ANNALES D'ÉCONOMIE ET DE STATISTIQUE. – N° 9 — 1988

Life Cycle Saving: A General Paradigm or a Caricature of the Petite-Bourgeoisie?

George M. VON FURSTENBERG *

ABSTRACT. – The paper interprets the life cycle hypothesis as an outgrowth of classical liberalism on account of the assumptions of egoism, intellectualism, and atomism which they share. A broader approach is modeled by letting differences in subjective survival probabilities reflect differences in altruism for heirs or posterity in general. The choice individuals make of family status may be indicative of differences in dynastic disposition even though such inclinations and their enforceability appear to have declined.

L'épargne du cycle de vie : un paradigme général ou une caricature de la petite bourgeoisie?

RÉSUMÉ. – Cet article interprète l'hypothèse du cycle de vie comme le produit du libéralisme classique dont il partage les postulats d'égoïsme, d'intellectualisme et d'atomisme. On propose une approche plus générale où les différences individuelles relatives aux probabilités de survie subjectives correspondent à des degrés d'altruisme différents vis-à-vis des générations à venir. La situation familiale choisie par l'individu est considérée comme un indicateur de sa propension à l'altruisme. La dimension dynastique des comportements semble moins marquée aujourd'hui qu'hier.

* G. M. VON FURSTENBERG: Indiana University, Bloomington, IN 47405, USA. An earlier draft of this paper was presented at the *International Seminar on Life-Cycle Theory* held in Paris, June 4-5, 1986. The author is indebted to Denis Kessler for useful comments and suggestions at that seminar and to an anonymous referee of this journal for subsequent comments.

1 Introduction

Dorante, bas, à Dorimène :
C'est un bon bourgeois assez ridicule, comme vous voyez, dans toutes ses manières.
LE BOURGEOIS GENTILHOMME
Acte III, scène XVI

Literary critics often say that Molière used comedy to reveal, not to disparage. So I may be forgiven for suggesting that the life-cycle theory presents Monsieur Jourdain without his stilted affectations and dynastic pretensions. Stripped of aspirations, what remains is a self-centered individual who accumulates and decumulates for his calculated benefit until a timely death relieves him of this dreary pursuit.

There is much more variety of behavior among beasts. The legendary phoenix is said to sacrifice itself for its young by feeding them of its breast. Such allegories are intended to shame humans by alleging altruism even in animals. In reality, the parents of several existing species become food for their progeny while some of the young in others get devoured by their parents without thought or credit. Humans, however, think about the future, elect to care for others and posture before posterity to varying degrees, seeking the rewards of nobility not unlike M. Jourdain. Robert LUCAS [1986], p. S425, recently has remarked that insofar economics is based on a superficial view of individual and social behavior, "it is exactly this superficiality that gives economics much of the power that it has: its ability to predict human behavior without knowing very much about the makeup and the lives of the people whose behavior we are trying to understand". Lucas also noted that an ability such as this necessarily has its limits, limits which, I think, are obvious from the baldness, or one-dimensionality, of life-cycle theory.

Why should we persist in modelling human kind as monotonous and singular in its motives? Could one perhaps attempt to account for diversity by looking for biological clues to differences in tastes and endowments? Intellect, character, the cultural and ethical environment, and the accepted postulates of faith, ideology and pride are part endowed and part acquired. Similarly, tastes and endowments affect predispositions about marital status, family stability, and fertility. Conversely, differences in demographic status variables may reveal differences in tastes.

If saving behavior differs identifiably between self-selected groups and the relative size of these groups changes, there will be macroeconomic effects on personal saving on account of composition effects. Motivation can, of course, also change over time *within* any of the classes distinguished, so that there could be cohort and period effects. The formal part of this paper will ignore any such effects and deal only with groups whose saving behavior may be expected to differ at any one time. However, in developing the background of life-cycle theory, and the issues it raises, in the next section, such narrow constraints will not yet be in force.

2 Heritage and Trends

Before attempting to stretch the theory later in this paper, it may be worthwhile to recall the ideological roots of the systematic egoism that underlies it. The four psychological assumptions on which classical liberalism is commonly presumed to rest are egoism, quietism, intellectualism, and atomism (see, for instance, Harry GIRVETZ [1966]). The life-cycle theory stands on the same pillars, as will be explained briefly for each.

First, psychological egoism, supported by a calculus seeking to maximize one's pleasure net of one's pain over a lifetime, supplies the theory of motivation. This desire for pleasure helps overcome that natural state of inactivity known as quietism in which, it is assumed, everyone would rest unless forced to work for a living. As the life-cycle hypothesis (LCH) has shown in the same spirit, the self-love that provides the motive power is an unemotional affair of far-flung calculations. In Franco MODIGLIANI's [1986], p. 305, words, "[t]he LCH presupposes a substantial degree of rationality and self-control to make preparations for retired consumption needs". Disciplined intellectualism is applied to seeking out the greater net pleasure from among the alternative combinations that could be reached both now and in the future. In the systematic pursuit of its interests, the self is endowed with foresight enabling it to exercise time preference via the discount mechanism. Apart from this concession to reality which allows the self to be viewed as an intertemporal organism, the self is pictured as atomistic. Thus the whole is no more than the sum of the parts, and the behavior and intent of the parts are unchanged when they are joined to, or divorced from, society.

In principle, classical liberalism would allow the word *family* to be substituted for *society* in the last sentence, but difficulties were recognized in doing so. These difficulties tended to be papered over by appealing to convenient "facts of human nature" that now would be recognized as factitious. As Gary BECKER [1976], p. 817, has remarked, the dominance of self-interest and the persistence of some benevolence largely limited to children have usually been explained by "human nature", or an equivalent evasion of the problem. In particular, the sexual impulse, – together with measures of state to discourage birth control and with the imperative to care for one's children, – was relied upon to overcome quietism and intellectualism long enough to start families and to bring the unwelcome compulsion of work down on the progenitors. GIRVETZ [1966], p. 38, documents how Malthus mobilizes what is decorously called "the natural desire for marriage" in this way to provide a necessary stimulus to industry. According to Malthus, the acknowledged indolence of humans is supposed to be overcome by obliging them to care for the families resulting from impulsive sex. Such acts thus appear as a "natural" exception to the cool pursuit of self-interest otherwise required by intellectualism. Reinforced by equally antinomic prohibitions against "unnatural or artificial modes of checking population", the sexual drive ultimately leads to individually unwelcome but socially useful compulsions to overcome quietism in this scheme.

Basically, therefore, conjugal relations and family are reduced to a work incentive, one that ceases to operate when children are either supported by the state or able to fend for themselves. Indeed children should be educated and put to work as soon as practicable and not be allowed to lapse into inactivity by having estates settled upon them. Unlike the effects of dependent children on their parents, when (elderly or sick) parents become dependent, they are taken to have little claim on the work effort of their children. Hence adults, who had received the legacy implied in their rearing, pass it on by temporarily sharing (see MODIGLIANI [1986], p. 304), and raising offspring of their own. Otherwise, however, they look after themselves and look out for themselves alone. In particular, doing more than the minimum for children which biology and culture may urge would be privately wasteful under this conception since parents have no stake in the future income or position of their children beyond what is needed to relieve them of dependents.

This last, unadorned paradigm fits the life-cycle theory to a T and bares the roots it has in classical liberalism should time have obscured them. The main difference is that the theory does not require Malthusian or Darwinian compulsions to overcome quietism but holds that naked self-interest without families is enough to stir people.

Life without families or without accepting lasting obligations to spouse and offspring has indeed become increasingly common in a number of industrial countries. Instead of reciting the bleak litany of changes observable even within a single generation, I will offer only one quote from Robert SHILLER [1984], p. 473, and then enumerate and comment further on a few of the factors in the United States:

> There is in the postwar period evidence of substantial changes in behavior big enough to have a major impact on the market. For example, the percentage of people who said that religion is "very important" in their lives fell from 75% in 1952 to 52% in 1978. The birth rate hovered around 2.5% throughout the 1950s and then began a gradual decline to around 1.5% in the 1970s. These changes may reflect changing attitudes toward the importance of family, of heirs, or of individual responsibility for others.

What could be behind the statistics and conjectures offered by Shiller? Making divorce cheaper and more easily available at the option of either party reduces the value of investing in marriage for both of them. Although marriage-specific skills are largely transferable through remarriage, expected lifetime demand for them is at least somewhat reduced and less certain. Rising divorce rates also raise the expected cost of children to women who have acquired increasingly independent control of marital fertility. Thus H. Elizabeth PETERS [1986], p. 443, notes that women who foresee the possibility of divorce might decide to have fewer children than they would otherwise because divorced women with children have a high cost of entering, or continuing in, the labor market and are less likely to remarry. Men might seek to exercise influence toward reducing marital fertility also if they fear being alienated from any children they might father as a result of divorce. One of the results of increasing future divorce probabilities, found by William JOHNSON and Jonathan SKINNER [1986], is a rise in current labor supply of women which, in turn, raises the opportunity cost of having children. US marriages begun in 1970 were 60% more likely to end in divorce than those begun in 1950 according to these joint authors. Cohabitation (with apologies for the use of a politically charged term) is an increasingly common way of avoiding fertility and the legal and economic ties of marriage. In the settled forms in which it can be determined by census takers, it has risen from 1% of all US couples in 1970 to 4% in 1986. Permanent childlessness has also become more common in marriage, as David BLOOM and Neil BENNETT [1985] have pointed out for the United States.

The increasing relative cost of rearing, caring for, and educating the young and of providing for earlier retirement and longer lasting custodial and medical care for the old may have contributed to persons having fewer children and leaving them less. SKINNER [1985] has shown that the bequest motive may negate and even reverse the positive correlation between longevity and savings implied by the pure life-cycle model. The fact (noted in BOARD OF GOVERNORS [1986 c], p. 817) that married couples with children under 18 have fallen from 45% of all US households in 1950 to 28% in 1985 is a harbinger of further changes as family life becomes an increasingly exceptional and transitory state of being and obligation. In the United States, at least, the pension and annuity proportions of household wealth are up and the portion represented by life insurance reserves is down (see BOARD OF GOVERNORS [1986 b]), although this may not hold in other industrial countries (BANCA D'ITALIA [1986]) as a referee has pointed out also for France. Life insurance policies are very much like reverse annuity contracts in that they take from the insured to give to his survivors, while pension and annuity contracts may well diminish the estates otherwise left (B. Douglas BERNHEIM [1985]). Even without survivor benefits, the actuarially expected present value of annuities can not, of course, go to zero as long as those covered by them are alive. So the fact that the elderly accumulate and retain substantial wealth at any age need not imply that this wealth will survive them.

Except for this, possibly misleadingly estimated lack of dissaving by the elderly noted in France (Bruno OUDET [1979]) and other industrial countries, the behavior of persons in these countries may indeed be getting closer to that envisaged in the life-cycle paradigm. Using longitudinal data on consumption and wealth late in the life cycle, Daniel HAMERMESH [1984] has found that, on account of a high positive rate of time preference, retired households optimize by consuming more than sustainable with their available means early in retirement and then reducing consumption rapidly as they age. High positive rates of pure time preference are most compatible with the life-cycle story, as Mancur OLSON and Martin BAILEY [1981], pp. 22-23 have explained at greater length, and this property is used analogously also in the model stated in the next section. Furthermore, at least at the middle and upper income levels, the family choices of people may now be made more deliberately than in Malthus' time. Mark ROSENZWEIG and T. Paul SCHULTZ [1985], p. 1013, relate that in their sample of white married women in the United States in 1970, 27% of the couples reported that they had one or more unwanted children by 1975, while 62% reported that they had experienced one or more births earlier than they had intended. Hence perhaps advances in intellectualism and the use of birth control should not be exaggerated.

Nevertheless the signal to noise ratio of family choices has probably been growing. They may reveal systematic differences in preferences and hence in the planned pursuit of egoism, not to say altruism, with implications for saving. What follows is the sketch of a limited model that could provide for the heterogeneity of tastes which could be revealed by differences in demographic status.

3 The Formal Model in Broad Outline

In the model below these differences are modeled as if they had to do with the probability of surviving from one year to the next. This subjective probability is here understood to reflect not just an individual's mortality calculations but his intertemporal empathy, concern for heirs, or even for unrelated generations yet unborn. The "as if" mortality rate, $1-\gamma$, is thus a taste parameter which may differ between groups but is formed with full knowledge of the actuarial facts of life by each. It may be contrasted with the objective risk of death per period $1-\gamma^*$.

Any differences between γ and γ^* are due not to irrationality or to an unfounded presumption (optimism) that one will beat the fair odds on surviving that suit one's particular class. They are not based on asymmetric information either. Rather they arise in this model from the possibility of an individual's concerns extending beyond his life cycle. If γ^* exceeded γ, a person would spend "as if there were no tomorrow". Myopic behavior of this kind may exist even at income levels well above subsistence, but it is not rational and thus ruled out. However, the opposite inequality, $\gamma^* \leqq \gamma$, may be entirely compatible with rationality and indicative not of dreams of immortality but the possibility of altruism. The subjective survival rate, γ, can at most be equal to 1, which is the limit value associated with "Ricardian equivalence" in Jacob FRENKEL and Assaf RAZIN [1986]. In what follows I am borrowing extensively from the formal outlines of that work although some of the details and the analytical purpose here are quite different.

Treating both γ and γ^* as constants which are independent of age and spending but potentially different by demographic group has a number of implications. These need to be brought out to reveal the peculiarities and limited usefulness of this specification. Regarding age, the implication is that the remaining life expectancy is equal for all those currently alive. There is no biological aging, only longer or shorter exposure to the decimation caused by accidents which strike at prespecified annual rates. If, for instance, population is stationary and the generation originating in year s is normalized as one individual when born, then the surviving fraction of the generation started one year earlier is γ^*, and so on backwards, up to $\gamma^{*\infty}$. Hence there would be a total of $(1-\gamma^*)^{-1}$ individuals currently living. Turning to the second implication, assuming that γ and γ^* are independent of consumption and of investments in health implies that income is at least sufficient for subsistence and that expenditures on health care, or other types of precautionary spending, have no effect on fatality rates. Finally, postulating fixed differences between demographic groups from birth (or from that "age" on at which accumulation becomes relevant) assumes that everybody decides irrevocably and very early in life to which group to belong and to what pattern to conform. This choice is assumed to be uncorrelated with any individual differences in "fitness", γ^*, whether actual or perceived.

The representative individual's utility of consumption may plausibly be characterized by a function indicating constant relative risk aversion. According to David CASS and Joseph STIGLITZ [1970], p. 128, the first derivative of this isoelastic class of functions with utility U and consumption C is:

$$U'(C) = aC^b, \qquad b<0 \tag{1}$$

Setting the scalar, a, equal to 1 for convenience, the corresponding utility function is commonly expressed in either of two ways:

$$\begin{cases} U(C) = (1+b)^{-1}C^{1+b} = [\beta/(\beta-1)]\,C^{(\beta-1)/\beta}, \\ \qquad\qquad \beta = -1/b > 0 \end{cases} \tag{2}$$

Evaluating the utility of a stream of consumption involves the use of the subjective annual discount factor δ which reflects time preference motivated by factors other than uncertainty of survival $(\gamma^* < 1)$. Since the time horizon of concern to the individual is dealt with explicitly through survival rate assumptions, there is no point in forcing variations in time preference rates, which are a logically separate taste parameter, to mimic differences in survival rates as well. Thus taking the discount factor δ to be constant and the same for all demographic groups, consumption i years hence is multiplied by δ^i. With this extension, eq. (1) implies that $U'(C_{i+1})/U'(C_i) = \delta(C_{i+1}/C_i)^b$ so that the intertemporal elasticity of substitution, $d\ln[C_{i+1}/C_i]/d\ln[U'(C_{i+1})/U'(C_i)]$, is $1/b = -\beta$.

Eq. (2) shows that the inverse of this intertemporal elasticity of substitution with sign reversed is the coefficient of relative risk aversion. That coefficient is $-CU''(C)/U'(C) = -b = 1/\beta$. Of course if $b=-1$ in eq. (1), integrating yields the natural logarithm of C, ln C, in eq. (2). By all previous estimates (summarized, for instance, in Benjamin FRIEDMAN [1985], p. 228; and in Glenn HUBBARD and Kenneth JUDD [1986], p. 18, ftnt. 40), the implied intertemporal elasticity of substitution of unity would be high. Nevertheless, the logarithmic (von Neumann) form will be used in further explaining the particulars of the demographic differentiation that concerns us.

4 Detailed Specifications

First to be explained are the subscripts that will be used in the formal development of the model. Index s indicates the year in which the generation (consisting of one individual) was born while t is the year of reference (where we are now), and v designates the years from t on to infinity lying $v-t$ years in the future. We also need to differentiate γ, and hence C, by demographic group, j, although the objective probability of survival from one year to the next, γ^*, and hence the budget constraints, are the same for all. With logarithmic utility and compounded subjective survival probabilities, γ_j, the expected utility of consumption, from year t on, of the individual born in year s and surviving at least to year t is:

$$\text{(3)} \qquad E_t \sum_{v=t}^{\infty} \delta^{v-t} \ln C_{sv,j} = \sum_{v=t}^{\infty} (\gamma_j \delta)^{v-t} \ln C_{sv,j}.$$

The budget constraint in period t for an individual born in period s and faced with a fixed annual market discount factor α is first developed without regard to differences in j. This constraint takes the form:

$$\text{(4)} \qquad \gamma^* W_{st} = \gamma^* [(W_{s,t-1} + Y_t - C_{st})/\alpha + (1-\gamma^*) W_{s-1,t-1}]$$

In this equation W_{st} is the individual's net worth at the end of period t conditional upon survival from the previous period. It is equal to its value at the end of the previous period, $W_{s,t-1}$, plus saving out of current labor income, $Y_t - C_{st}$, all already with one year's interest ($\alpha^{-1} = 1 + r_{t-1}$). The one-year rate, r_{t-1}, is the interest rate, quoted on both borrowing and lending at the end of the previous period, which, while variable in principle, is here taken to be fixed at r.

Looking ahead from the end of period $t-1$ to the end of period t, the individual's expected wealth is less than W_{st} since survival is not guaranteed. Should the individual die in year t, he is taken to leave his wealth to the immediately succeeding generation, $s+1$, in a will that takes one period of, say, a year to settle. Limited survival requires multiplication by γ^* of the law of motion, eq. (4), if its LHS is to represent expected wealth. On the other hand, while some part of generation s dies, there is the chance, $(1-\gamma^*)$, of its surviving part receiving an inheritance during year t from the generation immediately preceding, which is dated $s-1$. If it takes one year to settle these inheritances and the entire interest earned during this year is eaten up by settlement costs, inheritances of constant value come from a generation, $s-1$, which was just as large last year, in year $t-1$, as generation s is in year t, the size of both being $\gamma^{*(t-s)}$.

The last term on the RHS of eq. (4) requires detailed explanation. When wills are made, generation s is still $1/\gamma^*$ times as large as generation $s-1$, so that the average per capita bequest received from $s-1$ by those members of generation s who survive the settlement year, t, is $(1-\gamma^*)W_{s-1,t-1}$ multiplied by γ^*. By the time estates are to be released from escrow, some of those named in wills are dying. However, by the same token, each member of generation s surviving year t benefits from some members of earlier generations having been passed over because they died just when inheritances were to be settled on them, thereby further delaying the vesting of such inheritances in the order of succession. Thus, by the end of year t, survivors from s can expect to receive not only the fraction $\gamma^*(1-\gamma)^*$ of the wealth of generation $s-1$, but also $\gamma^*(1-\gamma^*)^2$ of $s-2$, and so on from yet earlier generations. The resulting geometric series, $\gamma^*[(1-\gamma^*)W_{s-1,t-1}+(1-\gamma^*)^2W_{s-2,t-2}+\ldots]$, sums to $(1-\gamma^*)W_{s-1,t-1}$ since the condition that only age and not the cohort matters implies that $W_{s-i,t-i}=W_{s-j,t-j}=W_{s,t}$ for any i, j. The above sum of inheritances is not divided by α on account of the assumed lack of growth in the value of estates during settlement.

Substituting W_{st} for $W_{s-1,t-1}$ in eq. (4), as explained before, yields the individual budget constraint:

$$\alpha\gamma^* W_{st}=W_{s,t-1}+Y_t-C_{st} \tag{5}$$

Taking account of the continuing rate of decimation caused by accidents occuring at the objective rate $1-\gamma^*$ each year, the transversality condition is:

$$\lim_{v\to\infty}(\gamma^*\alpha)^{v-t}W_{sv}=0 \tag{6}$$

Replacing subscript t by $v=t,\ t+1,\ \ldots\infty$ and multiplying each term in eq. (5) by $(\gamma^*\alpha)^{v-t}$ for matching intertemporal extension yields the present value of the budget constraint in any future year. Successive substitution in the resulting equations to the limit for all v, where $t\leqq v\leqq\infty$, with the help of eq. (6) then leaves the intertemporal budget constraint:

$$\sum_{v=t}^{\infty}(\gamma^*\alpha)^{v-t}C_{vs}=W_{s,t-1}+\sum_{v=t}^{\infty}(\gamma^*\alpha)^{v-t}Y_v=W^*_{st}. \tag{7}$$

Here W^*_{st}, as defined by eq. (7), is the stock value of human and nonhuman wealth at the *beginning* of period t. (Consistent with the previous assumption of a full year's interest being earned on this year's saving this year, each year's income is supposed to be generated in a single pulse at the beginning of each year which coincides with the end of the previous year.) This concludes the derivation of the budget constraint, at first without regard to differences among demographic groups, j.

We will now assume separation by demographic groups such that group j inherits only from previous members of the same group. This assumption could be seen as suggestive of dynasty based either on intergenerational discipline or spontaneous homogeneity of tates, if inheritances are left mainly to natural offspring. In fact it is little more than a sleight of hand employed to keep matters simple even though receiving bequests may instill a sense of obligation to also leave bequests in some. It allows us to avoid interdependence and to specialize eq. (7) to any group j simply by adding subscripts, so that:

$$(8)\quad \sum_{v=t}^{\infty} (\gamma^* \alpha)^{v-t} C_{vs,j} = W_{s,t-1,j} + \sum_{v=t}^{\infty} (\gamma^* \alpha)^{v-t} Y_{v,j} = W^*_{st,j}.$$

5 Solution

Using eqs. (3) and (8), the constrained problem of an individual belonging to demographic group j is to maximize:

$$(9)\quad L = \sum_{v=t}^{\infty} (\gamma_j \delta)^{v-t} \ln C_{sv,j} - \lambda \left(\sum_{v=t}^{\infty} (\gamma^* \alpha)^{v-t} C_{vs,j} - W^*_{st,j} \right)$$

The first order conditions, moving from the present ($v=t$) any i years into the future ($v=t+i$) are:

$$(10)\quad \begin{aligned} \partial L/\partial C_{st,j} &= 1/C_{st,j} - \lambda = 0, \qquad v=t \\ \partial L/\partial C_{s,t+i,j} &= (\gamma_j \delta)^i / C_{s,t+i,j} - \lambda (\gamma^* \alpha)^i = 0, \\ & v = t+i \end{aligned}$$

After eliminating λ, system (10) has the solution:

$$(11)\quad (\gamma_j \delta)^{v-t} C_{st,j} = (\gamma^* \alpha)^{v-t} C_{sv,j}, \qquad v = t,\ t+1 \ldots \infty$$

This shows that C is increasing or decreasing over time depending on whether $\gamma_j \delta$ is greater or less than $\gamma^* \alpha$. Summing equations of form (11) over all v and using eq. (8) yields:

$$(12)\quad C_{st,j}/(1-\gamma_j \delta) = \sum_{v=t}^{\infty} (\gamma^* \alpha)^{v-t} C_{sv,j} = W^*_{st,j}$$

$$= W_{s,t-1,j} + \sum_{v=t}^{\infty} (\gamma^* \alpha)^{v-t} Y_{v,j}.$$

Eq. (12) shows that consumption is a fixed, group-specific fraction, $(1-\gamma_j \delta)$, of total wealth, $W^*_{st,j}$. That fraction is lower the higher the subjective survival rate of a group, γ_j. Given the human component of total wealth, which is represented by the discounted present value of the expected labor income remaining to be earned, $\sum_{v=t}^{\infty} (\gamma^* \alpha)^{v-t} Y_{v,j}$, consumption at age $t-s$ is higher the greater the non-human component of wealth at the end of the previous period, $W_{s,t-1,j}$.

To determine the evolution of this last wealth component, we use the group-specific version of eq. (5) and substitute for $C_{st,j}$ from eq. (12). The final result, with $Y_{v,j}$ the same as Y_t for all v and j, is:

$$(13) \quad \alpha\gamma^* W_{st,j} = W_{s,t-1,j} + Y_t - (1-\gamma_j \delta)\left[W_{s,t-1,j} + \sum_{v=t}^{\infty} (\gamma^* \alpha)^{v-t} Y_{v,j} \right] = \gamma_j \delta (W_{s,t-1,j} + Y_t) - (1-\gamma_j \delta)[\gamma^* \alpha/(1-\gamma^* \alpha)] Y_t$$

In this equation, $[\gamma^* \alpha/(1-\gamma^* \alpha)] Y_t$ is the present value of an annuity of Y_t starting in year $v=t+1$. The fraction $(1-\gamma_j \delta)$ of this present value is consumed in year t and thus substracted to obtain the stock of wealth outstanding at the end of that year. On the other hand, contributing to that wealth are the part, $\gamma_j \delta$, of non-human wealth outstanding last period and not spent and of current income not spent, as well as the interest earned on past and present accumulations. Put more intuitively, to the extent income and non-human wealth are higher at the start, consumption and the non-human wealth remaining are greater as well.

The first-order non-homogeneous difference equation for non-human wealth, eq. (13), can be solved for present and future years $v \geqq t$ with a given initial value of $W_{s,t-1,j}$:

$$(14) \quad W_{sv,j} = [(\gamma_j \delta)/(\gamma^* \alpha)]^{v-t+1} [W_{s,t-1,j} + Y_t/(1-\gamma^* \alpha)] - Y_t/(1-\gamma^* \alpha).$$

This solution shows that for individuals surviving to age $v-s$, non human wealth is higher for given income the greater γ_j. Furthermore, if $\gamma_j \delta > \gamma^* \alpha$, it also rises with the age of the members of generation s remaining. Since the number of survivors in any such generation diminishes by γ^* each year, the aggregate wealth owned by all members of that generation will not explode and process (14) will be stable if $\alpha > \gamma_j \delta$.

Once one has standardized by age and (permanent) income, there is no reason other than differences in γ_j admitted in the model, for non-human wealth to differ between groups. Conversely, as stated at the outset of this paper, these differences in wealth holdings may be interpreted to reveal differences in cultural endowments and tastes between groups that have selected their demographic circumstances such as marital status and number of children. Assuming the objective survival rates, γ^*, are roughly the same for all groups in the model, differences in γ_j are attributable solely to group attitudes regarding posterity.

Before concluding the modeling effort it may be useful to emphasize the peculiarities of the "accidental death" specification by exploring the solution of eq. (14) for the special case of life-cycle saving. The closest we can come to the MODIGLIANI and BRUMBERG [1951] specification within the confines of the present model is to assume equality of the constant subjective discount factor, δ, and its objective (market) counterpart, α. Likewise, the subjective survival rate of group j, γ_j, may be equated to the objective rate for all groups, γ^*. Then eq. (14) shows that the particular "life-cycle" group j meeting these parameter specifications will have no reason to accumulate any wealth at all. If they are nevertheless endowed with some initial non-human wealth by windfall at the end of year $t-1$, they will consume only the annual yield thereon. Hence their wealth conditional upon survival remains intact. There is no natural aging or retirement in the model. Then if the time preference rate is equal to the market interest rate and individuals do not fancy to live longer than actuarial calculations would indicate, they will not be interested to save at all unless, of course, the initial endowment arbitrarily takes the form of negative wealth, *i.e.*, debt. By contrast, if $\gamma^* \alpha > \gamma_j \delta$, whatever wealth may have been generated by windfall initially would be dissaved gradually. Consumption would be falling in step with wealth and its marginal utility would be rising to supplement an interest rate that is below the time preference rate ($\gamma \geqq \gamma^*$ implies $\alpha > \delta$ above). Once wealth cannot be run down any further and borrowing has reached the limit of $Y_t/(1-\gamma^* \alpha)$, all of current income would be needed to service the debt. This debt would be forgiven in the event of death since insurance reserves had been built up from the allowance for accidents included together with pure interest in the annual rate of charge, $(\alpha\gamma^*)^{-1}-1$.

6 Empirical Indications

As often happens in the formal development of research, the variety of attitudes and behavior evoked at the beginning of the paper has given way to the study of something much narrower. This paper was limited to parameterizing differences in altruism when death comes only by accident at a constant annual rate. Ian HACKING [1975], p. 108, reports that this assumption about mortality has been used at least as far back as 1662 (in work published by John Graunt), but it remains wicked nonetheless. Furthermore, only "survival" preferences, not labor income or work effort, were allowed to differ.

To bring out the diversity of tastes about "survival", the first step in future empirical work would be to interpret differences in non-human wealth holdings of households. These households would be stratified by demographic circumstances but standardized by (permanent) income and age of head. Surveys of consumer finances can provide some of the material even though they do not reveal many of the factors that bear on personal saving motivation and concern for posterity. Obviously, permanent income (see Fumio HAYASHI [1982]) is not directly evident from such surveys. Nor are the many explicit and implicit contracts that govern the degree of reliance on social provision and risk sharing (see Roger Gordon and Hal Varian [1985]). Also, we normally do not get from surveys information about contributions to charity. Planned contributions, even if spent on consumption by the receiving entities, can contribute to net saving except in religious parables where rich men give to become poor and have no intention of remaining rich and giving again. Planned contributions could reveal a generous concern for posterity or a desire for leaving living monuments comparable to that revealed by a large excess of γ_j over γ^*.

Table 1

Mean and Median Net Worth of Families Distinguished by Life-Cycle Stage of Family Head

	Percent of Families	Net Worth (*thousands of dollars*)	
		Mean	Median
Under 45 years	(42)		
Unmarried, no children	12	16.3	1.1
Married, no children	7	24.9	7.5
Married, with children	23	41.4	17.9
45 years and over	(48)		
Head in labor force	26	107.1	54.5
Head retired	22	103.0	43.2
All ages	(9)		
Unmarried, with children	9	22.8	0.5

Note: Subtotals in parentheses do not add to 100 because of rounding.
Source: Board of Governors of the Federal Reserve System (1984*b*, p. 863).

The many two-way classifications published so far from a new data source, the 1983 Survey of Consumer Finances (Board of Governors [1984*a*], [1984*b*], [1986*a*]) do not present differences in net worth between demographic groups *ceteris paribus*. Nor can empirical distributions of γ_j or $(\gamma_j - \gamma^*)$ be derived for given age and income as required by the previous model. Nevertheless some of the crude differences revealed in the previous table are suggestive, revealing large differences in mean and median net worth between demographic groups distinguished by "life-cycle stage of family head" Since other two-way classifications (Board of Governors [1984*a*], p. 682) suggest that "married under 45 years" with "no children" and "with children" have almost identical incomes, not all of the differences will disappear after standardizing for age and income. Rather, it appears that preconceptions or received values, and their differing interpretations and applications through self-selection, may matter also. So could the process of gradual adaptation of social and family mores and the degree of behavioral variance permitted. As Patricia Ebrey [1984], p. 164, has written in *Family and Property in Sung China:* "How men responded to new economic opportunities or political institutions depended on notions in their heads, but these notions could also change as they came to deal with new situations".

In this light, the life-cycle paradigm should probably not be seen as timeless or universally paramount for savings behavior. Rather, it is a caricature telling a good deal about all of us in the one-sided and exaggerated way usually employed in that intellectual art form. Indeed, with the reduction of family, its size, endurance and valuation, life may have begun to imitate art, making the life-cycle theory descriptive of the principal savings motivation of ever larger shares of declining populations (Michael HURD [1987]). Nevertheless, for a broader understanding of irreducible heterogeneity of preferences, life-cycle concerns may have to be complemented by other, perhaps more dynastic, more altruistic, or simply prouder objectives than successful annuitization and consumption smoothing for one's lifetime. Before more ambitious objectives for saving usefully can be claimed, they must first be found feasible in society. They would have to be supported by a demonstrable (legal, moral, and conventional) order in which they may be realized and enforced through time with some assurance. There is little point in saving for a flight to Paris or a business to leave to your children if you are from Moscow. Some macroeconomic attempts have already been made to obtain evidence on both broader savings and wealth motives, and constraints on their exercise (*see*, for instance, Michael BOSKIN and Laurence KOTLIKOFF [1985]; and BERNHEIM *et al.*, [1985]). In future work with micro-level data, it may be possible to get at more of the different motives through demographic detail.

• References

BANCA D'ITALIA, (1986). – "The Wealth of Italian Households (1975-1985)", *Economic Bulletin*, No. 3, October, pp. 54-66.

BECKER, G. S. (1976). – "Altruism, Egoism, and Genetic Fitness", *Journal of Economic Literature*, 14, September, pp. 817-26.

BERNHEIM, P. D. (1985). – "Life Insurance, Annuities and Bequests", Stanford University, Department of Economics, *draft* dated November 1985.

BERNHEIM, P., SHLEIFER, A. and SUMMERS, L. H. (1985). – "The Strategic Bequest Motive", *Journal of Political Economy*, 96, December, pp. 1045-76.

BLOOM, D. E. and BENNETT N. G. (1985). – "Marriage Patterns in the United States", *NBER Working Paper*, No. 1701, September.

BOARD OF GOVERNORS OF THE FEDERAL RESERVE SYSTEM (1984*a*). – "Survey of Consumer Finances, 1983", *Federal Reserve Bulletin*, 70, September, pp. 679-92.

BOARD OF GOVERNORS OF THE FEDERAL RESERVE SYSTEM (1984*b*). – "Survey of Consumer Finances, 1983: A Second Report", *Federal Reserve Bulletin*, 70, December, pp. 857-68.

BOARD OF GOVERNORS OF THE FEDERAL RESERVE SYSTEM (1986*a*). – "Financial Characteristics of High-Income Families", *Federal Reserve Bulletin*, 72, March, pp. 163-77.

BOARD OF GOVERNORS OF THE FEDERAL RESERVE SYSTEM (1986*b*). – "Life Insurance Companies in a Changing Environment", *Federal Reserve Bulletin*, 72, July, pp. 449-60.

Board of Governors of the Federal Reserve System (1986 *ac*). – "Economic Implications of Changing Population Trends", *Federal Reserve Bulletin*, 72, December, pp. 815-26.

Boskin, M. J. and Kotlikoff, L. J. (1985). – "Public Debt and United States Saving: A New Test of the Neutrality Hypothesis", pp. 55-86 in Brunner, K. and Meltzer, A. H., Eds., *The "New Monetary Economics", Fiscal Issues and Unemployment*, Carnegie-Rochester Conference Series on Public Policy, Vol. 23, North-Holland, Amsterdam, August.

Cass, D. and Stiglitz, J. E. (1970). – "The Structure of Investor Preferences and Asset Returns, and Separability in Portfolio Allocation: A Contribution to the Pure Theory of Mutual Funds", *Journal of Economic Theory*, 2, June, pp. 122-60.

Ebrey, P. B. (1984). – *Family and Property in Sung China: Yuan Ts'ai's Precepts for Social Life*, Princeton University Press, Princeton.

Frenkel, J. A. and Razin, A. (1986). – "Fiscal Policies in the World Economy", *Journal of Political Economy*, 94, June, pp. 564-94.

Friedman, B. M. (1985). – "The Substitutability of Debt and Equity Securities", pp. 197-233 *in* Friedman, B. M., Ed., *Corporate Capital Structures in the United States*, University of Chicago Press, Chicago, IL.

Girvetz, H. K. (1966). – *The Evolution of Liberalism*, Collier Books, New York.

Gordon, R. H. and Varian, H. R. (1985). – "Intergenerational Risk Sharing", *NBER Working Paper*, No. 1730, October.

Hacking, I. (1975). – *The Emergence of Probability*, Cambridge University Press, Cambridge.

Hamermesh, D. S. (1984). – "Consumption During Retirement: The Missing Link in the Life Cycle", *Review of Economics and Statistics*, 65, February, pp. 1-7.

Hayashi, F. (1982). – "The Permanent Income Hypothesis", *Journal of Political Economy*, 90, October, pp. 895-916.

Hubbard, R. G. and Judd, K. L. (1986). – "Liquidity Constraints, Fiscal Policy, and Consumption", *Brookings Papers on Economic Activity*, 1, 1986, pp. 1-50.

Hurd, M. D. (1987). – "Savings of the Elderly and Desired Bequests", *American Economic Review*, 77, June, pp. 298-312.

Johnson, W. R. and Skinner, J. (1986). – "Labor Supply and Marital Separation", *American Economic Review*, 76, June, pp. 455-69.

Lucas, R. E., Jr. (1986). – "Adaptive Behavior and Economic Theory", *Journal of Business*, 59, October, Part 2, pp. S401-S426.

Modigliani, F. (1986). – "Life Cycle, Individual Thrift, and the Wealth of Nations", *American Economic Review*, 76, June, pp. 297-313.

Modigliani, F. and Brumberg, R. (1954). – "Utility Analysis and the Consumption Function: An Interpretation of Cross-Section Data", pp. 388-436 *in* Kurihara, K. K., Ed., *Post-Keynesian Economics*, Rutgers University Press, New Brunswick, NJ.

Olson, M. and Bailey, M. J. (1981). – "Positive Time Preference", *Journal of Political Economy*, 89, February, pp. 1-25.

Oudet, B. A. (1979). – "Data and Studies on Saving in France", pp. 257-76 *in* von Furstenberg G.M., Ed., *Social Security Versus Private Saving*, Ballinger Publishing Co., Cambridge, MA.

Peters, H. E. (1986). – "Marriage and Divorce: Informational Constraints and Private Contracting", *American Economic Review*, 76, June, pp. 437-54.

Rosenzweig, M. R. and Schultz, T. P. (1985). – "The Demand for and Supply of Births: Fertility and its Life Cycle Consequences", *American Economic Review*, 75, December, pp. 992-1015.

Shiller, R. J. (1984). – "Stock Prices and Social Dynamics", *Brookings Papers on Economic Activity*, 2, 1984, pp. 457-98.

Skinner, J. (1985). – "The Effect of Increased Longevity on Capital Accumulation", *American Economic Review*, 75, December, pp. 1143-50.