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SAVINGS AND BEQUESTS

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ABSTRACT

Empirical studies have indicated that the elderly seem to accumulate wealth after retirement, and that the desire to leave bequests is an important determinent of saving behavior. Both kinds of results have cast doubt on the validity of the life cycle hypothesis of consumption. In the first part of this paper, a model of bequests is specified, and the implications for consumption and wealth trajectories are derived. The main result is that, even with a bequest motive, consumption generally decreases with age after retirement, and that wealth will also decrease for all but wealthy households. In the empirical part of the paper, wealth changes of retired households are reported over 10 years of panel data. Contrary to many results from cross-section data, the elderly do dissave: over 10 years the wealth of the elderly in the sample decreases by about 27% real. A test for a bequest motive is proposed. There is no evidence whatsoever for a bequest motive.

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1. Introduction

Although the life cycle hypothesis of consumption has played a central role in theoretical and empirical work about consumption since it was proposed by Modigliani and Brumberg (1954), many economists have come to doubt its empirical validity. Three kinds of studies have contributed to the doubt: simulation and estimation of earnings and consumption paths, Euler equation estimation, and micro data estimation of the age-wealth relationship. In this paper I am mainly interested in the savings behavior of the elderly and how it relates to the age-wealth relationship, but I shall briefly mention all three kinds of studies.[1]

Studies that simulate the consumption and earnings paths of households (White (1978,1984), Darby (1979)), or estimate the paths directly (Kotlikoff and Summers (1981)) typically show that the aggregate of the present value of savings cannot account for a substantial amount of the capital stock that is held by households. Because the holdings of capital stock not generated by household saving must have been inherited, bequests must account for a large portion of the capital stock. The authors conclude that the strict life cycle hypothesis (no bequest motive) cannot be true for an important fraction of the population.

I find it difficult to draw the same conclusions. First, as far as the simulations are concerned, we have little knowledge of the true utility function parameters so that evaluation of the simulations is highly subjective. Second, the representative consumer approach is surely wrong given that wealth is highly concentrated in the population. Third, mortality uncertainty is not usually considered. If there were no uncertainty about the date of death, the strict life cycle hypothesis says that wealth would be exhausted at the date of death. However, when the date of death is uncertain people will often die with positive wealth as long as the consumption function is sufficiently concave and as long as annuities of a certain kind are not available. Therefore, with uncertainty, the existence of bequests, large or small, does not necessarily invalidate the life cycle hypothesis. More to the point is whether people would want to leave bequests even if the date of death were known. Stated differently: do bequests enter the utility function? Because we have little quantitative knowledge of the process generating savings, it seems to me that one can learn more about the bequest motive from directly examining data on wealth holdings than either from simulating data or from reconstructing the entire earnings and consumption paths.

Many studies have used the Euler equation approach (Hall (1978, 1985), Flavin (1981) and Haysahi (1982,1985)). The objective of these studies is to estimate using time series methods the parameters of a stochastic difference equation for consumption. In this framework the life cycle hypothesis makes the strong prediction that the influence of wealth and income on consumption will be zero. Often these studies reject the life cycle hypothesis at least as a hypothesis governing the behavior of all consumers (Hall and Mishkin (1982)).

Studies based on microeconomic data often investigate how wealth varies with age. The relationship between wealth and age that is generally found in cross section is implausible according to the life cycle hypothesis; in particular the elderly seem to accumulate wealth as they age even though the life cycle hypothesis implies they should decumulate (Mirer (1979), Menchik and David (1983), Danziger et al (1982), and Kurz (1984)). I quote from Danziger et al: "the elderly not only do not dissave to finance their consumption during retirement, they spend less on consumption goods and services (save significantly more) than the nonelderly at all levels of income. Moreover, the oldest of the elderly save the most at given levels of income." The empirical finding that the elderly seem not to dissave has probably had the greatest effect in convincing economists that the strict life cycle hypothesis is not valid. The reasoning is that there is a maximum age to which people can live, and, without a bequest motive, people will want to consume all their wealth by that age. Yet, wealth seems to increase at any age. The conclusion is that there must be a bequest motive.

I believe there are fundamental difficulties in drawing such an inference from cross-section results. Wealthy people tend to live a long time; therefore, the older people in the sample will have had above average earnings in their own cohorts, and their wealth holdings will be cet. par. higher than the wealth holdings of younger people. In addition, each cohort will have had different lifetime income levels, and rates of return on investments. Some adjustment, especially for lifetime income, must be made or else comparisons across age groups will be meaningless. In that the adjustment for each cohort cannot be estimated in the cross-section data, it has to be imposed; for example it is often assumed to follow long-term trends such as growth rates of wages. This means that lifetime income at each age is adjusted by the long-term trend with the greatest ages having the greatest adjustment. Whether one adjusts observed income to estimate lifetime income (King and Dicks-Mireaux (1982)), or adjusts wealth itself (Mirer (1979)), the age profile could slope up or down depending on the adjustment that is chosen. Thus, the adjustment itself, rather than the data, inevitably determines the relationship between wealth and age. My final reason for not having much confidence in the cross-section studies is that it is very difficult in cross-section data to be certain that people have retired. Because some of the young elderly are still working, wealth will initially increase with age even after normal retirement age. It is certainly not inconsistent with the life cycle hypothesis that the wealth of workers increases with the age.

Papers by Diamond and Hausman (1984) and Bernheim (1984) use panel data. In contrast to many of the cross-section studies, both find that the elderly dissave after retirement. The Diamond and Hausman paper is based on the National Longitudinal Survey of older men. This data set is not well-suited for a study of the wealth of the elderly after they retire because even by the end of the 10-year panel the ages of the sample range from 55 to 69. Even with a retirement age of 62, which is earlier than average, only half of the sample would be retired in the last year; therefore, wealth changes of retired people can only be observed for a few years, and, even then, most of the retired will be early retirees who may not be typical in their savings behavior. The authors give no information about the number of observations that are retired, but it is probably small. Furthermore, the wealth changes reported in the paper are not directly and simply calculated: they are inferred from a complicated estimation method which seems to focus on the retirement and savings of workers, not of retired people. Finally, it is difficult to judge the results because no definition of wealth is given in the paper. As the theoretical results given in Section 2 of this paper show, the construction of the wealth variable requires care: some seemingly reasonable wealth variables such as the expected present value of Social Security benefits will not give good indications of consumer behavior.

Bernheim's work is a substantial advance over previous work. He studies wealth changes of retired individuals and couples from panel data, and suggests an appropriate way to account for annuities and Social Security in consumption and wealth calculations.[2] In his sample wealth generally declines between 1969 and 1975 and between 1975 and 1979. This is the first solid evidence that the elderly do dissave. The evidence is not conclusive, however, because he only observed two wealth changes, and because he used only a small fraction of the sample.[3]

In this paper I offer evidence on the empirical validity of the strict life cycle hypothesis against the life cycle hypothesis with bequests. In the first part of the paper, some theoretical work indicates which variables should be studied. The main result is that measures of total wealth that include the present value of Social Security and other annuities usually do not give information about behavior. I then introduce and analyze a model in which lifetime utility depends on the consumption path and on bequests. As I model the bequest motive, the consumption trajectory will decline with age; the wealth trajectory will also decline unless initial wealth is large. One would expect that even with a bequest motive the wealth of most people would decrease with age. Therefore, a declining wealth trajectory is not evidence in favor of either hypothesis. In the empirical section I present data that show the retired elderly in my sample do dissave. I conclude from this that, in contradiction to many previous studies, the wealth-age relationship of the elderly is consistent with the strict life cycle hypothesis. Then I test for a bequest motive. My test is whether the saving of the elderly who have living children differs from the saving of the elderly who do not have living children. I find no evidence for a bequest motive.

The data are from the Retirement History Survey. From 1969 to 1979, the RHS followed approximately 11,000 households whose heads were born in 1906-1911. I study the wealth changes of the retired people in that survey.

2. Consumption and Wealth Trajectories

I first review a simple model of intertemporal utility maximization. I then introduce a model which includes a bequest motive and annuities with the goal of finding some guidance for the empirical results to be presented later. To simplify the problem both theoretically and empirically, I study only retired people so that utility is defined only over consumption and bequests. Without such a restriction the empirical work becomes much more difficult because the worker's attitude about future work is not known, so it is not easy to say how his wealth ought to evolve. A good estimate of the wealth of retired people can be made, however, and in the absence of unrecorded transfers, this is rest-of-lifetime wealth.

I use six assumptions: 1. People maximize expected lifetime utility. 2. The budget constraint is known; its specification depends on the model under consideration. 3. The probability of death is known and exogenous, but it will vary according to age, race and sex. 4. People are not allowed unsecured borrowings, which implies both that no one can die in debt, and that the budget constraint must hold at each moment. 5. Annuities are exogenously given. This assumption can be defended on the ground that most annuities are job-related pensions and Social Security, both of which are surely the result of job choices, not savings choices. Furthermore, privately purchased annuities are, in this body of data, almost nonexistent probably due to their very low yields, and their uncertainty. A paper by Friedman and Warshawsky (1985) shows that in some years yields on annuities are dominated by yields on long-term bonds, and in other years, they are only slightly lower. In that annuities are nominal and there is inflation variability, they are risky just as bonds are risky; but bonds are liquid whereas annuities are not. In fact, the desire for liquidity may mean that through Social Security and private pensions many people have been forced to hold more in annuities than they would have chosen even if actuarially fair annuities were available. 6. The real interest rate is known and constant.

2.1 No bequests or annuities

I begin with a very simplified model which, nonetheless, contains many of the important issues. Suppose that an individual chooses a consumption trajectory to maximize

$$\int U(c_t)e^{-\rho t}a_t dt,$$

where c_t is consumption at time t, U(.) is an increasing, concave utility function with unbounded marginal utility as c approaches zero, ρ is the (constant) subjective discount rate, and a_t, the life rate, is the probability that the individual will be alive at time t. The utility model is the standard time-separable expected utility maximization model. The budget constraint is

$$\int_0^{\tau} c_t e^{-rt} dt \leq w_0 \text{ for all } \tau.$$

The budget constraint must hold at each instant; otherwise there is some chance the person would die a debtor. Without annuities, however, the form of the consumption function guarantees that wealth will never become zero as long as the probability of begin alive is positive.

The first order conditions imply that

$$u_t a_t = u_\tau a_\tau e^{(r-\rho)(\tau-t)},$$

where u_t is marginal utility at time t, and similarly for u_τ. This equation simply says that expected marginal utility at time t must, at the optimum, equal expected marginal utility at time τ discounted back to time t. Taking $\tau > t$, we see that the ratio of marginal utilities depends on the conditional life rate, the probability of living at τ

given the person is alive at t. If τ is only slightly larger than t, we can use an approximation to show how the marginal utilities depend on the mortality rates. Let m_t be the instantaneous mortality rate at t; that is,

$$a_t = 1-\int_0^t m_s ds,$$

so that $m_t=-da_t/dt$.

$$a_\tau = a_t-\int_t^\tau m_s ds.$$

Then, $a_\tau/a_t = 1 - m_\tau(\tau-t)/a_t$ provided m_τ is approximately constant over the interval t to τ. But $1 - m_\tau(\tau-t)/a_t$ is approximately $e^{-(m_\tau/a_t)(\tau-t)}$. Therefore,

$$(1) \qquad u_t \approx u_\tau e^{(r-\rho-m_\tau/a_t)(\tau-t)}.$$

If $(\rho+m_\tau/a_t)>r$, $u_t < u_\tau$. Because of the concavity of u(.), this implies that $c_t > c_\tau$. At age 65 the conditional mortality rate of white males is about .04, so that consumption will decline unless r is considerably greater than ρ. Of course, even if $r > \rho$, consumption must eventually decline because the conditional mortality rates increase with age, eventually becoming unbounded at the last instant it is possible to be alive. Most people would probably assume that $\rho > r$, however, so that consumption will, _a fortiori_, decline when mortality is taken into account.[4] When $\rho + m_t/a_t > r$, wealth must decline with age: if wealth were ever to increase, it would always increase due to declining consumption, yet utility maximization requires that all wealth be consumed should someone live to the maximum possible age. That is, utility maximization requires that $w_N = 0$ whenever $a_N = 0$. This is the reason why the apparent increase in wealth that Mirer (1979) found has cast doubt on the life cycle hypothesis.

The conclusion that consumption eventually declines is robust to some changes in the model specification. For example, ρ may vary. The overall shape of the consumption trajectory would change; yet consumption would still decline at some age. Even marginal utility could change slowly and the conclusion would be the same.

It may be noted that if the form of $U(.)$ were known, equation (1) could be solved for c_τ as a function of c_t, a_t and a_τ, and the parameters of the utility function. For example, the constant relative risk aversion utility function $U(c_t) = c_t^{1-\gamma}/(1-\gamma)$ implies that

$$(2) \qquad c_\tau = c_t(a_\tau/a_t)^{1/\gamma}e^{(r-\rho)(t-\tau)/\gamma}$$

With panel data on the consumption of individuals who face different life rates, one could estimate γ, which is the index of relative risk aversion, and $r-\rho$.

2.2 Bequests

I now consider a model in which there is a specific bequest motive; that is, bequests are not simply a residual due to uncertain date of death but they give utility.

Suppose that an individual chooses a consumption path to maximize

$$\int U(c_t)e^{-\rho t}a_t dt + \int V(b_t)e^{-\rho t}m_t dt$$

where $V(.)$ gives the utility from a bequest, and b_t is a bequest given at time t.[5] The idea behind the bequest part of the objective function is that someone will receive utility today from the knowledge that should he die at time t his heirs would receive b_t. For simplicity, the subjective time rate of discount of bequests has been made the same as the discount rate of consumption; the two discount rates can easily be made to be different without seriously complicating the analysis.

The constraint on the maximization is that $b_t = w_t > 0$. Again the constraint will never be binding due to the form of the consumption function. The solution to the maximization problem is

$$(3) \qquad u_t a_t = u_{t+h} a_{t+h} e^{h(r-\rho)} + \int_t^{t+h} V_s e^{(s-t)(r-\rho)} m_s ds$$

where V_s is the marginal utility of bequests at time s. The interpretation of this equation is as follows: someone contemplating reallocating a dollar from consumption at time t to consumption at time t+h will lose $u_t a_t$ in utility on average at time t. If he lives to t+h, the dollar will have grown to e^{hr} which will produce utility at the rate of u_{t+h}. a_{t+h} and $e^{-h\rho}$ adjust for uncertainty and subjective discounting. With probability m_s the individual will die at s before reaching t+h; he will then have $V_s e^{(s-t)(r-\rho)}$ in utility from the dollar. The integral sums up all of those possible utility gains. The equation says that at the optimum the expected utility loss must equal the expected utility gain. Another interpretation comes from dividing equation (3) by a_t and putting h=1. Equation (3) is seen to be the Euler equation for the utility maximization problem; that is, equation (3) requires that consumption be chosen to make $u_t = E_t(u_{t+1})$, which is the Euler condition.

Holding constant c_{t+h}, u_t is larger than what it would be without a bequest motive ($V_s > 0$). This implies that, in the normal case in which consumption declines, a bequest motive causes the consumption trajectory to flatten, and, because the budget constraint cannot be violated, consumption will initially be smaller. Therefore, more wealth is held than without a bequest motive, and the wealth trajectory is flatter. This is why the empirical observation that the wealth trajectory of the elderly is flat or rising has been interpreted to be evidence for a bequest motive.

The theoretical finding that a bequest motive causes more wealth to be held is not surprising in that the bequest motive causes wealth to be an argument of the utility function. If, in fact, there were no bequest motive but wealth holdings produced utility, the first-order condition would be like that produced by a bequest motive except that the marginal utility of wealth would be weighted by the life rates rather than by the mortality rates. But in that the life rates are a function of the mortality rates this is just a difference in functional form of the utility function. In other words, there is a utility function defined over consumption and wealth that would lead to a first-order condition in which wealth is weighted by mortality rates. Thus, with wealth data only, the hypothesis of a bequest motive could not be separated from the hypothesis that wealth enters the utility function. What is required is the specification that the marginal utility of bequests will depend on some observable variables. Without that specification and without data on the variables, no estimation methods could separate the the two hypotheses.

Equation (3) suggests an informal test of the bequest motive: divide the sample into households with identifiable heirs and households without identifiable heirs. One would expect that if there were a bequest motive the wealth and consumption trajectories of those with heirs would be flatter than the trajectories of those without heirs. Although this test is not as powerful as ones based on specific utility functions, it has the attractive feature of being free of functional form.

2.3 Bequests and Annuities

The models I have considered take wealth to be a stock from which future consumption has to be financed. However, there is another important class of resources for the elderly, annuities. By annuities I mean those resources that offer an income flow, but which are not bequeathable. The resources are not a stock in that typically they cannot be borrowed against. Examples of annuities are Social Security, private and government pensions, Medicare and Medicaid, and privately purchased annuities. (In the data, privately purchased annuities are a insignificant fraction of total wealth, probably for reasons I mentioned in the introduction). I divide resources into two classes:

bequeathable wealth and annuities. When I refer to annuity wealth I mean the actuarial present value of an annuity stream.

The utility maximization problem with annuities is to maximize in the path $\{c_t\}$

$$\int U(c_t)e^{-\rho t}a_t dt + \int V(b_t)e^{-\rho t}m_t dt$$

The constraints on the maximization are

$$b_t + \int_0^t (c_s - A_s)e^{(t-s)r}ds \leq w_0 e^{rt}, \tag{4}$$

and

$$w_t = w_0 e^{rt} + \int_0^t (A_s - c_s)e^{(t-s)r}ds \geq 0. \tag{5}$$

where A_s is annuity income at time s, and w_t is bequeathable. As long as the marginal utility of bequests or consumption is positive, (4) will be binding. (5) is the borrowing or bequeathable wealth constraint, which states that bequeathable wealth cannot be negative.

The approach here may be contrasted with the usual kind of intertemporal maximization problem in which only the present values of income and consumption enter. The nonnegativity constraint (5) imposes important restrictions on the problem.

The solution to the optimization problem depends on whether the borrowing constraint is binding or not. If it is binding over an interval, c_t is just equal to A_t over that interval: there is no bequeathable wealth, and the individual simply consumes the annuity. If over an interval (t,t+h), the borrowing constraint is not binding, then

$$u_t a_t = u_{t+h}a_{t+h}e^{h(r-\rho)} + \int_t^{t+h} v_s e^{(s-t)(r-\rho)}m_s ds \tag{6}$$

as before. When there is no bequest motive, the bequeathable wealth constraint is eventually binding (it may happen at the greatest age possible), but with a bequest motive, the constraint may never be binding. If the marginal utility of bequests is large enough, the person will desire always to die with positive wealth. Let N be the greatest possible age so that $a_N = 0$. When the wealth constraint is never binding, from (6)

$$u_t = \int_t^N v_s e^{(r-\rho)(s-t)}(m_s/a_t)ds \tag{7}$$

The interpretation of this equation is that a dollar reduction in consumption at t will eventually result in a dollar increase in bequests; the integral accounts for the probability that it will occur at time s, and for the discounted utility that will result. With the specification of a declining marginal utility of bequests, greater wealth will cause the integral to become smaller; hence, consumption will increase.

In this bequest model, the utility of bequests comes from contemplating the utility the heirs will receive from the bequest. Because bequests are typically a small fraction of the lifetime wealth of the heir, the bequest should affect only slightly the marginal utility of wealth of the heir. Therefore, the size of the bequest will have only a small effect on the marginal utility of bequests. That is, a reasonable specification for the utility of bequests is that $V(b) = \alpha b$. An empirical specification should probably allow α to vary from individual to individual in that there is substantial variation in the wealth of heirs; but to find the consumption trajectory of a particular individual, it seems reasonable to specify that $V'(b) = \alpha$, a constant. I make that assumption for the rest of this paper.

I assume that annuities are constant in real terms both for simplicity and because in general it is empirically correct. In the RHS in 1975, at least 75% of annuities were constant in real terms; about 25% were constant in nominal terms, which implies that they had a negative growth rate (Hurd and Shoven (1985)). In fact, whether the annuities are constant or have a growth rate does not affect the analysis very much.

2.3.1 Positive terminal wealth

For a given level of annuities there are three kinds of solutions to the maximization problem depending on the level of w_0. i) If initial wealth is low, the borrowing constraint is binding at some time T < N. Bequeathable wealth reaches zero at T. ii) If initial wealth is high, the borrowing constraint is never binding and the individual has positive wealth at N. Consumption is always greater than annuities. iii) If initial wealth is medium, the borrowing constraint is never binding but $w_N = 0$. Consumption is always greater than annuities except possibly at age N when it may decline to A.

I first analyze the case in which w_0 is high ($w_N > 0$).

(8) $$u_t = \alpha\int_t^N e^{(r-\rho)(s-t)}(m_s/a_t)ds$$

In that u_t is independent of w_0, the consumption trajectory is independent of w_0 for all w_0 that lead to $w_N > 0$. This happens because after taking into account mortality and discounting, the marginal utility of consumption along the entire consumption path equals the marginal utility of bequests. If consumption were to increase in response to an increase in wealth, the marginal utility of consumption would fall below the marginal utility of bequests, which would not be optimal. Of course, one would have a similar result if the marginal utility of bequests has only small variation.

Although the consumption trajectory is the same for all w_0 that lead to $w_N > 0$, the wealth trajectories vary greatly. Some examples are shown in Figure 1. This illustrates that even if individuals have identical tastes, their wealth trajectories will be quite different provided they have different initial wealth.

The consumption trajectory when $w_N > 0$ will depend on $r-\rho$ and the time pattern of mortality rates. When $r = \rho$,

(9) $$\int_t^N e^{(r-\rho)(s-t)} m_s ds = a_t$$

so that $u_t = \alpha$ for all t, independent of the mortality rates. Consumption is constant. This happens because effectively there is no discounting: the individual is indifferent between leaving a bequest over all future dates. In that the conditional probability of death is one, the expected marginal utility of bequests is α, which is put equal to the marginal utility of consumption.

When $\rho > r$, the integral in (9) is less than one. At each t, consumption is higher than when $\rho = r$. As before, if consumption is reduced by a dollar, bequests increase by a dollar with probability one; but the bequest occurs in the future and must be discounted.

Whether the consumption trajectory is rising or falling depends on the interaction between $e^{r-\rho}$ and m_s. From (8) $du_t/dt = u_t' =$

(10) $$-\alpha m_t/a_t + (\beta + m_t/a_t)\alpha\int_t^N e^{-\beta(s-t)} m_s/a_t ds$$

where $\beta = \rho - r$. In general one cannot sign (10).

If we consider u_t' to be a function of β, $f(\beta)$, then for small β

$$f(\beta) = f(0) + \frac{\partial f}{\partial \beta}\Big|_o \beta^*$$

where $0<\beta^*<\beta$, and $\frac{\partial f}{\partial \beta}\Big|_o$ means that the derivative is eqvaluated at $\beta = 0$. In that $f(0) = 0$ (marginal utility is constant when $\rho = r$), the sign of du_t/dt depends on the sign of $\frac{\partial f}{\partial \beta}\Big|_o \beta^* = f_0'$.

$$f_0' = \alpha[1 - (m_t/a_t)\int_t^N (m_s/a_t)(s-t)ds].$$

Therefore, $f(\beta) > 0$ if

(11) $$(m_t/a_t)\int_t^N (m_s/a_t)(s-t)ds < 1.$$

It may be noted that the condition for $du_t/dt > 0$ depends only on the mortality function, not on α or on the details of $U(c)$.

I first show that (11) is not trivial by giving an example in which it is not satisfied. Without loss of generaltiy let $t = 0$. Suppose $m_s = 5/N$ for $0 < s < N/10$ and $m_s = (5/9)N$ for $N/10 < s < N$. Condition (11) is satisfied if

$$(12) \qquad m_0\int_0^N m_s s ds < 1.$$

But with this mortality rate function, the LHS of (12) is 25/18, and du_t/dt is negative.

I now give some examples in which condition (11) is satisfied; these examples seem to cover the reasonable cases.

a) Constant mortality rate

With m_s a constant, $m_s/a_t = m_t/a_t = 1/(N-t)$, which is a hyperbolic hazard rate. Then the LHS of (11) is

$$(1/(N-t))^2\int_t^N (s-t)ds = 1/2.$$

Thus condition (11) is satisfied.

b) An objection to a) is that constant mortality rates are not found in the mortality tables for the elderly. Actual mortality rates rise until about age 75 and then fall, and the hazard rate always rises. A function that satisfies both of these requirements is

$$a_t = e^{\delta}e^{-\delta e^{\theta t}} \text{ and}$$

$$m_t = -dm_t/dt = \delta\theta e^{\delta-\delta e^{\theta t}+\theta t}.$$

$$m_t/a_t = \delta\theta e^{\theta t}, \ \delta \text{ and } \theta \text{ positive}.$$

If $\delta < 1$, dm_t/dt is positive at $t = 0$, and eventually dm_t/dt becomes negative as required by the data. For large N (which is necessary so that $a_N \approx 0$) it can be shown that condition (11) holds.

c) For actual mortality data (11) holds by direct calculation.

We see, then, that both for actual mortality rates and for reasonable analytical mortality rate functions, du_t/dt is, to a linear approximation in β, positive. This implies that along the consumption path that is utility maximizing for all initial wealth such that $w_N > 0$, dc_t/dt is negative. This is the maximum consumption path, $\{c^*\}$. Along this path the marginal utility of consumption equals the marginal utility of bequests after proper accounting for mortality and $r-\rho$. For a given level of annuities, there is a certain minimal level of initial wealth that corresponds to this consumption trajectory. Call this w_0^*. Any initial wealth larger than w_0^* will lead to $w_N > 0$. The wealth trajectory $\{w^*\}$ is shown in Figure 1. $\{w_t^*\}$ must fall because if it were ever to rise, it would always rise due to falling consumption. But the terminal condition is that w_N be zero. All levels of initial wealth greater than w_0^* will produce the consumption path c^*. As the examples show, even though they produce the same consumption path, the wealth paths all lie above $\{w^*\}$, and they all differ. This is an interesting feature of this model. Many investigators find heterogenous saving behavior (Kurz (1985), Diamond and Hausman (1984)). Here individuals with identical tastes can have very different wealth trajectories. Therefore, if we observe some individuals with rising trajectories and some with falling trajectories, it is not necessary to conclude that preferences are different.

2.3.2 Zero terminal wealth

When initial wealth is less than w_0^*, terminal wealth is zero. The analysis is different from before because the borrowing constraint is binding on consumption. The consumption path will be below $\{c^*\}$. There are two possibilities: the medium wealth case in which bequeathable wealth reaches zero at N and, because the consumer never wants to borrow against future annuity income, the borrowing constraint is never binding; the low wealth case in which bequeathable wealth reaches zero before N, and the borrowing constraint is binding.

2.3.2.1 Borrowing constraint binding

This is the low wealth case: it is likely to be found over most observations. In 1975 in the lower 10% of the wealth distribution, about 6% of total wealth was bequeathable wealth. Over the entire sample bequeathable wealth amounted to about 44% of total wealth (Hurd and Shoven (1985)). The consumption path in the low wealth case is found from the solutions to

$$(13) \qquad u_0 = u_t a_t e^{t(r-\rho)} + \alpha\int_o^t e^{(r-\rho)s} m_s ds$$

$$w_T = w_0 e^{rT} + \int_o^T (A-c_s)e^{(T-s)r} ds = 0, \text{ and}$$

$$c_T = A$$

where w_0 is initial bequeathable wealth. The first equation comes from the requirement that consumption be continuous in t, so that it must equal A at T. The second equation implicitly defines T to be the time when bequeathable wealth is exhausted. The third equation comes from the first-order conditions for utility maximization. In principle one can solve these equations for T, c_t and w_t as functions of the utility function parameters, w_0, A, the mortality rates, and data on heirs. Typical consumption and wealth trajectories are shown in Figure 2.

These equations illustrate three important points: first, the expected present value of annuities does not enter the equations. In other words annuity wealth is not a determinent of behavior. A quantity that appears is

$$\int_o^T Ae^{-rs} ds,$$

which is the present value of annuities to the date at which the wealth constraint becomes binding. But this quantity is a result of the utility maximization, not a cause of it. Second, from the point of view of estimation, both A and w_0 are variables that help identify utility function parameters. Third, within the utility maximizing framework considered here, ignoring the borrowing constraint leads to a specification error.

It should be noted that the comparison of consumption paths or wealth paths across individuals cannot give good information about behavioral parameters unless annuities are taken into account. For example, the wealth trajectory of someone with a bequest motive may decline more rapidly than someone without a bequest motive if the initial mix of annuities and w_0 differs. Furthermore, one cannot aggregate bequeathable wealth with annuity wealth to produce a variable that is useful in investigating behavior.[6] For example, with a normal consumption trajectory, the sum of bequeathable wealth and annuity wealth will decline with age; but the rate of decline will depend on the parameters of the utility function, the mortality rates, and the mix of annuity wealth and bequeathable wealth. An extreme case is when the only wealth is annuity wealth. The rate of decline depends only on the mortality and interest rates, not on any behavioral parameters. Therefore, one cannot learn anything about behavior from studying the path of annuity wealth. In general nothing can be said about the parameters of the utility function from observing how the sum of bequeathable and annuity wealth evolves. It should be clear, however, that the trajectories of consumption and bequeathable wealth have behavioral parameters embedded in them, but their recovery is not a simple mattter: the estimation requires the solution of the system of equations given in (13).

When there is a bequest motive, the consumption and wealth trajectories are flatter than without a bequest motive. An interesting question is whether it is possible for the consumption and wealth trajectories to rise over at least part of the retirement period. By differentiating (13) one finds that

$$f(t) = du_t/dt = h_t(u_t-\alpha) + \beta u_t, \text{ and}$$

$$df(t)/dt = dh_t/dt(u_t-\alpha) + f(t)(\beta+h_t),$$

where $\beta = \rho - r$ and h_t is the mortality hazard rate, m_t/a_t. Again I take the normal case to be $\beta > 0$. I desire to find the cases in which du_t/dt always has the same sign. As Table 1 shows there are just three possibilities: f(t) is always negative; it is always positive; it is initially positive but then becomes negative. This is to say that du_t/dt can change sign only once, and in that case it goes from positive to negative, and then remains negative. A negative du_t/dt implies a positive dc_t/dt. But a terminal condition is that $c_T = A$; therefore if dc_t/dt is positive, c_t for $t < T$ will be less than A, and wealth will grow. Wealth at T will then be positive which violates the other terminal condition. We see then that the only possible sign of du_t/dt is positive, or dc_t/dt negative: consumption always declines. This implies that wealth always declines because if it were ever to increase it would always increase due to declining consumption; yet $w_T = 0$.

Consider now a value of w_0, $\hat{w}_0$, which just causes c_t to become equal to A and w_t to become zero at N. Any value of w_0 larger than $\hat{w}_0$ leads to $c_N > A$ and any smaller value causes consumption to reach A before N. Let $\{\hat{c}\}$ and $\{\hat{w}\}$ be the consumption and wealth trajectories associated with $\hat{w}_0$. They are shown in Figure 3 along with $\{c^*\}$ and $\{w^*\}$, which were discussed in the high wealth case. All the consumption and wealth trajectories in the low wealth case must lie below $\{\hat{c}\}$ and $\{\hat{w}\}$; in the high wealth case there is only one consumption trajectory, $\{c^*\}$, regardless of initial wealth, and all the wealth trajectories must lie above $\{w^*\}$. In the case of medium wealth ($c_T > A$ and $w_N = 0$), the consumption trajectory must lie between $\{\hat{c}\}$ and $\{c^*\}$ because consumption trajectories cannot cross. The wealth trajectory must lie between $\{\hat{w}\}$

and $\{w^*\}$ because wealth trajectories cannot cross.

Table 1 also applies to the medium wealth case, but the terminal condition $c_T = A$ no longer holds. That terminal condition was used to rule out du_t/dt negative, so at least in principle one might have a rising consumption trajectory. But the consumption trajectory must be bounded by $\{\hat{c}\}$ and $\{c^*\}$. Consider c_t to be a function of w_0. The function will be continuous so that for small departures of w_0 from either w_0^* or $\hat{w}_0$ $\{c_t\}$ will decline. It would, therefore, be surprising if $\{c_t\}$ did not decline for all $\hat{w} < w_0 < w^*$. Again, in view of the terminal condition on wealth, the wealth trajectory would also decline.

2.4 Summary

The main theoretical results to come from this section are: i) The consumption and wealth trajectories are flatter, cet.par., when there is a bequest motive than when there is not. If one is able to classify observations into a group that will not have a bequest motive and a group that may have a bequest motive, one ought to be able to test informally for the bequest motive by finding whether the consumption and wealth trajectories of the first group decline faster than the trajectories of the second group. ii) With normal mortality rates and with $\rho > r$, consumption trajectories decline even with a bequest motive. If they are observed to rise, one should be worried about the validity of the underlying model; the bequest motive will not explain such a rise. Wealth trajectories also decline unless initial wealth is so large that terminal wealth will be positive. One would think that most people would have declining wealth trajectories. Therefore, declining average wealth trajectories should not be taken as evidence in favor of either the strict life cycle hypothesis or the extended life cycle hypothesis. iii) There is no theoretical justification for studying the sum of annuity wealth and bequeathable wealth to determine behavioral consumption parameters. The annuity stream enters the problem, but in a complicated, nonlinear way. iv) Given a constant marginal utility of bequests, one would find that individual wealth trajectories vary greatly, some rising and some falling, even though the individuals had identical utility functions. All that is needed is variation in initial wealth.

3. Empirical Results

In this section I present evidence from the RHS on two issues: Did the elderly in the RHS dissave over the sample period? Is there any empirical evidence of a bequest motive? The results are guided by two general principles. The first is to minimize functional form assumptions. I hope to present the data in such a way that no functional forms beyond those assumed for the derivation of (3) will be required. This precludes parameter estimation. The second general principle is to study the wealth of the elderly as a group. Thus, I do not investigate individual behavior.[7] My results can best be compared with the results from cross-section analysis and from simulations.

3.1 Data

The data are from the Longitudinal Retirement History Survey. About 11,000 households whose heads were born between 1905 and 1911 were interviewed every two years from 1969 through 1979. The survey includes questions about all assets and liabilities with the exception of a meaningful question on the asset value of life insurance.[8] From the questions one can construct a (almost) complete balance sheet of the household. Because the asset catagories are so fine, there are missing values. The results reported here rely on a method to fill missing values in such a way as to retain any individual component. Details will be found the the Appendix.

The basic unit of observation is a household that is intact over two adjacent surveys. Were I to study changes in intact households over longer periods, the sample would be reduced due to mortality. Furthermore, the estimation should allow the households to reoptimize every two years in response to windfall gains and losses. In addition, I select only households in which it appears the wage earners are retired: that is, a household enters my active sample when the respondent, in the case of a single person household, or both the husband and wife, in the case of a couple, has no labor earnings at present or in the future surveys. As I mentioned earlier, the theory is not easily testable if workers are included in the sample.

The object of study is the change in bequeathable wealth over two years. There are five two-year periods. Data definitions are given in the Appendix; I mention here that the important components of bequeathable wealth are housing wealth, stocks and bonds, property, businesses and savings accounts less debts.

To study wealth changes one would like to estimate the coefficient in the equation $w_2 = kw_0$ in which w_2 and w_0 are real wealth levels in year 2 and year 0 respectively, and k is the wealth retention rate. In the RHS data there appear to be reporting errors in wealth, so I use an estimator that is robust to random errors with zero expectation. I estimate k by

$$\hat{k} = \Sigma w_2 / \Sigma w_0. \tag{14}$$

The ratio estimator $\tilde{k} = \frac{1}{n}\Sigma(w_2/w_0)$ is not consistent for k, nor is an OLS estimator.

3.2 Results.

In Table 2 I report real wealth changes over the ten year period of the RHS. They were calculated in the following way: in 1969 all households that remained intact until the next survey, in 1971, and which had no present or future labor earnings became the active sample. $\hat{k}_{1969}$ was calculated according to (14) separately for the singles and couples in that sample. This process was repeated for each of the years 1971, 1973, 1975 and 1977. Thus the sample on which the two year changes are based changed every two years because of retirement and death. The ten-year wealth retention rate is the product of the k's: it gives the fraction of a dollar that would remain at the end of ten years in real terms. The table shows the percentage change in real wealth. There are four sets of results. The columns give wealth changes according to whether housing is included in the calculation of bequeathable wealth or not. The first three rows are over observations which have positive bequeathable wealth in the initial period. The second three rows are over all observations. A later table (Table 3) gives information on the number of observations behind the calculations.

Before I discuss the results in Table 2, I outline the rationale for the four sets of results. In principle, all types of bequeathable assets will change as the consumption trajectory evolves: in practice, it is difficult to change the consumption level of housing because of the costs of transition from one consumption level to another. This is particularly true for the elderly. If actual consumption adjusts only slowly to desired consumption, the trajectory of housing wealth will be flatter than the trajectory of desired housing wealth. In addition, rates of return on housing appear to have been substantially higher than the inflation rate for the RHS sample. Therefore, wealth trajectories that include housing will be flatter than desired wealth trajectories. Until a complete model of desired housing services and transactions costs is developed, probably the best that can be done is to exclude housing wealth from the bequeathable wealth totals.[9] Later results are based on wealth calculations that do exclude housing; in this table, however, I present both kinds of results. It turns out that no substantive conclusion is changed by including housing in bequeathable wealth.

The idea behind restricting the sample to include only observations with positive wealth is that households with little wealth will not follow desired wealth trajectories because they will have reached the borrowing constraint before two years have passed. The initial rate of change of wealth would be mismeasured. Furthermore, anyone with negative wealth is, in the context of the economic model, observed with error. Simple errors in variables arguments predict that limiting the sample to positive initial wealth causes the rates of change to decrease which, indeed, is what is found in the first rows of the table. I believe that at this stage of descriptive statistics it is better to allow negative wealth than to predispose the wealth changes to be negative; thus, in later results I use the complete sample.

Table 2 shows that in all cases the elderly dissave: the estimates range from 13.9% of initial bequeathable wealth to 29.2% of initial bequeathable wealth over the period 1969 to 1979. In the case that I believe is most representative of desired wealth changes (housing wealth excluded, all observations) there is dissaving of 27.3%, which is at a rate of 3.2% per year. Both couples and singles dissave, singles more than couples. This result is predicted by the basic model because the mortality rates of singles are greater than of couples: the household composed of a couple will survive longer (possibly not intact) than the household composed only of a single person. Therefore, the consumption trajectory of a couple will be flatter according to (1), and the wealth trajectory will also be flatter. Although this result is predicted by the theory there are other explanations in the context of the basic model. The first is that there is a bequest motive: if there is a bequest motive that depends on identifiable heirs, the wealth trajectories of couples will on average be flatter in that a greater fraction of couples have identifiable heirs than singles. The second explanation is that couples have different levels of initial wealth and annuities than singles; wealth and annuities influence the wealth trajectories.

Imposing the restriction that initial wealth be positive changes the results by very little. Most of the excluded observations had zero initial and second year wealth.

The wealth changes that include housing wealth are much smaller than those that exclude housing, probably for the reasons given above.

The wealth levels in Table 2 were deflated by the CPI to find real wealth changes. I note here that deflating by a cost of living index that is tailored to the elderly changes the results by very little. For example, the Boskin-Hurd index (Boskin and Hurd (1985)) which is defined for five age groups of the elderly gives slightly less inflation than the CPI over the ten year period (6.7% vs. 7.1%). This produces a rate of wealth change of -24.6% against -27.3% in the base case (no housing wealth, all observations).

Table 3 shows percentage changes in real wealth in each of the two-year periods and the number of observations. Real wealth declined in all years except 1977-79. The table emphasizes an important fact: all the wealth changes in this paper are <u>ex post</u> wealth changes. The theory refers to desired or <u>ex ante</u> wealth changes. While one would expect the two to be equal on average, in any time period they will differ due to unanticipated windfall gains and losses. Apparently there were extraordinary losses in 1975-77 and extraordinary gains in 1977-79. In fact the wealth changes in the two time periods average to about -7.2% per period, (geometrical average) which is a reasonable continuation of the rates in the three periods from 1969 to 1975. An investigation of the components of the losses and gains in the portfolios of the RHS households deserves attention, but it is beyond the scope of this paper.

The table reveals a trend toward increasing rates of dissaving as the population ages and faces higher conditional mortality rates. The theory says that consumption declines with rising mortality rates. For constant initial wealth, therefore, wealth levels will also decline. However, the results in Table 3 are not conclusive in that neither initial wealth nor annuities is the same over time periods, so the trend in wealth changes can only be suggestive.

One explanation for the results for singles versus couples in Table 2 is a bequest motive. As I mentioned in Section 2, one cannot distinguish a bequest motive from a wealth-augmented utility function unless one is willing to specify that the utility of bequests depends on observable variables. Here I test for a bequest motive by specifying that it depends on whether the household has living children.[10] Of course, the definition could be expanded to include siblings, aunts, uncles, parents, nieces and nephews, but, as we shall see, the results are so unpromising that I have not gone further.

In Table 4 I give the wealth changes according to whether the household has living children or not, and the average number of observations in each two-year period. The theoretical work in Section 2 indicated that a bequest motive would flatten the consumption trajectory; therefore the household would save more. The empirical result in the table is that households with children actually save less than households without children; therefore, there is no evidence for a bequest motive. The empirical result does not depend on whether housing wealth is included: both singles and couples with children still save less than singles and couples without children.

Although the results in Table 4 give no evidence for a bequest motive, they are certainly not conclusive even within the context of the model in this paper. In particular, the theoretical results of Section 2 showed that both w_0 and annuities determine the wealth trajectory; the trajectory is not homogeneous in w_0, and annuities enter in a nonlinear way. If households with living children have different levels of wealth and annuities than households without children, one would expect that their trajectories would differ. In particular, decreasing w_0 while holding annuities constant causes w_2/w_0 to decrease.[11] This can easily been seen when w_0 is small compared to annuities: then, decreasing w_0 so that w_2 goes to zero will cause w_2/w_0 to go to zero; thus, w_2/w_0 is not independent of w_0 and annuities.

Couples with children have about the same levels of annuities as couples without children, but their levels of initial wealth are quite different. For example, in 1975 couples with children had initial wealth excuding housing equity of about $32,000 whereas couples without children had initial wealth of about $47,000. For singles the corresponding figures are $10,000 and $19,000. If housing is included the figures for the couples are raised almost exactly $20,000; the figures for the singles are raised about $10,000. Over the five sample periods couples without children averaged 58% more initial wealth excluding housing than couples with children; for singles the figure is 72%. These wealth data taken by themselves imply that households with children should dissave more in percentage terms than households without children; they certainly leave open the possibility that if the wealth levels could be made the same, households with children would have higher savings rates.

The experiment with the data I report now holds approximately constant the initial wealth and annuity levels. The 1969 sample of couples with children was divided into 16 cells according to the initial wealth quartile and annuity quartile.[12] $\Sigma w_2/\Sigma w_0$ was calculated in each cell to give wealth retention rates by annuity and wealth quartile. A similar calculation was made over the 1969 sample of couples without children using the same quartile points. Because the number of observations in some cells is small and the initial wealth levels are close to zero, it is not meaningful to average the savings rates across cells. Instead I compare the wealth retention rates for couples with and without children in the same quartile cell. In each year 16 such comparisons can be made across couples and 16 across singles; over five years a total of 160 comparisons can be made. Holding constant annuities and wealth, I test for a bequest motive by asking whether households with children had higher wealth retention rates than households without children. Table 5 shows the fraction of cells in each year in which households with children had higher rates than households without children. Under the hypothesis that there is no bequest motive as reflected in the presence of children, the entries should average 8/16. Under the hypothesis that there is such a bequest motive, the entries should be larger. We see that for couples three of five entries are less than 8/16 and two are exactly 8/16. Summing over all years we find that in 33 of 80 cells couples with children saved at a greater rate than couples without children; put differently, in about 59% of the cells the presence of children caused greater dissaving. This is, of course, the wrong outcome to support a bequest motive. Over singles, there is almost no difference by saving rates according to the presence of children.

The results of Table 5 are consistent with the results of Table 4: when there is no stratification by wealth and annuity levels as in Table 4, singles with children saved somewhat less than singles without children; with stratification as in Table 5 the rates of saving are about the same. In Table 4, couples with children save so much less than couples without children that controlling for initial wealth and annuities does not reverse that finding.

The theory in Section 2 suggested that the strength of the bequest motive could vary from person to person, and I speculated that it might vary with wealth levels. Perhaps bequests are a superior good. Table 6 gives information that will allow an informal test of that hypothesis. In each cell I count the number of years in which the wealth retention rate of households with children exceeded the wealth retention rate of households without children. That count is recorded in the main body of the table. The greatest entry possible is five; under the hypothesis of no bequest motive, 2.5 is expected. The greatest entry in the final column or row is 20; with no bequest motive, 10 is expected. High values support a bequest motive.

Over couples there seems to be no pattern in the table either by wealth levels or by annuity levels. I conclude that any differential wealth retention rate by wealth or annuities is purely random. Over singles it appears there is some differential by wealth level: singles with children in the two lowest wealth quartiles had higher wealth retention rates than singles without children in 26 out of 40 comparisons. Singles in those wealth quartiles are poor: for example in 1975 the quartile points were $1200, $5759 and $18000 excluding housing wealth. Singles with children would mostly be widows. Although the annuity variable includes transfers from relatives, it may be that there are more unrecorded transfers from children in the lowest quartiles than in the highest quartiles. The effect is not strong enough in the table to draw any firm conclusion without more investigation.

A problem with the classification method in Table 6 is that with observation errors on w_0 wealth retention rates are bound to be higher in the lower wealth quartiles than in the higher wealth quartiles. Put differently, the estimator given in (14) is not consistent for w_2/w_0 in each cell when observations are assigned according to w_0. Furthermore, the means in the lowest quartile will be small making the variance of $\Sigma w_2/\Sigma w_0$ large. In Table 7, I report similar results but the classsification is by quartiles of initial capital income rather than by quartiles of initial capital wealth. Again, the quartiles for couples are calculated across the capital income of all couples whether or not the household has living children, and similarly for singles. This way of classification is like instrumental variable classification: under instrumental variables, the classification would be from fitted values of the probability that a household fell in a particular cell where the predictor would be capital income. When w_0 has observation error, capital income is a good instrumental variable because it comes directly from the survey data; it is not derived from capital.[13]

The results for couples are very similar to those given in Table 6. As before, there is no pattern by initial capital income or annuity level. The number of cells in which households with children saved at a higher rate than households without children is, however, smaller: only 34/80. Under the hypothesis of a bequest motive we would expect more than 1/2.

In Table 6 there was some indication that there are unreported transfers from children to single parents. The pattern that suggested the transfers is not evident in Table 7.[14] In fact, it appears that any differential saving according to whether the household has children is random with respect to annuities and capital income. The fraction of cells in which saving was higher for households with children fell to .42. The general impression, as in Table 4, is that there is no evidence for a bequest motive even when wealth and annuities are held constant.

4. Conclusion

Over the five two-year periods of the RHS the elderly in the sample generally decumulated real wealth. The estimated rate of decumulation over 10 years is about 3.2% per year. At this rate, a household with a 20 year life expectancy will have reduced its bequeathable wealth to about half of its initial level. The basic theory suggests that the rate of decumulation is not constant: the slope of the consumption trajectory depends on the conditional mortality rate, which increases with age. This implies that the rate of wealth decumulation will increase with age, so that one could expect even smaller wealth levels after 20 years.

These results are in contradiction to most cross-section results. There are a number of reasons why these results are more reliable than those from cross section: I study only the wealth changes of the retired elderly; differential mortality by wealth level is not important as it is in cross-section. Finally, no speculation about lifetime earnings is necessary. With time separability of the utility function, the household can remaximize each time period subject to its wealth; that is, the wealth trajectory at t only depends on wealth at t, not on past earnings or consumption. In the data, initial wealth can be calculated from survey questions.

Bernheim (1984) gives wealth decumulation rates excluding housing. His results imply 10-year decumulation rates of .41 for couples and .38 for singles. The comparable figures from Table 2 are .15 and .36. I believe the results of this paper are more reliable because they are based on a much larger sample; nonetheless, Bernheim's results are consistent with the conclusion that the elderly dissave.

There is no evidence for a bequest motive, at least insofar as it depends on whether the household has living children. In fact, what little evidence there is suggests the opposite. Furthermore, the households with children have less bequeathable wealth than households without children. If the observed rates of decumulation continue beyond the ages of the RHS households, the households with children will always have less wealth than households without children. In that about 80% of the households in the RHS have children, those households may bequeathe more wealth in total than households without children; but the amount per household will certainly be less.

Although intergenerational transfers are not the focus of this paper, some of the findings can by applied to that issue. Kotlikoff and Summers (1981) estimate that about 80% of the capital stock held by households arises from intergenerational transfers. The results of this paper cannot be used to check that estimate because the wealth holdings of the RHS sample cannot be aggregated to estimate wealth holdings of the population. Nonetheless, these results do have implications for the Kotlikoff and Summers findings.

Even though no bequest motive was detected by the methods of this paper, there are two ways in which desired bequests could still be an important part of capital transfers. Bequests could be a superior good to such an extent that only the very wealthy respond to the bequest motive. In that the distribution of wealth is highly skewed, a few large desired bequests could account for most desired bequests. Because the RHS is a representative sample, such highly concentrated wealth is not found in the RHS and probably would not be found in any survey because the extremely wealth may be reluctant to be interviewed.[15] It should be noted, however, that even in the upper wealth quartile there was no evidence for a bequest motive. One would imagine that even if only a few wealthy in the RHS had a bequest motive, it would be detected in the upper wealth quartile: the estimator of the wealth retention rate in each cell can be written as

$$\hat{k} = \Sigma w_2 / \Sigma w_0 = (\Sigma(w_2/w_0) w_0) / \Sigma w_0.$$

This is a weighted average of individual rates where the weights are initial wealth.

Intervivos giving could be an important part of intergenerational transfers. The RHS has questions on amounts given to relatives and children outside the home. The amounts are very small, ranging from $39 to $60 on average depending on the year. While these transfers are probably highly concentrated and may be important to a few individuals, they are too small to affect average rates of decumulation. The RHS also has questions on the number of children supported either fully or partially and on whether supoort is received from children. I estimated the wealth retention rates over the sample which neither supports children nor is supported by them. The 10-year rates of wealtn change for that sample along with some excerpts from Table 4 for comparison are

	Living Children		No Living Children
	No Transfers	All*	All*
Couples	-13.5%	-16.8%	-1.7%
	(769)	(957)	(175)
Singles	-41.1%	-38.0%	-32.6%
	(782)	(1104)	(477)

*From Table 4. The average number of observations is in parentheses.

There is no change in the basic result: eliminating households in which there are transfers between the parents and the children increased the measured saving rate for couples and decreased it for singles, but the saving rates of households without children remain higher than the saving rates of households with children. The change in the number of observations indicates that there are substantial numbers of families that have some transfers; but apparently the magnitude of the transfers is small.

It may be that intervivos giving increases at later ages, but that seems unlikely: households with children already have less wealth than households without children. This wealth differential suggests that intervivos transfers take place before retirement, most likely to support consumption and education of the children when they are young.[16] As such these transfers do not enter the stock of capital held by households.

The most straightforeward interpretation of the results of this paper is that there is no bequest motive in the RHS, and, by extension, in the elderly population with the possible exception of the very wealthy. Bequests seem to be simply the result of mortality risk combined with a very weak market for private annuities. If this is the case, there is no reason to replace the strict life cycle hypothesis by models that emphasize the determinents of intergenerational transfers, as called for by Kotlikoff and Summers. Of course, one should use a model that illuminates the question under study. If one is interested in understanding how most elderly would respond to, say, a change in Social Security benefits, the strict life cycle hypothesis is surely the place to start. If one wants to understand how the capital stock is accumulated, one would probably want to study the very wealthy. However, the standard consumption models may not apply: time constraints prevent the very wealthy from consuming even the interest from their wealth.

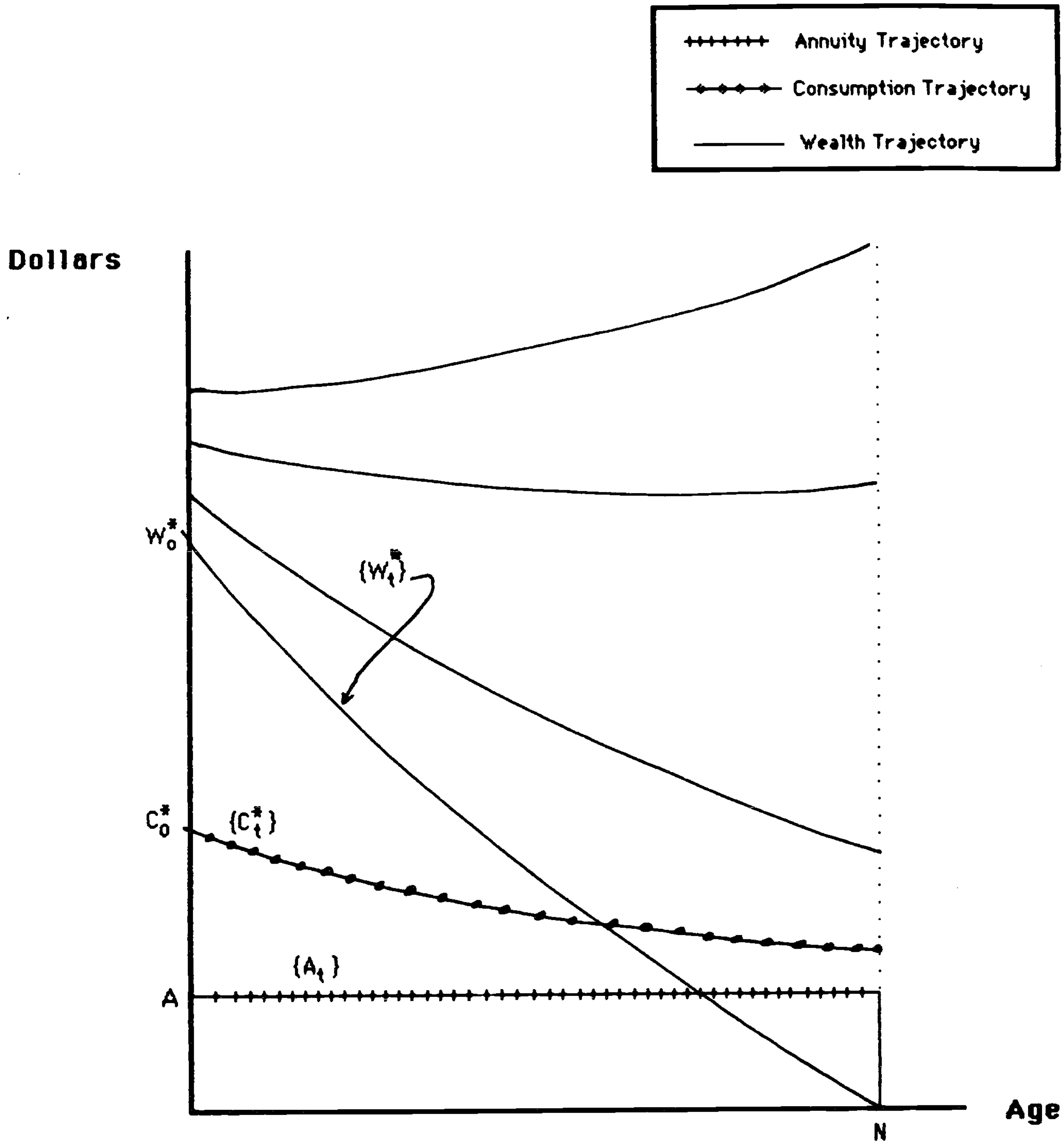

Figure 1

Wealth and Consumption Trajectories:
Terminal Wealth Positive

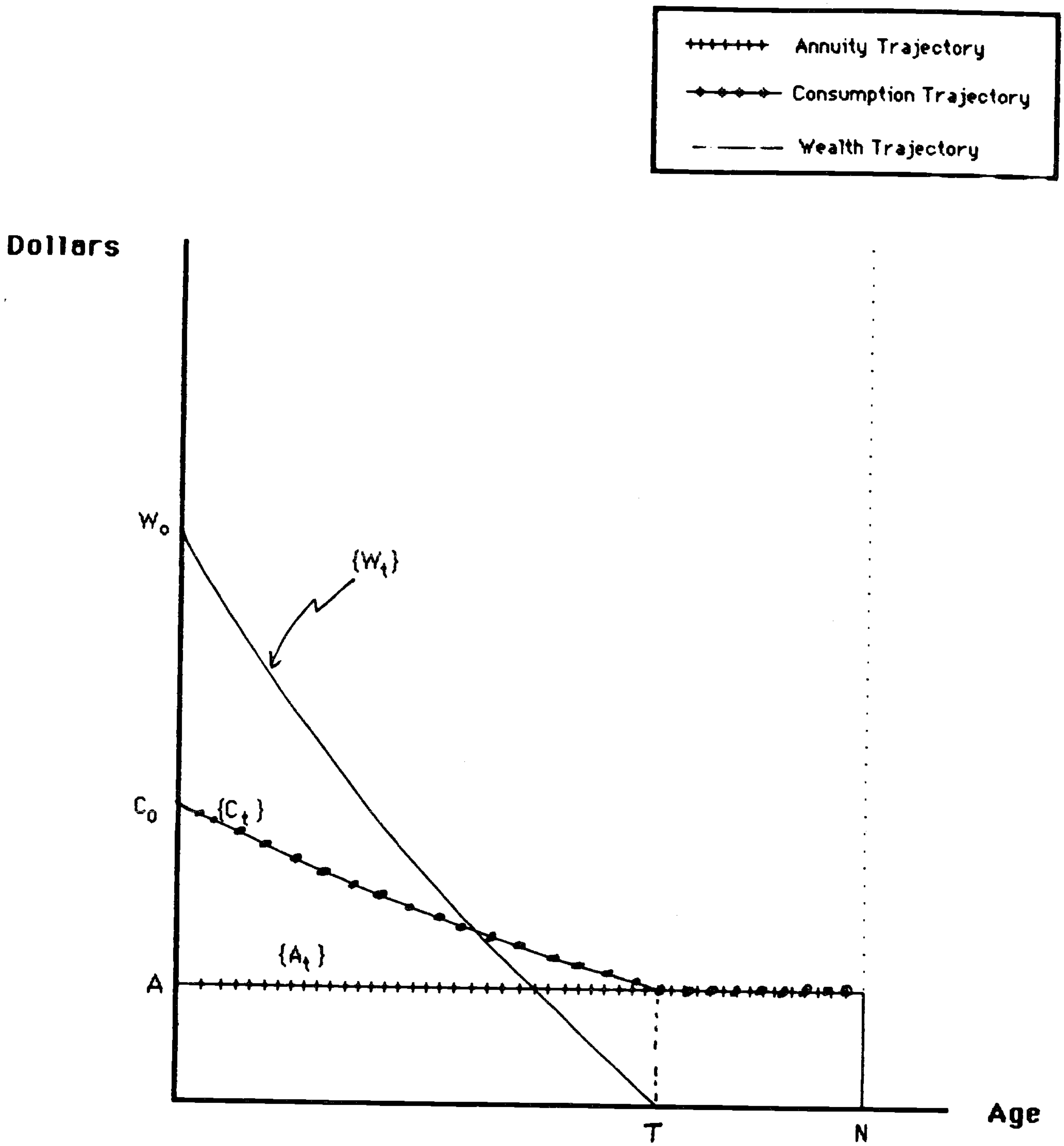

Figure 2

Wealth and Consumption Trajectories:
Borrowing Constraint Binding

Figure 3

Wealth and Consumption Trajectories:
Terminal Wealth Zero

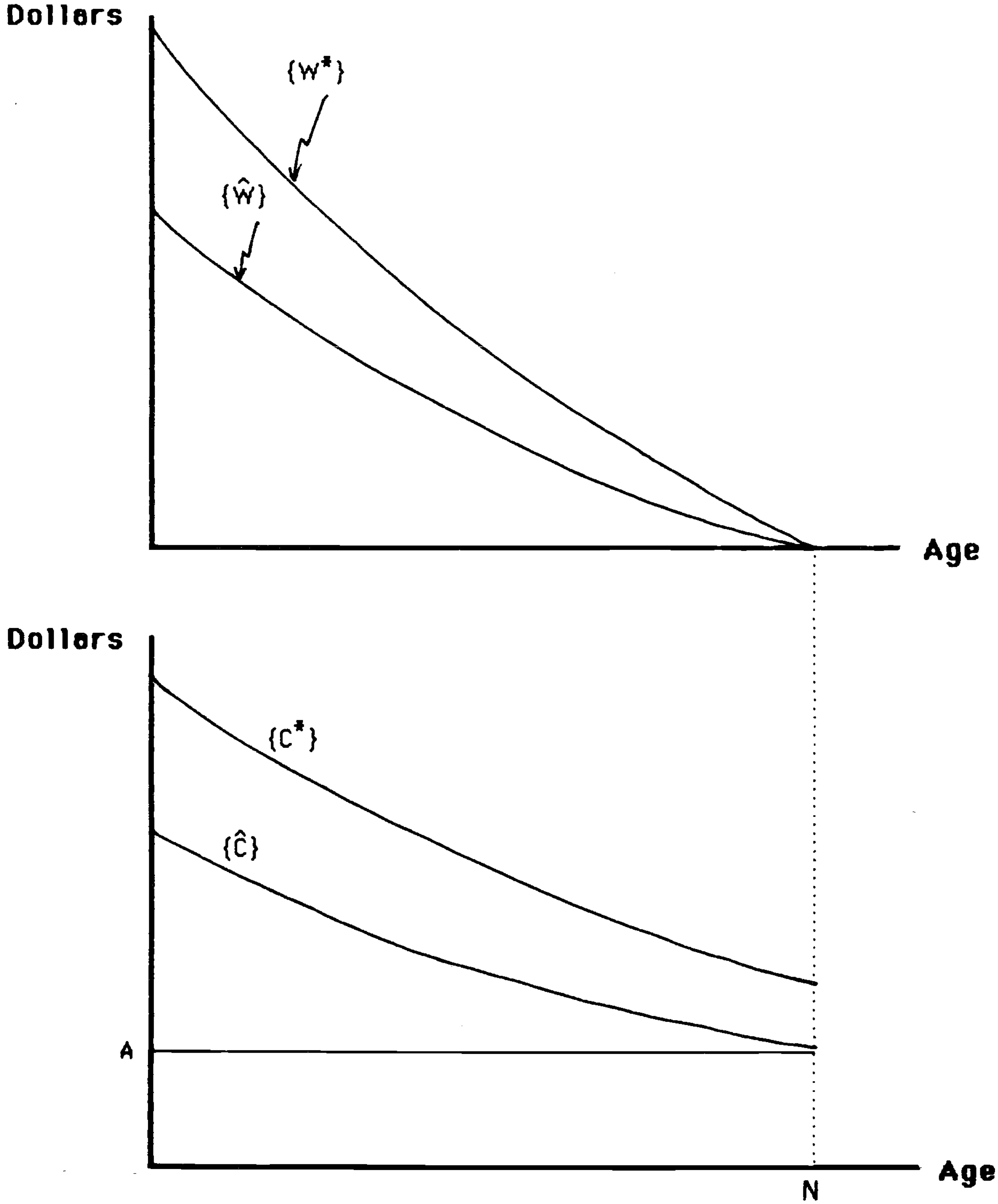

TABLE 1

Determination of the Sign of $\{\partial U_t/\partial t\}$

CASES	$U_t-\alpha$	$\partial U_t/\partial t$	$\partial^2 U_t/\partial t^2$	$U_\tau-\alpha$	$\partial U_\tau/\partial \tau$
1	+	-	not possible	not possible	not possible
2	+	+	+	+	+
3	-	-	-	-	-
4	-	+	+/-	+/-	+/-

N.B. $\tau > t$

In case 4, $\partial U_\tau/\partial \tau$ can only become negative while $U_t < \alpha$. When this occurs, the trajectory switches to case 3.

TABLE 2

Real Wealth Changes from 1969-1979:
Housing Wealth and liquidity constraint comparison.

Initial Wealth	Population	Housing Wealth Included	Housing Wealth Not Included
Observations with Positive Only	Singles	-25.2%	-39.8%
	Couples	-2.9%	-16.9%
	All	-15.0%	-29.2%
All Observations	Singles	-22.4%	-36.4%
	Couples	-2.0%	-14.5%
	All	-13.9%	-27.3%

TABLE 3

Real Wealth Changes
and number of observations

Year	Singles	Couples	All
1969-71	-3.9% (1009)	-3.0% (419)	-3.6% (1428)
1971-73	-6.1% (1290)	-2.5% (740)	-4.2% (2030)
1973-75	-12.6% (1552)	-0.5% (1204)	-7.3% (2756)
1975-77	-19.7% (1864)	-25.4% (1511)	-22.3% (3375)
1977-79	1.0% (2187)	22.9% (1790)	10.9% (3977)

N.B. Housing Wealth is excluded. No liquidity constraint imposed. Number of observations is in parentheses.

TABLE 4

Real Wealth Changes from 1969-1979:
Bequest Motive.

	Living Children	No Living Children	All
Singles	-38.0% (1104)	-32.6% (477)	-36.4% (1581)
Couples	-16.8% (957)	-1.7% (175)	-14.5% (1132)
All	-28.2% (2061)	-24.2% (652)	-27.3% (2713)

N.B. Housing Wealth is excluded. No liquidity constraint imposed. Number in parentheses is the average number of observations in each two-year period.

TABLE 5

Comparison of Saving Rates

	1969-71	1971-73	1973-75	1975-77	1977-79	Total
Couples	8/16	4/16	7/16	6/16	8/16	33/80
Singles	6/16	12/16	6/16	8/16	10/16	42/80

N.B. Entries are the fraction of annuity-wealth cells in which households with children had higher saving rates than households without children.

TABLE 6

Comparison of saving rates by
initial wealth and annuity quartiles.

A. Couples

Wealth Quartiles	Annuity Quartiles 1	2	3	4	All Annuity Levels
1	2/5	2/5	4/5	2/5	10/20
2	1/5	1/5	3/5	2/5	7/20
3	1/5	4/5	2/5	1/5	8/20
4	2/5	2/5	2/5	2/5	8/20
All Wealth Levels	6/20	9/20	11/20	7/20	33/80

B. Singles

Wealth Quartiles	Annuity Quartiles 1	2	3	4	All Annuity Levels
1	3/5	3/5	2/5	3/5	11/20
2	5/5	3/5	4/5	3/5	15/20
3	2/5	2/5	0/5	3/5	7/20
4	3/5	2/5	1/5	3/5	9/20
All Wealth Levels	13/20	10/20	7/20	12/20	42/80

N.B. Entries are the fraction of years in which saving rates of households with children exceeded the saving rates of households without children.

TABLE 7

Comparison of saving rates by initial capital income and annuity quartiles.

A. Couples

Income Quartiles	Annuity Quartiles 1	2	3	4	All Annuity Levels
1	2/5	2/5	3/5	2/5	9/20
2	2/5	2/5	3/5	2/5	9/20
3	1/5	2/5	3/5	1/5	7/20
4	2/5	2/5	1/5	4/5	9/20
All Income Levels	7/20	8/20	10/20	9/20	34/80

B. Singles

Income Quartiles	Annuity Quartiles 1	2	3	4	All Annuity Levels
1	3/5	0/3	2/5	2/5	7/18
2	2/5	2/5	2/4	2/4	8/18
3	2/5	2/5	3/5	3/5	10/20
4	3/5	2/5	2/5	0/5	7/20
All Income Levels	10/20	6/18	9/19	7/19	32/76

N.B. Entries are the fraction of years in which saving rates of households with children exceeded the saving rates of households without children.

Footnotes

1. See the survey by King (1985)

2. In his paper, Bernneim says that a good approximation to the true value of an annuity stream is its simple discounted sum, not weighted by the life rates. Although I believe this is not always accurate, his presentation of the problem has influenced the approach I give in Section 2.

3. Bernheim calculated the 1969-1975 wealth changes over just 574 households, and the 1975-1979 changes over 1047 households. From the same data set I use an average of 2071 households over the first period and an average of 3673 households over the second period.

4. Although there seem to be no reliable estimates based on microeconomic data in the literature, two kinds of evidence support the claim that $\rho > r$. Surveys and psychological experiments in which people are asked to choose between a present and a future reward typically show very high rates of time preference (Fuchs (1982)). Many people pay high rates of interest on borrowing even though their incomes seem to be roughly constant over time. On the other side, however, growth models in optimal steady state imply that $\rho < r$, and that assumption is often used in simulations (Davies (1981)).

5. This formulation is the same as Yaari's (1965).

6. Bernheim (1984) takes the sum of w_0 and A/r to be a good approximation to total wealth. How good an approximation dpends on how large T is. Many households in the RHS have very low ratios of w_0/A; it would be surprising if those households would have large values of T.

7. King and Dicks-Mireaux (1982), Kurz (1984), and Diamond and Hausman (1984) emphasize the heterogeneity of wealth holdings and behavior of the elderly. There is certainly substantial variation in wealth holdings in this data set. See Hurd and Shoven (1985).

8. Hurd and Shoven (1985) describe the categories in detail.

9. King and Dicks-Mireaux (1982) advocate a similar approach.

10. Because of the age of the heads of the households, most of the children probably are between 30 and 45 years old. Thus, very few households have children at home. Excluding households in which children are present does not change the basic results.

11. Bernheim makes this point in a model in which the mortality rate is constant. In this model in which mortality rates vary, simulations of trajectories from the constant relative risk aversion consumption function verify the result.

12. The classification method I use here is exactly the same as an instrumental variable method if there is positive correlation between capital income and wealth, and the instrumental variable method classifies according to the quartiles of fitted w_0.

13. The annuity classification is only approximate. According to the basic theory the entire annuity trajectory influences the wealth path. I used annuity wealth to reduce the trajectory to a single number, which was used for the classification. This is preferable to classifying by annuity income in that some early retirees must wait several years to begin to receive Social Security and private pensions.

14. There were no single households in four cells; thus, there are only 76 comparisons.

15. A further problem in the RHS is that the maximum entry in any asset catagory is $999,999.

16. The lower wealth cannot be explained by lower earnings: typically men with children have higher incomes than men without children.

Appendix

1. Bequeathable wealth. The RHS includes very detailed questions on assets and liabilities. They were aggregated to form the following assets: net business wealth, net real property, net vehicle value, U.S. Savings Bonds, stocks and bonds, loans owned, checking and savings accounts. Debts were: medical, store, bank and debts to private individuals. Bequeathable wealth is the sum of these assets less the sum of the liabilities. In Table 2, net housing equity was added.

2. Annuity wealth. The expected present value of Social Security, Railroad Retirment, military, government and private pensions were added to expected present value of transfers from relatives, Supplemental Security Income, welfare, Medicare and Medicaid, and private annuities.

3. Capital Income. This is the sum of interest and dividends, a service flow from housing equity, and rental income.

4. Imputation methods. Because there are more than 40 asset and liability catagories, there are missing values. To eliminate observations on the basis of any missing values would be to reduce substantially the working sample; therefore, missing values were imputed. The imputation methods is described in detail in Hurd and Shoven (1985); but here I give a brief description. The goal of the imputation method was to retain information about the asset holdings of the individual. If a respondent indicated he had an asset but the amount was missing, other suvey years were searched to find a valid value of the asset. A median rate of growth was applied to the valid entry to impute a value in the year in which it was missing. If no valid values could be found, the median over observations with positive values by marital status was imputed. If, in a particular year, a question about a particular asset was not asked, an interpolation for that individual from adjacent years was used. This did not happen for the important asset catagories.

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