Testing the Theory of Social Security and Life Cycle Accumulation

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Since its inception the Social Security system has engaged in resource transfers of three kinds, intergenerational, intragenerational, and intertemporal. Transfer of resources across generations, the consumption loan feature of the system, began in 1939 with the payment of benefits to elderly citizens who had paid little or nothing into the system. The 1939 and subsequent amendments to the Social Security Act also weakened the link between taxes paid and benefits received within generations. Within a generation, dependent and surviving widow and widower benefits lead to resource transfers from single to married households and from two-earner households to single earner households. The third resource transfer, the intertemporal transfer, involves simply a reduction in resources when young due to Social Security taxation and an increase in resources when old, the receipt of Social Security benefits.

The impact of these three transfers on the historic level of aggregate savings and hence the size of the current capital stock has been the subject of much recent debate. The unfunded financing of the social insurance program is central to the discussion. While the original 1935 legislation authorized the accumulation of a large trust fund, this goal was essentially abandoned with the 1939 amendments. The failure to accumulate a trust fund, the pay-as-you-go feature of the system is, of course, equivalent to the intergenerational resource transfer. It is argued that this transfer is responsible for an historic reduction in savings relative to consumption.

The theoretical impact of these three types of resource transfers is, however, quite model dependent. For example, a simple Keynesian consumption function with a constant and identical marginal propensity to save out of disposable income for all age groups predicts no change in aggregate savings arising from Social Security resource transfers. A life cycle model of accumulation has, on the other hand, quite different implications. Within a simple life cycle model the introduction of an unfunded Social Security system characterized by a 10 percent tax rate reduces the steady-state capital stock by about 20 percent in general equilibrium and 40 percent in partial equilibrium (see the author). One prerequisite to the resolution of Social Security's historic impact on capital accumulation is, therefore, the empirical verification of micro-economic behavioral responses to Social Security.

This paper presents new micro evidence on the accumulation response of households to Social Security. It is organized in the following manner: Section I reviews the theory of Social Security and life cycle savings: considered here will be the one-for-one replacement of accumulated Social Security taxes for accumulated private savings, the retirement effect, and the effect of changes in lifetime wealth due to the yield of the Social Security system. In Section II econometric specification is used to test the theory. Section III discusses the sample selected from the National Longitudinal Survey (*NLS*) of men aged 45–59, and Section IV presents the empirical findings.

I. The Theory of Social Security and Life Cycle Savings[1]

The different effects of Social Security on life cycle accumulation are easily understood

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[1]The pioneering work on this subject is by Martin Feldstein (1974).

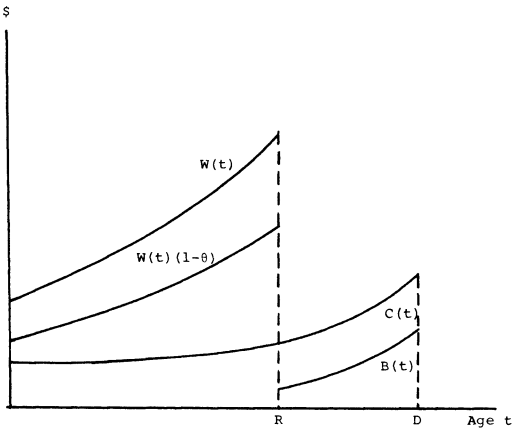

FIGURE 1

with the help of Figure 1. In the diagram a representative life cycler with (for simplicity) a fixed life span D faces, in the absence of Social Security, an earnings stream such as $W(t)$ and chooses a consumption stream such as $C(t)$ and an age of retirement such as R. The choice of consumption at every age t as well as the age of retirement arises from the maximization of an intertemporal utility function of consumption and leisure subject to the following budget constraint (assuming no bequests):

$$(1) \qquad \int_0^D C(t)e^{-rt}\,dt = \int_0^R W(t)e^{-rt}\,dt$$

where r = the rate of interest.

At the micro level the introduction of Social Security reduces the earnings profile by the amount of the Social Security tax $\theta \cdot W(t)$ prior to retirement and provides a Social Security benefit stream $B(t)$ thereafter. The term $\theta \cdot W(t)$ refers to the combined tax on employers and employees. The new budget constraint facing the individual is

$$(2) \qquad \int_0^D C(t)e^{-rt}\,dt = \int_0^{R'} W(t)(1-\theta)e^{-rt}\,dt + \int_{R'}^D B(t)e^{-rt}\,dt$$

If retirement does not change ($R = R'$) and the Social Security system offers an implicit yield on paid taxes equal to the market rate of interest r, then lifetime wealth is not affected by the Social Security system and the consumption profile is unaltered. Under these assumptions accumulated Social Security taxes simply replace accumulated private savings dollar-for-dollar prior to retirement age R.[2] This will be referred to below as the replacement effect.

The assumption of a Social Security yield equal to the rate of interest requires

$$(3) \qquad \int_0^R W(t)\theta e^{-rt}\,dt = \int_R^D B(t)e^{-rt}\,dt$$

Equation (3) states that the present value of lifetime taxes paid in must equal the present value of lifetime benefits received for the system to be actuarially fair. The failure of this equation to hold implies either lifetime wealth increments or decrements due to the Social Security system. Certainly the vast majority of Social Security beneficiaries up to the present have enjoyed positive lifetime wealth increments from the system due on the one hand to high real benefit levels and, on the other hand, to their escape from taxation when young; so far no cohort has paid Social Security taxes for more than forty years. The life cycle model predicts an upward shift in the consumption profile in responses to a positive lifetime wealth increment, assuming consumption at every age is a normal good. This lifetime wealth increment would reduce savings at every age implying a greater than one for one reduction in private accumulation. The magnitude of this departure from the

[2]To see this let A_T be the value of private assets at time T, then

$$A_T + \int_R^D B(t)e^{-r(t-T)}\,dt + \int_T^R W(t)(1-\theta)e^{-r(t-T)}\,dt = \int_T^D C(t)e^{-r(t-T)}\,dt$$

Future consumption is financed out of current private assets, future Social Security benefits, and net future earnings. Using equation (3) we may rewrite the expression as:

$$A_T + \int_0^T \theta W(t)e^{r(T-t)}\,dt = \int_T^D C(t)e^{-r(t-T)}\,dt - \int_T^R W(t)e^{-r(t-T)}\,dt$$

Since the right-hand side is independent of Social Security, private assets are offset dollar-for-dollar by accumulated Social Security taxes.

one-for-one replacement of private net worth by accumulated Social Security taxes is limited at any age to some fraction of the lifetime wealth increment evaluated at age zero (LWI_0). For example, if the increase in consumption financed by the LWI_0 was a constant ΔC at every age, then

$$(4) \qquad \int_0^D \Delta C e^{-rt}\, dt = LWI_0$$

or

$$\Delta C = \frac{r}{1 - e^{-rD}} LWI_0$$

In terms of the diagram, the consumption profile would shift upward by an amount $rLWI_0/(1 - e^{-rD})$ at every age. By age x the fraction of LWI_0 consumed equals $(1 - e^{-rx})/(1 - e^{-rD})$. The effect of this additional consumption on wealth holdings at age x is found by accumulating forward up to age x the reduction in savings due to the LWI_0 and may be expressed as

$$(5) \quad \int_0^x \Delta S e^{rt}\, dt = \frac{-(1 - e^{-rx})}{(1 - e^{-rD})} e^{rx} LWI_0 = \frac{-(1 - e^{-rx})}{(1 - e^{-rD})} LWI_x$$

LWI_x is the value at age x of the lifetime wealth increment receivable at age zero. Economic theory suggests then that the inclusion of the variable LWI_x in an accumulation regression should yield a coefficient ranging between 0 and -1 depending on the age of the respondent. For example, in the case of constant incremental consumption at every age x, the term $(1 - e^{-rx})/(1 - e^{-rD})$ takes the value .68 for an age of death of 55, x equal to 30, and an interest rate of .02. Since age zero in the life cycle model corresponds not to birth but rather to the beginning of one's productive life, say age 20, .68 is the fraction of LWI_x a 50-year old would have consumed who expected to live until age 75.[3]

[3]The presence of inflation does not alter any of these conclusions since all the variables in the preceding equations may be taken as real including the rate of interest. In this empirical work all variables are measured in real 1966 dollars.

Both the intergenerational and intragenerational resource transfers are captured by the LWI_x variable. The intertemporal transfer, holding LWI_x constant, is neatly summarized by the amount of accumulated Social Security taxes ($ASST$). Again the intertemporal transfer refers to the payment of taxes when young and the transfer back of these taxes when old in the form of benefits with an implied return equal to the market rate of interest. *Ceteris paribus*, the predicted coefficient of $ASST$ in an accumulation regression should equal -1. The life cycle model predicts explicit signs and magnitudes of coefficients for resource transfer variables within an annual savings regression as well. In an annual regression of savings every dollar of Social Security taxes should reduce annual private savings by more than one dollar holding LWI_x fixed, since disposable income is reduced by the amount of interest on accumulated Social Security tax payments. Holding LWI_x fixed, the annual reduction in savings for the preretirement age group should equal the annual amount of taxes plus the interest on accumulated Social Security taxes. A dollar increase in LWI_x should reduce annual savings by a fraction of a dollar depending on the age of the respondent.

Thus far I have not considered the impact of Social Security on the age of retirement and through retirement age on accumulation. As Martin Feldstein has pointed out, Social Security may induce early retirement due to an implicit tax on post-62 earnings;[4] the savings response of the young to a planned earlier retirement is likely to be positive. A reduction in the age of retirement will reduce lifetime wealth by shortening the earnings stream. Under reasonable assumptions this will shift the consumption profile downwards increasing savings at young ages. The magni-

[4]The "actuarial" reduction of benefits for those choosing early retirement may imply a zero implicit tax between the ages 62–65 to the extent that the actuarial reduction is truly fair. To be truly fair benefits levels must rise to compensate for the postponement, the higher risks of mortality, as well as the additional tax contributions paid in during these years. For a comprehensive review of the growing literature on Social Security and retirement see Colin Cambell and Rosemary Cambell.

tude of the retirement effect is critical in determining Social Security's net impact on accumulation. The argument for an historical reduction in aggregate *U.S.* savings relative to consumption rests on an increase in consumption due to intergenerational transfers (the lifetime wealth increment effect) by the initial older generation without a completely offsetting reduction in consumption because of earlier anticipated retirement by the young. Note that the intertemporal transfer, the replacement effect, implies by itself no change in aggregate consumption according to the life cycle model since it involves no change in anyone's lifetime budget constraint.[5]

The above discussion concerning the lifetime wealth increment and replacement characteristics of Social Security is subject to qualification in the case of imperfect capital markets. If capital markets are imperfect and one cannot borrow against future Social Security benefits, fixed savings goals (for example, a downpayment on a house) prior to retirement may lead to a one-for-one reduction in consumption up to a certain age and an increase in consumption compared to previous levels thereafter. In other words the consumption profile could rotate counter clockwise at a given age. Variables to test for this capital market imperfection will be suggested below.

II. Econometric Specification

To test empirically the micro response to Social Security I specify two linear regressions, one for household wealth accumulation prior to age of retirement and one for the expected age of retirement. The basic framework for the accumulation equation is given by

$$(6)\quad \textit{Net Worth} = B_1 + B_2 ASST + B_3 LWI_x + B_4 RETAGE + B_6 LTLABI + \gamma' Z + E$$

where *Net Worth* = assets less liabilities of the household.

$ASST$ = the value to the present of household accumulated Social Security taxes; that is, paid in employee plus employer Social Security taxes are accumulated up to the present at the market rate of interest. Households here are taken to be the husband and wife if married, otherwise the single household head. Social Security taxes and benefits of other family members are not considered.

LWI_x = the absolute dollar yield of the Social Security system to the individual household in current dollars and is equal to the present expected value of future Social Security benefits less the present expected value of future Social Security taxes less the value of past paid in Social Security taxes accumulated up to the present. Letting $PVFB$ and $PVFT$ stand for the present value of future benefits and taxes, respectively,

$$LWI_x = PVFB - PVFT - ASST$$

If LWI_x is positive, the household has received a higher yield on its taxes from the Social Security system than the market rate of return.

$RETAGE$ = the expected age of retirement of head.

$LTLABI$ = the current dollar value of household lifetime gross labor income; where gross refers to gross of employer plus employee Social Security taxes although net of income taxes.

$\gamma' Z$ = the vector sum of additional exogenous variables.

E = the error of the regression.

Recall that the expected coefficient on the term $ASST$ is -1: to see this most clearly, compare two families. Family A is insured by Social Security and family B is not insured. Both families have identical streams of gross labor income. Assume all other characteristics of the two families are identical and that the family with Social Security has an LWI_x equal to zero. Assuming either no capital

[5]The intertemporal transfer would occur whether or not the system was funded. For example, under a fully funded system we would still observe people paying in taxes when young and drawing out benefits when old. Under a fully funded system, however, the benefits drawn out would equal one's own contribution plus interest, while under an unfunded system the benefits drawn out would correspond to the tax contribution of the succeeding generation.

market constraints to borrowing against future Social Security benefits or that such borrowing is not desired, the consumption streams of the two families are identical since they are both based on the same lifetime wealth. Hence, the sum of accumulated savings in both private (*Net Worth*) and Social Security forms (*ASST*) will be identical for both families and the coefficient on *ASST* should equal -1. (The predicted partial coefficient for *ASST* is -1 regardless of the value of LWI_x.)[6] Let us now make the assumption that family *A* has a positive value of LWI_x. Family *A* has therefore a higher lifetime wealth than does family *B*. Family *A* will consume more at any point in time than family *B* assuming noninferiority of consumption at any point in time. Prior to retirement family *A* will have less private plus Social Security accumulation (*Net Worth* plus *ASST*) than family *B* since they have consumed more each year for identical gross labor incomes. The coefficient in LWI_x should therefore be negative. In addition this coefficient should be less than 1 in absolute value since only a portion of this lifetime wealth increment will have been consumed by family *A* each year up to the current period. A significant negative coefficient on the lifetime wealth increment variable is critical to the argument that Social Security has reduced aggregate savings. A negative coefficient on *ASST* for our preretirement sample would not by itself imply a reduction in aggregate savings since even a simple Keynesian savings function of the form $S = a + bY_d$ (where S is savings, Y_d is disposable income, and a, b are coefficients) would predict a reduction in preretirement savings because of the reduction in disposable income from the Social Security tax.

Ideally equation (6) should include the expected retirement age of the spouse as well as that of the head, *RETAGE*. Unfortunately the *NLS* data reports this information only for the head. In addition the data does not report information about earnings histories. Hence in our regression we use a proxy for *LTLABI* a two-year average of disposable labor income adding in the employer's tax contribution to Social Security based on the two-year earnings average and deducting an estimate of income taxes paid on that labor income.[7] A recent study by James Adams points to an elasticity of lifetime bequests with respect to lifetime wealth in excess of unity. To capture rising accumulation for bequests as lifetime resources increase the square of this constructed average gross labor income (henceforth *ALY* and *ALY2*) is included in the regression. Since this proxy presumably measures *LTLABI* with error the education of the head is included as an explanatory variable. An additional bequest variable *IHER* was coded 1 for respondents indicating a desire to leave an inheritance.

The savings behavior of two-earner families may differ from that of single earner families for at least two reasons. First two-earner families have greater work-related expenses; hence for a given level of *ALY* the disposable labor income of two-earner families is less than that of single earner households. Second the riskiness of the future labor earnings stream from death, disability, or loss of work is smaller when the labor income is divided among two earners rather than one. Hence two-earner families will have a smaller precautionary motive for savings. To allow for the possibility that two-earner families save less we include the variables *ALYT* and *ALY2T* which equal *ALY* and *ALY2* multiplied by a dummy variable for two-earner households.

Other variables included in the regression are dummies for marriage (*MAR*), race (*RACE*), and heads who are separated, widowed, or divorced (*SWD*). In addition the head and wife's ages and the square of their ages (*AGEH*, *AGEH2*, *AGEW*, *AGEW2*) as well as the number of family members (*SIZE*) are exogenous variables. Ideally one would like to treat pension contributions in an identical manner as Social Security taxes, accumulating them up at the market rate of

[6]To see this alter (3) to let the lifetime wealth increment equal the difference between present benefits and present taxes and proceed as in fn. 2.

[7]Presumably, reported labor income is gross of the employee's Social Security tax contribution but net of the employer's; hence, we need add in only the employer's half to obtain gross labor income.

interest and testing for a coefficient of minus one. Unfortunately the data do not provide reliable information for current, let alone past, pension contributions. Hence two dummy variables are introduced to capture the average effects of pensions on the accumulation of wealth: *PEN* takes the value 1 if the respondent reported participation in a pension plan; since government workers have more generous and secure pensions, *GPEN* was coded 1 if in addition the respondent was a government worker.

So far I have presented variables to capture three of the four theoretical points in Section I, viz., replacement, lifetime wealth increment, and retirement. The fourth issue pertains to capital market constraints on borrowing against future Social Security benefits. Families with fixed accumulation goals such as a downpayment for a house may be forced to reduce consumption in response to the Social Security tax if these taxes constitute a large fraction of their pre-Social Security savings. For such families the coefficient of the Social Security variables *ASST* and LWI_x may be zero. To test for this possibility two additional variables are used in separate regressions below. They are *HASST* and $HLTW_x$, dummy variables for home ownership multiplied by *ASST* and LTW_x. The coefficients of *HASST* and *ASST* should be positive and negative one, respectively. The coefficients on $HLTW_x$ and LTW_x should also be of opposite sign, equal, and less than one in absolute value. Hence, when homeownership is indicated the two sets of variables will cancel implying zero effect of Social Security on accumulation.[8]

A. *Social Security and Retirement Intentions*

The *NLS* data provide an excellent opportunity to test whether the Social Security system does indeed reduce the intended age of retirement. The decision to retire rests on a comparison of the shadow price of leisure at a given age with the wage. A number of factors enter the calculations of the shadow price of leisure including health, work attitudes, marital status, and age. Certainly a key to the decision is the level of Social Security benefits available when working compared to the available benefits when retired. For workers between the ages 65 and 72 the Social Security earnings test represents an implicit tax on labor supply (see Michael Boskin). Currently, benefits for this age group are reduced by 50 cents for every dollar earned over $4,000. Beyond the age of 72 all workers are entitled to full benefits independent of retirement. Between the ages 62 and 65 the same earnings test applies; however, available benefits are "actuarially" reduced 5/9 of 1 percent for each month that benefits are received before age 65. Thus a worker retiring at age 62 receives a benefit which is permanently 20 percent lower than the benefit he would receive if he first retires at age 65. The "actuarial" reduction, if it is truly actuarially fair, implies that the Social Security earnings test does not represent an implicit tax on work effort between 62 and 65; foregoing benefits at these ages will result in higher benefits in later years when actual retirement occurs, leaving the present expected value of benefits as of age 62 the same independent of age of retirement between 62 and 65. Given the extent of early retirement between 62 and 65, the possibility that workers either do not have knowledge of or do not understand actuarial reduction must be strongly entertained.[9] Our econometric analysis will consider each possibility, perception of actuarial reduction and nonperception of actuarial reduction in turn.

The non-linear Social Security earnings test schedule implies that the implicit marginal tax on an additional hour of work depends itself on the extent of earnings as well as the age. If our data on expected future work effort were sufficiently rich, a maximum likelihood technique could be employed assessing the probability of a worker's locating on a given branch of his budget frontier at a given age. Given the data limitations the

[8]This assumes that savings for fixed savings goals occurs up to the current age of the respondent.

[9]Another explanation for Social Security induced retirement between 62 and 65 is the inability to borrow against Social Security benefits. Note, there is a trivial 1 percent annual reduction in benefits for retirement prior to age 72 but after age 65.

econometric path chosen was to specify a Social Security tax variable (*SBENL*) defined as the ratio of Social Security benefits lost at full-time work to full-time earnings. While this tax variable obviously does not capture the full complexity of the kinky budget frontier, it distinquishes quite well workers facing high implicit taxes in the neighborhood of full-time work. Since the dependent variable to be explained is the expected age of retirement, that is, the expected age at which full-time work will cease, this tax variable seems quite appropriate. The basic framework for the expected retirement age regression can now be written as

$$(7)\quad RETAGE = \alpha_1 + \alpha_2 SBENL + \alpha_3 LWI_x + \alpha_4 LTLABI + \delta' H + u$$

where $\delta' H$ is a vector of additional exogenous variables and u is the regression error. The specification of (7) is suggested by the life cycle theory which relates the endogenous decisions of accumulation and work effort to the exogenous variables of lifetime wealth and provisions of the Social Security system. Indeed since the error term in (7) may be correlated with E in (6) we shall consider a two-stage estimation of (6) as well as simple *OLS*. Even under the assumption of nonperception of actuarial reduction, (7) is inappropriately specified for the entire sample. Prior to age 62 there is no implicit Social Security tax on work effort. Hence, *OLS* estimation of (7) over the entire sample will yield an estimate of the tax rate coefficient α_2 biased toward zero; given the decision to retire prior to age 62, the choice of the exact age to retire before 62 is independent of the tax rate one would face after age 62. In the case that actuarial reduction is perceived, the decision to retire prior to age 65 is independent of the tax rate one would face after age 65. To test this possible bias on α_2 equation (7) was run for samples with expected retirement ages greater than 62 and 65 correcting for the sample selection bias introduced from truncating the sample on the dependent variable.[10]

The exogenous variables of the expected retirement age regression not yet identified include dummies for race, marriage, and separated, widowed, or divorced heads; age and education of the head; two pension dummies mentioned above; and number of family members. In addition there are three health dummies *HG*, *HF*, and *HP*, corresponding to the respondent's assessment of his health as good, fair, or poor, the excluded category being excellent health. Finally, three dummy variables are included to capture work attitudes and attachment: *PROF* takes the value 1 for respondents reporting professional or managerial occupations; *ATDJ* corresponds to attitude toward current job and is coded 1 for people who indicated disliking their job either somewhat or very much; *ATDW* takes the value 1 for respondents answering no to the question, "If you could live comfortably without working would you still work?"

III. The National Longitudinal Sample

Beginning in 1966 the Bureau of Census conducted a series of surveys of male household heads age 45–59. While the surveys deal primarily with labor market questions, a rich

[10]See James Heckman. The procedure is simply to take account of the fact that the error u in (7) has a nonzero mean given the sample selection rule. An additional variable $E(u/\text{sample selection})$ is added to the list of exogenous variables (written compactly here as $\lambda' Z$) to form the regression: $RETAGE = \lambda' Z + E(u/\text{sample selection}) + v$. Since $v = u - E(u/\text{sample selection})$ the expectation of v over the selected sample is zero and the above equation may be estimated by least squares yielding consistent estimates for the coefficients in λ. In forming the term $E(u/\text{sample selection})$ let us follow the labor leisure choice literature. It is assumed that the expectation of full-time work beyond the attainment of age 65 is based on a comparison of the shadow price of leisure expected to prevail at age 65, S^*_{65}, with the expected age 65 net wage W^{e*}_{65}. The decision to retire implies that the shadow price of leisure at forty hours of work exceeds the wage. This comparison gives rise to a probit regression from which $E(u/\text{sample selection})$, which is called a mills ratio, is estimated up to a constant; that is, the coefficients obtained in the probit regression are used in forming the mills ratio.

amount of information was collected concerning financial status, retirement plans, and eligibility for private pensions and Social Security. The data used in this study come almost exclusively from the 1966 survey. The 1966 survey also asks extensive questions about earnings in 1965. The dependent variable, household accumulated wealth, is one of the key variables recreated by statisticians in the U.S. Department of Labor. This variable falls short of the economist's definition of net worth since it fails to include the cash value of equity in life insurance and the value of consumer durables.

Information detailing the expected age of retirement is of two kinds. Either the respondent stated an actual age, or he indicated the intention never to retire (this group represents 14 percent of respondents in our sample). In the accumulation regression the *RETAGE* variable is replaced by *RET*, the actual retirement age when indicated or by *NORET*, a dummy taking the value 1 when the respondent stated he would never retire. For purpose of the expected retirement age regressions, an expected age of retirement of 70 was assigned to this second group.

Since the construction of the Social Security variables (see the Appendix) is based in large part on estimates of labor income, only those observations reporting positive labor income for working heads in both 1965 and 1966 were included; self-employed heads were excluded since their reported wage income may include a return to capital. After several additional consistency checks the final sample totaled 2,124.

In Table 1, I present the distribution of computed household lifetime wealth increments (LTW_x) by age of head, marital status, and average household labor income (ALY). The table is based on 2,587 observations; both households with covered and uncovered heads are included; the distribution excluding uncovered heads is quite similar.

The intergenerational transfers in Table 1 are quite large when compared with either the mean value of average household labor income \$7,000, or the mean value of household net worth, \$15,000. Perhaps the most striking feature of Table 1 is the unequal treatment of married and single households. The average married lifetime wealth increment of \$10,431 is 3.7 times the average for

TABLE 1—MEAN HOUSEHOLD LIFETIME WEALTH INCREMENTS[a]

Household Average Labor Income	45–50		51–54		55–59		Total	
	M	*S*	*M*	*S*	*M*	*S*	*M*	*S*
0–3,000	8997	2647	9998	3838	11310	4652	10023	3668
	(1632)	(664)	(2364)	(542)	(3193)	(921)	(2418)	(718)
3–6,000	9880	1046	12048	3049	15588	5542	11910	3032
	(2364)	(852)	(3120)	(904)	(3133)	(1315)	(2783)	(1028)
6–10,000	8599	−273	11441	1748	14720	4968	10821	1671
	(2541)	(796)	(2558)	(965)	(3282)	(1457)	(2725)	(1036)
10–15,000	6705	−458[b]	9578	–	13018	–	8677	1071[b]
	(3358)	(729)	(3180)		(3593)		(3352)	(1179)
15–25,000	6447	–	9068	–	13378	–	8948	–
	(3779)		(3475)		(3375)		(3583)	
25,000+	8036[b]	–	10845[b]	–	13744[b]	–	10385	–
	(3952)		(3732)		(3920)		(3744)	
Total	8330	1058	10954	2929	14098	5102	10431	2802
	(2768)	(763)	(2844)	(779)	(3290)	(1249)	(2919)	(936)

Note: Standard deviations are in parentheses. Dashes indicate fewer than five observations.

[a]*M* and *S* stand for married and single, respectively.

[b]Fewer than fifteen observations.

single heads, $2,802. If we divide the married figure by two it is clear that for some cells the gain in becoming married is as much as $4,000 per person.

The lifetime wealth increments increase by age for two reasons. The older the cohorts the fewer the number of years exposed to the Social Security tax; 59 year olds in the sample were age 30 at the initiation of the Social Security system and thus escaped ten years of tax payments. The second reason for the sharp increase in LWI_x with age is that for a given age-zero lifetime wealth increment (LTW_0), the older the cohort the longer the accrued interest on the LTW_0; i.e., $LWI_x = e^{rx} LWI_0$. For example, if a 50-year old and a 40-year old both had a lifetime wealth increment of $10,000 evaluated in present dollars as of age zero, the value of the $10,000 evaluated in present dollars as of age 50 must exceed the $10,000 evaluated in present dollars as of age 40. To make the figures for the older 55–59 age group more comparable to those of the 45–50 we can ask what the value of the former group's increment was ten years earlier when the cohort was 45–49. Discounting $14,098 at 3 percent for ten years yields a figure of $10,432, $2,102 greater than the $8,330 figure for the 45–50 group. This differential is now solely a function of the number of years of exposure to the Social Security tax. Table 1 indicates that as a fraction of labor income the lifetime wealth increments arising from Social Security are progressive. The standard deviations are substantial and point to sizeable within cell inequalities.

IV. The Empirical Findings

Table 2 reports the regression results for the accumulation regression specified above as equation (6). The regression is highly significant with an R^2 of .332. The coefficient of accumulated Social Security taxes is −.666 with a standard error of .305. This coefficient is significantly different from zero and lies within 1.3 standard deviations of −1, the prediction of the life cycle theory. The coefficient for LWI_x, .237, on the other hand, differs significantly from a predicted negative fraction of about −.68. One interpretation of this insignificant coefficient for LWI_x is simply that households fail to accurately foresee their future benefits prior to age of retirement. Accurate projection of Social Security benefits requires detailed knowledge of the dependent and surviving spouse benefit provisions, an assessment of husband and wife survival probabilities at different ages, an understanding of current benefit levels, and some notion of the future growth rate of these benefits. In the absence of such knowledge, households may simply assume they will receive the market yield on their tax contributions, that is, that LWI_x is zero. This, of course, casts doubt on the validity of life cycle model in general, since the life cycle model requires a great deal of foresight if it is to be valid. Objections may be raised to including uncovered respondents in the regression since they account for a large part of the variance in the Social Security variables and are primarily government employees who may become eligible for Social Security in the future. Excluding this group leads to coeffi-

TABLE 2—REGRESSION COEFFICIENTS FROM ACCUMULATION EQUATION

Variable	Mean	Coefficient	Standard Error
ASST	6629	−.666	.305
LWIx	9591	.237	.202
ALY	6994	1.25	.598
ALY2	.621 *D*+8	.158 *D*−3	.250 *D*−4
ALYT	3799	.004	.327
ALY2T	.351 *D*+8	−.684 *D*−4	.256 *D*−4
AGEH	51.1	−2756.	3059.
AGEH2	2633.	30.6	29.7
AGEW	42.1	105.3	363.
AGEW2	2016.	1.72	4.25
PEN	.647	−1054.	1221.
GPEN	.147	141.	1500.
RET	55.0	−428.	150.
NORET	.138	−27455.	9714.
MAR	.894	−7997.	8747.
EDH	9.46	489.	163.
RACE	.686	3482.	1190.
SWD	.075	−2801.	3263.
IHER	.595	1325.	983.
SIZE	4.67	−370.	−1.71
Constant	1.00	82609.	79027.

$R^2 = .330$
$F(20,2104) = 51.687$
Mean of Dependent Variable = 15098

Note: Variables are defined in the text. The notation $D + a$ means the coefficient is multiplied by 10^a.

cient values of $-.902$ ($t = 1.977$) for *ASST* and .189 ($t = .065$) for LWI_x.

Turning to the retirement variables, the coefficients for *RET* and *NORET* are each significantly negative as predicted by the life cycle theory. The expectation of a year's earlier retirement increases accumulation by about \$428. Multiplying \$428 by 63.8, the average expected age of retirement for those stating an explicit expectation, yields \$27,306. This figure is \$149 less than the coefficient for *NORET*, a dummy for respondents who state they will never retire. These respondents appear, then, to accumulate only \$149 less than respondents expecting to retire at age 63.8.[11] The \$428 figure appears small when compared to the mean value of the heads average labor income, \$6,034. Four factors are pertinent to the evaluation of this figure. First the average head's age in the sample is 51.1 (12.7 years less than the average expected age of retirement for those with retirement expectations). Hence a typical respondent has an additional thirteen years to save for his retirement period.[12] Secondly, Social Security benefits will replace foregone earnings for retirement ages greater than 65 beyond which actuarial reduction does not occur. Third, the stated intention to retire does not necessarily mean the respondent plans to stop working altogether. Forty percent of new male and 34 percent of new female Social Security beneficiaries reported some employment in a 1968 survey. (See Patience Lauriat and William Rabin, p. 8.) Finally, these retirement expectations are formed under considerable uncertainty about future health and family needs. Indeed the correlation between retirement intentions and actual retirement is not high.

The *NLS* data permits a comparison of expected with actual retirement behavior. The expected retirement age stated in 1966 was compared with 1973 retirement expectations and 1973 employment status for 1,787 respondents who appeared in both the 1966 and 1973 surveys. Of the 1,787 observations, 369 (21 percent) exhibited employment behavior at variance with their stated 1966 expectation. An additional 570 observations (32 percent) changed their expected age of retirement by at least one year. The figures for the 56–59 age group are more revealing since a larger percentage of this group had the opportunity to demonstrate employment behavior at odds with their 1966 expectations. For this group 38 percent exhibited inconsistent behavior and another 8.6 percent changed their expectations about retirement. The change in expected retirement age averaged 4.0 years for those who revised upwards their retirement expectation and 3.7 years for those who revised downward (after excluding those expecting never to retire either 1966 or 1973). These figures suggest that the expectations formed in 1966 are best characterized as guesses rather than firm plans. Serious planning and saving for retirement may occur only a few years prior to the actual reduction in work effort. Given the uncertainty with which these retirement expectations appear to be held, the small coefficient on *RET* is not surprising.

The size of the *RET* coefficient rules out the possibility that increased savings due to induced earlier retirement substantially offsets the replacement of private savings by Social Security taxes. Taking the point estimate of the *ASST* coefficient, -0.666, the average reduction in private accumulation from this variable was \$4,415. To offset this reduction expected retirement age must fall by an implausible $10.32 = \$4{,}415/\$428$ years.

The coefficient of the labor income variables *ALY*, and its square *ALY2*, and those of *ALYT* and *ALY2T* (the *ALY* and *ALY2* variables times a dummy for two-earner households) exhibit predicted signs and reasonable magnitudes. At the mean level of *ALY* an additional dollar of average labor income raises accumulation by \$3.46 for single earner families and \$2.51 for two-

[11]This comparison simply uses the regression equation to determine the difference in predicted net worth for two respondents, identical in all respects, except that one expects to retire at age 63.8 and the other expects never to retire.

[12]This is confirmed by respecifying *RET* as *RET* times three dummies for age 45–50, 51–55, and 56–59. The coefficients obtained are -406, -449, and -466, respectively.

earner families. The point elasticities of accumulation with respect to *ALY* are 1.59 for single earner and 1.15 for two-earner households and accord well with wealth elasticities of bequest estimated in Adams. While the inclusion of *ALYT* and *ALY2T* seems justified on theoretical grounds we caution that the coefficients of *ASST* and LWI_x are highly sensitive to these variables. Omitting these variables leads to coefficients of .686 ($t = 3.88$) for LWI_x and -1.270 ($t = -4.71$) for *ASST*.

The effects of both the head's education and race on accumulation are measured quite precisely. Whether these variables independently influence life cycle accumulation or are simply correlated with the error in the proxy for lifetime earnings *ALY* is impossible to say. The coefficient on household size, -370, ($t = 1.71$) probably reflects offsetting consumption expenditures for children and increased savings for their education.

Surprisingly, neither the pension dummy *PEN* nor its interaction with a dummy for government workers is significantly negative. Allowing for interaction of these variables with *ALY* failed to yield significantly negative coefficients. These findings differ from those of Alicia Munnell (1976) who used the same data set to run an annual savings regression. Rather than examine Munnell's specification in detail I report findings on a savings regression of my own derived from differentiating the accumulation equation with respect to time. The dependent savings variable is defined as in Munnell by the difference in net worth in 1969 and 1966 divided by 3. In the savings equation *ASST* is replaced by *SSTX*, household Social Security tax contributions. The coefficient for *SSTX* is -2.42 but is measured very imprecisely; the standard error is 2.53. The LWI_x coefficient again displays the wrong sign (.203 with a standard of .099). In addition neither of the pension dummies is significantly negative; indeed *GPEN* is significantly positive. The overall explanatory power of the exogeneous variables is quite low, the $R^2 = .046$. The coefficient of LWI_x suggests that my savings equation provides no support for a reduction in aggregate savings due to the introduction of unfunded Social Security.

Returning to the accumulation regression, the capital market constraint variables await discussion. Recall, to test capital market constraints against borrowing we add two variables *HASST* and $HLWI_x$, defined as *ASST* and LWI_x, multiplied by a dummy for home ownership. The results here are quite supportive of the borrowing constraint hypothesis. The coefficients are -1.500 for *ASST* and 1.173 for *HASST* with respective *t*-values of -4.029 and 3.842. The LWI_x coefficient is .080 ($t = .322$), and the $HLWI_x$ coefficient is .139 ($t = .859$). These findings imply essentially a dollar for dollar replacement of savings by tax contributions for nonhomeowners and a zero reduction in savings for homeowners. Since homeowners constitute a large proportion of this sample (70 percent) and of household heads in general, this finding greatly narrows the scope for an aggregate reduction in savings due to Social Security. However, the potential endogeneity of the homeownership dummy as well as its unproven ability to proxy for households with fixed savings goals facing borrowing constraints cautions against relying too strongly on these results.

One final accumulation regression requires reporting. Since *RET* and *NORET* are potentially endogenous I estimated the accumulation equation with two-stage least squares. In the second stage the coefficient for the predicted retirement age is a positive 2028.5 ($t = 3.342$). The coefficients of *ASST* increased to $-.773$ and that of LWI_x decreased to .093. Other coefficients were essentially unaffected with the exception of the *PEN* variable. This coefficient is now 1915.9 although still insignificant. The R^2 for the first stage retirement age prediction equation is only .131 and presumably accounts for these poor second stage findings.

A. *Expected Retirement Age Regressions*

The coefficients for the expected retirement age regression appear in Table 3. In this regression I ignore the issue of bias in the coefficient of *SBENL* and run over the entire sample. The coefficient of the key Social Security tax rate variable *SBENL*, .626, is insignificant and the wrong sign. Eliminating

TABLE 3—EXPECTED AGE OF RETIREMENT REGRESSIONS

Variable	Coefficient	Standard Error
SBENL	.626	.847
LWIx	.570 *D*−4	.330 *D*−4
ALY	−.320 *D*−3	.838 *D*−4
ALY2	.921 *D*−8	.374 *D*−8
ALYT	.733 *D*−4	.535 *D*−4
ALY2T	−.238 *D*−8	.428 *D*−8
AGEH	.097	.028
AGEW	−.026	.015
PEN	−1.236	.197
GPEN	−.601	.245
SIZE	.006	.036
MAR	.092	.896
EDH	−.541 *D*−2	.029
RACE	−.044	.198
SWD	−.880	.539
HG	−.036	.175
HF	−.235	.252
HP	−.229	.642
ATDJ	−.823	.311
ATDW	−1.595	.190
PROF	.758	.251
Constant	62.834	1.575
R^2 = .128		
$F(21,2102)$ = 14.708		
Mean of Dependent Variable = 64.64		

Note: Variables defined in the text. The notation *D* + *a* means the coefficient is multiplied by 10^a.

respondents who reported compulsory retirement ages and those not covered by Social Security produced a negative, although still insignificant −.488 (t = −.475) *SBENL* coefficient. Since the wife can collect dependent benefits only if the husband collects some benefits, *SBENL* was changed to include the wife's dependent benefit less her own benefit for wives no more than five years younger than their husbands. This second lost benefit variable yielded a −.260 coefficient but still insignificant (t = .448). Table 3 indicates that positive lifetime wealth increments captured by LWI_x also do not lead to earlier expected retirement.

In contrast with the Social Security variables the pension dummies are important predictors of expected retirement age. Coverage under a private pension plan entails a 1.2-year earlier expected retirement; for government pension coverage the impact is 1.8 years.

The coefficient on the age of the head is significant and quite interesting. A ten-year increase in age means a 11.6 month later expected date of retirement. Since my comparison of retirement intentions with actual practices indicates that both the young and the old tend to overproject their additional working span, this coefficient probably reflects the general trend among the young to retire earlier.(See *Manpower Report of the President.*) The health and employment attitudinal variables all display the anticipated negative signs, although none of the health dummies is significant. Professionals and managers expect to retire about nine months later than other respondents indicating a lower disutility to work for this group.

B. *Correction for Bias in the Social Security Tax Variable*

The regression in Table 3 is a reduced form even when actuarial reduction is perceived; however, the coefficient on *SBENL* is likely to be biased toward zero as discussed in Section II. Including the term to correct for sample selection bias, and estimating the regression for the sample with expected retirement age greater than 62 failed to yield a significantly negative coefficient for *SBENL*; the estimated coefficient is −1.061 (t = −1.458). Checking for a remaining bias due to actuarial reduction by sampling over the post-65 expected retirement age group also failed to yield a significantly negative coefficient for *SBENL*. For this sample the estimated coefficient is −.069 (t = −.067). At this stage we tentatively conclude that Social Security does not significantly influence the intended age of retirement for our sample of 45–59 year olds. Taking the largest coefficient found for *SBENL*, −1.0612, implies only one-third of a year earlier intended retirement when this tax rate falls from its mean of about .3 to zero. Finally, since one may object to the arbitrary assignment of age 70 to respondents intending never to retire, a simple probit regression was run explaining the choice of intended retirement age—between those who would choose to retire at or before 65, and those who would retire later. Here the variable *SBENL* was introduced independently and yielded a coefficient of −.155 (t = .475).

V. Summary and Conclusion

This paper has examined the theoretical savings response to Social Security implied by the life cycle theory of accumulation. The life cycle theory predicts explicit signs and magnitudes of coefficients for Social Security variables in both accumulated savings and annual savings regressions. In addition, the theory predicts that savings is responsive to retirement plans; these retirement plans may, in turn, be influenced by the availability of Social Security benefits.

The econometric results give mixed support to the notion that the micro-economic mechanisms of the life cycle model are at work. Social Security appears to significantly reduce accumulated savings of this 45–59 year old sample. Whether they view Social Security taxes as equivalent to other taxes or as a significant replacement for private savings remains unclear, however. The point estimate of this replacement ($ASST$) is $-.666$ which is neither significantly different from the -1 predicted by the life cycle theory or the $-.2$ to $-.3$ predicted by a simple Keynesian consumption function. The finding of a positive and insignificant coefficient for LWI_x for this age group runs counter to the life cycle theory. While there is evidence that Social Security tax contributions have reduced private savings of the young, there is no evidence that aggregate saving has been reduced. The poor findings on the lifetime wealth increment imply that the savings of the old may have increased to offset the reduced savings of the young leaving zero net impact on aggregate savings. Since the argument for an historic aggregate reduction in savings invokes the life cycle theory and the wealth increment effect, the findings lend little support to the notion that Social Security has reduced the capital stock. The results cast doubt on the ability of people to accurately project their Social Security benefits and their age of retirement; large differences in lifetime wealth generated by the Social Security systems do not appear to influence savings. The expected age of retirement coefficient does, on the other hand, provide some support for the life cycle theory as opposed to a simple Keynesian consumption out of disposable income theory. The magnitude of the retirement coefficient is small; its size rules out the possibility that increased savings due to induced early retirement substantially offset the reduction in accumulation due to Social Security taxation ($ASST$). Indeed our parameterization of Social Security's implicit tax on post-62 work effort indicates that Social Security does not significantly influence the expected retirement decision.

In conclusion I feel that the final resolution of Social Security's effect on capital accumulation will require additional empirical work at both the micro and macro levels. Of particular interest at the micro level is determining the savings behavior of the post-65 age group. If every dollar of taxes reduces savings of the young by \$.666, what does a dollar of benefits imply for the savings of the elderly? At the opposite end of the age distribution, the savings response of the very young to Social Security deserves attention, this age group is both more likely to face borrowing constraints and less likely to think about retirement when deciding how much to save. Additional empirical work as well as improved data detailing earnings histories and pension contributions will hopefully resolve the question of Social Security's effect on capital accumulation.

Appendix: Construction of Social Security Variables

Feldstein has presented concepts of gross and net Social Security wealth in a number of recent articles. The Social Security variables $ASST$ and LWI_x presented here are closely related to his 1976 Social Security wealth variables, and the methodology used to construct these variables follows his. All computations to form $ASST$ and LWI_x are based on separate information for the head and wife. For example, $ASST$ is the sum of the head's accumulated taxes and that of the wife's where the head's accumulated taxes are based on his average (1965 and 1966) labor income and the wife's accumulated taxes are based on her average (1965 and 1966) labor income. Since earnings histories are not available, $ASST$ was generated by applying historic growth rates of nominal wages to the two-year average of labor income (here gross of income taxes) as well as historic tax rates

and tax ceilings. The estimated paid in taxes were accumulated forward at a 6 percent nominal rate of interest.

The starting date for tax accumulation was 1937 or later. For respondents indicating they were in college beyond 1937, accumulation began the year they finished college. Other respondents indicated they had begun full-time work before age 20. In this case the year such work began or 1937 was used depending on which occurred latter. In all other cases the larger of 1937 and the year the respondent reached age 20 was the starting date. For wives, accumulation started the last year of college, the year they reached 20, or 1937 depending on which year was latest. The tax ceilings, starting age, marital status, employment of wife, income tax rate, and ages of the head and wife all contribute to variation in $ASST$ independent of the household average labor income (ALY).

Turning to the LWI_x variable, the 1937 starting date for the Social Security system means that for the majority of heads and wives in my sample, a substantial number of their early working years were years of no Social Security tax payments. Since benefits are only loosely related to tax contributions LTW_x is a positive and large number for almost all households (see Table 1). The higher than interest yield on Social Security is due here not to a rate of labor force plus productivity growth in excess of the rate of interest, rather it is due to a truncation of the age-tax profile at the early end, that is, the intergenerational transfer.

In computing LWI_x, the present expected value of future taxes and future benefits are needed. To obtain the former of these magnitudes I project a real growth of current Social Security taxes at 2 percent up to age 65 and discount them back at a 3 percent real rate of interest applying survival probabilities at each age for the husband and wife separately.[13] The computation of present expected future benefits is much more involved. First basic benefits were assigned to the head and wife based on their individual current average labor income (again gross of income taxes). Next these basic benefits were assumed to grow at a 2 percent rate into the future and to become available for the head or wife the year the head or wife attains age 65.[14] Beyond the age 65 both the husband and the wife may be eligible for dependent or widow (widower) benefits. For each year the maximum possible benefit under each household survival contingency is used, the probability of each contingency occurring is applied to this benefit, and the expected benefit is discounted back. Thus, for example, if the wife can collect more as a dependent than she can collect based on her own tax contributions, this higher benefit is used for the contingencies that both spouses are alive. This assignment of highest possible benefits is the Social Security procedure.

Two methods of allocating basic benefits were tried. The first method treats individuals as if they could retire immediately and collect benefits based on their computed average monthly wage. The second method applies replacement ratios to current average labor income where the replacement ratios are based on the individual's position in the distribution of labor income. These replacement ratios are derived from looking at the distribution of benefits of new retirees. Since the results proved quite insensitive to which benefit allocation method was used, I report only results using the first method.

Finally, as mentioned above, the *NLS* data reports on Social Security eligibility. For heads reporting they would never be eligible for Social Security, all head components of household Social Security variables were set to zero and the wife was permitted no dependent or widow benefits.

[13]In this and other computations separate male and female survival probabilities were constructed from information provided in Social Security Administration (1966a).

[14]The early retirement provisions of Social Security permit the receipt of these benefits as of age 62 but on an actuarially reduced basis. This actuarial reduction makes our computation independent of whether age 62, 63, 64, or 65 is used as the starting age.

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