

This PDF is a selection from an out-of-print volume from the National Bureau of Economic Research

Volume Title: Issues in Pension Economics

Volume Author/Editor: Zvi Bodie, John B. Shoven, and David A. Wise, eds.

Volume Publisher: University of Chicago Press

Volume ISBN: 0-226-06284-8

Volume URL: <http://www.nber.org/books/bodi87-1>

Publication Date: 1987

Chapter Title: Concepts and Measures of Earnings Replacement During Retirement

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Chapter URL: <http://www.nber.org/chapters/c6856>

Chapter pages in book: (p. 113 - 146)

5 Concepts and Measures of Earnings Replacement During Retirement

Michael J. Boskin and John B. Shoven

5.1 Introduction

The current generation of elderly retired persons is wealthier than any elderly generation that has preceded 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 comparing elderly retirees' standard of living 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

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This paper was prepared for the National Bureau of Economic Research Conference, "Pensions and Retirement in the United States," April 13–14, 1984, San Diego. We would like to thank Doug Puffert and Tim Wilson for their excellent research assistance and Alan Gustman for comments on the original draft. Funding for this research was provided by the Department of Health and Human Services in a grant to the National Bureau of Economic Research.

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 3 of the 10 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, and so on, 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-income, and rise somewhat for high-income, families through time (see Hay/Huggins 1983). As we shall see, it is by no means evident that average replacement rates are "low," as the usual measures seem to imply, from the standpoint either of relative economic position of pre- and post-retirement or 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 5.2 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, and so on.

Section 5.3 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 5.4 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 5.5 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.

5.2 A Brief Literature Review

A variety of previous studies have attempted to explore questions that are similar or related 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 (before and after 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 embedded 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% of that of a couple aged 35–54 with children 15 and 6 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), and so on. These adjustments substantially increase the incomes of the elderly.

Boskin and Hurd (1985) establish that the cost of living for the elderly as a group, and also by various 5-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 repaid 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 or 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 nonsustainability is sensitive to any potential measurement error in the ratio.

Finally, Kotlikoff et al. (1982) come to a conclusion that is exactly opposite to that of 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 before retirement *based on eventual realized* social security and pension “wealth”; we examine earnings before retirement, a likely upper bound on *actual* consumption. Since it is unclear that consumption plans before 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 to that 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.”

5.3 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 suboptimal 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 1985) distorted the age profile of consumption for this group? Third, what is the distribution of standard of living in retirement relative to that before 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 measurable. Consumption is better than income, but again, consumption data are

notoriously bad in panel surveys. This leads us to an income-based measure which can be adjusted in several ways to make it correspond more closely 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 5.1. The point for our purposes is that if we compare post-retirement income, $rW(\text{age})$, where r is the interest rate and W is 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-

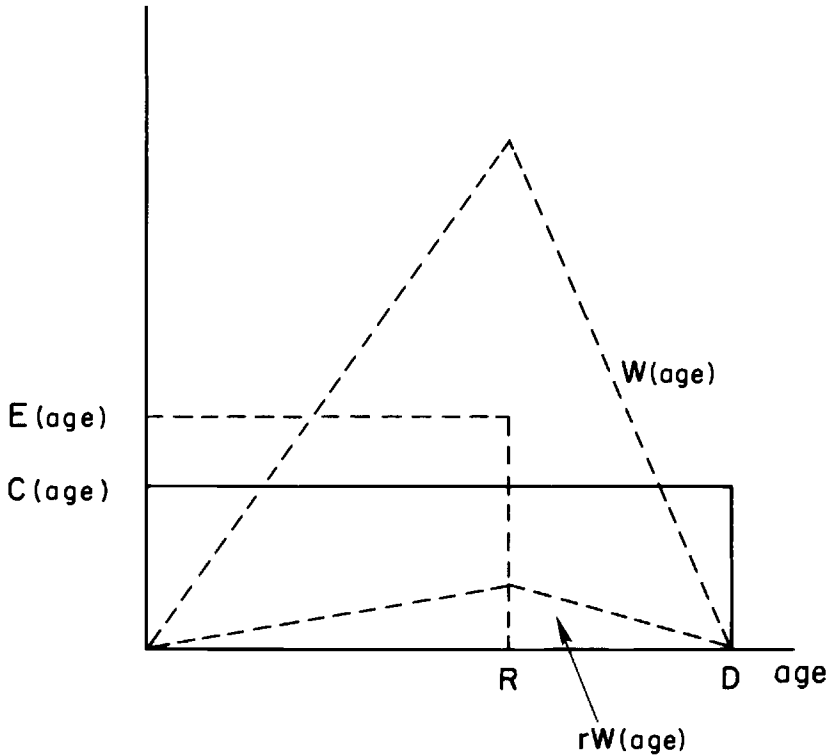


Fig. 5.1 Wealth (W), Earnings (E), Consumption (C), and Capital Income (rW) as a Function of Age for a Simple Life-cycle Model

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 5.1 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.

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).

5.3.1 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:

$$(1) \quad W_e = \sum_{t=1}^D U_t(C_t, L_t, \mathbf{Z}_t)$$

where C_t , L_t , and \mathbf{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, and so on, 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

$$(2) \quad U_i = U_i(C_i, L_i, \mathbf{Z}_i), \quad i = W, R.$$

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

$$(3) \quad \frac{U^R(C_R, L_R, \mathbf{Z}_R)}{U^W(C_W, L_W, \mathbf{Z}_W)}$$

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 important, 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.

5.3.2 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, and so on, 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 retirement (see Hurd and Boskin 1984) at a time of improved health of the elderly¹ 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 health would be seriously impaired if they continued to work. 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 vector \mathbf{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;

$$\frac{V^R(\mathbf{P}_R, I_R)}{V^W(P_W, I_W)}$$

where \mathbf{P}_i is the vector of prices faced by the household in stage of life i , and I_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 transaction 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 or 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 physician 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 nontrivial, 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, and so on, may be substantial. Define the equivalent certain income as that which satisfies

$$E U(\bar{y}) = U(y),$$

where \bar{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 $R(m) \equiv -[U'(y)/U''(y)]$, 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.

5.4 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 5.1 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;² first, the ratio of social security

retirement benefits received to the average of the highest 3 years of price-indexed earnings in the 10 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 5.1 seem rather modest, ranging for married couples from 22% replacement in 1971 to 37.4% 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% of their "Primary Insurance Amount," while the surviving spouse receives 100%.³ The average social security replacement rate for married couples in this population increased by more than 50% from 1971 to 1979. This reflects a number of facts. First, at the later dates both spouses are more likely to be collecting social 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%. 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

Table 5.1 Unadjusted Replacement Rates Relative to High-3 Average Annual Indexed Earnings, By Household Type

	1971	1973	1975	1977	1979
Married couples:					
Social security	22.4	30.6	34.0	36.5	37.4
Pension and social security	34.1	42.2	45.6	47.7	47.6
Total	70.6	72.3	69.0	68.7	68.6
Widows:					
Social security	. . .	18.0	21.3	22.6	23.9
Pension and social security	. . .	25.1	29.5	28.0	28.4
Total	. . .	60.3	47.6	48.9	44.0

5.1 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 5.2 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 5.2 is very similar to those in table 5.1, but the level is increased by roughly 50%.⁴ Interestingly, the average total replacement rate for married couples is 100% by 1979 when the denominator is career average indexed earnings. The social security replacement rate with this basis for comparison is over 50% by 1979. The 50% increase in replacement rates of table 5.2 versus table 5.1 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 5.3 and 5.4 show social security, social security plus private pensions, and total replacement rates where the denominator is average high-three out of the 10 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% 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% for married couples with low earnings histories, but only 19.4% 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.⁵

Tables 5.5 and 5.6 contain the same information except that the standard of comparison is the 1951–74 career average indexed earnings.

Table 5.2 Unadjusted Replacement Rates Relative to Career Average Annual Indexed Earnings, By Household Type

	1971	1973	1975	1977	1979
Married couples:					
Social security	31.8	44.0	49.2	53.3	54.5
Pension and social security	47.4	60.5	65.8	69.3	69.2
Total	102.8	105.5	101.2	101.0	101.5
Widows:					
Social security	...	26.4	32.6	33.1	34.7
Pension and social security	...	35.9	43.2	40.9	41.4
Total	...	82.5	71.8	75.1	65.1

Table 5.3 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
Less than \$7,500:					
Social security	32.6 (48)	46.8 (111)	52.6 (193)	55.6 (241)	57.4 (273)
Pension and social security	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)
\$7,500–\$12,500:					
Social security	25.1 (61)	36.5 (133)	40.0 (233)	43.9 (314)	44.4 (364)
Pension and social security	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)
\$12,500–\$20,000:					
Social security	21.4 (53)	26.9 (166)	32.4 (370)	36.4 (550)	37.1 (671)
Pension and social security	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)
\$20,000–\$30,000:					
Social security	15.5 (23)	22.2 (78)	23.8 (216)	26.2 (359)	27.8 (431)
Pension and social security	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)
\$30,000–\$50,000:					
Social security	9.4 (18)	14.2 (51)	17.0 (84)	18.8 (125)	19.4 (95)
Pension and social security	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)
More than \$50,000:					
Social security	2.2 (10)	5.4 (19)	6.7 (27)	6.7 (34)	7.2 (39)
Pension and social security	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.

Now the total replacement rate is 88.2% for the middle-income (\$12,500–\$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%* even for widows in the lowest earnings category. Perhaps a surprising finding of tables 5.3–5.5 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 5.7. 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 10% 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 5.7.⁶

Table 5.4 Unadjusted Replacement Rates Relative to High-3 Average Annual Indexed Earnings By Income Class for Widows

Average Annual Indexed Earnings	1973	1975	1977	1979
Less than \$7,500:				
Social security	24.8 (26)	35.0 (50)	29.7 (68)	35.2 (97)
Pension and social security	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)
\$7,500–\$12,500:				
Social security	18.5 (23)	21.9 (54)	28.6 (86)	28.4 (128)
Pension and social security	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)
\$12,500–\$20,000:				
Social security	16.9 (36)	20.0 (81)	22.0 (139)	22.4 (179)
Pension and social security	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)
\$20,000–\$30,000:				
Social security	9.8 (13)	12.3 (37)	14.6 (71)	14.6 (98)
Pension and social security	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)
\$30,000–\$50,000:				
Social security	8.0 (4)	6.9 (13)	9.0 (19)	12.0 (27)
Pension and social security	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)
More than \$50,000:				
Social security	0.0 (0)	2.8 (5)	3.5 (5)	4.4 (5)
Pension and social security	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.

Tables 5.8–5.12 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,

Table 5.5 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
Less than \$7,500:					
Social security	54.2 (48)	73.7 (111)	86.5 (193)	96.4 (241)	99.8 (273)
Pension and social security	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)
\$7,500–\$12,000:					
Social security	32.1 (61)	51.4 (133)	57.4 (233)	65.0 (314)	65.4 (364)
Pension and social security	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)
\$12,500–\$20,000:					
Social security	28.2 (53)	36.4 (166)	43.8 (370)	48.7 (550)	49.8 (671)
Pension and social security	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)
\$20,000–\$30,000:					
Social security	20.0 (23)	29.6 (78)	31.6 (216)	35.4 (359)	37.3 (431)
Pension and social security	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)
\$30,000–\$50,000:					
Social security	12.0 (18)	19.7 (51)	22.4 (84)	24.7 (125)	25.6 (142)
Pension and social security	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)
More than \$50,000:					
Social security	3.3 (10)	7.8 (19)	10.1 (27)	10.3 (34)	11.9 (39)
Pension and social security	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.

but that is roughly what we have done. We have assumed that the married couples had two children, that child-raising costs account for 28% 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% because of child-raising expenses. This reduction is substantially less than the BLS estimates of expense differences for elderly couples relative to middle-aged 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 esti-

Table 5.6 Unadjusted Replacement Rates Relative to Career Average Annual Indexed Earnings By Income Class for Widows

Average Annual Indexed Earnings	1973	1975	1977	1979
Less than \$7,500:				
Social security	39.8 (26)	62.6 (50)	55.7 (68)	61.2 (97)
Pension and social security	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)
\$7,500–\$12,500:				
Social security	27.4 (23)	33.1 (54)	40.2 (86)	39.8 (128)
Pension and social security	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)
\$12,500–\$20,000:				
Social security	22.4 (36)	26.2 (81)	28.3 (139)	28.8 (179)
Pension and social security	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)
\$20,000–\$30,000:				
Social security	13.8 (13)	16.7 (37)	19.8 (71)	19.8 (98)
Pension and social security	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)
\$30,000–\$50,000:				
Social security	11.7 (4)	10.6 (13)	13.0 (19)	16.6 (27)
Pension and social security	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)
More than \$50,000:				
Social security	0.0 (0)	4.4 (5)	5.7 (5)	6.7 (8)
Pension and social security	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.

mated 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 10% relative to other income sources.⁷

Table 5.8 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% higher and are, in general, extremely high. By 1979, the social security replacement rate is in excess of 150% and the total rate is 250%. Table 5.10 shows the same adjustments for those with career average earnings between \$12,500 and \$20,000. The total adjusted replacement rate is over 100% for all years and the social security adjusted replacement rate alone is over 75%. In fact, our adjusted total replacement rates exceed 100% of career average earnings for all income

Table 5.7 **Composition of Income Sources By Earnings Categories**

Source of Income	< \$7,500	\$7,500– \$12,500	\$12,500– \$20,000	\$20,000– \$30,000	\$30,000– \$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 5.8 Replacement Rates for Career Average Annual Indexed Earnings Less Than \$7,500 for Married Couples

	1971	1973	1975	1977	1979
Unadjusted:					
Social security	54.2 (48)	73.7 (111)	86.5 (193)	96.4 (241)	99.8 (273)
Pension and social security	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)
Tax adjustment:					
Social security	56.4 (48)	76.9 (111)	90.4 (193)	100.7 (241)	104.3 (273)
Pension and social security	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)
Tax and children adjustments:					
Social security	71.3 (48)	97.2 (111)	114.2 (193)	127.3 (241)	131.8 (273)
Pension and social security	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)
Tax, children, and certainty bonus adjustments:					
Social security	82.3 (48)	112.0 (111)	131.5 (193)	146.7 (241)	152.3 (273)
Pension and social security	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 5.9 Replacement Rates for Career Average Annual Indexed Earnings \$7,500-\$12,500 for Married Couples

	1971	1973	1975	1977	1979
Unadjusted:					
Social security	32.1 (61)	51.4 (133)	57.4 (233)	65.0 (314)	65.4 (364)
Pension and social security	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)
Tax adjustment:					
Social security	34.7 (61)	55.4 (133)	62.1 (233)	70.3 (314)	70.8 (364)
Pension and social security	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)
Tax and children adjustments:					
Social security	44.3 (61)	70.7 (133)	79.3 (233)	89.7 (314)	90.4 (364)
Pension and social security	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)
Tax, children, and certainty bonus adjustments:					
Social security	49.5 (61)	79.2 (133)	87.8 (233)	98.6 (314)	99.6 (364)
Pension and social security	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.

Table 5.10 Replacement Rates for Career Average Annual Indexed Earnings \$12,500–\$20,000 for Married Couples

	1971	1973	1975	1977	1979
Unadjusted:					
Social security	28.2 (53)	36.4 (166)	43.8 (370)	48.7 (550)	49.8 (671)
Pension and social security	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)
Tax adjustment:					
Social security	31.9 (53)	41.2 (166)	49.5 (370)	55.1 (550)	56.3 (671)
Pension and social security	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)
Tax and children adjustments:					
Social security	41.2 (53)	53.3 (166)	64.0 (370)	71.2 (550)	72.8 (671)
Pension and social security	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)
Tax, children, and certainty bonus adjustments:					
Social security	44.6 (53)	57.8 (166)	68.4 (370)	75.6 (550)	77.3 (671)
Pension and social security	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 5.11 Replacement Rates for Career Average Annual Indexed Earnings \$20,000–\$30,000 for Married Couples

	1971	1973	1975	1977	1979
Unadjusted:					
Social security	20.0 (23)	29.6 (78)	31.6 (216)	35.4 (359)	37.3 (431)
Pension and social security	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)
Tax adjustment:					
Social security	23.5 (23)	35.0 (78)	37.3 (216)	41.7 (359)	44.0 (431)
Pension and social security	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)
Tax and children adjustments:					
Social security	30.8 (23)	45.8 (78)	48.9 (216)	54.6 (359)	57.6 (431)
Pension and social security	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)
Tax, children, and certainty bonus adjustments:					
Social security	32.8 (23)	48.9 (78)	51.9 (216)	57.8 (359)	60.9 (431)
Pension and social security	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 5.12 Replacement Rates for Career Average Annual Indexed Earnings \$30,000–\$50,000 for Married Couples

	1971	1973	1975	1977	1979
Unadjusted:					
Social security	12.0 (18)	19.9 (51)	22.4 (84)	24.7 (125)	25.6 (142)
Pension and social security	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)
Tax adjustment:					
Social security	14.5 (18)	23.9 (51)	27.3 (84)	30.0 (125)	31.2 (142)
Pension and social security	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)
Tax and children adjustments:					
Social security	19.1 (18)	31.6 (51)	36.0 (84)	39.7 (125)	41.3 (142)
Pension and social security	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)
Tax, children, and certainty bonus adjustments:					
Social security	20.9 (18)	34.4 (51)	39.7 (84)	43.3 (125)	45.5 (142)
Pension and social security	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.

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 were 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 5.8 through 5.12, then, seems quite conclusive that retirement resources are at least adequate to finance consumption at the average pre-retirement consumption level.

Tables 5.13 and 5.14 divide the Retirement History population of couples by year of retirement. Table 5.13 shows the fully adjusted social security replacement rates, while table 5.14 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 di-

Table 5.13 Replacement Rates for Career Average Annual Indexed Earnings More Than \$50,000 for Married Couples

	1971	1973	1975	1977	1979
Unadjusted:					
Social security	3.3 (10)	7.8 (19)	10.1 (27)	10.3 (34)	11.9 (39)
Pension and social security	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)
Tax adjustment:					
Social security	4.4 (10)	10.5 (19)	13.5 (27)	13.8 (34)	15.9 (39)
Pension and social security	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)
Tax and children adjustments:					
Social security	6.1 (10)	14.3 (19)	18.5 (27)	18.8 (34)	21.8 (39)
Pension and social security	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)
Tax, children, and certainty bonus adjustments:					
Social security	7.0 (10)	16.6 (19)	22.2 (27)	22.5 (34)	25.8 (39)
Pension and social security	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 5.14 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

agonal elements are the least dependable numbers. Table 5.13 shows that the social security benefits of each wave of retirees rose in the year following retirement. This is due to the spouse's 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 rates were over 80% for all vintages of retirees. Table 5.14 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% for all retirement cohorts.

Table 5.15 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

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 suggested by Kotlikoff et al. (1982).

5.5 Conclusion

5.5.1 Summary

Our results suggest that by the late 1970s our sample had quite high average replacement rates, as adjusted.⁸ 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%. Calculated either way, social security replacement rates increased about 50% 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 child-rearing costs, taxes, and risky earnings.

5.5.2 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, and so on. 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 subsample, our definition of replacement rate, the adjustments applied in deriving our improved measures of replacement rates, and our methods for aggregating replacement rates.

5.A.1. Data

The Retirement History study was a 10-year longitudinal survey of the retirement process conducted for the Social Security Administration. In 1969, 11,153 persons born between 1905 and 1911 were selected for the survey. 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 totaled less than the year's maximum taxable earnings. In cases where reported covered earnings equaled 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 equaled 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.

5.A.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. We dropped from the sample 284 households that received federal or military pension income.
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. Because they paid no social security taxes between 1958 and 1974, 715 households were dropped from the survey.
4. We eliminated households with unusually high replacement rate values—any households with a social security income replacement rate above 250%, a pension income replacement rate above 200% or a total income replacement rate above 400%. 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 2 (2-year) earlier wave; for example, for 1971, the retirement occurred by 1968 and does not include those who retired in 1969 and 1970. For example, in table 5.5, about 10% 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%.

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 with the year of retirement or the year of widowhood, whichever is later.

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.

5.A.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 5% and 10% 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 wage earnings (plus those of spouse, if any) were inflated to 1983 dollars. Then two averages were computed. "Career Average Annual Indexed Earnings" is average earnings over all years from 1951 to retirement or 1974, whichever is earlier. "High-Three Average Annual Indexed Earnings," on the other hand, is the average of the 3 highest years' earnings in the 10 years before the most recent year of positive social security tax payments. This 10-year period is 1965–74 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 1951–74:

Income	Rate (%)
< \$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

Income	Rate (%)
< \$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% 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.

5.A.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 5.1 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% of high-three average annual indexed earnings.

In all tables, except tables 5.14 and 5.15, 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.

Notes

1. As documented in U.S. Bureau of the Census, Current Population Reports, ser. P-23, no. 128.

2. 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.

3. The widow’s benefit was increased to 100% of PIA in 1972.

4. 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 10 boils down to the peak of the life-cycle earnings pattern.

5. 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.

6. We hope to explore who are, and why, these respondents with low career average earnings but high property income in subsequent work.

7. Of course, other risk-sharing devices exist, such as unemployment insurance, AFDC, etc., so variable earnings in many cases have an income floor.

8. Recall the provisos mentioned in n. 4 about the special nature of our sample and time period.

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Comment Alan L. Gustman

It is a pleasure to be asked to comment on a paper concerning social security by Professors Boskin and Shoven. For some time now, they have been examining a number of the problems associated with the social security system as it is currently constituted, helping us to understand the roots of these problems, and searching in the most creative and constructive way for appropriate reforms.

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In this paper the authors have considered the scope of the redistribution over the life cycle which is fostered by the social security system in concert with other sources of income in retirement. The authors provide us with a road map of how to get from here to there. "Here" is the conventionally measured replacement rate, a ratio of social security benefits to peak earnings at the end of the life cycle. "There" is a fraction, with a numerator equal to total retirement income after taxes augmented by the utility value of the reduced risk from having the certain income from social security rather than an uncertain earnings stream, and with a denominator equal to average lifetime earnings, after taxes, with the earnings adjusted downward for the costs of child rearing. These adjustments take us from a social security replacement rate for peak earnings of married couples which ranges from a fifth to a little over a third, to an augmented full replacement rate ranging from 140% to 170% depending on year of retirement and wave of the survey. Along the way detailed statistics are presented for average replacement rates for individuals grouped not only by year of retirement and by year of the survey wave, but also by the level of the family's covered lifetime earnings and by source of retirement income. Information is also presented for a number of the many cells which are created when individuals are grouped by more than one of these criteria at once.

The novel aspect of this paper is the set of adjustments in replacement rates which are calculated by the authors. The value of the contribution made by the paper will be determined both by the usefulness of their general approach and by the appropriateness of the specific calculations the authors make. Although I have some questions about the general approach, I think it is important and useful. I do, however, have more serious doubts about the appropriateness of some of the particular calculations which the authors present.

Consider first an adjustment which is designed to make pre- and post-retirement incomes more comparable in terms of the utility value these incomes generate. Despite the caveat in their note 4, social security is held by Professors Boskin and Shoven to be a certain source of income, while earnings are a variable source of income. Hence social security is deemed to be more valuable. More specifically, the authors compute the trend in earnings and the variance around the trend, and then use these figures in an expected utility framework to calculate a certainty bonus of 10%, which they add to the value of social security, increasing the value of the replacement rate accordingly. I have no quarrel with the idea that the inflation protection provided by social security and the low risk of default enhance the value of social security benefits. However, there is also a great deal of uncertainty associated with social security which the authors ignore in this calculation. This is so for the group of recipients examined in this study whose pre-retirement period

is the start-up period for social security, and it is true for later cohorts whose benefits may be adjusted to permit adequate financing of a mature system. A start-up period must involve great uncertainty, defined, as by the authors, either as realized deviations around a trend, or defined in an *ex ante* sense. Even those who fully understand the financing arrangements for the social security system have no way of telling when large increases in the benefit formula would stop, when it is that demographic and financial realities would finally take hold and a majority coalition would develop which favors limiting further growth in real benefits. Indeed, a major conclusion of the authors pertaining to the sample of retirees used in their study is that these cohorts of elderly retirees did not fully anticipate their social security wealth windfalls and hence, in an *ex post* sense, oversaved. Moreover, even for those who have already retired, their benefits have a substantial risk component. This risk is reflected in political reactions to the financial problems of the system, reactions which take the form not only of continuous study of the system, but also of legislated changes in benefit formulas. For example, potential reforms, including those proposed elsewhere by Boskin, may have large effects on the benefits of those at or near retirement age. (See Aaron 1983). Adjustments for uncertainty, although difficult to determine in practice, are appropriate. However, it is particularly inappropriate to adjust earnings but not social security, both for cohorts experiencing the start up of the social security system and for those whose retirement will coincide with the maturation of the system.

There are other adjustments employed by the authors which, although they have some merit, nevertheless raise troublesome questions. For example, I find the adjustment which reduces the value of pre-retirement earnings to reflect all costs of raising children to be more questionable than the authors do. As the authors note, the adjustment treats children as a durable good, with no special effect on one's utility from having the children home rather than having already grown up. Accordingly, the assumption they make is that, on average, costs are entirely concentrated during the period of child raising but benefits are spread over the lifetime. By focusing the cost on the period of child raising, but not allocating a disproportionate (although certainly not the entire) share of the utility gained from children to this period, the authors' adjustment for costs of child rearing leads to an overstatement of the replacement rate in retirement.

The largest single adjustment in replacement rates follows from the substitution in the denominator of the replacement rate fraction of a measure of career average earnings for high 3-year earnings—which according to the authors usually occur a few years before retirement. Yet nothing in the conceptual discussion presented by the authors pro-

vides any guidance as to which earnings measure—average earnings or full-time earnings just before retirement—is more appropriate. The theoretical model they present has a completely flat earnings profile; there is no bequest motive; there are no adjustment costs to altering the consumption stream; and capital markets are perfect.

To understand a set of questions I have about the effects of substituting a measure of career average real earnings for high 3-year averaged indexed earnings in the denominator of the replacement rate, it is useful to review some specifics about the authors' calculations. According to their note 6, the high 3-year earnings occur 3–5 years before retirement, and at the latest, are computed for the 10-year period from 1964 to 1974. Career average earnings are measured from 1951 to the earlier of the retirement year (i.e., the year that an individual without a working spouse first reports he is either partially or fully retired), or 1974. Thus, for example, it might be assumed that for a person who retired in 1975, high 3-year earnings would be centered around 1971, while career average earnings would be centered around 1963. In this example, the dates on which these alternative earnings measures are centered are 8 years apart. Alternatively, for a person who retired in 1979, the difference between the center of the peak earning period and the period over which average lifetime earnings are computed might be around 10 years apart, while for a person who retires in 1971, the difference might be around 6 years.

The authors find that the replacement rates decline by about 50% when career average earnings are substituted for high 3-year earnings. The reason for this decline is that the high 3-year earnings exceed career average earnings by that proportion. Although the yearly growth rate in real earnings that would generate a 50% difference of this sort depends on the exact shape of the age-earnings profile (e.g., very low earnings right before retirement would pull down the lifetime average), the underlying growth rates are very large. For example, if 8 years separate the centers of peak earnings and career average earnings, a very rough estimate of the growth rate in real earnings which would generate the observed difference between peak and average lifetime earnings is 5% per year. The period over which these relevant earnings computations are made for the cohorts in this study is, as the authors concede, a very unusual one. It is the period of the sixties, which was characterized by a continuing expansion from trough to peak of economic activity. Real median income for year-round full-time male workers grew 23% between 1962 and 1970 (*President's Economic Report* 1984, table B27).

The conclusion I draw is that, other things the same, using the authors' sample to calculate the effects on replacement rates of substituting a measure of career average earnings for peak earnings may lead

to an overstatement of the increase in replacement rates which would be observed were data for a more normal period of economic activity used instead.

As the paper is presently written, the reader will have to exercise great care in interpreting the detailed tables. There are two problems here, which happen to have opposite implications for replacement rates computed with aggregated data. It can be seen by dividing replacement rates in table 5.5 by the replacement rates reported in corresponding cells in table 5.3 that for four of the six of the detailed earnings groups, ratios of peak to average earnings are higher for late retirees, sometimes substantially so, than are similar ratios for early retirees. For the other two categories of earners, the ratios for late retirees are lower, but only slightly so. One can also see from the counts presented in table 5.5 that the mix of retirees by lifetime earnings class changes over time. For example, using counts for the total retirement income category, it can be seen that those from the two lowest lifetime earning categories (individuals, who, in addition to high social security replacement rates probably have high ratios of wages offered for work while partially retired compared to wages paid on the main job while not retired) constitute 47% of the retirees in the sample in 1971, but only 33% of those in the 1979 group. When the characteristics of the retired group change over time, as appears to be the case for the sample in the paper, more attention needs to be paid to separating the effects of the changing composition of the sample from the effects of such changes in public policy as increases in social security replacement rates over time.

Let me conclude with a brief summary. I agree with the overall thrust of the adjustments of replacement rates advocated by Boskin and Shoven. High replacement rates in retirement are a problem we should be alert to, because the social security system is large and costly, because, as the authors point out, high replacement rates may be inefficient in that they force "too much consumption" into the retirement period, and because of other distortions they may cause. I also agree with their emphasis on the value of making the course of social security benefits over time more predictable as one way of avoiding an inefficient concentration of consumption after retirement. However, there are problems with too many of the adjustments made on the road to a 150% replacement rates for this paper to be used, as yet, by policymakers. Some problems result because the decade preceding retirement of their sample, as well as the one immediately following, both have unique features which have important implications for the replacement rate adjustments. Earnings growth was extremely rapid in the 1960s, while the early seventies are characterized by an unusual and extremely rapid increase in social security replacement rates (see Committee on Finance 1982, table 39). Other problems arise because some of the ad-

justments the authors have made, adjustments which have the effect of raising the replacement rate, appear to be questionable. On the other hand, there are factors which have not been mentioned, such as the gap between the year at which peak earnings occur and the center of the period over which they calculate average earnings, a gap that will increase in future years with an increase in the fraction of the lifetime covered by social security, that might lead the authors' calculations to understate the effects on the replacement rate of the adjustments they make. Given the potential importance of the outstanding questions, I believe that further work along the lines of this paper is required before we can determine with reasonable confidence the appropriate size of any adjustments in replacement rates so that the adjusted rates provide a useful comparison of earnings, consumption or utility differences between pre- and post-retirement periods.

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