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CONCEPTS AND MEASURES OF EARNINGS
REPLACEMENT DURING RETIREMENT

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ABSTRACT

This paper compares the well-being of the Retirement History Survey of the elderly with their own previous levels of income and economic welfare. Traditional replacement rates are calculated, although a number of shortcomings of such measures are discussed. Modifications are made by examining career average rather than peak earnings, by adjusting for the fact that the incomes of the elderly are taxed more lightly, that the elderly do not have dependent children, and that Social Security income in retirement is a safer source of income than earnings earlier in life. The fully adjusted total income measures are at least as high for almost all classes of households in the survey as their career average pre-retirement earnings.

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1. Introduction

The current generation of elderly retired persons is wealthier than any elderly generation preceding it. By some measures, it is quite well off relative to the current younger generation of workers. For a variety of reasons, however, we may be interested in how well off elderly retirees are relative to their standard of living during their own working years. This interest may stem from a desire to infer the private planning and foresight capabilities of persons prior to retirement; or to report the economic history of the entire life cycle of the cohort; or to evaluate the role of public policy in affecting the well-being of the elderly (for example, by providing social security benefits).

Any such comparison is fraught with conceptual and measurement difficulties. The concepts and measures one might employ to examine the economic well-being of the elderly relative to their own previous economic well-being certainly presume much about the structure of the economy, not to mention what makes people economically better or worse off. For example, most life cycles have age-specific opportunities and expenses, such as those involved with raising children. One's views about the extent to which capital markets are sufficiently well-developed to insure against all risks at actuarially fair rates certainly must color the time period over which well-being is measured and the method of valuing income streams at different dates from alternative sources with varying risk properties. Many other such issues arise, some of which will be discussed in more detail below.

Perhaps the most commonly used measure of relative well-being post and pre-retirement is the so-called replacement rate. Replacement rates frequently are used in describing, and evaluating, the level of social security or private pension benefits. They are, simply, a ratio of some measure of post-retirement income to some, not necessarily similar, measure of pre-retirement income. Many private pensions report the ratio of the pension benefits to earnings in the year prior to retirement. A frequent measure for social security is the ratio of social security benefits to an average of the highest three of the ten years prior to retirement. While such measures of relative well-being may be simplistic, and subsume much about absolute versus relative incomes, the value of leisure, income versus consumption, ability to draw down the principal from accumulated savings, etc., they do tend to dominate public policy discussions. For example, recent proposals to alter the structure of social security benefits were often criticized because they would have reduced replacement rates, as usually measured, somewhat. Current replacement rates are due to fall slightly for low, and rise somewhat for high, income families through time.¹ As we shall see, it is by no means evident that average replacement rates are "low" as the usual measures seem to imply, either from the standpoint of relative economic position of pre- and post-retirement or from the standpoint of apparent planning/foresight ability.

The purpose of this paper is to begin to examine some of the issues surrounding potential improvements in concepts and measures of replacement rates. We are aware that more elaborate information may be useful, but since much of the discussion undoubtedly will continue to take place in the context of replacement rates, we seek to point toward some improvements in their

measurement. Some of these (potential) improvements have been suggested, explicitly or implicitly, in previous research. Section 2 presents a brief literature review focusing on concepts and measures of the economic well-being of the elderly and/or of comparisons of post and pre-retirement incomes, consumption, wealth, etc.

Section 3 highlights what we consider to be many of the major conceptual issues in measuring the well-being of the elderly relative to their previous standard of living. Among the issues raised are the treatment of taxes, expenses of raising children, health and health care costs, income uncertainty, and uncertainty about the date of death.

Section 4 presents our empirical results, a series of measures of replacement rates under alternative assumptions/definitions for various groups in the elderly population. These are estimated from the longitudinal Retirement History Survey combined with social security earnings records. The adjustments we tentatively propose as reasonable lead to a quite different perception about the "adequacy" of replacement rates, both for social security and for total income, than the traditional measures. Indeed, they suggest that earnings are virtually fully replaced for many of the elderly by social security alone; that for many more, social security replaces a large fraction of earnings; and that total post-retirement income usually exceeds pre-retirement income.

Section 5 discusses potential future research. Included are the need to go beyond averages to better understand the extent and causes of low replacement rates among those elderly not very well off and to analyze more fully the potential role by imperfections in annuities markets combined with

rapidly increasing life expectancies for the elderly and difference between anticipated and unanticipated beneficiaries. This section also offers a brief summary and conclusion.

The Appendix details the data and our use of them.

2. A Brief Literature Review

A variety of previous studies have attempted to explore similar or related questions to those we pose here. For example, Fox (1982) calculates social security, pension and total income replacement rates for 1976 for various population groups based on the first few waves of the Retirement History Survey. While he makes several comparisons similar in spirit to some of our adjustments (pre and post-tax; relative to career average earnings, etc.), his results are comparable only to the earlier years we report. The continued growth of social security benefits, the additional benefits as spouses reach eligibility age and several other factors, render our results noncomparable. Even by 1976, however, he shows the importance such adjustments might make. However, his career average earnings are indexed by wage growth and therefore greatly overstate the average absolute real level of earnings; his career average replacement rates have a relative income component imbedded in them.

Schultz, et al. (1974) discuss alternative concepts and measures of replacement. They report various organizations' notions of appropriate measures of "full replacement." For example, the AAUP suggests comparing post-retirement benefits to the last few years of after-tax earnings prior to retirement, and that two-thirds is the appropriate replacement rate.

Various cost-of-living comparisons by the Bureau of Labor Statistics (1968) put the income required of a couple with husband aged 65-74 at 51 percent of that of a couple aged 35-54 with children 15 and six years of age. Henle (1972) adjusts for differences in expenses and taxes and gets 0.7 and 0.8 as estimates of "full" replacement for high and low wage workers, respectively.

Marilyn Moon (1977), using data from the Survey of Economic Opportunity of 1966-67, makes a variety of adjustments in the usual money income measure to get a more comprehensive measure of the "real income" of the elderly. Among her important adjustments are for in-kind transfers, the annuitized value of assets (following Hansen and Weisbrod's (1968) approach), etc. These adjustments substantially increase the incomes of the elderly.

Boskin and Hurd (1982) establish that the cost-of-living for the elderly as a group, and also by various five year age cohorts, is quite close to that of the general population, once a rental equivalence substitution is made (as is now being done in the CPI) in the historical CPI figures. Thus, income measures will reflect real purchasing power.

The most extensive recent treatment of the real income of the elderly is by Hurd and Shoven (1982). They document the rapid absolute and relative gains made by the elderly in the 1970s and attribute much of it to the growth of real social security benefits.

Hammermesh (1982) attempts to estimate consumption and annuitizable income for a subsample of the Retirement History Survey. He reports for 1973 and 1975 that consumption exceeds annuitizable income and therefore argues savings are inadequate to maintain consumption. While direct examination of consumption is surely an important contribution, several reasons lead us to be dubious of these conclusions. First, as noted above, real benefits continued to increase in social security. More important, for many of these families, the value of the spouse's social security benefit would not be apparent until later on when he/she became eligible (it is not apparent how Hammermesh treated spouse's and widow's benefits). Also, at this stage of their lives, the elderly spend substantial amounts on

health care, and (apparently) no adjustment is made for medicare. Most important, the estimated ratio of consumption spending reported in the Retirement History Survey to true consumption is about 0.6. The inclusion of non-sustainability is sensitive to any potential measurement error in the ratio.

Finally, Kotlikoff, Spivak and Summers (1982) come to exactly the opposite conclusion as Hammermesh, again examining early years of the Retirement History Survey. They attempt to estimate two polar cases: Simulating perfect annuities markets and no annuities markets. They calculate the ratio of the level consumption paths which could be purchased when young and old, respectively, based on the present expected value of lifetime resources and old age resources in the annuities case; and the constant levels which would be planned assuming no annuities but level consumption until age 88. They also examine the level of the annuity which could be purchased in 1969 versus 1971, to examine how the elderly manage their retirement resources. They conclude that no strong case can be made that savings are inadequate and that the ratios of old age to lifetime consumption streams as constructed cluster around one or slightly above one. Their results are not really comparable to ours, but are complementary in that they examine consumption possibilities pre-retirement based on eventual realized social security and pension "wealth"; we examine earnings pre-retirement, a likely upper bound on actual consumption. Since it is unclear that consumption plans pre-retirement could be based on expectation of the growth in social security benefits and coverage which eventually occurred, including the introduction of Medicare in 1965, an alternative interpretation of Kotlikoff, et al. (1982) is possible. It may well be that these households did not expect

these large windfalls and that their modest pre-retirement consumption levels were due less to careful retirement planning than to lower expected wealth.

In brief summary, other than documenting the rise in real social security benefits in recent years and the improved absolute and relative income of the elderly, there is little agreement on whether consumption can be maintained during retirement given current resources, or on the proper measurement of consumption, or on what income or consumption-based replacement rate is "appropriate."

3. Conceptual Issues

The primary purpose of this paper is to compare the standard of living of the elderly with their own standard of living in their earlier work years. This topic raises several research questions. First, is the observed pattern of consumption by age consistent with the perfect foresight life cycle model, or is there evidence of sub-optimal saving during work life resulting in inadequate provision for consumption during retirement? Second, is there evidence that the large and unexpected windfall gains from social security received by the Retirement History population (see Hurd and Shoven (1983)) distorted the age profile of consumption for this group? Third, what is the distribution of standard of living in retirement relative to pre-retirement? What are the figures for those with different earnings histories? Fourth, who in the population has low replacement rates? Who is at the bottom of the replacement rate distribution, particularly among the poor? We will not answer all of these questions, but they are our research agenda.

The problem we are addressing is not a simple one. There are both serious methodological and measurement issues. Should the replacement rate be defined in terms of consumption, income, or utility? While utility is closest to what we would like, it is the least measureable. Consumption is better than income, but again, consumption data is notoriously bad in panel surveys. This leads us to an income based measure which can be adjusted in several ways to make it more closely correspond with our more ideal measures.

The literature on replacement rates has always had unity as the standard. Certainly for income based measures, however, there is no

particular appeal to unity and the life cycle model would predict a replacement rate below one. Take, for example, the simplest life cycle model with a fixed lifetime D , fixed retirement age R , fixed labor earnings between age 0 and R and a rate of time preference equal to the interest rate. If utility is time separable, if there is no bequest motive, and if $U'' < 0$, then the optimal age-consumption profile is flat, as shown in Figure 1. The point for our purposes is that if we compare post-retirement income ($rW(\text{age})$), where r is the interest rate and W accumulated wealth, with before retirement earnings, we get a ratio far less than unity, highly dependent on the rate of return on accumulated wealth. For example, if the interest rate were zero, an income based measure of replacement rates would be zero, while there would be full replacement of consumption. In fact, retirement income, in this example, must always be less than consumption (which must be less than pre-retirement earnings). If it were not, wealth would continue to accumulate and large bequests would be left. However, this cannot be optimal since we have assumed $U' > 0$ and zero bequest motive.

While capital income in retirement in Figure 1 falls short of pre-retirement earnings, the remaining wealth at each retirement year is sufficient to finance a consumption annuity. If a tax-transfer version of social security is imposed on the above life cycle model, it would lower after-tax earnings during the work life and raise income during retirement. Income based measures of replacement rates would be higher, but the basic pattern would be similar and the magnitude would still be less than unity if social security benefits were fully anticipated and there were perfect capital markets.

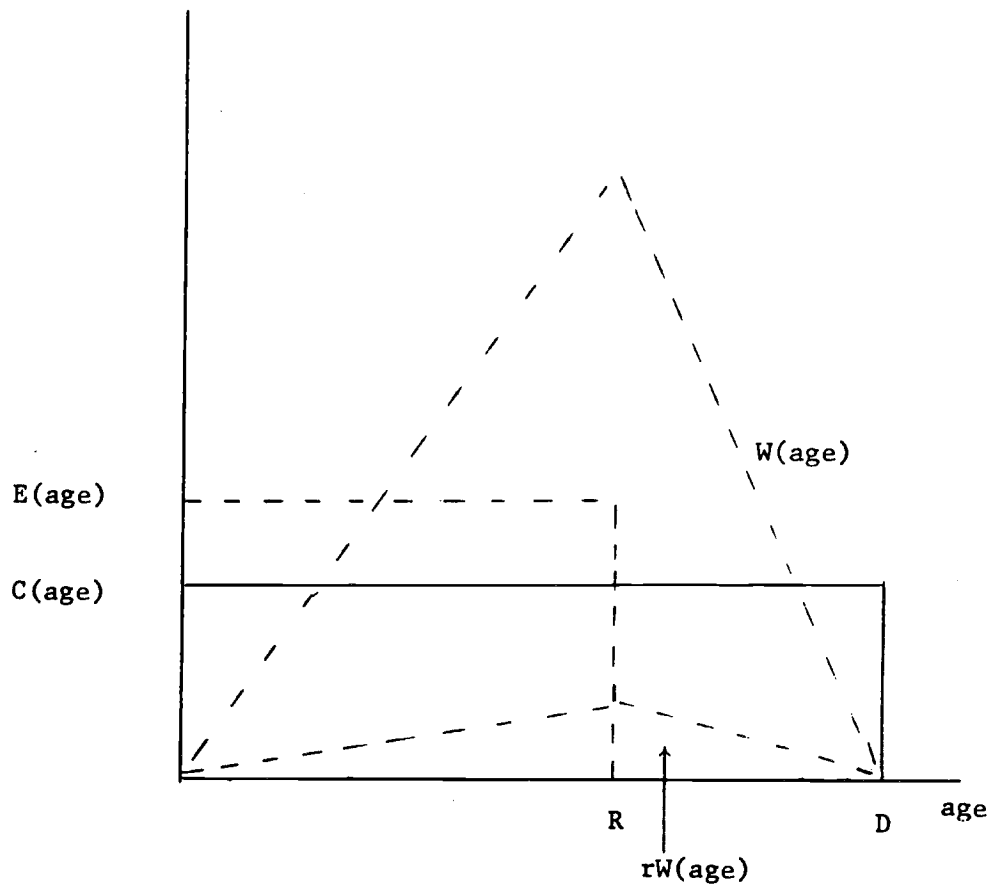


Figure 1

The example above would change if we incorporate an uncertain date of death. With perfect annuity markets, the analysis would be identical to that of a certain death date at the life expectancy. However, with imperfect or no annuity markets, the pattern of planned consumption is more likely to decline with age. This is due to discounting at the sum of the pure rate of time preference plus the mortality hazard rate (which increases with age and which at least eventually exceeds the interest rate).

A Notation for Discussing Some Important Issues

We follow the usual convention of writing lifetime well-being as an additively separable utility function of instantaneous, or annual, utilities:

$$(1) \quad W_{\lambda} = \sum_{t=1}^D U_t(C_t, L_t, Z_t)$$

where C_t , L_t , and Z_t are consumption of goods, leisure and a vector of other variables at time t , and D is the (known) date of death. Clearly, additive separability is quite extreme in discussing lifetimes; for example, a minimum consumption of food, medical care, etc., is necessary for survival. We merely use this as a way of discussing issues, not as an estimation device.

Further simplification divides the lifetime into two periods, working years (W) and retirement (R). Representative utility in each period is described by

$$(2) \quad U_i = U_i(C_i, L_i, Z_i) \quad i = W, R$$

Usually, W will be about twice (or more) as long as R . Let us, however, compare a typical or representative year in each period. We then need to evaluate

$$(3) \quad \frac{U^R(C_R, L_R, Z_R)}{U^W(C_W, L_W, Z_W)}$$

Of course, in actuality, income, consumption and other variables fluctuate during both the work life and the retirement period. Some of this fluctuation may represent errors in measurement and some imperfect capital markets and therefore imperfect opportunities for smoothing. Most importantly, opportunities for income generation are not constant during an individual's work life. These considerations regarding income and consumption variability imply that there is a large difference between career average consumption or income and the peaks of these flows. Our judgment is that retirement resources should be compared with career average resources as the base case, with other comparisons augmenting this information.

Some Conceptual Issues

The first difficulty in usual replacement rate calculations or comparisons of consumption streams is readily apparent: the failure to value leisure or nonmarket work time. Obviously, $L_R > L_W$ on average, as usually measured. The interpretation of this phenomenon is, however, quite complicated. For the "young" elderly without severe health problems, it is not reasonable to ignore the value of the extra nonmarket time available to them relative to working years. However, a variety of distortions, selection problems, etc., make it difficult to argue that the market wage of "similar" persons

continuing to work is the relevant shadow value of the leisure at the margin. Further, we suspect several institutional rigidities make it difficult for all those who wish to do so to move to part-time work (see Fuchs (1984), who notes a trend to shift to self-employment presumably as one vehicle for making hours more flexible). Blinder, et al. (1980) note a decline in hourly earnings as the elderly change jobs. Presumably, valuing the marginal unit of extra leisure at the corresponding wage of those who work places a lower bound on the value of the first unit of leisure. But, as leisure (or household work or volunteer time) becomes "full-time," it is likely that its marginal value will fall. And the trend to earlier retirement² at a time of improved health of the elderly³ surely indicates the voluntary nature of much of this "leisure."

At the other extreme, the "old" elderly may contain a substantial number of persons whose work would seriously impair their health. Others may suffer severe psychological problems from withdrawal from the labor force.

All of these issues, and more, make it difficult to value "leisure" for the elderly. We only note the problems here and return to the more usual measures.

The variable Z may include items such as age-specific expenses, for example, in raising children or on health care. This immediately raises additional issues. The direct utility function (3) may be rewritten in indirect form:

$$\frac{V^R(P_R, I_R)}{V^W(P_W, I_W)}$$

where P_i is the vector of prices faced by the household in stage of life i , and I is income in i . Is gross income the appropriate measure to include

in V^I ? In addition to netting out taxes (and perhaps pension contributions and other retirement saving), what about "necessary" expenses? Suppose K represents spending on children. If expenditure on children is perfectly inelastic--a basic amount is necessary to "produce and raise" a standard child, there is no joint consumption and no special utility value of children early in life (children are a "durable good" providing (net) utility throughout one's life), then the appropriate income measure is $I - K$ and we should calculate

$$\frac{V^R(P_R, I_R)}{V^W(P_W(I_W - K))}$$

Even worse examples of ignoring expenditures on children exist. Suppose, for example, one works more or harder and income increases more than directly observed K when the children come along because of transactions costs in borrowing. Then the observed extra income and consumption may not measure increased utility. Of course, not all spending on children is "necessary." Some is clearly for (attempted) quality improvement, or discretionary. How should this be netted out?

Analogous problems arise with health care expenditures. If the demand for medical services is perfectly inelastic with a given amount necessary to maintain health and amounts beyond that provide no utility, then income net of health expenditure is the appropriate measure. If demand for health care is not completely inelastic, actual health expenditures are only a proxy for true health needs, and subtracting all expenditures will understate "net" income. Again, observed income may rise to compensate for greater medical costs (if he/she is able), further complicating the story.

Health expenditures rise substantially as a share of income in old age. Further, the bulk of the costs are paid for by Medicare and Medicaid.

If we do not include at least the insurance value of Medicare in the retirement income, we ought to subtract net health insurance premiums from earnings during work years.

Because the out-of-pocket hospital and physicians expenditures for the elderly are small relative to the total, it may well be that adding the average Medicare payment to the incomes of the elderly, as is often done, would overstate the proper adjustment.

While each of these problems is non-trivial, it is clear that ignoring the public transfers in the insurance value of Medicare as income sources for the elderly without netting health care costs for work years will, on average, lead to an understatement of replacement rates. Thus, the empirical results presented below probably understate replacement rates.

Another important conceptual issue in comparing a certain income stream from social security to an uncertain earnings stream is the discount for risk in the earnings, or equivalently, the "certainty bonus," for social security (aside from its annuity value). At one extreme, capital markets may be so imperfect and informal intrafamily arrangements nonexistent, that annual fluctuation in earnings may be quite a problem. Even with perfect capital markets, however, the risk in career earnings from occupational choice, etc., may be substantial. Define the equivalent certain income as that which satisfies

$$E U(\tilde{y}) = U(y)$$

where \tilde{y} denotes a random income and y certain income. If y has mean m and variance σ^2 , taking a Taylor series expansion of U about m yields

$$y \approx m - \frac{\sigma^2}{2 R(m)}$$

where $R(m) \equiv -\frac{U'(y)}{U''(y)}$, what is called the risk-tolerance in the finance literature, or the reciprocal of the Arrow-Pratt measure of absolute risk aversion. The difference between the mean and the equivalent certain income is a "risk charge." Alternatively, one can "gross-up" the certain income with a certainty bonus in comparison with risky income flows. We make such an adjustment below. To our empirical results we now turn.

4. Results

We have computed replacement rates for the Retirement History Survey population in a number of different ways, for various years, and for several subpopulations. Table 1 displays the results for a conventional measure similar to that frequently reported by the Social Security Administration. Two figures are given for those retired in the 1971 through 1979 Survey waves;⁴ first, the ratio of social security retirement benefits received to the average of the highest three years of price-indexed earnings in the ten years prior to retirement and second, the ratio of total income (pensions, interest, dividends, rental income, earnings, transfers, social security, etc.) in retirement to the same average high-three earnings figure. The numbers are calculated separately for widows and for married couples. The widows in our tables are those whose spouses died since the survey began in 1969. This permits us to compare retirement benefits with the combined earnings records of both spouses. These combined earnings histories are the basis for the denominator for both widows and married couples.

The social security numbers in Table 1 seem rather modest, ranging for married couples from 22 percent replacement in 1971 to 37.4 percent in 1979. They are lower for widows by a factor only slightly different than two-thirds, which is what we anticipated. Our priors were based on the fact that single earner married couples who wait until 65 years of age to collect retirement receive 150 percent of their "Primary Insurance Amount", while the surviving spouse receives 100 percent.⁵ The average social security replacement rate for married couples in this population increased by more than 50 percent from 1971 to 1979. This reflects a number of facts. First, at the later dates both spouses are more likely to be collecting social

TABLE 1

UNADJUSTED REPLACEMENT RATES RELATIVE TO HIGH-3 AVERAGE ANNUAL INDEXED EARNINGS, BY HOUSEHOLD TYPE

	1971	1973	1975	1977	1979
<u>Married Couples</u>					
Social Security	22.4	30.6	34.0	36.5	37.4
Pension + Soc. Sec.	34.1	42.2	45.6	47.7	47.6
Total	70.6	72.3	69.0	68.7	68.6
<u>Widows</u>					
Social Security	. . .	18.0	21.3	22.6	23.9
Pension + Soc. Sec.	. . .	25.1	29.5	28.0	28.4
Total	. . .	60.3	47.6	48.9	44.0

security rather than just one. Second, those who retire at later dates and ages receive actuarial adjustments in their annuities. Third, as this population ages, it works less and therefore fewer of the retired give back their social security benefits via the earnings test. Fourth, the real level of benefits was increased in 1972 and rose further for those who worked in the double indexing period of 1973-77. Despite the rise in the social security replacement rate for married couples, their total unadjusted replacement rate remained virtually constant at 70 percent. This may indicate that the population is decumulating private assets in a way which offsets their increased social security receipts. The significant difference between the average total replacement rates in Table 1 and the average social security replacement rates indicates that those who rely totally on social security have reasonably low resources available to them in retirement relative to their pre-retirement earnings.

Table 2 compares retirement income with 1951-74 career average real earnings where earnings have been indexed using the Personal Consumption Expenditure deflator of the National Income Accounts. The pattern of the figures in Table 2 is very similar to those in Table 1, but the level is increased by roughly 50 percent.⁶ Interestingly, the average total replacement rate for married couples is 100 percent by 1979 when the denominator is career average indexed earnings. The social security replacement rate with this basis for comparison is over 50 percent by 1979. The 50 percent increase in replacement rates of Table 2 versus Table 1 reflects both the issues previously mentioned: income variability and the extraordinary real wage growth that members of this generation experienced near the ends of their careers.

Tables 3 and 4 show social security, social security plus private pensions, and total replacement rates where the denominator is average

TABLE 2

UNADJUSTED REPLACEMENT RATES RELATIVE TO CAREER AVERAGE ANNUAL INDEXED EARNINGS, BY HOUSEHOLD TYPE

	1971	1973	1975	1977	1979
<u>Married Couples</u>					
Social Security	31.8	44.0	49.2	53.3	54.5
Pension + Soc. Sec.	47.4	60.5	65.8	69.3	69.2
Total	102.8	105.5	101.2	101.0	101.5
<u>Widows</u>					
Social Security	. . .	26.4	32.6	33.1	34.7
Pension + Soc. Sec.	. . .	35.9	43.2	40.9	41.4
Total	. . .	82.5	71.8	75.1	65.1

TABLE 3

UNADJUSTED REPLACEMENT RATES RELATIVE TO HIGH-3 AVERAGE ANNUAL INDEXED EARNINGS BY INCOME CLASS FOR MARRIED COUPLES

Average Annual Indexed Earnings	1971	1973	1975	1977	1979
<u>Less than \$7,500</u>					
Social Security	32.6 (48)	46.8 (111)	52.6 (193)	55.6 (241)	57.4 (273)
Pension + Soc. Sec.	37.5 (47)	50.2 (111)	57.6 (191)	60.6 (240)	62.1 (270)
Total	88.4 (33)	97.5 (92)	100.2 (132)	96.3 (175)	100.0 (200)
<u>\$7,500 - \$12,500</u>					
Social Security	25.1 (61)	36.5 (133)	40.0 (233)	43.9 (314)	44.4 (364)
Pension + Soc. Sec.	34.0 (58)	44.7 (133)	49.2 (233)	52.7 (312)	52.8 (356)
Total	76.7 (35)	77.4 (103)	78.8 (142)	77.5 (241)	76.3 (274)
<u>\$12,500 - \$20,000</u>					
Social Security	21.4 (53)	26.9 (166)	32.4 (370)	36.4 (550)	37.1 (671)
Pension + Soc. Sec.	36.0 (50)	42.4 (162)	45.0 (362)	47.5 (531)	47.3 (658)
Total	58.9 (40)	64.3 (130)	61.1 (248)	64.4 (411)	64.3 (494)
<u>\$20,000 - \$30,000</u>					
Social Security	15.5 (23)	22.2 (78)	23.8 (216)	26.2 (359)	27.8 (431)
Pension + Soc. Sec.	37.6 (22)	39.4 (76)	39.3 (214)	40.9 (354)	41.0 (422)
Total	62.4 (18)	55.1 (58)	53.5 (147)	54.8 (251)	56.2 (331)
<u>\$30,000 - \$50,000</u>					
Social Security	9.4 (18)	14.2 (51)	17.0 (84)	18.8 (125)	19.4 (95)
Pension + Soc. Sec.	30.8 (17)	31.8 (50)	35.3 (81)	36.9 (116)	35.8 (138)
Total	55.1 (10)	54.3 (35)	55.6 (55)	54.0 (87)	54.4 (95)
<u>More than \$50,000</u>					
Social Security	2.2 (10)	5.4 (19)	6.7 (27)	6.7 (34)	7.2 (39)
Pension and Soc. Sec.	6.2 (10)	12.0 (18)	16.3 (26)	20.5 (32)	16.6 (37)
Total	65.7 (7)	58.0 (13)	34.2 (15)	45.0 (18)	36.3 (23)

Note: The numbers in parentheses are sample sizes.

TABLE 4

UNADJUSTED REPLACEMENT RATES RELATIVE TO HIGH-3 AVERAGE ANNUAL INDEXED
EARNINGS BY INCOME CLASS FOR WIDOWS

Average Annual Indexed Earnings	1973	1975	1977	1979
<u>Less than \$7,500</u>				
Social Security	24.8 (26)	35.0 (50)	29.7 (68)	35.2 (97)
Pension + Soc. Sec.	35.6 (26)	53.0 (49)	37.3 (66)	41.9 (69)
Total	88.6 (22)	69.4 (36)	75.8 (51)	61.9 (82)
<u>\$7,500 - \$12,500</u>				
Social Security	18.5 (23)	21.9 (54)	28.6 (86)	28.4 (128)
Pension + Soc. Sec.	20.7 (23)	27.1 (52)	34.0 (84)	32.7 (128)
Total	61.9 (20)	51.4 (39)	52.6 (70)	50.0 (98)
<u>\$12,500 - \$20,000</u>				
Social Security	16.9 (36)	20.0 (81)	22.0 (139)	22.4 (179)
Pension + Soc. Sec.	19.6 (36)	24.6 (81)	25.6 (133)	25.6 (178)
Total	39.9 (31)	40.9 (54)	43.4 (99)	39.6 (146)
<u>\$20,000 - \$30,000</u>				
Social Security	9.8 (13)	12.3 (37)	14.6 (71)	14.6 (98)
Pension + Soc. Sec.	29.1 (13)	21.6 (37)	20.9 (69)	18.2 (97)
Total	59.6 (9)	36.7 (28)	35.5 (55)	29.8 (83)
<u>\$30,000 - \$50,000</u>				
Social Security	8.0 (4)	6.9 (13)	9.0 (19)	12.0 (27)
Pension + Soc. Sec.	15.7 (3)	11.1 (13)	16.7 (18)	20.3 (27)
Total	47.4 (1)	31.5 (7)	31.0 (11)	37.0 (21)
<u>More than \$50,000</u>				
Social Security	0.0 (0)	2.8 (5)	3.5 (5)	4.4 (5)
Pension and Soc. Sec.	3.0 (0)	3.5 (4)	5.7 (4)	8.3 (7)
Total	10.0 (0)	10.6 (4)	11.2 (4)	32.9 (6)

Note: The numbers in parentheses are sample sizes.

high-three out of the ten years prior to retirement. The figures are calculated for different income groups, where the income classifying variable is career average real earnings expressed in 1983 dollars. The figures in parentheses are sample sizes. The numbers indicate that the poor have by far the highest social security replacement rates, and even have the highest total replacement rates. By 1979, the total replacement rate was 100 percent even relative to the average of the high-three earnings years for those with average career earnings below \$7,500. Social security replacement rates (in 1979) are 57.4 percent for married couples with low earnings histories, but only 19.4 percent for those whose high earnings years were between \$30,000 and \$50,000. We also see that private pensions are an important component of total retirement income, although less so for those in the lowest earnings history category.⁷

Tables 5 and 6 contain the same information except that the standard of comparison is the 1951-74 career average indexed earnings. Now the total replacement rate is 88.2 percent for the middle income (\$12,500 to \$20,000) group of married couples in 1979; higher for the lower earnings groups and lower for the higher earnings groups. The total replacement rate is over 100 percent even for widows in the lowest earnings category. Perhaps a surprising finding of Tables 3 - 5 is that those in the lowest earnings category have substantial non-social security income sources, at least relative to their own pre-retirement earnings histories. We did an investigation of their retirement income sources and found that the largest non-social security component was earnings. Income composition by earnings class for married couples in 1979 is shown in Table 7. Those with low career average earnings are far more likely to work part time in retirement. Those in the lowest category were still making more than one-third of their pre-retirement earnings in 1979, while the corresponding figure was less than

TABLE 5

UNADJUSTED REPLACEMENT RATES RELATIVE TO CAREER AVERAGE ANNUAL INDEXED
EARNINGS BY INCOME CLASS FOR MARRIED COUPLES

Average Annual Indexed Earnings	1971	1973	1975	1977	1979
<u>Less than \$7,500</u>					
Social Security	54.2 (48)	73.7 (111)	86.5 (193)	96.4 (241)	99.8 (273)
Pension + Soc. Sec.	61.8 (47)	79.8 (111)	95.9 (191)	104.0 (240)	107.5 (270)
Total	146.3 (33)	152.3 (92)	162.7 (132)	164.2 (175)	175.8 (200)
<u>\$7,500 - \$12,500</u>					
Social Security	32.1 (61)	51.4 (133)	57.4 (233)	65.0 (314)	65.4 (364)
Pension + Soc. Sec.	43.5 (58)	62.8 (133)	71.2 (233)	78.6 (312)	78.5 (356)
Total	111.1 (35)	113.7 (103)	117.4 (142)	117.9 (241)	116.3 (274)
<u>\$12,500 - \$20,000</u>					
Social Security	28.2 (53)	36.4 (166)	43.8 (370)	48.7 (550)	49.8 (671)
Pension + Soc. Sec.	48.3 (50)	58.5 (162)	61.5 (362)	64.1 (531)	64.0 (658)
Total	81.4 (40)	90.9 (130)	83.9 (248)	88.4 (411)	88.2 (494)
<u>\$20,000 - \$30,000</u>					
Social Security	20.0 (23)	29.6 (78)	31.6 (216)	35.4 (359)	37.3 (431)
Pension + Soc. Sec.	47.7 (22)	53.2 (76)	52.4 (214)	55.4 (354)	55.2 (422)
Total	78.5 (18)	73.8 (58)	73.0 (147)	73.3 (251)	76.1 (331)
<u>\$30,000 - \$50,000</u>					
Social Security	12.0 (18)	19.7 (51)	22.4 (84)	24.7 (125)	25.6 (142)
Pension + Soc. Sec.	39.8 (17)	44.0 (50)	47.4 (81)	48.8 (116)	48.2 (138)
Total	71.6 (10)	76.4 (35)	76.6 (55)	72.3 (87)	69.9 (95)
<u>More than \$50,000</u>					
Social Security	3.3 (10)	7.8 (19)	10.1 (27)	10.3 (34)	11.9 (39)
Pension and Soc. Sec.	10.7 (10)	20.0 (18)	24.2 (26)	31.0 (32)	27.1 (37)
Total	86.3 (7)	74.1 (13)	58.0 (15)	70.7 (18)	63.0 (23)

Note: The numbers in parentheses are sample sizes.

TABLE 6

UNADJUSTED REPLACEMENT RATES RELATIVE TO CAREER AVERAGE ANNUAL INDEXED
EARNINGS BY INCOME CLASS FOR WIDOWS

Average Annual Indexed Earnings	1973	1975	1977	1979
<u>Less than \$7,500</u>				
Social Security	39.8 (26)	62.6 (50)	55.7 (68)	61.2 (97)
Pension + Soc. Sec.	54.5 (26)	84.6 (49)	67.4 (66)	72.8 (96)
Total	134.1 (22)	125.1 (36)	160.3 (51)	113.2 (82)
<u>\$7,500 - \$12,500</u>				
Social Security	27.4 (23)	33.1 (54)	40.2 (86)	39.8 (128)
Pension + Soc. Sec.	32.1 (23)	41.2 (52)	48.2 (84)	46.0 (128)
Total	78.9 (20)	77.4 (39)	72.2 (70)	70.1 (98)
<u>\$12,500 - \$20,000</u>				
Social Security	22.4 (36)	26.2 (81)	28.3 (139)	28.8 (179)
Pension + Soc. Sec.	26.1 (36)	32.6 (81)	33.4 (133)	33.4 (178)
Total	53.0 (31)	53.8 (54)	55.3 (99)	51.1 (146)
<u>\$20,000 - \$30,000</u>				
Social Security	13.8 (13)	16.7 (37)	19.8 (71)	19.8 (98)
Pension + Soc. Sec.	35.2 (13)	27.4 (37)	27.6 (69)	25.1 (97)
Total	67.4 (9)	45.1 (28)	45.8 (55)	40.5 (83)
<u>\$30,000 - \$50,000</u>				
Social Security	11.7 (4)	10.6 (13)	13.0 (19)	16.6 (27)
Pension + Soc. Sec.	24.0 (3)	16.8 (13)	22.9 (18)	26.3 (27)
Total	64.0 (1)	42.6 (7)	44.4 (11)	52.5 (21)
<u>More than \$50,000</u>				
Social Security	0.0 (0)	4.4 (5)	5.7 (5)	6.7 (8)
Pension and Soc. Sec.	0.0 (0)	5.5 (4)	9.5 (4)	12.7 (7)
Total	0.0 (0)	17.9 (4)	19.8 (4)	51.5 (6)

Note: The numbers in parentheses are sample sizes.

TABLE 7

COMPOSITION OF INCOME SOURCES BY EARNINGS CATEGORIES

Source of Income	\$7,500 -		\$12,500 -		\$20,000 -		\$30,000 -		\$50,000 -		> \$50,000
	< \$7,500	\$7,500 - \$12,500	\$12,500 - \$20,000	\$20,000 - \$30,000	\$30,000 - \$50,000	\$50,000 -	> \$50,000				
Wages	\$1,728 (273)	\$ 1,834 (382)	\$ 1,735 (712)	\$ 2,004 (493)	\$ 2,026 (155)	\$ 5,615 (37)					
Pensions	372 (304)	1,321 (412)	2,279 (740)	3,955 (492)	7,753 (162)	10,958 (40)					
Non-Social Security Disability	146 (304)	68 (424)	32 (761)	82 (526)	0 (174)	63 (43)					
Interest and Dividends	660 (260)	1,563 (346)	1,781 (603)	2,710 (434)	6,864 (129)	14,412 (31)					
Rent	382 (271)	618 (383)	399 (694)	493 (485)	422 (151)	1,919 (40)					
Social Security	4,516 (288)	6,511 (405)	7,895 (733)	8,688 (483)	9,012 (157)	8,326 (41)					
SSI	254 (305)	74 (424)	20 (765)	0 (527)	0 (174)	0 (43)					
Other government Transfers	53 (298)	42 (422)	24 (763)	51 (525)	60 (173)	0 (42)					
Relatives	1 (306)	19 (425)	9 (764)	4 (526)	8 (173)	0 (43)					
Other	74 (306)	123 (423)	31 (764)	32 (526)	8 (174)	166 (43)					
Item: Career											
Average Earnings	\$4,949 (308)	\$10,062 (425)	\$16,121 (770)	\$23,804 (527)	\$35,619 (174)	\$75,094 (43)					

Note: Dollar figures are averages for 1979 over all married couples who reported a valid value (possibly zero) for the relevant income source.

The numbers in parentheses are sample sizes.

TABLE 8

REPLACEMENT RATES FOR CAREER AVERAGE ANNUAL INDEXED EARNINGS
LESS THAN \$7,500 FOR MARRIED COUPLES

	1971	1973	1975	1977	1979
<u>Unadjusted</u>					
Social Security	54.2 (48)	73.7 (111)	86.5 (193)	96.4 (241)	99.8 (273)
Pension + Soc. Sec.	61.8 (47)	79.8 (111)	95.9 (191)	104.0 (240)	107.5 (270)
Total	146.3 (33)	152.3 (92)	162.7 (132)	164.2 (175)	175.8 (200)
<u>Tax Adjustment</u>					
Social Security	56.4 (48)	76.9 (111)	90.4 (193)	100.7 (241)	104.3 (273)
Pension + Soc. Sec.	64.3 (47)	83.2 (111)	100.0 (191)	108.6 (240)	112.3 (270)
Total	151.2 (33)	157.7 (92)	168.8 (132)	170.4 (175)	182.3 (200)
<u>Tax and Children</u>					
<u>Adjustments</u>					
Social Security	71.3 (48)	97.2 (111)	114.2 (193)	127.3 (241)	131.8 (273)
Pension + Soc. Sec.	81.2 (47)	105.2 (111)	126.5 (191)	137.3 (240)	142.0 (270)
Total	191.1 (33)	199.4 (92)	213.4 (131)	215.5 (175)	230.6 (200)
<u>Tax, Children and</u>					
<u>Certainty Bonus</u>					
<u>Adjustments</u>					
Social Security	82.3 (48)	112.0 (111)	131.5 (193)	146.7 (241)	152.3 (273)
Pension + Soc. Sec.	92.2 (47)	119.9 (111)	143.8 (191)	156.7 (240)	162.5 (270)
Total	203.0 (33)	213.2 (92)	231.0 (132)	235.5 (175)	250.4 (200)

Note: The numbers in parentheses are sample sizes.

TABLE 9

REPLACEMENT RATES FOR CAREER AVERAGE ANNUAL INDEXED EARNINGS
\$7,500 TO \$12,500 FOR MARRIED COUPLES

	1971	1973	1975	1977	1979
<u>Unadjusted</u>					
Social Security	32.1 (61)	51.4 (133)	57.4 (233)	65.0 (314)	65.4 (364)
Pension + Soc. Sec.	43.5 (58)	62.8 (133)	71.2 (233)	78.6 (312)	78.5 (356)
Total	111.1 (35)	113.7 (103)	117.4 (142)	117.9 (241)	116.3 (274)
<u>Tax Adjustment</u>					
Social Security	34.7 (61)	55.4 (133)	62.1 (233)	70.3 (314)	70.8 (364)
Pension + Soc. Sec.	46.7 (58)	67.5 (133)	76.6 (233)	84.6 (312)	84.6 (356)
Total	115.8 (35)	120.1 (103)	124.7 (142)	125.5 (241)	123.2 (274)
<u>Tax and Children</u>					
<u>Adjustments</u>					
Social Security	44.3 (61)	70.7 (133)	79.3 (233)	89.7 (314)	90.4 (364)
Pension + Soc. Sec.	59.6 (58)	86.1 (133)	97.8 (233)	108.0 (312)	107.9 (356)
Total	148.1 (35)	153.2 (103)	159.3 (142)	160.2 (241)	157.2 (274)
<u>Tax, Children and</u>					
<u>Certainty Bonus</u>					
<u>Adjustments</u>					
Social Security	49.5 (61)	79.2 (133)	87.8 (233)	98.6 (314)	99.6 (364)
Pension + Soc. Sec.	65.0 (58)	94.6 (133)	106.3 (233)	116.9 (312)	117.1 (356)
Total	153.3 (35)	162.1 (103)	165.5 (142)	169.3 (241)	166.5 (274)

Note: The numbers in parentheses are sample sizes.

ten percent for all those with incomes greater than \$20,000. Among those with low earnings histories a non-trivial fraction have substantial amounts of interest, dividends, and rents, as indicated by the substantial average amounts in Table 7.⁸

Tables 8-12 show the effect of making three of the adjustments we discussed above for married couples with different levels of career average earnings. The replacement rates are relative to 1951-74 career indexed average earnings. The three adjustments reflect taxes, the costs of raising children, and the welfare effects of uncertainty of income and wealth. The tax adjustments take into account the payroll tax, the mildly progressive average income tax rates in the United States (Pechman, 1983), and the facts that social security benefits were untaxed until 1984 and the elderly enjoy double personal exemptions. The children adjustment is only a rough approximation of the necessary costs of raising children. While children presumably generate utility for their parents, it is implausible that a couple with grown children requires the same resources in retirement as they did when raising the children to achieve the same standard of living. Whether all costs of raising children should be deducted from pre-retirement resources before making the comparison with post-retirement income is open to question, but that is roughly what we have done. We have assumed that the married couples had two children, that child raising costs account for twenty-eight percent of all consumption in child raising years (for two-child families, see Lazear and Michael, 1983) and that child raising years are roughly half of the adult work life, but the first half (and, therefore, count for more than half in present value). We have made a rough adjustment by lowering the denominator (career average earnings) by 20 percent because

TABLE 10

REPLACEMENT RATES FOR CAREER AVERAGE ANNUAL INDEXED EARNINGS
\$12,500 TO \$20,000 FOR MARRIED COUPLES

	1971	1973	1975	1977	1979
<u>Unadjusted</u>					
Social Security	28.2 (53)	36.4 (166)	43.8 (370)	48.7 (550)	49.8 (671)
Pension + Soc. Sec.	48.3 (50)	58.5 (162)	61.5 (362)	64.1 (531)	64.0 (658)
Total	81.4 (40)	90.9 (130)	83.9 (248)	88.4 (411)	88.2 (494)
<u>Tax Adjustment</u>					
Social Security	31.9 (53)	41.2 (166)	49.5 (370)	55.1 (550)	56.3 (671)
Pension + Soc. Sec.	54.0 (50)	65.1 (162)	68.9 (362)	72.0 (531)	72.0 (658)
Total	87.9 (40)	98.8 (130)	93.0 (248)	98.0 (411)	97.7 (494)
<u>Tax and Children</u>					
<u>Adjustments</u>					
Social Security	41.2 (53)	53.3 (166)	64.0 (370)	71.2 (550)	72.8 (671)
Pension + Soc. Sec.	69.8 (50)	84.2 (162)	89.0 (362)	93.2 (531)	93.2 (658)
Total	113.5 (40)	127.7 (130)	120.2 (248)	126.6 (411)	126.3 (494)
<u>Tax, Children and</u>					
<u>Certainty Bonus</u>					
<u>Adjustments</u>					
Social Security	44.6 (53)	57.8 (166)	68.4 (370)	75.6 (550)	77.3 (671)
Pension + Soc. Sec.	73.3 (50)	88.8 (162)	93.4 (362)	97.5 (531)	97.7 (658)
Total	117.0 (40)	132.7 (130)	124.9 (248)	131.1 (411)	131.1 (494)

Note: The numbers in parentheses are sample sizes.

TABLE 11

REPLACEMENT RATES FOR CAREER AVERAGE ANNUAL INDEXED EARNINGS
\$20,000 TO \$30,000 FOR MARRIED COUPLES

	1971	1973	1975	1977	1979
<u>Unadjusted</u>					
Social Security	20.0 (23)	29.6 (78)	31.6 (216)	35.4 (359)	37.3 (431)
Pension + Soc. Sec.	47.7 (22)	53.2 (76)	52.4 (214)	55.4 (354)	55.2 (422)
Total	78.5 (18)	73.8 (58)	73.0 (147)	73.3 (251)	76.1 (331)
<u>Tax Adjustment</u>					
Social Security	23.5 (23)	35.0 (78)	37.3 (216)	41.7 (359)	44.0 (431)
Pension + Soc. Sec.	54.1 (22)	61.3 (76)	60.6 (214)	64.3 (354)	64.2 (422)
Total	87.2 (18)	84.2 (58)	83.0 (147)	842.2 (251)	87.0 (331)
<u>Tax and Children</u>					
<u>Adjustments</u>					
Social Security	30.8 (23)	45.8 (78)	48.9 (216)	54.6 (359)	57.6 (431)
Pension + Soc. Sec.	70.7 (22)	80.2 (76)	79.3 (214)	84.2 (354)	84.0 (422)
Total	114.0 (18)	110.3 (58)	108.7 (147)	110.2 (251)	113.9 (331)
<u>Tax, Children and</u>					
<u>Certainty Bonus</u>					
<u>Adjustments</u>					
Social Security	32.8 (23)	48.9 (78)	51.9 (216)	57.8 (359)	60.9 (431)
Pension + Soc. Sec.	72.8 (22)	83.4 (76)	82.3 (214)	87.4 (354)	87.3 (422)
Total	116.1 (18)	122.8 (58)	111.5 (147)	113.4 (251)	117.3 (331)

Note: The numbers in parentheses are sample sizes.

TABLE 12

REPLACEMENT RATES FOR CAREER AVERAGE ANNUAL INDEXED EARNINGS
\$30,000 TO \$50,000 FOR MARRIED COUPLES

	1971	1973	1975	1977	1979
<u>Unadjusted</u>					
Social Security	12.0 (18)	19.9 (51)	22.4 (84)	24.7 (125)	25.6 (142)
Pension + Soc. Sec.	39.8 (17)	44.0 (50)	47.4 (81)	48.8 (116)	48.2 (138)
Total	71.6 (10)	76.4 (35)	76.6 (55)	72.3 (87)	69.9 (95)
<u>Tax Adjustment</u>					
Social Security	14.5 (18)	23.9 (51)	27.3 (84)	30.0 (125)	31.2 (142)
Pension + Soc. Sec.	45.0 (17)	50.2 (50)	54.2 (81)	56.4 (116)	56.0 (138)
Total	80.4 (10)	84.3 (35)	84.8 (55)	82.0 (87)	80.1 (95)
<u>Tax and Children Adjustments</u>					
Social Security	19.1 (18)	31.6 (51)	36.0 (84)	39.7 (125)	41.3 (142)
Pension + Soc. Sec.	59.4 (17)	66.3 (50)	71.7 (81)	74.6 (116)	74.1 (138)
Total	106.1 (10)	111.4 (35)	112.2 (55)	108.4 (87)	106.0 (95)
<u>Tax, Children and Certainty Bonus Adjustments</u>					
Social Security	20.9 (18)	34.4 (51)	39.7 (84)	43.3 (125)	45.5 (142)
Pension + Soc. Sec.	61.0 (17)	69.0 (50)	75.4 (81)	78.3 (116)	78.4 (138)
Total	107.4 (10)	114.9 (35)	115.5 (55)	112.0 (87)	110.1 (95)

Note: The numbers in parentheses are sample sizes.

of child raising expenses. This reduction is substantially less than the BLS estimates of expense differences for elderly couples relative to middle age families with children. The third adjustment is also very difficult to measure precisely. Certainly younger workers have substantial uncertainty about both next year's earnings and, more relevant, perhaps, the value of their human capital. Retired couples, on the other hand, probably have less uncertainty about the value of their social security claim. We feel we have made a relatively conservative correction for the comparative certainty of social security. We have estimated the trend growth and variation about trend of earnings and taken the one period utility function to be the natural log of consumption. Many estimates suggest that households display more risk aversion than this implies. The net effect of adding the "certainty bonus" is to raise the social security benefits by roughly ten percent relative to other income sources.⁹

Table 8 shows the effect of these adjustments for our category with the lowest earnings history. The tax adjustment is small for this group. The replacement rates, after these three adjustments, however, are 50 percent higher and are, in general, extremely high. By 1979, the social security replacement rate is in excess of 150 percent and the total rate is 250 percent. Table 10 shows the same adjustments for those with career average earnings between \$12,500 and \$20,000. The total adjusted replacement rate is over one hundred percent for all years and the social security adjusted replacement rate alone is over 75 percent. In fact, our adjusted total replacement rates exceed 100 percent of career average earnings for all income classes in all years. It should be noted that several of the omitted adjustments would tend

to raise replacement rates further. For example, while our tax adjustment does take into account social security contributions during the working life, we do not subtract from earnings the contributions to pensions or other means of retirement asset accumulation. Second, we have not annuitized wealth at all in the retirement period. Our total replacement includes capital income, but the principal is left intact as if the household was planning to live forever. This effect may be offset since inflation may exaggerate capital income. We have not corrected interest income or dividends for inflation. Neither have we attributed retained earnings to equityholders. It is our view that the sum of all the inflation adjustments would leave our figures little changed. The total evidence of Tables 8 through 12, then, seems quite conclusive that retirement resources are at least adequate to finance consumption at the average pre-retirement consumption level.

Tables 13 and 14 divide the Retirement History population of couples by year of retirement. Table 13 shows the fully adjusted social security replacement rates, while Table 14 shows fully adjusted total replacement rates. The first year after retirement is unusual for a number of reasons. We do not know the exact timing of retirement, so we may pick up some pre-retirement earnings and may have less than a full year of social security benefits. Also, there may be some severance pay or lump sum settlements of retirement plans. Thus the main diagonal elements are the least dependable numbers. Table 13 shows that the social security benefits of each wave of retirees rose in the year following retirement. This is due to the spouse collecting benefits at a later point in time, the increase in the generosity of the system in 1972, and the gradual reduction in the effect of the earnings test. By 1979, the fully adjusted social security replacement

TABLE 13

REPLACEMENT RATES FOR CAREER AVERAGE ANNUAL INDEXED EARNINGS
MORE THAN \$50,000 FOR MARRIED COUPLES

	1971	1973	1975	1977	1979
<u>Unadjusted</u>					
Social Security	3.3 (10)	7.8 (19)	10.1 (27)	10.3 (34)	11.9 (39)
Pension + Soc. Sec.	10.7 (10)	20.0 (18)	24.2 (26)	31.0 (32)	27.1 (37)
Total	86.3 (7)	74.1 (13)	58.0 (15)	70.7 (18)	63.0 (23)
<u>Tax Adjustment</u>					
Social Security	4.4 (10)	10.5 (19)	13.5 (27)	13.8 (34)	15.9 (39)
Pension + Soc. Sec.	12.8 (10)	24.3 (18)	29.2 (26)	36.4 (32)	32.8 (37)
Total	91.8 (7)	81.7 (13)	66.8 (15)	79.0 (18)	72.6 (23)
<u>Tax and Children</u>					
<u>Adjustments</u>					
Social Security	6.1 (10)	14.3 (19)	18.5 (27)	18.8 (34)	21.8 (39)
Pension + Soc. Sec.	17.5 (10)	33.2 (18)	40.0 (26)	49.7 (32)	44.9 (37)
Total	125.5 (7)	111.6 (13)	91.3 (15)	107.9 (18)	99.2 (23)
<u>Tax, Children and</u>					
<u>Certainty Bonus</u>					
<u>Adjustments</u>					
Social Security	7.0 (10)	16.6 (19)	22.2 (27)	22.5 (34)	25.8 (39)
Pension + Soc. Sec.	18.5 (10)	35.5 (18)	43.3 (26)	52.9 (32)	48.9 (37)
Total	126.8 (7)	113.9 (13)	93.9 (15)	110.5 (18)	103.0 (23)

Note: The numbers in parentheses are sample sizes.

TABLE 14

FULLY ADJUSTED SOCIAL SECURITY REPLACEMENT RATES RELATIVE TO CAREER AVERAGE ANNUAL INDEXED EARNINGS BY YEAR OF RETIREMENT FOR MARRIED COUPLES

Year of Retirement	1969	1971	1973	1975	1977	1979
1968 or earlier	33.1	49.4	67.7	81.5	89.2	94.0
1969 or 1970	. . .	29.2	69.6	80.0	89.7	91.0
1971 or 1972		. . .	41.2	73.1	78.8	82.1
1973 or 1974			. . .	51.1	80.5	78.8
1975 or 1976				. . .	74.0	87.1
1977 or 1978					. . .	75.4

TABLE 15

FULLY ADJUSTED TOTAL INCOME REPLACEMENT RATES RELATIVE TO CAREER AVERAGE ANNUAL INDEXED EARNINGS BY YEAR OF RETIREMENT FOR MARRIED COUPLES

Year of Retirement	1969	1971	1973	1975	1977	1979
1968 or earlier	162.4	145.4	155.9	153.3	166.1	169.4
1969 or 1970	...	165.1	149.9	153.6	158.9	152.7
1971 or 1972		...	159.2	143.4	141.6	144.0
1973 or 1974			...	156.0	142.7	144.2
1975 or 1976				...	164.5	152.5
1977 or 1978					...	168.8

rates were over 80 percent for all vintages of retirees. Table 14 gives the same picture for total income. The figures are essentially constant with time since retirement, in contrast to the social security numbers, and are at least 150 percent for all retirement cohorts.

Such high replacement rates seem to us most consistent with the notion that these cohorts of elderly retirees did not fully anticipate their social security wealth windfalls and hence in an ex post sense, oversaved. Had they known how large their benefits would become, they may well have preferred to consume more earlier in life, saving less for retirement and driving total replacement rates toward unity. Our numbers seem to contradict Hammermesh's (1982) contention that consumption cannot be maintained in retirement, but that is with the benefit of several more years worth of data. Since we find it implausible that the rate of time preference plus the mortality hazard rate falls short of the interest rate for these households, we prefer the interpretation that this apparent "oversaving" was unplanned, not the careful foresight hinted by Kotlikoff, et al. (1982).

5. Conclusion

Summary

Our results suggest that by the late 1970s our sample had quite high average replacement rates, as adjusted.¹⁰ The income available to them usually exceeds that available on average during their working lives. Indeed, had they anticipated their social security benefit growth, they probably would have consumed more earlier in their lifetime.

Traditional measures of replacement rates are quite misleading today. Just replacing "high-three" average earnings by career average earnings increases replacement rates by 50 percent. Calculated either way, social security replacement rates increased about 50 percent from 1971 to 1979.

Replacement rates are substantially in excess of one by 1979 for most income classes. Social security alone fully replaces average earnings for the elderly poor and replaces over half for middle income elderly couples once adjustments are made for childrearing costs, taxes, and risky earnings.

Further Research

We hope the previous discussion and analysis prove useful in reevaluating concepts and measures of earnings replacement. But, we view the above as the first part of a larger research agenda. Among the important issues (in addition to improving the current measures) we hope to address are the following:

1. The distribution of replacement rates with special emphasis on those with low rates in the low earnings categories;
2. The differences between and implications of anticipated and unanticipated social security benefit growth and replacement rates for cohorts of different ages;

3. The relationship of the ratio of the length of the retirement period to the working period and replacement rates. Just examining the ratio for a typical year is only part of the story. The ratio could be high, say two, but if R is only a few years and W many, the implications of such ratios are quite different.
4. Alternative saving scenarios and public/private retirement income substitution assumptions and their implications for replacement rates;
5. The annuity value of social security under alternative assumptions concerning private annuities markets;
6. Variations in replacement rates by occupation/industry and their implications;
7. The cracks in the safety net--who falls through due to lack of coverage, marital status, earnings histories, etc. For example, widows of uncovered workers may not have adequate protection from private insurance/pensions/saving.

APPENDIX

This appendix briefly describes the Retirement History Survey data, the criteria used to select our sub-sample, our definition of replacement rate, the adjustments applied in deriving our improved measures of replacement rates and our methods for aggregating replacement rates.

1. Data

The Retirement History study was a ten-year longitudinal survey of the retirement process conducted for the Social Security Administration. 11,153 persons born between 1905 and 1911 were selected for the survey in 1969. There was substantial attrition (by placement in nursing homes or loss of contact as well as by death) for each successive biennial survey, so that 7,352 original respondents or their widows remained to answer the last survey in 1979.

Respondents were surveyed in odd-numbered years concerning current family composition, labor force participation, health, activities, and assets and wealth and concerning the previous (even-numbered) years' income and benefits. Replacement rates are calculated here for the years prior to the survey years.

The Social Security Administration prepared a matched data set of its records of the survey respondents' and spouses' covered earnings through 1974. It is this information which was used to determine the earnings histories which formed the denominator in the calculation of replacement rates.

Social Security Administration records consider only the earnings for each year in each job which totalled less than the year's maximum taxable

earnings. In cases where reported covered earnings equalled or exceeded the taxable maximum, the following imputation procedures were used:

The few cases of covered earnings above the taxable maximum were taken as given. In these instances the person paid taxes in two or more jobs. We assumed that earnings in neither job exceeded the taxable maximum.

In cases where covered earnings equalled the taxable maximum, we assumed that the taxable maximum was attained in the middle of the last quarter in which taxes were paid. If, for example, the respondents finished paying social security taxes in the third quarter, we imputed his year's wage income to be $8/5$ times the taxable maximum. This method should prove relatively unbiased, if inexact.

2. Selection of Subsample

Our estimates understate pre-retirement earnings for workers who spent a substantial portion of their career in jobs not covered by social security. To limit this bias, we sought to restrict our subsample to Retirement History Survey respondents who had spent most of their working lives in the social security system. This required four categories of excluded households:

1. 284 households that received federal or military pension income were dropped from the sample.
2. We excluded households which never retired. We define retirement as occurring in the year before the first Retirement History Survey in which the respondent reports being either completely or partly retired and the spouse (if any) reports an employment status of "keeping house,"

"retired," "unable to work," or "other" as opposed to "working," "with a job but not at work," or "looking for work." A total of 2,225 households failed to satisfy these criteria before the Retirement History Survey study was completed or the respondent and spouse (if any) both died.

3. 715 households were dropped for having paid no social security taxes between 1958 and 1974.
4. We eliminated households with unusually high replacement rate values--any households with a social security income replacement rate above 250 percent, a pension income replacement rate above 200 percent or a total income replacement rate above 400 percent. These 1,154 excluded households typically had low career average earnings. About half had career average earnings--as estimated from social security tax payments--of less than \$1,000 in 1983 dollars, indicating that most had spent a substantial fraction of their working lives in sectors of the economy not covered by social security.

Because the "retirement date" is somewhat ambiguous (we do not know exactly when during the period the person retired), the interpretation of actual annual earnings and social security benefits is difficult. To minimize this problem, we "skip" one survey wave to make certain we are not confounding retirement with part of a year's work. Thus, for each year reported in the tables, the percentage of the sample already retired might appear low; however, the data refer to those who had retired by the next (two year) earlier wave; e.g., for 1971, the retirement occurred by 1968, and does not include those who retired in 1969 and 1970. For example, in Table 5, about ten percent of the total sample is counted retired in 1971.

Actually, an additional 268 households in our sample retired between 1969 and 1971, and thus the total actually retired (as opposed to having "clean data" for the year) by 1971 was 29 percent.

Since replacement rates can be most sensibly compared within groups of relatively homogeneous composition, we limit our subsamples to (1) married couples who remain alive and together for all six surveys from 1969 to 1979, and (2) widows who lose their husbands between 1969 and 1979 and live until 1979. Replacement rates for widows are calculated starting the later of the year of retirement and the year of widowhood.

Finally, households with missing values for social security, pension or total income were excluded from calculations of the replacement rates using that type of income in the numerator.

3. Replacement Rate Definitions

The replacement rate numerators used in this paper were derived from data on post-retirement income reported in the Retirement History Surveys. For each Retirement History Survey wave starting with retirement, we calculated: (1) social security income, (2) social security plus pension income, and (3) total income from all sources. Married couples' figures include the incomes of both husband and wife. Total income was constructed by summing the households' income from wages, interest and dividends, rent, annuities, pensions, relatives, disability benefits, state welfare benefits, workers' compensation, AFDC, unemployment insurance, SSI and social security (old age, disability, survivor's and black lung benefits).

In a typical Retirement History Survey wave, between five and ten percent of our subsample households report missing values for social security

income or social security plus pension income. Because total income is "missing" if any of its many components is badly reported, about one-third of the subsample households do not have usable values for total post-retirement income. However, social security and pension income replacement rates do not differ significantly between households with valid and invalid values for total income. Thus, within a given set of replacement rates for social security income, social security plus pension income and total income, the three replacement rates may be compared even though they are averages based on somewhat different samples.

Like all other dollar figures used in this paper, the Retirement History Survey post-retirement income data in these numerators were converted to constant 1983 dollars using the Personal Consumption Expenditure deflator.

A description of how we netted income taxes out of the numerator in our replacement rate calculations is presented below.

The replacement rate denominator attempts to measure a household's pre-retirement standard of living. We focus on two basic denominators, calculated from wage earnings estimated from social security tax payments. For each year from 1951 to 1974, the respondent's (plus spouse, if any) wage earnings were inflated to 1983 dollars. Then two averages were computed. "Career Average Annual Indexed Earnings" is average earnings over all years from 1951 to the earlier of retirement or 1974. "High-three Average Annual Indexed Earnings," on the other hand, is the average of the three highest years' earnings in the ten years before the most recent year of positive social security tax payments. This ten year period is 1965 to 1974 at the latest, as 1974 is the last year for which we have social security tax data.

In all but our unadjusted replacement rates, taxes are netted out of the numerator and the denominator. Census Bureau data were used to

estimate average effective tax rates for our six income classes. We derived the following average rates for federal income, state income, and social security taxes for the pre-retirement period 1951 to 1974:

<u>Income</u>	<u>Rate</u>
< \$7,500	3.89%
\$7,500 - \$12,500	6.22%
\$12,500 - \$20,000	10.49%
\$20,000 - \$30,000	14.74%
\$30,000 - \$50,000	17.44%
> \$50,000	25.37%

Our estimated post-retirement average tax rates for federal and state income taxes for 1968, 1970, 1972, 1974, 1976 and 1978 are:

<u>Income</u>	<u>Rate</u>
< \$7,500	0.47%
\$7,500 - \$12,500	2.81%
\$12,500 - \$20,000	7.09%
\$20,000 - \$30,000	11.47%
\$30,000 - \$50,000	15.48%
> \$50,000	24.43%

Households were assigned to a pre-retirement tax bracket based on their career average annual indexed earnings augmented by 14 percent to allow for unearned income. A household's post-retirement tax bracket depended on its total Retirement History Survey income, and could vary from survey to survey. Retirees were allowed an extra personal exemption, further reducing their effective tax rates.

Replacement rates which include the "children's adjustment" were based on denominators that were reduced by 20 percent of the pre-tax value of the denominator. The size of this adjustment is derived from Lazear and Michael (1983).

The fully adjusted replacement rate figures reported in this paper include social security income augmented by a certainty bonus, as described in the main body of the paper.

4. Aggregation of Replacement Rates

The replacement rates reported in each cell of our tables are means of the replacement rates of the households in the relevant cell. For example, in Table 1 we see that, on average, for married couples who satisfy all our selection criteria, the (indexed) social security income reported in the 1979 Retirement History Survey wave replaced 37.4 percent of high-three average annual indexed earnings.

In all tables, except Tables 14 and 15, cell averages exclude households that just became retired or widowed. A household whose status has just changed tends to have higher replacement rates than a similar household that became retired or widowed in an earlier survey. Often this difference is spurious, resulting, for example, from pre-retirement wage income being reported in the same Retirement History Survey in which retirement first occurs.

Footnotes

1. See Hay-Huggins (1983).
2. See M. Hurd and M. Boskin, "The Effect of Social Security on Retirement in the Early 1970s," Quarterly Journal of Economics, forthcoming, 1984.
3. As documented in U.S. Bureau of the Census, Current Population Reports, Series P-23, No. 128.
4. This time period was somewhat unusual for at least two reasons. First, the very substantial growth in real social security benefits from 1969-73 was almost certainly not anticipated. Thus, these "windfalls" might have a different impact on behavior, e.g., private asset accumulation for retirement, than benefit increases which were anticipated enough in advance to allow a very different lifetime consumption/saving plan to be followed. Future beneficiaries may save a smaller proportion of their income and have less capital income in retirement.

Second, real wages grew at unusually rapid rates in the 1960s, and thus both the benefits and the "high-three" earnings years may be somewhat high relative to a normal wage growth history.
5. The widow's benefit was increased to 100 percent of PIA in 1972.
6. Data from the continuous work history survey indicate the peak earnings year was 3-5 years prior to retirement. Thus 'high-three' in the last ten boils down to the peak of the life cycle earnings pattern.
7. We have data on pension income, not the terms of the pension payments. Some (unknown) fraction of these payments are not annuities and may cease prior to the recipient's date of death.
8. We hope to explore who are, and why, these respondents with low career average earnings but high property income in subsequent work.

9. Of course, other risk-sharing devices exist, such as unemployment insurance, AFDC, etc., so variable earnings in many cases have an income floor.
10. Recall the provisos noted in fn. 4 about the special nature of our sample and time period.

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