NBER WORKING PAPER SERIES

SOCIAL SECURITY BENEFITS AND THE ACCUMULATION OF PRERETIREMENT WEALTH

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Working Paper No. 477

NATIONAL BUREAU OF ECONOMIC RESEARCH
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May 1980

This paper was prepared for presentation at the International Economics Association Conference on "The Determinants of National Saving and Wealth," at Bergamo, Italy, in June, 1980. The research reported here is part of the NBER's study of Capital Foramation. I am grateful to Douglas Bernheim and Anthony Pellechio for assistance with this work and to the NBER and the National Science Foundation for financial support. The views expressed in this paper are my own and should not be attributed to any organization.

NBER Working Paper 477
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ABSTRACT

This paper uses a new and particularly well-suited body of data to assess the impact of social security retirement benefits on private savings. The Retirement History Survey combines survey evidence on the wealth of couples in their early sixties with detailed information from the administrative records of the Social Security Administration on the lifetime earnings of those individuals and the social security benefits to which they are entitled. The present paper uses these data to estimate a model of the determination of preretirement net worth. On balance, the estimates developed in this study favor the extended life cycle model as a theory of asset accumulation and indicate a substantial substitution of social security wealth for private wealth accumulation.

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Social Security Benefits and the Accumulation of Preretirement Wealth

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Social security benefits have become the principal method of financing retirement consumption in the United States and probably in most other industrial countries. For the majority of American families, the actuarial present value of social security benefits exceeds the value of all other household wealth. Measuring the effect of anticipated social security benefits on the accumulation of wealth by individuals is therefore of fundamental importance for both the verification of key economic theories and the analysis of major issues of economic policy.

The principal idea in the economic theories of household consumption and aggregate capital accumulation is the life cycle model suggested by Harrod (1948) and developed by Modigliani (1954, 1957, 1970). The social security program introduces large and exogenous variations from the traditional life cycle pattern of income. The response of households to this lifetime redistribution of income provides a potentially powerful test of the life cycle model. Moreover, the incentives that the social security program provides for

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earlier retirement[1] make it important to extend the traditional life cycle model to make the age of retirement endogenous and then to test the savings implication of this extended theory.

The desirability of expanding or reducing the role of social security in the financing of retirement consumption depends crucially on the extent to which social security displaces private saving. If social security benefits have no efffect on individual saving, the provision of substantial benefits can eliminate poverty in old age with little or no adverse side effect.[2] In the opposite case in which the provision of social security benefits simply displaces equivalent private annuities, the only effect of social security would be the adverse one of reducing national saving.[3] More generally, to the extent that social security benefits reduce private saving, the loss from this must be balanced against the gains in reducing poverty.

This present paper uses a new and particularly well-suited body of data to assess the impact of social security benefits on private saving. These data combine survey evidence on the wealth of individuals in their early sixties

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1 Evidence of the powerful effect of the social security rules on retirement is given by Boskin (1977), and Pellechio (1979).

2 This depends on the way in which benefits are financed and the extent to which they distort retirement decisions.

3 Even a small reduction in saving involves a welfare loss if taxes on investment income place a wedge between the pretax marginal rate of return on capital and consumers' marginal rates of time preference. More generally, there is a welfare loss on each dollar of reduced net saving if the marginal social return on capital exceeds the marginal rate of time preference. See Feldstein (1977a).

with detailed information from administrative records of the Social Security Administration of the lifetime earnings of those individuals and the social security benefits to which they are entitled.

The first section of the paper develops the implication of the extended life cycle theory and indicates the types of inferences that can in principle be made by analyzing the current set of data. Section 2 describes the data and specification in more detail. The statistical estimation problems are discussed and the results presented in the third section. There is then a brief conclusion.

1. Implications of the Extended Life Cycle Theory

The theoretical relationship between social security retirement benefits and saving has been discussed in detail elsewhere (see Feldstein 1974, 1977b, 1979) and can be summarized here very briefly.

According to the traditional life cycle model, the individual maximizes the utility of lifetime consumption subject to a lifetime budget constraint. The solution to the individual's optimization problem implies a pattern of saving during working years and of dissaving during retirement. The particular time pattern depends on expected interest rates, the time path of labor income, and the individual's preferences. An "actuarially-fair lump-sum" (AFLS) social security program imposes a tax that reduces disposable labor income during the individual's working years and returns those tax receipts during retirement years with an increment equivalent to the interest that the individual would have earned. By definition, an actuarially-fair lump-sum program leaves the individual's lifetime budget unchanged and also leaves all relative prices unchanged. The solution to the individual's optimization plan therefore continues to imply the same lifetime path of consumption. The social security tax reduces saving dollar-for-dollar as it is paid and the social security benefits finance the consumption that would have been paid for by dissaving.

Relaxing the assumption that the program is actuarially fair modifies the conclusion only slightly. If the actuarial present value of the benefits is less than the present value of the taxes, the lifetime budget constraint is reduced. Individuals will in general consume less in every year. The reduction in saving would therefore be less than one-for-one. Conversely, a better than actuarially fair program would induce even greater dissaving during the early years.

A more basic challenge to the prediction of reduced private saving comes from those who reject the life cycle model of rational saving. According to this alternative view, individuals are myopic and save irrationally if at all. Saving reflects a delayed adjustment of consumption to rising income, a satisficing level of consumption based on the imitation of a reference group, the result of mortgage repayment or other contractual obligations, or the outcome of following arbitrary rules of thumb. The implication of this view is that only social security prevents individuals from reaching old age with insufficient resources.[1] Katona (1965), Pechman et. al. (1968) and others have even

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[1] Diamond (1977) presents evidence on the low level of private assets of the aged but does not distinguish between the assets that exist in the presence of social security and the assets that would otherwise exist. See Kotlikoff and Summers (1980) for a critical analysis of the Diamond argument and evidence on the relation of total retirement assets to preretirement consumption levels.

argued that social security, by reminding people of the importance of providing for old age, may induce them to save more.

Some aspects of this view can be tested explicitly with the data that are available for the current study. The analysis presented below shows how the assets accumulated by a couple in their early sixties is related to their lifetime earnings and the social security benefits to which they are entitled. According to the "myopic and irrational" view of saving, a higher level of social security benefits should have no effect on lifetime asset accumulation. A significant negative effect of anticipated social security benefits on asset accumulation would be clear evidence in favor of the life cycle theory.[1]

Even within the framework of the traditional life cycle model, there are at least four reasons why the actual impact of social security may differ from the one-for-one replacement implied by the simplest form of the life cycle model [2]: (1) Social security is a restricted asset: it is illiquid, cannot be given away or bequeathed, and cannot be used as collateral for a loan. For these reasons, social security wealth is likely to replace less than an equal value of private wealth. (2) Social security provides a real annuity and may therefore be a more effective replacement. (3) Anticipated social security benefits are not contractual and may be revised by legislative action;

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[1] Of course, individuals may differ in the extent to which they are rational life-cyclers. The estimated coefficient measures the overall net effect. Note also that the coefficient of the social security benefits variable measures the effect of inter-individual <u>differences</u> in social security and does not preclude the possibility that the provision of social security per se induces a recognition of the need for individual retirement planning which increases saving.

[2] These ideas are discussed more fully in Feldstein and Pellechio (1979).

pessimists will regard the current legislation as an overstatment of likely benefits while optimists will expect further increases in benefit levels. (4) Induced changes in private intergenerational transfers may offset the public transfers of the social security program.[1]

Although these characteristics can influence the magnitude of the effect of social security on private wealth accumulation, they do not alter the expected direction of that effect. However, if the traditional life cycle model is replaced by a more general "extended life cycle" theory, even the direction of the effect of social security becomes theoretically ambiguous. In particular, as I have noted in earlier writing (e.g., Feldstein, 1974), dropping the assumptions that the period of retirement is fixed and that social security benefits and taxes are of a lump-sum character makes the effect of social security ambiguous. In particular, the provision of social security benefits may induce earlier retirement[2] which in turn increases the incentive to save. The net effect of social security in this extended life-cycle model depends on the balance between the induced retirement effect and the asset substitution effect. Because the asset substitution effect may be weakened by the four factors noted in the previous paragraph, the induced retirement effect might possibly be the dominant influence.[3]

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[1]This point has been emphasized by Barro (1974, 1978) and discussed in Feldstein (1978, 1979). New evidence on the limited empirical relevance of offsetting private transfers is presented in Feldstein (1980).

[2]The incentive for earlier retirement is obvious when the provision of social security benefits is conditional on retirement or reduced earnings as it is in the United States. But even if there is no "retirement test", the provision of substantial benefits will induce earlier retirement if it is not possible to borrow against such benefits; the U.S. law prevents the use of social security benefits as security for a loan.

[3]More generally, the extended life cycle model with endogenous labor supply also recognizes that labor supply and earnings during preretirement years may respond to the social security program. The nature of this response will depend on the extent to which the additional earnings cause higher tax payments and the extent to which those tax payments lead to higher retirement benefits. The incentives for earlier retirement raise the relative reward for work at younger ages and may increase labor supply during those years.

In considering this possibility, however, it is important to distinguish between the total effect of social security and the effect of marginal changes in social security benefits. The social security program as a whole may have induced a substantial increase in retirement while the current extent of variations in benefits among individuals has a much smaller effect on retirement. To the extent that the marginal effect on retirement behavior is small relative to the average effect, the negative asset substitution effect is likely to dominate.[1]

Because of these sources of ambiguity, empirical analysis of the relation between social security benefits and household wealth accumulation cannot provide clear evidence <u>against</u> a general extended life cycle model. An empirical finding that social security had no effect on households' accumulation of private wealth would not imply that individuals are irrational or myopic but might simply reflect the offsetting effects of countervailing factors. Despite these limitations, the empirical analysis can potentially provide evidence in <u>favor</u> of the extended life cycle model. If the data imply that social security depresses household wealth accumulation, this provides strong evidence in favor of the life cycle hypothesis and against the view that saving is irrational or myopic. Evidence that total wealth accumulation is an increasing function of both age and lifetime income would also support the life cycle model.

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[1]It is, of course, the marginal effect of changes in benefits that is relevant to the policy issue of the optimal size of the social security program.

Quite apart from its contribution to clarifying the theory of saving, measuring the impact of potential changes in social security is of substantial practical importance because of the large magnitude of the Social Security program. For the majority of American households, the present actuarial value of future social security benefits exceeds all other net wealth combined. In the aggregate, this social security "wealth" reached $4 trillion in 1977, more than two-thirds of all other private wealth. Moreover, the total tax collections of the social security program ($97 billion in 1979) nearly equal total private saving in all forms ($106 billion in 1979).

No single study can provide a definitive estimate of the impact of social security or of the appropriateness of the extended life cycle model. My previous studies imply that social security does replace private wealth accumulation by somewhere between 50 cents and one dollar for every dollar of "social security wealth," i.e., for every dollar of actuarial present value of future social security benefits.[1] These studies thus provide substantial support for the life cycle approach. Although some other researchers have reported smaller or non-existent effects of social security, I believe that their conclusions are generally based on misspecified models; these analyses are examined in Feldstein (1979) and need not be discussed again here. The current study, based on a new and different type of data, provides

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[1] These studies are summarized in Feldstein, (1979).

provides further support for my earlier conclusions about the impact of social security and, because of the much more complete information on lifetime earnings than was available in previous studies, further evidence about the appropriateness of the life-cycle model.

2. The Data, Specifications and Definitions

In 1969, the Social Security Administration and the Census Bureau collected extensive information on a sample of individuals who were born between 1905 and 1911. The individuals in the sampling universe excluded married women, i.e., information was collected on unmarried men and women and on couples in which the man was between the ages of 58 and 63. The Social Security Administration then augmented each survey record with information from the Social Security Administration files on annual earnings in each year since 1951 and the total of earnings between 1937 and 1950.[1]

The analysis in this paper focuses on married couples only. Since most of the unmarried individals in the sample are widows or widowers, a separate specification of their wealth accumulation behavior would be required to reflect such things as life insurance proceeds, the earnings of the deceased spouse, remarriage, etc.

The sample is also restricted to couples in which neither spouse was self-employed or employed by the government. Self-employed individuals are

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[1] The data are officially known as the Longitudinal Retirement History Survey and are described in (U.S. Department of Health, Education, and Welfare, 1976). Each individual in the sample was reinterviewed every other year through 1979. The data that I had when this study began included only the survey of 1969 and the administration records through 1974.

likely to save very differently, particularly if their self-employment involves a business with significant physical assets. Employees of the federal government and of many state and local governments are not covered by social security but have separate public pensions instead. This exclusion was made if either the husband or the wife was classified as self-employed or a government employee in 1969, in his or her previous job, or in the job that he or she had held for the longest period of time.

A relatively small number of additional couples were eliminated because of inadequate records; e.g., because the earnings record was incomplete, the age was apparently incorrect, the "value of house" question was not answered in an acceptable way, or the number of quarters required to reach the maximum covered earnings was not feasible. The final sample contains 2087 couples.

The traditional life cycle model implies that the net worth (NW) of individuals at retirement age should be a function of lifetime earnings, or, more precisely, of the accumulated value of lifetime earnings as of that date (LE).[1] Under certain more restricted conditions, it can be shown that the net worth of individual (or couple) i will be a linear function of this accumulated value:

(1) $NW_i = \beta_0 + \beta_1 LE_i + e_i$

where e_i is a random variable that reflects differences in investment experience, tastes, etc.

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[1]The "accumulated value" is the analog of a discounted value; earnings at earlier dates are accumulated with interest to the date of retirement. In applying this concept in the current paper, since everyone has not reached retirement age the variable LE includes both the accumulated value of previous earnings and the discounted actuarial value of earnings until age 65. The text that follows provides more information on the construction of this variable.

The extended life cycle model implies that the accumulation of private net worth is "reduced" by some fraction of "social security wealth" (SSW), i.e.,, the actuarial present value of the benefits to which the couple is entitled at age 65:[1]

$$(2)\ NW_i = \beta_0 + \beta_1 LE_i + \beta_2 SSW_i + e_i$$

If the wealth replacement effect of social security outweighs the induced retirement effect, β_2 will be negative and presumably between zero and minus one. Of course, as Section 1 explained, other values of β_2 are theoretically possible.

Three modifications of this specification are worth considering. First, the accumulation of net worth may depend on the time sequence of earnings and not just the accumulated value. This will be true when the rate of return on assets differs over the individual's lifetime or when the actual evolution of earnings differs from what was expected when the individual entered the labor force. Although it is not possible to incorporate all this information, some indication of differences in the time patterns of earnings can be allowed for by including the ratio of current earnings to accumulated lifetime earnings (CE/LE) as a factor influencing the fraction of lifetime earnings that is saved to finance retirement consumption and bequests:[2]

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[1] The calculation of social security wealth for each couple in the sample is described below.

[2] It would in principle be possible to do more by comparing each couple's earnings history with a standard lifetime evolution of earnings and then examining how "surprises" influenced the final accumulation of wealth. Alternatively, the LE variable of equation 2 might be replaced by several accumulated values corresponding to different portions of the individual's life.

(3) $NW_1 = \beta_0 + [\beta_1 + \beta_3 \, (CE/LE)_i] \, LE_i + \beta_2 \, SSW_i + e_i$

Second, among those who are not yet at retirement age, the ratio of net worth to accumulated earnings should be an increasing function of age. Since everyone in the sample is not exactly the same age (although all of the men are between 58 and 63 years old) the specification should be generalized to permit variation with age:

(4) $NW_i = \beta_0 + [\beta_1 + \beta_3 \, (CE/LE) + \beta_y \, AGEH_i + \beta_5 \, AGEW_i] \, LE_i + \beta_2 \, SSW_i + e_i$

where AGEH is the husband's age and AGEW is the wife's age.

Finally, the assumption that the relationship between net worth and lifetime earnings is linear can be relaxed in favor of a more general second-order specification of the form:

(5) $NW_i = \beta_0 + [\beta_1 + \beta_3 \, (CE/LE)_i + \beta_4 \, AGEH_i + \beta_5 \, AGEW_i + \beta_6 \, LE_i] \, LE_i + \beta_2 \, SSW_i + e_i$

Of course, even this more general specification may not reflect the proper non-linear relation between net worth and lifetime earnings. Since social security wealth is itself related to lifetime earnings in a nonlinear way, there is always the possibility that the estimated coefficent of social security wealth reflects in part the spurious effect of incorrectly specifying the relation between lifetime income and net worth. This problem of underidentification or misspecification is, of course, a very common one in all empirical analysis since the explicit functional form can rarely if ever be specified with certainty.

The value of net worth (NW) used to estimate this equation is the sum of the values of all assets net of the values of all liabilities as reported in the survey questionnaire. Assets include financial assets, real estate and other investment property but exclude the value of cars and other household articles. Unfortunately, the survey collected no information on the value of private pensions. For some couples, this asset is substantial and its omission may bias the estimated coefficients of the other variables in general and of the social security wealth variable in particular. The sign of the bias in the coefficient of SSW depends on whether there is a positive or negative partial correlation between private pension wealth and social security wealth (given the values of the other variables in the equation.)

If the partial correlation between social security wealth and private pension wealth (given lifetime earnings and age) is negative, the estimated coefficient of social security wealth will be biased toward zero.[1] Since social security benefits are based on income up to a limit while private pensions coverage tends to be greater for high income workers, the partial correlation is likely to be negative. Unfortunately, the information on the joint distribution of lifetime earnings, pension wealth and social security wealth that is needed to resolve this question fully is not available. It is perhaps reassuring therefore that the bias is likely to cause an underestimate of the effect of social security and that the typical values of private pension benefits among individuals born around 1910 were much smaller than for more recent cohorts.

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[1]This assumes that social security wealth and private pension wealth affect the accumulation of fungible net worth (NW) in the same direction; i.e., both discourage or both encourage the accumulation of other forms of net worth.

Unlike previous survey data which contained only current or recent earnings, the Retirement History Survey has the earnings histories of the husband and wife based on Social Security Administration records for each year between 1951 and 1974. Although this represents a much richer body of information than has previously been available, there are still several serious measurement problems in evaluating the accumulated lifetime earnings variable. First, earnings in each year are reported only up to the taxable maximum under the Social Security law. More than 80 percent of individuals have earnings below this limit. For the remaining individuals, the administrative record shows the quarter of the year in which the maximum is reached and this information is used to estimate total annual earnings.[1] This process introduces a random error in the measurement of high incomes and causes a systematic understatement of the highest incomes. There is a further problem of misestimation for individuals whose earnings exceeded the taxable maximum and who also had more than one employer.

A second source of bias is introduced by the restriction of earnings to the amount obtained in employment covered by the Social Security program. For individuals who worked temporarily for the government or in other uncovered sectors (not all private occupations and industries were covered in the first decade of the earnings history information), the calculated value of LE underestimates the true value of accumulated earnings.

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[1]This method estimation is described in Fox (1976).

A third problem is that the detailed earnings history is not available for years before 1951, a year in which the men in the sample were between the ages of 40 and 46. The only information on earnings in previous years is the sum of all covered earnings between 1937 when the social security program was established and 1950. Because of the importance of military service during this period, there is no way to distribute these earnings among individual years. The total pre-1951 earnings are therefore included in the lifetime earnings variable as if they were earned in 1951.

Finally, there is no information on the bequests or gifts that individuals receive. Although this is likely to be a small amount for most individuals, it represents a further source of measurement error in the lifetime budget constraint.

The earnings for each year were restated in 1969 dollars and accumulated (or discounted) to 1969 using a three percent interest rate. Differences in the actual real rate of return that couples obtained over their lifetime is a further source of substantial error in measuring the true lifetime budget constraint.

Finally, lifetime earnings are calculated on the basis of earnings through age 65, i.e., everyone is assumed to retire at age 65 unless he or she has already stopped working before that age. Since the actual earnings history through 1974 is available in the Retirement History Survey record and the youngest man is then 63, relatively little extrapolation is needed to complete earnings profiles through age 65 for the entire sample. The required extrapolation assumes that earnings grow at a rate of five percent a year.

Despite these problems in measuring the accumulated value of lifetime earnings, the detailed earnings histories provide sufficient information to calculate quite precisely the real social security benefits to which each couple would be entitled at age 65 and beyond. With this information, social security wealth (SSW) was defined as the present actuarial value as of 1969 of the benefits to which the couple would be entitled if both were retired when the man reached age 65 net of the social security taxes to be paid between 1969 and retirement at age 65 or before. These benefits include the potential survivor's benefit as well as the regular retirement and dependent's benefits. Since benefits are automatically adjusted for changes in the price level, inflation was ignored and the benefits were discounted at a real rate of three percent. The calculation of benefits uses the Social Security law as of 1971 (when the youngest beneficiary reached 65) and therefore reflects the quite substantial increase in future benefits that was enacted in 1969. Since this increase represented a departure from previous benefit-income ratios, the calculated social security wealth values are probably higher (by 10 to 20 percent) than most individuals would have anticipated on the basis of the previous history of this program.

Before turning to the estimated equations, it is useful to review the characteristics of the sample couples. The mean net worth of these couples in 1969 was $23,682, or approximately seven times disposable income per capita for the population as a whole in that year. The standard deviation of $62,445 indicates very substantial variation around this mean. The average value of social security wealth was approximately twice as large, 45,194, with a relatively small standard deviation of $7,068. Total wealth available to finance retirement consumption therefore averaged $68,875, plus the unobserved value of private pension wealth.

It is interesting to compare this retirement wealth with lifetime earnings. The average accumulated value of lifetime earnings was $244,566 with a standard deviation of $132,926. The average value of net worth plus social security wealth therefore equaled about 25 percent of accumulated lifetime earnings. Thus more than one-fifth of total lifetime resources was available for consumption after the normal retirement age.

Finally, the current 1969 earnings per couple averaged $7,910 with a standard deviation of $7,003; this variability reflects the fact that some of sample were already wholly or partly retired.

3. Parameter Estimates

This section presents estimates of the parameters of equations 4 and 5. These estimates imply that higher levels of social security wealth reduce the accumulation of ordinary wealth. In the specification of equation 4, in which the accumulation of ordinary net worth is proportional to lifetime earnings, each extra dollar of social security wealth reduces private wealth accumulation by approximately one dollar. With the nonlinear specification of equation 5, in which the accumulation of ordinary net worth is a quadratic function of lifetime earnings, the greater colinearity between social security wealth and the lifetime earnings variables makes precise inference more difficult. The point estimates with this specification also imply that higher levels of social security wealth reduce the accumulation or ordinary wealth but each extra dollar of social security wealth reduces private wealth accumulation by approximately 50 cents.

In addition to ordinary least squares estimates, this section also presents both instrumental variable estimates and estimates with a heteroskedasticity transformation. Table 1 presents the OLS and I.V. estimates of the untransformed specification o.

Equation 1.1 implies that each additional dollar of social security wealth reduces the accumulation of ordinary net worth by 1.11 dollars. The standard error of 0.24 implies that the substitution is not significantly different from one-for-one. Conventional inference rules imply that there is less than one chance in ten that each additional dollar of social security wealth replaces less than 75 cents of ordinary wealth.

The other coefficients of equation 1.1 are plausible and consistent with a priori expectations. An additional dollar of lifetime earnings raises net worth by $-0.54 + 6.84 \cdot 10^{-3}$ AGEH $+ 4.58 \cdot 10^{-3}$ AGEW; evaluating this at the mean values of AGEH (61 years) and AGEW (57 years) implies that each dollar of additional lifetime earnings raises net worth by 14 cents. An additional year of age for the husband or wife has a positive but small effect. Adding a year to the ages of both husband and wife raises net worth by 11.42 per 1,000 of lifetime earnings. Since net worth averages about 250 per 1,000 of lifetime earnings, the increase is relatively small. Finally, the coefficient of current earnings indicates that recent earnings are likely

Table 1

Parameter Estimates of the Net Worth Equations

Equation	Estimation Method	Constant β_0	LE β_1	SSW β_2	CE β_3	AGEH x LE (10^{-3}) β_4	AGEW x LE (10^{-3}) β_5	LE^2 (10^{-6}) β_6	R^2	N
1.1	O.L.S.	26907 (9851)	-0.54 (0.19)	-1.11 (0.24)	1.46 (0.24)	6.84 (3.05)	4.58 (0.89)		0.16	2087
1.2	O.L.S.	15421 (9956)	-0.24 (0.19)	-0.35 (0.27)	1.11 (0.24)	0.35 (3.21)	3.96 (0.89)	0.18 (0.03)	0.17	2087
1.3	I.V.	27973 (10993)	-0.78 (0.23)	-1.04 (0.28)	1.80 (0.27)	10.56 (3.74)	4.34 (1.08)		0.13	2087
1.4	I.V.	21123 (11218)	-0.35 (0.28)	-0.42 (0.36)	0.60 (0.52)	2.62 (4.74)	3.07 (1.17)	0.25 (0.009)	0.13	2087

The dependent variable in each equation is the net worth of the couple. Standard errors are shown in parentheses. The instrumental variable equations use SSW, CE, AGEH, AGEW and the dummy variables as the instrument set. See text for definitions of variables. Equations 1.1 and 1.3 correspond to equation 4 in the text while equations 1.2 and 1.4 correspond to equation 5.

to have a bigger effect on wealth accumulation than earlier earnings that made the same contribution to the accumulated value of lifetime earnings.

Equation 1.2 adds the quadratic term in lifetime earnings. Its coefficient is statistically significant and has an economically plausible value. The new specification implies that each additional dollar of lifetime earnings raises net worth by 9 cents at the mean value of lifetime earnings. For a couple with lifetime earnings equal to the mean plus one standard deviation, this increases from 9 cents to 14 cents; with lifetime earnings one standard deviation below the mean, the 9 cents drop to 4 cents.

The coefficient of social security wealth is now substantially lower, only -0.35. The standard error implies that a 50 percent confidence interval stretches from -0.27 to -0.53; there is approximately one chance in 10 of observing this estimate if the true value of the coefficient is positive.

The errors in the measurement of lifetime earnings that were discussed in the previous section could make these OLS estimates biased and inconsistent. Even though the social security wealth variable itself is measured quite accurately, the estimate of its coefficient can be inconsistent if the lifetime earnings variable is measured with error since the two variables are correlated. This inconsistency can in principle be eliminated by instrumental variable estimation. Since there is no natural instrumental variable in the available data (i.e., a variable that is highly correlated with true lifetime earnings but uncorrelated with the measurement error in the constructed measure of lifetime earnings), I have used an extension of Wald's (1940) method.

More specifically, the range of the lifetime earnings variable is divided into four sections and binary variables are used to denote each section; three such binary variables are then included in the instrument set. If the division into four sections corresponded to the true lifetime earnings, this procedure would be fully consistent. In reality since the classification is not perfect, the estimates are still inconsistent but should have smaller assymptotic bias than the O.L.S. estimates. The other variables in the instrument set are social security wealth, current earnings and the two age variables. Excluded from the instrument set are therefore lifetime earnings, the product of lifetime earnings with each age variable, and the square of lifetime earnings.

The instrumental variable estimates are presented in equations 1.3 and 1.4 of Table 1. The absolute size of the lifetime earnings coefficents are increased, suggesting that the O.L.S. estimates were subject to the usual type of errors in variables bias (toward zero). The coefficients of the social security wealth variable change relatively little with both estimates moving in the direction of minus one.

The very substantial variation in all of the key variables suggests that the residuals are likely to be heteroskedastic and, more specifically, that the variance of the residuals is likely to be an increasing function of lifetime earnings. This implies that O.L.S. estimation gives too much weight to the couples with high lifetime earnings. The reasonable assumption that the standard deviation of the residual is proportional to accumulated lifetime earnings implies that the heteroskedasticity can be eliminated by dividing all of the variables (including the constant term) by accumulated lifetime earnings.

Unfortunately, this transformation is likely to exacerbate the errors in variables problem. In particular, dividing social security wealth by accumulated lifetime earnings introduces a correlation between that variable and the error in the other variables that depend on lifetime earnings. The use of a consistent alternative to O.L.S. estimation may therefore by important with this transformed specification even though the use of instrumental variables had relatively little effect with the undeflated specification of Table 1. Two approaches to instrumental variable estimation were tried. The first method extends the Wald - type procedure by creating three additional binary variables on the basis of the ratio of social security wealth to lifetime earnings. More specifically, these variables indicate whether the ratio is: less than 0.15; 0.15 to 0.20; or 0.20 to 0.35. The appropriateness of these six binary variables (i.e. the three based on lifetime earnings and the three based on the social security wealth ratio) depends on the extent of measurement error. Unfortunately, the ratio of social security wealth to lifetime earnings might well be misclassified. Although these estimates should have a smaller asymptotic bias than the OLS estimates, the remaining bias could still be large.

The second method, which also builds on Wald's procedure, sacrifices efficiency in order to achieve essentially complete consistency. The sample is divided into three groups according to the ratio of social security wealth to lifetime earnings: less than 0.15; 0.15 to 0.35; and greater than 0.35. The observations in the middle group are then discarded. A single binary variable corresponding to the low group is then used as an instrumental variable. Since there is only a very small probability of misclassifying a couple with a low true ratio of social security wealth to lifetime earnings as a high ratio couple or vice versa, the estimates produced in this way should have a substantially smaller asymptotic bias. Although a substantial fraction of the sample is sacrificed by this procedure, the remaining sample has 806 observations.

Table 2 presents results for the three kinds of estimators: ordinary least squares; instrumental variables; and the third method, which I will refer to as the Wald procedure. The column captions show the variables as they appear in equations 4 and 5 of the text and then, in square brackets, the actual regression variables in the deflated estimation equation.

The basic ordinary least squares estimates in equation 2.1 are generally very insignificant and have very little explanatory power. Only the coefficients of current earnings and of the wife's age exceed their standard errors. The other coefficients generally differ in order of magnitude or sign from the corresponding coefficients in Table 1. The same discrepancy and lack of statistical significance prevail in equation 2.2 when the quadratic effect of lifetime earnings is introduced. Since deflation to correct for heteroskedasticity is intended to incease the efficiency of the estimates and not to correct for biases, the change in coefficients between Tables 1 and 2 indicates that something more than heteroskedasticity is involved. In particular, it suggests the errors in variables problem that I described above.

Table 2

Parameter Estimates of Deflated Net Worth Equations

Equation	Estimation Method	Constant [1/LE] β_0	LE [1] β_1	SSW [SSW/LE] β_2	CE [CE/LE] β_3	AGEH x LE [AGEH] (10^{-3}) β_4	AGEW x LE [AGEW] (10^{-3}) β_5	LE^2 [LE] (10^{-6}) β_6	R^2	N
2.1	O.L.S.	1387 (3719)	-0.09 (0.17)	0.01 (0.11)	0.51 (0.19)	0.46 (2.70)	2.17 (0.81)		0.01	2087
2.2	O.L.S.	2044 (3689)	-0.03 (0.17)	0.16 (0.11)	0.41 (0.19)	-1.80 (2.71)	1.80 (0.80)	0.27 (0.05)	0.03	2087
2.3	I.V.	27732 (15792)	-1.37 (0.52)	-0.91 (0.45)	4.23 (2.11)	16.87 (6.72)	6.08 (1.73)		0.01	2087
2.4	I.V.	12186 (14974)	0.10 (0.59)	-0.03 (0.46)	-1.13 (2.33)	-3.21 (7.86)	1.40 (1.95)	0.36 (0.09)	0.02	2087
2.5	Wald	46718 (13448)	-1.38 (0.44)	-1.34 (0.39)	0.17 (0.28)	18.12 (6.62)	7.66 (1.97)		0.02	806
2.6	Wald	28818 (18060)	-0.85 (0.57)	-0.72 (0.58)	0.17 (0.27)	10.04 (8.54)	5.43 (2.46)	0.14 (0.10)	0.03	806
2.7	O.L.S.	1879 (4844)	-0.24 (0.30)	-0.03 (0.14)	0.27 (0.27)	2.74 (4.79)	3.11 (1.44)		0.01	806
2.8	O.L.S.	2423 (4806)	-0.12 (0.29)	0.13 (0.14)	0.20 (0.27)	-0.54 (4.83)	2.43 (1.44)	0.25 (0.06)	0.03	806

The dependent variable in each equation is the ratio of the couple's net worth to their accumulated lifetime earnings. Standard errors are shown in parentheses. The instrumental variable equations use SSW, CE, AGEH, AGEW and the dummy variables as instruments. See text for definitions of variables and discussion of the I.V. and Wald estimation methods.

The instrumental variable estimates presented in equation 2.3 tend to confirm this diagnosis. The coefficients of this equation are quite similar to the coefficients of the undeflated equation 1.3 that is also estimated by the method of instrumental variables. Although the explanatory power of the equation remains low, each of the coefficients is more than twice its standard error. The coefficient of the social security wealth variable, -0.91, is quite similar to the -1.04 obtained in the undeflated specification.

Adding the extra lifetime earnings variable causes substantial changes in the other coefficients. The coefficient of the social security variable drops in absolute value to a trivial -0.03 with a standard error of 0.46. The coefficient of the current earning variable becomes implausibly negative and insignificant. The husband's age variable also becomes negative and insignificant. Indeed, the only coefficient that exceeds its standard error is the new accrued lifetime earnings variable itself. One interpretation is that this is the correct specification, i.e., that age, current earnings and social security wealth are all irrelevant and that the ratio of net worth to lifetime earnings is determined primarily by the level of lifetime income. My own belief is that such a specification is implausible on a priori grounds and that the parameter estimates of equation 2.4 are the result of either inadequate instrumental variables or the fact that the lifetime earnings variable is the only variable in the transformed specification with a substantial range of variation.

The Wald estimators, presented in equations 2.5 and 2.6, support this view. These coefficients imply a significant role for age and social security wealth as well as lifetime earnings as determinants of accumulated net worth. The coefficients in equation 2.5 are generally similar to those of the instrumental variable estimates of equation 2.3. The coefficient of the social security wealth variable is -1.34 which, with a standard error of 0.39, is not significantly different from minus one. When the quadratic effect is introduced in equation 2.6, the other coefficients remain qualitatively similar. In particular, the social security coefficient becomes -0.72 with a standard deviation of 0.58. The age variables remain positive and are only slightly diminished in magnitude. The impact of a change in lifetime earnings also remains similar when evaluated at the mean value of lifetime earnings.

The two final equations of Table 2 are based on the same censored sample that was used with the Wald procedure but the estimation is by ordinary least squares. These coefficients confirm that it is the consistent instrumental variable aspect of Wald's procedure and not the nature of the sample that produces the estimates of equation 2.5 and 2.6.

4. Conclusion

This paper has examined a very rich body of data on social security benefits, lifetime earnings, histories, and net worth accumulation. The estimated net worth equations provide quite strong support for the extended life cycle model in general and for the specific hypothesis that increased social security benefits reduce private wealth accumulation.

The estimated magnitude of the effect of social security wealth depends on the specification of the equation and the method of estimation. In the most basic linear specification, the data imply that each dollar of additional social security wealth reduces private wealth accumulation by approximately one dollar. This is true of both the ordinary least squares and instrumental variable estimates; when the variables are all deflated to reduce heteroskedasticity, the same dollar-for-dollar substitution is found when the coefficients are estimated by an instrumental variable method or a method based on Wald's procedure.

A more general specification, with a quadratic effect of lifetime earnings, was also estimated. The increased colinearity makes it more difficult to estimate the coefficients of the other variables, particularly when all of the variables are deflated by lifetime earnings. Moreover, the deflated estimates seem particularly subject to the problem of measurement error and the estimates of all the coefficients are quite sensitive to the method of estimation. The estimated coefficient of social security wealth was also unstable but varied between -0.35 and -0.72 in the equations in which the other parameters had plausible values. More generally, the estimates show the importance of using a consistent estimation procedure that is quite robust with respect to substantial measurement error.

On balance, the estimates in this study favor the extended life cycle model as a theory of asset accumulation and indicate a substantial substitution of social security wealth for private wealth accumulation. It is unnecessary to repeat all of the caveats that were discussed in earlier sections. The nonexperimental character of economic research makes it almost inevitable that no single study can provide a decisive test of a theory or a conclusive measurement of a key parameter. Only by combining evidence from several studies can uncertainty be reduced and a conclusion reached with confidence.

Cambridge, Massachusetts
May, 1980

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