits, they will lower their current consumption in response to the social security tax or pension contribution rather than simply reduce their own private savings.

When capital markets are imperfect, forced savings policies may be effective even in the case of "irrational, but non-myopic" savers. The capital market imperfection we have in mind here is an inability to borrow against future streams. Forced contributions to savings plans may lead to a reduction in consumption when young to the extent that the constraint against borrowing against future streams is binding. This constraint may become binding even for individuals who have positive net worth; it may be impossible, or at least very difficult, to consume illiquid assets, such as the equity in one's house. In addition, "irrational, but non-myopic" savers may have short term savings goals, such as the education of their children, that preclude a reduction in their net worth below a certain level. This discussion suggests that individuals with the greatest level of net worth and earnings relative to the size of the involuntary savings contribution will be the least constrained by imperfect capital

markets and would provide a better test for "irrational, but non-myopic" saving in a world with imperfect capital markets.

For myopic savers public policy will be effective whether or not capital markets are imperfect; myopic savers by definition do not foresee or think about future resource streams and, hence, will never be in a position of desiring to borrow against those streams. As in the case of non-myopic, but possibly borrowing-constrained savers, the strongest test for myopic undersaving will be among that group of savers who have been least affected by forced savings policies. These points about the effectiveness of forced savings policies are summarized in Figure 1.

Fig. 1. Effectiveness of Forced Savings Policies

	Unconstrained Savers	Constrained Savers
non-myopic savers	Ineffective	Effective
myopic savers	Effective	Effective

II. Testing for Under-Savings

Any test of myopia or irrationality on the part of consumers must be somewhat arbitrary. Any given consumption path can be justified as optimal using some utility function. Our tests are based on the premise that rational consumers would be unlikely to plan ahead for significant reductions in consumption levels in their later years.

The basic test for significant under-saving involves a comparison of the constant level of old age consumption that can be financed by the elderly based on their resources in old age with the constant level of lifetime consumption they could have financed based on the lifetime resources available at the start of their lives. This comparison is based on the actual realized pattern of voluntary and involuntary savings and provides an entirely valid test for significant undersaving only in the case of non-myopic, unconstrained savers. This is the group for whom public forced savings policy does not alter the intertemporal allocation of consumption. As mentioned above, focusing on that group of savers for whom forced saving is a small fraction of lifetime earning will increase the power of the test. For non-myopic savers, choosing the group with the smallest ratio of forced savings (out of disposable income) to earnings will identify the group least likely to be constrained by imperfect capital markets. For myopic savers, the group with the smallest ratio of forced savings to earnings will be the group with the greatest potential for exhibiting substantial undersaving.

There is another, but more extreme way to examine the evidence concerning the current adequacy of savings. This is simply to assume that all forced savings would otherwise have been consumed and to compare the level

of old age consumption resources with lifetime consumption resources ignoring those forced savings assets. In addition to presenting results based on total old age assets, we present results that are based on the counter-factual assumption that social security had never existed, i.e., both social security taxes and benefits are ignored in computing the levels of lifetime and old age consumption. This will obviously bias our results towards a finding of undersaving for those non-myopic as well as myopic savers who would have saved some fraction, if not all, of their social security taxes.

So far, the discussion has carefully avoided questions of uncertainty. One major risk that affects intertemporal consumption decisions is the uncertainty of the date of death. Economic theory suggests that this risk can be completely hedged by the purchase of actuarially fair annuities. In the U.S., private markets do not appear to provide actuarially fair, or indeed, even indexed annuities. Private purchase of annuities is rare. Less than 3 percent of respondents in the Retirement History Survey (RHS) report ownership of annuities. On the other hand, virtually everyone owns annuities in the form of social security benefits, pension benefits, and old age labor earnings. In addition, Kotlikoff and Spivak (1981) suggest that a sizable fraction of the risk of death can be hedged by risk pooling within families. Furthermore, even very small families can substitute to a significant degree for an actuarially fair annuities market. For example, two member families, such as a husband and a wife, or a father and son, can capture close to 50 percent of the insurance gains from perfect markets; three member families can capture close to 70 percent. Given the significant risk pooling opportunities among family and friends, and

given the significant level of social security and pension annuities as well as survival contingent labor earnings, most non-myopic individuals may well formulate their intertemporal consumption plans as if they were purchasing perfectly fair, real annuities.

Since the extent to which consumption choices are subject to the risk of death is in doubt, we present our comparisons of old age consumption with lifetime consumption for the two polar cases of perfect annuity markets and no annuity markets. For the case of perfect annuity markets, we compute the ratio R_A, where

$$(1) \qquad R_A = \frac{C^O_A}{C^L_A} \quad .$$

In (1), C^O_A is the level annuity that can be purchased when old given the present expected value of old age resources PER^O. C^L_A is the level annuity that can be purchased when young based on the present expected value of lifetime resources PER^L[2]. C^O_A and C^L_A are, in turn, calculated as:

$$(2) \qquad C^O_A = \frac{PER^O}{PEF^O} \quad , \quad C^L_A = \frac{PER^L}{PEF^L} \quad .$$

The terms PEF^O and PEF^L are, respectively, the present expected value factors when old and young. They equal the sum from the initial age, a*, of the probabilities of surviving to age a, divided by the discount factor $(1+r)^{a-a^*}$, where r is the market rate of interest.

When annuities are not available, expected utility maximizers will not equate the present expected value of consumption to the present expected value of lifetime resources; rather, they will equate the present value of planned consumption over the lifetime to the present value of resources. For this case, we compute

the ratio R, where:

$$R = \frac{C^O}{C^L} \quad . \tag{3}$$

The terms C^O and C^L are, respectively, the constant levels of planned consumption based on the present value of old age resources and the present value of lifetime resources that can be financed over all the possible remaining years of one's life. In this study, 88 is taken to be the maximum age of death. The formulae for C^O and C^L are simply the ratio of present resources from the age in question to the present value factor from the age in question through age 88.

In the case of married couples, the terms C^O_A, C^L_A, C^O, and C^L refer to the constant streams that each spouse could consume based on the combined lifetime and old age resources of the two spouses. The present and present expected value factors used to compute C^O_A, C^L_A, C^O, and C^L are the sum of the husband's and wife's present and present expected value factors.

III. Data and Sample Selection

The Social Security Administration's Retirement History Survey was initiated in 1969. Since that time, four additional panels of data have been collected in the years 1971, 1973, 1975, and 1977 from the initial respondents . This paper uses data from the 1969, 1971, and 1973 surveys. The initial 1969 RHS sampled 11,152 respondents between the ages of 58 and 63. The sampling procedures, etc., are described in Irelan, et al. Both the 1969 and 1971 surveys provide data which is used to calculate household net worth, including equity in residential and non-residential real estate.

In each of the years the survey respondents were asked a large number of questions concerning pension benefits they were currently receiving or expected to receive. The respondents also indicated their working status and expected age of retirement in each of the surveys. This information was processed to calculate PENW, the present expected value of pension wealth as of the respondent's age in 1969. Pension benefits were taken to begin in the first year the respondent reports receiving benefits or in the year the respondent indicated he (she) will retire, whichever is earliest. We assume that the reported pension benefit remains fixed in nominal value over time. Survival probabilities are taken from a 1966 Social Security actuarial study.

We follow procedures set out by Feldstein (1974) and Kotlikoff (1979) to calculate the present expected value of gross social security wealth (SSW). The basic benefit for each

respondent and his (her) spouse is computed using the 1969 Social Security Benefit Schedules. Across the board increases in real social security benefits after 1969 are not included in the calculations. The Social Security Primary Insurance Amount (PIA) is calculated from the respondent's reported earnings history. The SSW calculation takes into account dependent and survivor benefits as well as basic retirement benefits. Benefits are taken to begin at the age of retirement. An individual's age of retirement was determined, if possible, from the Social Security earnings file. If a respondent was still working in 1974, his (her) retirement age was taken to be his (her) 1973 expected retirement age. Respondents who said they would never retire were assumed to retire at age 70.

The procedure of using actual outcomes in calculating the present expected value of pension and social security streams in 1969 was also followed in computing the present expected value of future labor earnings (FUTW). The actual value of earnings was estimated from the Social Security earnings records up to 1974. If a respondent indicated in 1973 that he (she) expected to work after 1974, we assumed that the respondent continued to earn his (her) 1974 real earnings level until retirement. Earnings between 1951 and 1969 were obtained from the Social Security earnings records. Earnings prior to 1951 are not reported in the data. Each respondent's earnings back to age 30 are estimated by taking his (her) average earnings between 1953 and 1956 and extrapolating this figure backwards starting in 1950 and

applying the economy-wide growth rates of real earnings. Since the typical respondent was 41 in 1950, this imputation procedure was used for about 11 years of earnings.

In the computations, all earnings and benefit streams are first converted into real 1969 dollars. A 2 percent real interest rate was assumed in the calculations. Tabulations were also constructed using a 4 percent real interest rate and the results proved quite similar. The earnings stream from age 30 to the age of retirement is reduced by 15 percent to allow for income taxes and work related expenses. In addition, social security tax contributions by both the employers and employees are subtracted out.

The Social Security earnings data report annual earnings up to the covered maximum. They also indicate the quarter in which the respondent exceeded the maximum, if such was the case. A procedure developed by Alan Fox (1976) was used to estimate earnings above the maximum for individuals who hit the ceilings in a particular year.

While the Retirement History Survey asks detailed net worth questions, two important components of the net worth of the elderly are not reported, namely consumer durables and the cash value of life insurance. The exclusion of these data from the net worth calculation biases the calculated values of R_A and R downward.

These estimates of pension wealth, social security wealth, and lifetime net labor earnings from age 30 to retirement are used to calculate the present expected value of all lifetime resources as of age 30. The computation of the present expected value of old age resources is based on the 1969 values of net-

worth (NW), future net labor earnings (FUTW) , social security net wealth (SSW), and pension wealth (PENW). The present value calculations used to generate R are based on the same flows described above, with the exception that social security survivor benefits are ignored in the calculation.

These two measures of lifetime and old age resources are both potentially biased because they fail to account for inheritances as well as contributions from children, items that are quite poorly reported in the survey. To the extent that these inheritances and contributions from children have occurred prior to the respondent's attaining retirement age, the estimate of lifetime resources will be undermeasured, while the estimate of future resources is correct. If, on the other hand, such family transfers primarily arrive in the future, both future and lifetime resources will be undermeasured. The former case is the more problematic for our estimate of the ratio of old age to lifetime sustainable consumption since the omission of preretirement transfers in the lifetime resources calculation will bias upwards the computed ratio of sustainable old-age consumption to sustainable lifetime consumption. However, the potential bias here seems benign; social policy towards savings is presumably concerned not with the intertemporal consumption allocation of family transfers, rather the intertemporal allocation of lifetime earnings and other lifetime resources, e.g., pensions and social security that individuals can rely on receiving. In this context, family transfer payments can be thought of as a bonus. For purposes of this study, the appropriate lifetime resources base to consider can be thought of as excluding family

transfers since social planners are presumably unconcerned whether a high ratio of old age to lifetime consumption out of non-family transfer resources results from good planning, forced government social security, forced pension savings, or family transfers; their main concern is that this ratio be sufficiently high.

Sample Selection

Federal government employees and many state and local government employees are not covered by social security and, hence, have no earnings records to use in the computation. These individuals were excluded from the analysis. A second group that was excluded is the self-employed. Many of the self-employed were first covered by social security starting in the late 1950's. For these individuals, the earnings records are obviously incomplete. In addition, quarters of coverage information is much more limited for the self-employed than for employees. This fact precludes estimating earnings above the covered ceiling for the self-employed.

This paper focuses on married couples. Surviving widows, in many cases, worked only a limited amount during their lifetimes; since the decedent husband's earnings record is not available, there is no way of determining widow's pre-1969 standard of living. Respondents were excluded from the basic sample if they failed to report a particular component of

Table I

R-RATIO OF OLD AGE CONSUMPTION STREAM

TO LIFETIME CONSUMPTION STREAM, NO-ANNUITY CASE

Couple's Average Earnings

FREQUENCY / PERCENT / ROW PCT	40	50	60	70	80	90	100	110	120	130	140	TOTAL
$ 3000	0	0	4	4	6	8	15	20	18	9	98	182
	0.00	0.00	0.20	0.20	0.31	0.41	0.76	1.02	0.92	0.46	4.99	9.27
	0.00	0.00	2.20	2.20	3.30	4.40	8.24	10.99	9.89	4.95	53.85	
4000	0	3	2	2	11	10	13	12	15	15	60	143
	0.00	0.15	0.10	0.10	0.56	0.51	0.66	0.61	0.76	0.76	3.05	7.28
	0.00	2.10	1.40	1.40	7.69	6.99	9.09	8.39	10.49	10.49	41.96	
5000	0	0	1	5	6	12	22	19	27	19	59	170
	0.00	0.00	0.05	0.25	0.31	0.61	1.12	0.97	1.37	0.97	3.00	8.66
	0.00	0.00	0.59	2.94	3.53	7.06	12.94	11.18	15.88	11.18	34.71	
6000	0	0	1	4	11	20	26	30	20	26	77	215
	0.00	0.00	0.05	0.20	0.56	1.02	1.32	1.53	1.02	1.32	3.92	10.95
	0.00	0.00	0.47	1.86	5.12	9.30	12.09	13.95	9.30	12.09	35.81	
7000	0	0	3	3	10	23	31	32	38	29	71	240
	0.00	0.00	0.15	0.15	0.51	1.17	1.58	1.63	1.93	1.48	3.62	12.22
	0.00	0.00	1.25	1.25	4.17	9.58	12.92	13.33	15.83	12.08	29.58	
8000	0	0	2	3	15	17	28	42	52	33	61	253
	0.00	0.00	0.10	0.15	0.76	0.87	1.43	2.14	2.65	1.68	3.11	12.88
	0.00	0.00	0.79	1.19	5.93	6.72	11.07	16.60	20.55	13.04	24.11	
9000	0	0	0	5	15	20	25	26	23	27	67	208
	0.00	0.00	0.00	0.25	0.76	1.02	1.27	1.32	1.17	1.37	3.41	10.59
	0.00	0.00	0.00	2.40	7.21	9.62	12.02	12.50	11.06	12.98	32.21	
10000	0	1	1	7	6	10	12	21	29	28	50	165
	0.00	0.05	0.05	0.36	0.31	0.51	0.61	1.07	1.48	1.43	2.55	8.40
	0.00	0.61	0.61	4.24	3.64	6.06	7.27	12.73	17.58	16.97	30.30	
11000	0	0	1	1	6	13	15	18	12	15	30	111
	0.00	0.00	0.05	0.05	0.31	0.66	0.76	0.92	0.61	0.76	1.53	5.65
	0.00	0.00	0.90	0.90	5.41	11.71	13.51	16.22	10.81	13.51	27.03	
12000	1	0	5	8	17	18	31	38	29	39	91	277
	0.05	0.00	0.25	0.41	0.87	0.92	1.58	1.93	1.48	1.99	4.63	14.10
	0.36	0.00	1.81	2.89	6.14	6.50	11.19	13.72	10.47	14.08	32.85	
TOTAL	1	4	20	42	103	151	218	258	263	240	664	1964
	0.05	0.20	1.02	2.14	5.24	7.69	11.10	13.14	13.39	12.22	33.81	100.00

Table II

R_A–RATIO OLD AGE ANNUITY TO LIFETIME ANNUITY

Couple's Average Earnings

FREQUENCY / PERCENT / ROW PCT	30	50	60	70	80	90	100	110	120	130	140	TOTAL
$3000	0	0	4	4	4	7	6	13	15	11	118	182
	0.00	0.00	0.20	0.20	0.20	0.36	0.31	0.66	0.76	0.56	6.01	9.27
	0.00	0.00	2.20	2.20	2.20	3.85	3.30	7.14	8.24	6.04	64.84	
4000	1	2	2	2	1	12	4	14	6	12	87	143
	0.05	0.10	0.10	0.10	0.05	0.61	0.20	0.71	0.31	0.61	4.43	7.28
	0.70	1.40	1.40	1.40	0.70	8.39	2.80	9.79	4.20	8.39	60.84	
5000	0	0	1	3	3	10	8	8	20	12	105	170
	0.00	0.00	0.05	0.15	0.15	0.51	0.41	0.41	1.02	0.61	5.35	8.66
	0.00	0.00	0.59	1.76	1.76	5.88	4.71	4.71	11.76	7.06	61.76	
6000	0	0	0	3	3	13	13	15	23	23	122	215
	0.00	0.00	0.00	0.15	0.15	0.66	0.66	0.76	1.17	1.17	6.21	10.95
	0.00	0.00	0.00	1.40	1.40	6.05	6.05	6.98	10.70	10.70	56.74	
7000	0	0	1	2	4	12	14	25	21	20	141	240
	0.00	0.00	0.05	0.10	0.20	0.61	0.71	1.27	1.07	1.02	7.18	12.22
	0.00	0.00	0.42	0.83	1.67	5.00	5.83	10.42	8.75	8.33	58.75	
8000	0	0	2	2	6	9	12	20	26	24	152	253
	0.00	0.00	0.10	0.10	0.31	0.46	0.61	1.02	1.32	1.22	7.74	12.88
	0.00	0.00	0.79	0.79	2.37	3.56	4.74	7.91	10.28	9.49	60.08	
9000	0	0	0	3	4	10	16	19	19	17	120	208
	0.00	0.00	0.00	0.15	0.20	0.51	0.81	0.97	0.97	0.87	6.11	10.59
	0.00	0.00	0.00	1.44	1.92	4.81	7.69	9.13	9.13	8.17	57.69	
10000	0	1	1	1	8	6	5	9	10	13	111	165
	0.00	0.05	0.05	0.05	0.41	0.31	0.25	0.46	0.51	0.66	5.65	8.40
	0.00	0.61	0.61	0.61	4.85	3.64	3.03	5.45	6.06	7.88	67.27	
11000	0	0	0	1	3	1	14	10	8	17	57	111
	0.00	0.00	0.00	0.05	0.15	0.05	0.71	0.51	0.41	0.87	2.90	5.65
	0.00	0.00	0.00	0.90	2.70	0.90	12.61	9.01	7.21	15.32	51.35	
12000	0	1	1	4	9	14	16	10	25	30	167	277
	0.00	0.05	0.05	0.20	0.46	0.71	0.81	0.51	1.27	1.53	8.50	14.10
	0.00	0.36	0.36	1.44	3.25	5.05	5.78	3.61	9.03	10.83	60.29	
TOTAL	1	4	12	25	45	94	108	143	173	179	1180	1964
	0.05	0.20	0.61	1.27	2.29	4.79	5.50	7.28	8.81	9.11	60.08	100.00

net worth or if they indicated receiving a pension benefit, but failed to state the level.[1] The ultimate sample used contains about 1900 married couples. There are small variations in the tables because of differing data requirements.

Tables I and II report the distributions of old age to lifetime consumption ratios, cross-tabulated by the average earnings level (in 1969 dollars) of the couple between 1951 and 1969. Both tables indicate that over 90 percent of married couples can afford an old age level of consumption that exceeds 80 percent of their affordable lifetime consumption level. 84 percent of the couples can afford to purchase a larger annuity in their old age than they could afford to purchase at age 30; and 60 percent of elderly couples in the absence of annuity markets could afford to consume until age 88 at a constant higher level than the constant level of consumption they could have financed at age 30. The lower tails of the distribution are also of interest. Fewer than 1 percent of elderly respondents in 1969 faced an implied reduction in their standard of living of more than 40 percent; no respondents faced more than a 60 percent reduction. While these tables are based on an assumed two percent interest rate, tables based on a 4 percent interest rate yielded virtually identical distributions.

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[1] The consumption ratios do not appear to be biased upwards because of the omission of those respondents who fail to report either their value of their expected pension benefits or components of their wealth. Making the extreme assumption that all unreported components of wealth were zero and including respondents with unreported wealth in the analysis generated virtually no change in the distribution of R and R_A. The inclusion of those couples who have pensions, but who do not indicate their value in the analysis also has a trivial impact on the distributions even under the assumption that these couples will receive no pension whatsoever.

The distribution of R_A is shifted to the right relative to the distribution of R. The ability to purchase an annuity enhances consumption opportunities the most when the ratio of current net worth to total present expected resources is the greatest. Hence, the ratio of C^O_A to C^O exceeds the ratio of C^L_A to C^L and R_A exceeds R. The tables do not indicate any obvious pattern with respect to average earnings levels of greater or lesser old age resources relative to lifetime resources.

Table III presents the distribution of R, the consumption ratio under the no-annuities assumption for those couples with retired household heads. Retired couples seem to be significantly less well prepared for their old age than are couples whose head is still working in 1969. For 18 percent of retired couples, retirement assets are insufficient to finance old age consumption streams greater than 80 percent of the lifetime stream. The comparable percent for the entire sample is 9 percent. Under the annuity concept, 11 percent of retired respondents exhibit a ratio of old age to lifetime sustainable consumption under .8; the overall sample percentage in this case is less than 5 percent.

For those couples with no private pension,[2] the distributions of the RA and R ratios suggest somewhat less adequacy in old age resources than for the overall sample. Under the no-annuity consumption concept, 12 percent of the couples without pensions had a ratio less than .8, while 7 percent had an annuity ratio

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[2]The table underlying these conclusions is available on request from the authors.

Table III

R--RATIO OF OLD AGE CONSUMPTION STREAM TO LIFETIME CONSUMPTION STREAM, NO-ANNUITY CASE

Retired Sample

Couple's Average Earnings

FREQUENCY / PERCENT / ROW PCT	50	60	70	80	90	100	110	120	130	140	TOTAL
$3000	0	2	7	8	14	20	15	14	8	25	113
	0.00	0.56	1.97	2.25	3.93	5.62	4.21	3.93	2.25	7.02	31.74
	0.00	1.77	6.19	7.08	12.39	17.70	13.27	12.39	7.08	22.12	
4000	0	1	3	4	8	5	4	5	6	10	46
	0.00	0.28	0.84	1.12	2.25	1.40	1.12	1.40	1.69	2.81	12.92
	0.00	2.17	6.52	8.70	17.39	10.87	8.70	10.87	13.04	21.74	
5000	0	2	1	5	8	6	8	10	6	3	49
	0.00	0.56	0.28	1.40	2.25	1.69	2.25	2.81	1.69	0.84	13.76
	0.00	4.08	2.04	10.20	16.33	12.24	16.33	20.41	12.24	6.12	
6000	0	0	1	4	12	3	5	2	4	6	37
	0.00	0.00	0.28	1.12	3.37	0.84	1.40	0.56	1.12	1.69	10.39
	0.00	0.00	2.70	10.81	32.43	8.11	13.51	5.41	10.81	16.22	
7000	0	0	0	0	2	7	9	5	6	9	38
	0.00	0.00	0.00	0.00	0.56	1.97	2.53	1.40	1.69	2.53	10.67
	0.00	0.00	0.00	0.00	5.26	18.42	23.68	13.16	15.79	23.68	
8000	0	0	0	0	2	4	5	5	3	6	25
	0.00	0.00	0.00	0.00	0.56	1.12	1.40	1.40	0.84	1.69	7.02
	0.00	0.00	0.00	0.00	8.00	16.00	20.00	20.00	12.00	24.00	
9000	1	0	1	3	6	2	1	2	1	0	17
	0.28	0.00	0.28	0.84	1.69	0.56	0.28	0.56	0.28	0.00	4.78
	5.88	0.00	5.88	17.65	35.29	11.76	5.88	11.76	5.88	0.00	
10000	0	0	1	0	1	0	1	2	1	2	8
	0.00	0.00	0.28	0.00	0.28	0.00	0.28	0.56	0.28	0.56	2.25
	0.00	0.00	12.50	0.00	12.50	0.00	12.50	25.00	12.50	25.00	
11000	0	1	0	0	1	0	3	2	1	1	9
	0.00	0.28	0.00	0.00	0.28	0.00	0.84	0.56	0.28	0.28	2.53
	0.00	11.11	0.00	0.00	11.11	0.00	33.33	22.22	11.11	11.11	
12000	0	0	0	0	0	3	4	3	0	4	14
	0.00	0.00	0.00	0.00	0.00	0.84	1.12	0.84	0.00	1.12	3.93
	0.00	0.00	0.00	0.00	0.00	21.43	28.57	21.43	0.00	28.57	
TOTAL	1	6	14	24	54	50	55	50	36	66	356
	0.28	1.69	3.93	6.74	15.17	14.04	15.45	14.04	10.11	18.54	100.00

Interest rate is zero.

less than .8. For both the samples of retired couples and couples with no pension, fewer than one percent of respondents indicate R and RA ratios that are less than .5.

While we encourage the reader to draw his (her) own conclusions from the tables, we find the numbers in these tables fairly high relative to our priors. Assuming unconstrained and non-myopic stress, we see no evidence of significant undersaving. In viewing these numbers, it should be recalled that some individuals, even in the presence of perfect annuity markets, may prefer to consume at a lower rate in their old age than in their youth, while some couples may prefer the opposite. In the absence of perfect annuity markets, there is a fairly strong argument for rational, expected utility maximizing individuals to plan to consume at significantly lower levels in their old age than in their youth. When annuity markets, or good substitutes, are not available, a consumer's probability of death will enter into his intertemporal optimization problem exactly like a higher rate of time preference. Real world mortality probabilities would suggest a fairly steep decline in consumption with age when annuities are not available. Table IV uses the CES utility function,

$$EU = \sum_{t=0}^{D} P_t \frac{C_t^{1-\gamma}}{1-\gamma} \alpha^t \quad ,$$

to calculate the optimal decline in consumption for a single individual with no access to an annuities market. P_t is the probability of surviving to period t; D is the latest date at which

Table IV.

AGE CONSUMPTION AND AGE WEALTH PATHS
FOR SINGLE MALE WITH NO ANNUITIES

Age	Risk Aversion	Consumption	Wealth
55	.75	6825	$100,000
65	.75	4720	47,415
75	.75	2250	13,830
85	.75	395	1,420
95	.75	10	30
55	1.25	5465	100,000
65	1.25	4395	57,200
75	1.25	2810	23,675
85	1.25	990	5,165
95	1.25	110	475
55	1.75	4795	100,000
65	1.75	4100	52,680
75	1.75	2980	30,680
85	1.75	1415	9,505
95	1.75	295	1,690

Interest rate is 1 percent. Rate of time preference is 1 percent.

the individual can remain alive. The term α is the time preference parameter and γ is the degree of risk aversion. The table indicates that a single 55-year old male with risk aversion parameter of 1.75 would optimally consume at 65 only 85 percent of his aged 55 consumption level. For risk aversion of .75, age 65 consumption is only 70 percent of aged 55 consumption.

There are, of course, arguments for a rising level of consumption of resources as one ages. There appear to be particular types of risks, such as the need for nursing home care, that are poorly insured by private markets. In addition, many elderly people appear to have a strong fear of becoming a "burden" to their children.

How do these numbers square with the standard findings from national surveys of the elderly that large fractions of the elderly have little or no net wealth and a larger fraction has no positive liquid wealth? The figures presented here are consistent with these facts. While fewer than 5 percent of married couples exhibit values of RA that are less than .8, slightly more than one-third of couples reported levels of net worth that represent less than 10 percent of their total future resources. In addition, 67 percent of married couples held less than 10 percent of their future resources in liquid wealth. Of these couples, 21 percent had no liquid wealth whatsoever. Despite the fact that a significant fraction of the elderly have little or no liquid or illiquid wealth, their social security, pension, and earnings stream are sufficient to finance a level of old age

consumption that is as large or larger than they enjoyed in their youth.

Analysis of the rate at which the elderly consume their retirement resources provides another test of the ability of the elderly to cogently plan their old age consumption. Table V presents the ratio of the annuity that elderly couples could have financed in 1971 to the annuity they could have financed in 1969. A ratio close to unity suggests that couples are managing to provide a level consumption stream as they age. Table V indicates that roughly 60 percent of couples have ratios of the 1971 affordable annuity that is within 10 percent of the 1969 affordable annuity. In 1971, over 15 percent of couples could have financed an annuity that was more than 10 percent larger than they could have financed in 1969. On the other hand, almost 25 percent of 1971 couples could not have financed an annuity as large as 90 percent of the 1969 annuity; 6 percent of couples could not afford an annuity that was 70 percent of the 1969 annuity.

These data provide no overwhelming prima facia support for our existing massive forced savings programs; they also provide no strong support for recommended expansion of the social security and private pension systems. While this evidence provides little positive justification for forced savings, does it provide any compelling evidence against forced savings? To consider this question, the distributions of R and RA were recomputed under the extreme assumption that in the absence of social

Table V

RATIO OF ANNUITY IN 1969 TO ANNUITY IN 1971*

Couple's Average Earnings

FREQUENCY / PERCENT / ROW PCT	30	40	50	60	70	80	90	100	110	120	130	140	TOTAL
3000	1	2	2	3	5	4	13	61	53	34	26	17	221
	0.04	0.08	0.08	0.12	0.19	0.15	0.50	2.36	2.05	1.32	1.01	0.66	8.56
	0.45	0.90	0.90	1.36	2.26	1.81	5.88	27.60	23.98	15.38	11.76	7.69	
4000	0	0	1	1	5	3	24	64	41	32	9	10	190
	0.00	0.00	0.04	0.04	0.19	0.12	0.93	2.48	1.59	1.24	0.35	0.39	7.36
	0.00	0.00	0.53	0.53	2.63	1.58	12.63	33.68	21.58	16.84	4.74	5.26	
5000	0	1	2	1	3	9	26	78	48	29	12	9	218
	0.00	0.04	0.08	0.04	0.12	0.35	1.01	3.02	1.86	1.12	0.46	0.35	8.44
	0.00	0.46	0.92	0.46	1.38	4.13	11.93	35.78	22.02	13.30	5.50	4.13	
6000	2	0	1	7	3	6	37	116	72	25	8	11	288
	0.08	0.00	0.04	0.27	0.12	0.23	1.43	4.49	2.79	0.97	0.31	0.43	11.15
	0.69	0.00	0.35	2.43	1.04	2.08	12.85	40.28	25.00	8.68	2.78	3.82	
7000	0	0	0	5	8	13	39	134	79	24	4	11	317
	0.00	0.00	0.00	0.19	0.31	0.50	1.51	5.19	3.06	0.93	0.15	0.43	12.28
	0.00	0.00	0.00	1.58	2.52	4.10	12.30	42.27	24.92	7.57	1.26	3.47	
8000	0	0	3	5	14	14	43	152	63	23	12	11	340
	0.00	0.00	0.12	0.19	0.54	0.54	1.67	5.89	2.44	0.89	0.46	0.43	13.17
	0.00	0.00	0.88	1.47	4.12	4.12	12.65	44.71	18.53	6.76	3.53	3.24	
9000	0	1	0	4	10	15	37	111	61	17	7	7	270
	0.00	0.04	0.00	0.15	0.39	0.58	1.43	4.30	2.36	0.66	0.27	0.27	10.46
	0.00	0.37	0.00	1.48	3.70	5.56	13.70	41.11	22.59	6.30	2.59	2.59	
10000	1	1	1	4	5	17	39	94	42	10	3	4	221
	0.04	0.04	0.04	0.15	0.19	0.66	1.51	3.64	1.63	0.39	0.12	0.15	8.56
	0.45	0.45	0.45	1.81	2.26	7.69	17.65	42.53	19.00	4.52	1.36	1.81	
11000	2	0	0	4	8	9	20	58	21	11	5	4	142
	0.08	0.00	0.00	0.15	0.31	0.35	0.77	2.25	0.81	0.43	0.19	0.15	5.50
	1.41	0.00	0.00	2.82	5.63	6.34	14.08	40.85	14.79	7.75	3.52	2.82	
12000	2	3	12	19	11	34	92	124	40	12	12	14	375
	0.08	0.12	0.46	0.74	0.43	1.32	3.56	4.80	1.55	0.46	0.46	0.54	14.52
	0.53	0.80	3.20	5.07	2.93	9.07	24.53	33.07	10.67	3.20	3.20	3.73	
TOTAL	8	8	22	53	72	124	370	992	520	217	98	98	2582
	0.31	0.31	0.85	2.05	2.79	4.80	14.33	38.42	20.14	8.40	3.80	3.80	100.00

*Measured as a percent

security, all individuals would have fully consumed their tax contributions. The effect of setting all social security taxes and benefits to zero has a dramatic effect on the distribution of the ratios of old age to lifetime consumption. In the case of annuities, over 40percent of the sample would suffer at least a 20 percent reduction in their consumption levels in a world in which social security had no effect on private savings. Of the 40percent, 20 percent would suffer over a 50 percent reduction in consumption, and 9 percent would suffer over a 70 percent reduction in consumption.

The results are even more impressive if one considers the subset of the population that is retired and that has no pension benefits. For this group, eliminating social security from the calculation and assuming no offsetting private savings response leaves 32 percent of the sample with a retirement annuity lower than one-third of their lifetime annuity. In the no annuity framework, 65 percent of the sample would face a 50 percent or greater reduction in their standard of living.

These numbers are sufficiently dramatic to conclude that no strong case could be made for or against social security and other forced savings programs unless and until one pins down the exact savings resonse to these programs. This is a topic explored in the next section.

Explaining Individual Differences in the Adequacy of Savings

In this section, we study the determinants of individual savings adequacy. Two broad classes of variables are examined. First, the relation of savings adequacy to demographic characteristics is studied. Second, resource adequacy at retirement is related to the pattern of lifetime income receipts. Under the strict life-cycle hypothesis with no capital market constraints or myopia, the level of wealth should be independent of the form and timing of lifetime income. If individuals do not foresee income streams such as social security or pensions, which come later in life, or if they do foresee them, but are unable to borrow against them, then persons receiving relatively more income in these forms should have more adequate resources available for retirement consumption.

Table VI presents regressions relating the ratios R_A and R, old age consumption to lifetime consumption, to demographic variables and variables reflecting the form and timing of lifetime resources. The demographic variables are self-explanatory. Home is a dummy variable which equals one if the family owns a home and zero otherwise. The variable SSRATI is the ratio of social security wealth to the present value of lifetime resources from all sources -- social security, labor income and pension benefits. PRATI is a similar ratio constructed using pension wealth (PENW), and FRATI is constructed in the same way using the present value of future labor income (FUTW). In equations (3) and (4) the level of lifetime resources LTR and

EXPLAINING THE INTERTEMPORAL ALLOCATION OF CONSUMPTION

Dependent Variable	Equation 1 R_A	Equation 2 R	Equation 3 R_A	Equation 4 R
Independent Variables				
Constant	-2.134 (5.523)	-0.581 (2.323)	-1.813 (4.716)	-0.279 (1.135)
Age	0.042 (6.833)	0.018 (4.563)	0.044 (7.307)	0.020 (5.209)
ED 1	-.063 (3.259)	0.036 (2.669)	-0.088 (4.255)	-0.053 (3.989)
ED 3	.085 (2.734)	0.045 (2.281)	0.079 (2.586)	0.047 (2.435)
RACE	-0.087 (2.907)	-0.052 (2.695)	-0.113 (3.847)	-0.071 (3.790)
HOME	0.102 (4.525)	0.064 (4.404)	0.120 (5.462)	0.078 (5.534)
SSRAT 1	2.517 (18.611)	1.571 (17.962)	2.509 (10.375)	1.372 (8.878)
PRAT 1	2.258 (13.686)	1.713 (16.051)	2.315 (5.490)	1.576 (5.848)
FRAT 1	2.027 (23.863)	1.243 (22.632)	2.191 (11.271)	1.357 (10.918)
DEN 1	--	--	1.5×10^{-7} (0.376)	-2.3×10^{-7} (0.891)
DSRAT 1	--	--	-1.2×10^{-5} (7.686)	-8.1×10^{-6} (8.276)
DPRAT 1	--	--	9.0×10^{-7} (0.505)	1.6×10^{-6} (1.402)
DFRAT 1	--	--	2.3×10^{-7} (0.247)	2.5×10^{-7} (0.409)
$\bar{R}^2$	0.3673	0.3595	0.4030	0.4009

Note: Absolute value of t-statistic in parentheses.

other variables reflecting the form of lifetime income are introduced.

The results for the demographic variables are quite consistent with a priori expectations. The adequacy of wealth accumulation rises sharply with education and is lower for minority groups. The magnitude of the coefficient implies that the consumption profile of non-whites is 9 percent lower relative to that of whites during the retirement period. Education has an even greater effect; a 15 percent difference separates persons without a high school degree from those with a college education. As one would expect, home owners, ceteris paribus, have a higher level of retirement assets. Comparison of equations (1) and (2), or (3) and (4) shows that the results do not depend significantly on whether or not feasible consumption is calculated on an annuity basis.

The three variables reflecting the form and timing of lifetime income are all highly significant. The equations based on the annuity concept imply that a 10% increase in the fraction of lifetime income coming in the form of social security raises the level of relative old age consumption by close to 20 percent. The impact of private pensions and future labor income is similar. The coefficients imply that in the absence of social security and private pensions, consumption in old age relative to lifetime consumption would be about 40 percent lower for the average person. This finding suggests that because of either capital market constraints or myopia, social security significantly raises the level of retirement consumption. Likewise, it implies

that the crowding out of private savings is substantially less than dollar for dollar.

It was hypothesized above that if capital markets constraints are an important reason for the positive relationship between social security and savings, the relationship should be relatively more attenuated for more affluent persons who have higher lifetime incomes and more access to the capital markets. This suggestion is borne out by equations (3) and (4), which reveal a significant negative interaction between the social security fraction of lifetime income and lifetime income. Interestingly, a similar effect is not found for private pensions or future labor income. This may be evidence that myopia is more prevalent with respect to pension than social security benefits.

V. Summary and Conclusion

The results in this paper suggest that there is currently no systematic problem of undersaving among the elderly population. The vast majority of the aged population can sustain a higher level of consumption than they could have financed at earlier ages based on their lifetime resources. While these data came from the early 1970's, substantial increases in real Social Security benefits and real home prices that have occurred over the last decade suggest our conclusion would be strengthened if current data were available. Claims that additional public measures are needed to insure an adequate amount of savings for retirement appear to be unfounded.

To a large extent, Social Security contributed to the sound financial position of the aged population. If Social Security were removed, and not replaced by private accumulation, a large fraction of the aged population would face very sharp declines in living standards. Econometric evidence presented in the final section of the paper indicates that persons receiving more Social Security benefits have relatively higher levels of sustainable consumption at retirement. This finding suggests that Social Security may have made a substantial contribution to the economic welfare of the elderly.

This research could usefully be extended by considering more recent data, and by more fully exploiting the longitudinal character of the data. It might also be desirable to examine the economic situation of single persons, particularly widows, who are thought to suffer the most economic deprivation in old age. More fundamentally, our results underscore the need for a fuller

understanding of the motivations for and determinants of individual saving.

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