

LIFE CYCLE, INDIVIDUAL THRIFT AND THE WEALTH OF NATIONS

by

FRANCO MODIGLIANI

Sloan School of Management, Massachusetts Institute of Technology, Cambridge, MA

Introduction

This paper provides a review of the theory of the determinants of individual and national thrift that has come to be known as the Life Cycle Hypothesis (LCH) of saving. Applications to some current policy issues are also discussed.

Part I deals with the state of the art on the eve of the formulation of the LCH some 30 years ago. Part II sets forth the theoretical foundations of the model in its original formulation and later amendment, calling attention to various implications, distinctive to it and, sometimes, counter-intuitive. It also includes a review of a number of crucial empirical tests, both at the individual and the aggregate level. Part III reviews some applications of LCH to current policy issues, though only in sketchy fashion, as space constraints prevent fuller discussion.

I. Antecedents

(1) The role of thrift and the Keynesian revolution

The study of individual thrift and aggregate saving and wealth has long been central to economics because national saving is the source of the supply of capital, a major factor of production controlling the productivity of labor and its growth over time. It is because of this relation between saving and productive capital that thrift has traditionally been regarded as a virtuous, socially beneficial act.

Yet, there was a brief but influential interval in the course of which, under the impact of the Great Depression, and of the interpretation of this episode which Keynes suggested in the *General Theory* [1936], saving came to be seen with suspicion, as potentially disruptive to the economy and harmful to social welfare. The period in question goes from the mid '30s to the late '40s or early '50s. Thrift posed a potential threat, as it reduced one component of demand, consumption, without systematically and automatically giving rise to an offsetting expansion in investment. It might thus cause "inadequate" demand - and, hence, output and employment lower than the capacity of the economy. This failure was attributable to a variety of reasons including wage rigidity, liquidity preference, fixed capital coefficients in production and to investment controlled by animal spirits rather than by the cost of capital.

Not only was oversaving seen as having played a major role in the Great Depression, but, in addition, there was widespread fear that the problem might come back to haunt the post war era. These fears were fostered by a widely held conviction that, in the future, there would not be too much need for additional accumulation of capital while saving would rise even faster than income. This combination could be expected to result, sooner or later, in saving outstripping the "need" for capital. These concerns were at the base of the "stagnationist" school which was prominent in the 40s and early 50s.

(2) *Early Keynesian theories of the determinants of saving*

It is interesting and somewhat paradoxical that the present day interest and extensive research activity about saving behavior owes its beginnings to the central role assigned by Keynesian economics to the consumption function as a determinant of aggregate demand and to the concern with oversaving as a source of both cyclical fluctuations and long run stagnation. It is for this reason that the early endeavor to model individual and aggregate saving behavior was dominated by the views expressed on this subject by Keynes in the *General Theory*, and in particular by his well known "fundamental psychological [rather than 'economic'] law" [1936, p. 96] to the effect that an increase in income can be counted on to lead to a positive but smaller change in consumption. Even when the analysis followed the more traditional line of demand theory, it relied on a purely static framework in which saving was seen as one of the many "goods" on which the consumer could spend his income. Thus, income was seen as the main systematic determinant of both individual and national saving, and, in line with Keynes' "law", it was regarded as a superior commodity (i.e., one on which "expenditure" rises with income) and most likely a luxury, for which expenditure rises faster than income. Also, in contrast to other goods, the "expenditure" on saving could be negative - and, accordingly, dissaving was seen as typical of people or countries below some "break even" level of income. All these features could be formalized by expressing consumption as a linear function of income with a substantial positive intercept. This formulation appeared to be supported by the findings of numerous budget studies, and even by the newly developed National Income Accounts, spanning the period of the Great Depression, at the bottom of which saving turned small or even negative.

As is apparent, in this early phase the dominant approach could best be characterized as crudely empirical; little attention was given to why rational consumers would choose to "allocate" their income to saving. The prevailing source of substantial saving was presumably the desire of the rich to bequeath an estate (Keynes' "pride" motive, [1936, p. 108]). Accordingly, the main source of the existing capital *stock* could be traced to inheritance. Similarly, there was little evidence of concern with how, and how long, "poor" people, or countries, could dissave without having saved first or without exceeding their means.

3) *Three landmark empirical studies*

In the second half of the '40s three important empirical contributions dealt a fatal blow to this extraordinarily simple view of the saving process. First, the

work of Kuznets [1946] and others provided clear evidence that the saving ratio had not changed much since the middle of the 19th century, despite the large rise in per capita income. Second, a path breaking contribution of Brady and Friedman [1947] provided a reconciliation of Kuznets' results with budget study evidence of a strong association between the saving rate and family income. They demonstrated that the consumption function implied by family data shifted up in time as mean income increased, in such a way that the saving rate was explained not by the *absolute* income of the family but rather by its income *relative* to overall mean income.

Ways of reconciling these findings with the standard linear consumption function were soon provided by Duesenberry [1949] and Modigliani [1949], though within the empirical tradition of the earlier period. Duesenberry's "relative income hypothesis" accounted for the Brady-Friedman results in terms of imitation of the upper classes. This is an appealing explanation, though it fails to come to grips with the budget constraint in the case of would-be dissavers below mean income. Similarly, the "Duesenberry-Modigliani" consumption function tried to reconcile the cyclical variations of the saving ratio with its long run stability by postulating that current consumption was determined not just by current income but also by its highest previous peak, resulting in a ratchet-like upward creep in the short run consumption function. In my own formulation, primary stress was placed on reasons why the savings rate should move procyclically and on the consideration that in an economy with stable long run growth, the ratio of the current to highest previous income could be taken as a good measure of cyclical conditions. Duesenberry, on the other hand, put more stress on consumers explicitly anchoring their consumption on the previous peak. This formulation was brought to its logical conclusion by Brown [1952] when he proposed that the highest previous income should be replaced by the highest previous consumption.

The third fundamental contribution was the highly imaginative analysis of Margaret Reid [not published] which pointed to a totally different explanation for the association between the saving ratio and relative income, namely that consumption was controlled by normal or 'permanent', rather than current, income.

This contribution was an important source of inspiration, both for the Life Cycle and for the roughly contemporaneous Permanent Income Hypothesis (PIH) of Milton Friedman [1957].

II. *The Life Cycle Hypothesis*

Between 1952 and 1954, Richard Brumberg and I wrote two essays, "Utility Analysis and the Consumption Function: an Interpretation of Cross Section Data" (Modigliani and Brumberg [1954]), and "Utility Analysis and the Aggregate Consumption Function: an attempt at Integration" (Modigliani and Brumberg [1979]) which provide the basis for the Life Cycle Hypothesis of Saving (LCH). They will be referred to hereafter as MB-C and MB-A respectively. Our purpose was to show that all the well-established empirical regular-

ities could be accounted for in terms of rational, utility maximizing, consumers, allocating optimally their resources to consumption over their life, in the spirit of Irving Fisher [1930]. (For an earlier and extensive, but strictly theoretical, application of utility maximization to the theory of saving by households, see Ricci [1926].)

(1) *Utility maximization and the role of Life Resources (Permanent Income)*

The hypothesis of utility maximization (and perfect markets) has, all by itself, one very powerful implication - the resources that a representative consumer allocates to consumption at any age, it, will depend only on his life resources (the present value of labor income plus bequests received, if any) and not at all on income accruing currently. When combined with the self evident proposition that the representative consumer will choose to consume at a reasonably stable rate, close to his anticipated average life consumption, we can reach one conclusion fundamental for an understanding of individual saving behavior, namely that the size of saving over short periods of time, like a year, will be swayed by the extent to which current income departs from average life resources.

This conclusion is common to LCH and to Friedman's PIH which differs from LCH primarily in that it models rational consumption and saving decisions under the "simplifying" assumption that life is indefinitely long. Accordingly, the notion of life resources is replaced by that of "permanent income", while the discrepancy between current and permanent income is labeled "transitory" income.

The notion that saving largely reflects transitory income has a number of implications which have been made familiar by the contributions of Friedman and by our own 1954 paper, and which have received ample empirical support, even with some occasional controversy. Among these implications, the best known and well established is that relating to the upward bias arising in estimating the slope of a saving-income relation from budget data, when, as is usual, the individual observations are classified by current income classes. Because of the correlation between transitory and current income (relative to mean income), the regression line tends to be steeper than the underlying true relation between the (permanent) saving rate and permanent income. Thus, the estimated saving function departs from the true one by being rotated counterclockwise around the mean, to an extent that is greater the greater the variability of transitory income, e.g., more for a sample of farmers than for one of government employees. It is this phenomenon that accounts for the finding of Brady-Friedman cited above, to the effect that the saving ratio, estimated from budget studies at different points of time, appears to depend on the income not in absolute terms but rather relative to overall mean income.

This same consideration provides an explanation for a famous counter intuitive empirical finding first observed in a large survey conducted in the USA in 1936, namely that black families appeared to save more (or dissave less) than white families at any level of income. The reason, of course, is that black families tend to have a much lower average level of permanent income, and, therefore, at any given level of *current* income the transitory component,

and hence saving, tended to be larger - see, e.g., Fisher and Brown [1958]).

The extent of bias in the cross-sectional saving function should tend to decline if the households are classified by some criterion less positively correlated with transitory income, and this prediction too has been extensively verified - see, e.g., Modigliani and Ando [1960]. However, we do not intend to pursue here any further the implications of the relation between saving and transitory income since, as already noted, these implications are basically the same for LCH as for PIH. We concentrate, instead, on those aspects that are specific to LCH.

(2) *LCH - The "stripped down" version*

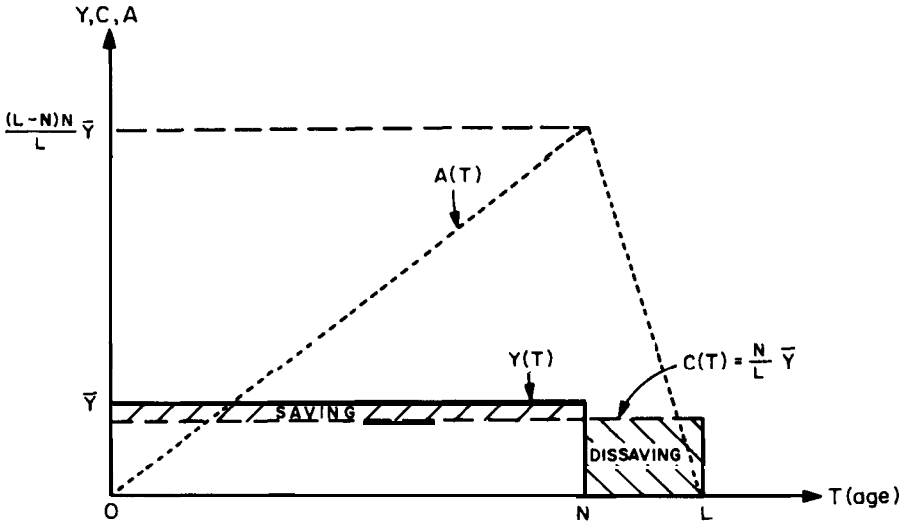
By explicitly recognizing the finite life of households, the LCH could deal with variations in saving other than those resulting from the transitory deviations of income from life resources of PIH. In particular, it could focus on those systematic variations in income and in "needs" which occur over the life cycle, as a result of maturing and retiring, and of changes in family size - hence the name of Life Cycle Hypothesis. In addition, the LCH was in a position to take into account bequests and the bequest motive, which were not amenable to analysis within the approximation of infinite life.

In MB-C and in the first two parts of the MB-A, we made a number of simplifying, stylized, assumptions concerning the life cycle path of household opportunities and tastes, in order to draw out succinctly the essential implications of the LCH approach. These were: (1) opportunities: income constant until retirement, zero thereafter; zero interest rate; and (2) preferences: constant consumption over life, no bequests.

For this "basic" or "stripped down" model, the life cycle path of saving and wealth is described in the, by now familiar, graph of Figure 1. Because the retirement span follows the earning span, consumption smoothing leads to a humped-shaped age path of wealth holding, a shape that had been suggested earlier by Harrod [1948] under the label of hump saving (though "hump wealth" would seem like a more descriptive label).

In MB-A, it was shown that this basic model led to a number of implications which were at that time quite novel and surprising - almost counter intuitive. They included the following:

1. The saving rate of a country is entirely independent of its per capita income.
2. The national saving rate is not simply the result of differential thrift of its citizens, in the sense that different national saving rates are consistent with an identical individual (life cycle) behavior.
3. Between countries with identical individual behavior the aggregate saving rate will be higher the higher the long run growth rate of the economy. It will be zero for zero growth.
4. The wealth-income ratio is a decreasing function of the growth rate, thus being largest at zero growth.
5. An economy can accumulate a very substantial stock of wealth relative to income even if no wealth is passed on by bequests.
6. The main parameter that controls the wealth-income ratio and the saving rate for given growth is the prevailing length of retirement.



INCOME, CONSUMPTION, SAVING AND WEALTH AS A FUNCTION OF AGE

Figure 1

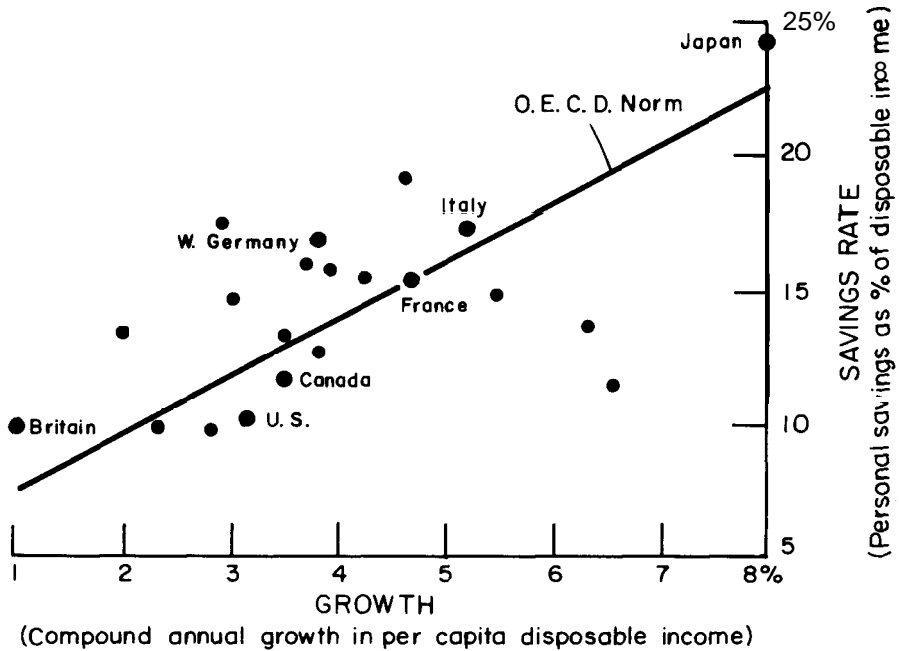


Figure 2

Source: "Determinants of Private Saving with Special Reference to the Role of Social Security - Cross-country Tests" R. Hemming, ed., *The Determinants of National Saving and Wealth*, proceedings of a Conference held by the International Economic Association at Bergamo, Italy, June 9-14, 1980, The Macmillan Press Ltd, London, 1983.

6. The main parameter that controls the wealth-income ratio and the saving rate for given growth is the prevailing length of retirement.

To establish these propositions, we begin by considering the case of a stationary economy, and then that of steady growth.

i) *The case of a stationary economy.*

Suppose that there is neither productivity nor population growth, and assume, conveniently, that mortality rate is 1 at some age L and 0 before. Then, clearly, Figure 1 will represent the age distribution of wealth, saving, consumption, and income, up to a factor representing the (constant) number of people in each age bracket. Hence, the aggregate wealth-income ratio, W/Y , is given by the ratio of the sum of wealth held at each age - the area under the wealth path - to the area under the income path. This has a number of significant implications.

a) It is apparent from the graph that W/Y depends on a single parameter, the length of retirement, M - which establishes Proposition 6. The relation between M and W/Y turns out to be extremely simple, to wit:

$$W/Y = M/2 \quad (1)$$

(see MB-A, footnote 38).

b) In MB-A, for illustrative purposes, we conservatively took the average length of retirement as 10 years, implying a wealth-income ratio of 5. This result was an exciting one in that this value was close to the income ratio suggested by preliminary estimates of Goldsmith's [1956] monumental study of U.S. savings. It implied that one could come close to accounting for the entire wealth holding of the U.S. without any appeal to the bequest process - Proposition 5 - a quite radical departure from conventional wisdom.

c) With income and population stationary, aggregate wealth must remain constant in time and, therefore, the change in wealth or rate of saving must be zero, despite the large stock of wealth - Proposition 3. The explanation is that, in stationary state, the dissaving of the retired, from wealth accumulated earlier, just offsets the accumulation of the active population in view of retirement. Saving could occur only transiently if a shock pushed W away from $(M/2)\bar{Y}$, where \bar{Y} is the stationary level of income; then, as long as Y remained at \bar{Y} , wealth would gradually return to the equilibrium level $(M/2)\bar{Y}$.

ii) *The case of a steadily growing economy*

In this case, the behavior of the saving rates can be inferred from that of aggregate private wealth, W , through the relation $S = \rho W$, implying:

$$s \equiv \frac{S}{Y} = \frac{\Delta W}{W} \frac{W}{Y} = \rho w, \quad \frac{ds}{d\rho} = w + \rho \frac{dw}{d\rho} \quad (2)$$

where w is the wealth-income ratio and ρ is the rate of growth of the economy which in steady state equals the rate of growth of wealth, $\Delta W/W$. Since w is positive and is based on a level life cycle consumption and earning, which insures that it is independent of the level of income, we have established Propositions 1 and 2. If, in addition, the age profile of the wealth-income ratio

could be taken as independent of *growth*, then the saving rate would be proportional to growth with a proportionality factor equal to $M/2$, substantiating Proposition 3. Actually, the model implies that w is, generally, a declining function of ρ —Proposition 4—though with a small slope, so that the slope of the relation between s and ρ tends to flatten out as ρ grows.

When the source of growth is population, the mechanism behind positive saving may be labelled the Neisser effect (see his [1944]): younger households in their accumulation phase account for a larger share of population, and retired dissavers for a smaller share, than in the stationary society. However, w also falls with ρ because the younger people also are characterized by relatively lower levels of wealth holding. Thanks to the simplifying assumptions of the basic model, it was possible to calculate explicitly values for w and s : for $\rho = 2$ percent, $w = 4$, $s = 8$ percent; for $\rho = 4$ percent, $w = 3\frac{1}{4}$, $s = 13$ percent.

When the growth is due to productivity, the mechanism at work may be called the Bentzel [1959] effect (who independently called attention to it). Productivity growth implies that younger cohorts have larger life time resources than older ones, and, therefore, their savings are larger than the dissaving of the poorer, retired cohorts. It was shown in MB-A that, if agents plan their consumption as though they did not anticipate the *future* growth of income, then $w(\rho)$ and $s(\rho)$ for productivity growth are just about the same as for population growth, for values of ρ in the relevant range.

It should be noted that this conclusion is diametrically opposite to that reached by Friedman [1957, p. 234], namely that productivity growth should tend to *depress* the saving ratio on the ground that a rise in income “expected to continue tends to raise permanent income relative to measured income and so to raise consumption relative to measured income”. This difference in the implications of the two models - one of the very few of any significance - can be traced to the fact that, if life is infinite, there cannot be a Bentzel effect. To be sure, to the extent that agents anticipate fully future income, they will tend to shift consumption from the future to the present and this will tend to reduce the path of wealth and perhaps even generate negative net worth in early life (see e.g., Tobin [1967]). But this effect must be overshadowed by the Bentzel effect, at least for small values of ρ which, realistically, is what matters. (This follows from the continuity of $ds/d\rho$ in equation (2)).

The model also implies that the short run behavior of aggregate consumption could be described by a very simple aggregate consumption function, linear in aggregate (labor) income (YL), and wealth (W).

$$C = \alpha YL + \delta W \quad (3)$$

An equation of this type had been proposed somewhat earlier by Ackley [1951], though both the functional form and the presumed stability of the coefficients rested on purely heuristic considerations. By contrast, it was shown in MB-A that, if income followed closely the steady growth path, then the parameters α and δ could be taken as constant in time and determined by the length of life (L), of retirement (M), and the rate of growth (MB-A, p. 135). For the

standard-assumption $L = 50$, $M = 10$ and $\rho = .03$, δ comes to .07 (See MB-A, p. 180). Furthermore, the parameters could be well approximated by the same constant even if income moved around the trend line, as long as the departures were not very long lasting and deep, except that YL should be interpreted as long run expected rather than current income. The short run equation (3) is, of course, consistent with the long run properties 1 to 6, as one can readily verify.

(ii) *Empirical verifications*

None of these long and short run implications of the basic model could be explicitly tested at the time they were established. There were no data on Private Net Worth to test equation (3), except for some indirect estimates pieced together by Hamburger [1951] and some preliminary Goldsmith figures for a few selected years. Similarly, information on Private National Saving were available only for a couple of countries. We could only take encouragement from the fact that the model seemed to fit the single observation available, namely the U.S. Both the wealth income ratio, 4 to 5, and the saving rate, S , "between $1/7$ and $1/8$ " (Goldsmith [1956]) were broadly consistent with the prediction of the model, for a 3 percent growth rate, namely $4\frac{1}{3}$ for w and 13 percent for s .

But the availability of data improved dramatically in the next decade. For the U.S., an annual time series of Private Wealth was put together in the early 60s (Ando, Brown, Kareken and Solow [1963]), and equation (3) was tested (Ando and Modigliani [1963]). It was found to fit the data quite well, and with parameter estimates close to those predicted by the model. By now the consumption function (3) has become pretty much standard, having been estimated for many countries and periods. The coefficient of wealth is frequently lower than .07 quoted earlier but this can be accounted for, at least in part, by the fact that Y is typically defined as total rather than just labor income.

Similarly, by the early 60s the United Nations had put together National Account statistics for a substantial number of countries, characterized by wide differences in the growth rate, and it became possible to test the relation between the national saving ratio and the growth rate. The early tests were again quite successful (Houthakker [1961 and 1965], Leff [1969] and Modigliani [1970]). The newly available data also revealed the puzzling and shocking fact that the saving ratio for the U.S., by far the richest country in the world, was rather low compared with other industrial countries (see, e.g., Figure 2). The LCH could account for the puzzle through a relatively modest growth rate. By now it is generally accepted that growth is a major source of cross country differences in the saving rate.

(3) *The effect of dropping the simplifying assumptions*

As was demonstrated in MB-A, most of the simplifying assumptions can be replaced by more "realistic" ones without changing the basic nature of the results, and, in particular, the validity of Propositions 1 to 5.

i) *Non Zero interest*

Allowing for a non zero interest rate, r , has two effects. One effect is on income as we must distinguish between labor income, say YL , property income, YP , whose "permanent component" may be approximated by rW , and

total income, $Y = Y_L + Y_P = Y_L + rW$. If we continue to assume a constant labor income till retirement, then the graph of income in Figure 1 is unchanged. However, the graph of consumption changes through an income and substitution effect: the addition of rW increases income, but at the same time r also affects the opportunity cost of current, in terms of future consumption. It is possible that the consumer would still choose a constant rate of consumption over life (if the elasticity of substitution were zero). In this case, in Figure 1, consumption will still be a horizontal straight line, but at a higher level because of the favorable "income effect" from rW . As for saving, it will be the difference between C and Y . The latter differs from the (piecewise) horizontal Y_L in the figure by rW , which is proportional to W . As a result, the path of W will depart somewhat from the "triangle" of Figure 1, and, in particular, the overall area under the path can be shown to decline with r . This means that W and, a fortiori, $w = W/Y$, will fall with r .

This result has interesting implications for the much debated issue of the effect of interest rates on saving. Turning back to equation (2), we see that: i) in the absence of growth, a change in r has *no* effect on saving (which remains zero), and ii) for any positive rate of growth, a higher interest rate means a lower saving rate. However, this conclusion depends on the special assumption of zero substitution. With positive substitution, consumption will start lower and will rise exponentially: this "postponement" of consumption, in turn, lifts saving and peak assets. If the substitution effect is strong enough, w will rise, and so will s , as long as ρ is positive.

This same conclusion can be derived from (3) and the definition of Y . These can be shown to imply:

$$\frac{W}{Y} = \frac{1 - \alpha}{\rho + \delta - \alpha r} \quad (4)$$

Numerical calculations in MB-A suggest that α is not much affected by r , but δ is. In [1975] I hypothesized that the effect of r on δ might be expressed as $\delta = \delta^* + \mu r$ when μ is unity for 0 substitution, and declines with substitution (possibly to a negative value). Substituting for δ in (4), one can see that, when the interest rate rises, saving may fall or rise depending on whether μ is larger or smaller than α .

Which of these inequalities actually holds in an empirical matter? Unfortunately, despite a hot debate, no convincing general evidence either way has been produced, *which leads me to the provisional view that s is largely independent of the interest rate*. It should be noted in this connection that, insofar as saving is done through pension schemes aimed at providing a retirement income, the effect of r on s is likely to be zero (or even positive) in the short run but negative in the long run.

ii) *Allowing for the life cycle of earning and family size*

Far from being constant, average labor income typically exhibits a marked hump pattern which peaks somewhat past age 50, falls thereafter, partly because of the incidence of retirement, and does not go to zero at any age, though it falls sharply after 65. However, consumption also varies with age,

largely reflecting variations in family size, as one might expect if the consumer smooths consumption *per equivalent adult* (Modigliani and Ando [1957]). Now the life cycle of family size, at least in the U.S., has a very humped shape rather similar to that of income, though with a somewhat earlier peak. As a result, one might expect, and generally finds a fairly constant rate of saving in the central age group, but lower saving or even dissaving in the very young or old. Thus, as in our Figure 1, the wealth of a given cohort tends to rise to a peak around age 60 to 65 (see, e.g., Projector [1968], King and Dicks-Mireaux [1985], Avery, et.al. [1984], Ando and Kennickell [1985] and Diamond and Hausman [1985]).

It is also worth noting that available evidence supports the LCH prediction that the amount of net worth accumulated up to any given age in relation to life resources is a decreasing function of the number of children and that saving tends to fall with the number of children present in the household and to rise with the number of children no longer present (of. Blinder, Gordon and Wise [1983], Ando and Kennickell [1985] and Hurd [1986]).

iii) *Length of working and retired Life*

One can readily drop the assumption that the length of retired life is a given constant. As is apparent from Figure 1, a longer retirement shifts forward, and raises, the peak of wealth, increasing w and the saving rate. This does not affect the validity of Propositions 2 to 6, but could invalidate 1. It is possible, in fact, that, in an economy endowed with greater productivity (and, hence, greater per capita income), households might take advantage of this by choosing to work for fewer years. This, in turn, would result in a higher national saving rate. Note, however, that this scenario need not follow. The increase in productivity raises the opportunity cost of an extra year of retirement in terms of consumables, providing an incentive to *shorter retirement*. Thus the saving rate could, in principle, be affected by per capita income, but through an unconventional, life-cycle mechanism, and, furthermore, in a direction unpredictable *a-priori*. Empirical evidence suggests that the income effect tends to predominate but is not strong enough to produce a measurable effect on the saving rate (Modigliani and Sterling [1981]).

Aside from income, any other variable that affects the length of retirement could, through this channel, affect saving. One such variable, that has received attention lately, is Social Security. Several studies have found that the availability of Social Security, and terms thereof, can encourage earlier retirement (Feldstein [1974, 1977], Munnell [1974], Boskin and Hurd [1978], Modigliani and Sterling [1983] and Diamond and Hausman [1985]). To this extent, Social Security tends to encourage saving, though this effect may be offset, and even more than fully, by the fact that it also reduces the need for private accumulation to finance a given retirement.

iv) *Liquidity Constraint*

Imperfections in the credit markets as well as the uncertainty of future income prospects may, to some extent, prevent households from borrowing as much as would be required to carry out the unconstrained optimum consumption plan. Such a constraint will have the general effect of postponing consump-

tion and increase w as well as s . But, clearly, these are not essential modifications, at least with respect to the aggregate implications - on the contrary they contribute to insure that productivity growth will increase the saving rate. However, significant liquidity constraints could affect quantitatively certain specific conclusions, e.g., with respect to temporary tax changes (see 111.1).

v) *Myopia*

LCH presupposes a substantial degree of rationality and self control to make preparations for retired consumption needs. It has been suggested - most recently by Shefrin and Thaler [1985] - that households, even if concerned in principle with consumption smoothing, may be too myopic to make adequate reserves. To the extent that this criticism is valid it should affect the wealth income ratio in the direction opposite to the liquidity constraint, though the effect of transitory changes in income from any source would go in the same direction. However, such myopia is not supported empirically. The assets held at the peak of the life cycle are found to represent a substantial multiple of average income (in the order of 5, at least for the U.S.) and an even larger multiple of permanent income which, in a growing economy, is less than current income. Such a multiple appears broadly consistent with the maintenance of consumption after retirement. This inference is confirmed by recent studies which have found very little evidence of myopic saving behavior. In particular, both Kotlikoff, Spivak and Summers [1982] and Blinder and Gordon [1983, especially figure 4.1], working with data on households close to retirement, find that for most families the resources available to provide for retired consumption appear to be quite adequate to support retired consumption at a rate consistent with life resources.

(4) *The Role of Bequests and the Bequest Motive*

i) *Evidence on the Bequest Process*

The basic version of the LCH that ignores the existence of bequests has proved quite helpful in understanding and predicting many aspects of individual and aggregate behavior. However, significant bequests do exist in market (and non market) economies, as can be inferred from two sets of observations. One observation relates to the behavior of saving and assets of elderly households, especially after retirement. The basic LCH implies that, with retirement, saving should become negative, and thus assets decline at a fairly constant rate, reaching zero at death. The empirical evidence seems to reveal a very different picture: dissaving in old age appears to be at best modest (e.g., see Fisher [1950], Lydall [1955], Mirer [1979] and Ando and Kennickell [1985]). According to Mirer, the wealth-income ratio actually continues to rise in retirement. (Note, however, that his estimate is biased as a result of including education in his regression. Given the steady historical rise in educational levels, there will be a strong association between age, educational attainment, and socio-economic status *relative* to one's cohort, if one holds constant the absolute level of education. Thus, his results could merely reflect the association between bequests, wealth, and relative income discussed below.)

Most other recent analysts have found that the wealth of a given cohort tends to decline after reaching its peak in the 60-65 age range (Shorrocks [1975],

King and Dicks-Mireaux [1982], Diamond and Hausman [1985], Avery, Ellhausen, Lenner and Gustavison [1984], Ando [1985]), though there are exceptions-e.g. Menchik and David [1983] discussed below. To be sure, the results depend on the concept of saving and wealth used. If one makes proper allowance for participation in pension funds, then the dissaving (or the decline in wealth) of the old tends to be more apparent, and it becomes quite pronounced if one includes an estimate of social security benefits. But, when the saving and wealth measures include only cash saving and marketable wealth, the dissaving and the decline appear weaker or even absent.

However, the latest US study by Hurd [1986] using a very large sample and relying on panel data finds that, at least for retired people, marketable wealth systematically declines, especially so if one leaves out the very illiquid asset represented by owner occupied houses.

The finding that decumulation, though present, is slow, may partly reflect the fact that survey data give an upward biased picture of the true behavior of wealth during old age, and for two reasons. First, as Shorrocks has argued [1975], one serious bias arises from the well-known positive association between longevity and (relative) income. This means that the average wealth of successively older age classes is the wealth of households with higher and higher life resources. Accordingly, the age profile of wealth is upward biased. Second, in a similar vein, Ando and Kennickell [1985] have found evidence that aged households which are poor tend to double up with younger households and disappear from the sampled population so that the wealth of those remaining independent is again an upward biased estimate of average wealth.

But even allowing for these biases, the decline in wealth - especially of the bequeathable type - is unquestionably less fast than one would expect under a pure life cycle with certain time of death.

This conclusion is confirmed by a very different set of observations coming from probate data. These data, discussed further below, confirm that there is a non negligible annual flow of bequests.

ii) How important is inherited wealth?

The next question is a factual one: just how important is the bequests process in accounting for the existing stock of wealth?

I recently [1985] reviewed a substantial body of information on inherited wealth based on direct surveys of households and on various sources of estimates on the flow of bequests. This review yields a fairly consistent picture suggesting that the proportion of existing wealth that has been inherited is around 20 percent, with a margin of something like 5 percentage points.

This conclusion has recently found support in an interesting calculation carried out by Ando and Kennickell (A&K) [1985]. Starting from estimates of national saving and allocating them by age, using the saving-age relation derived from a well-known budget study (the Bureau of Labor Statistics' Consumer Expenditure survey, 1972-73), they are able to estimate the aggregate amount of wealth accumulated through life saving by all the cohorts living in a given year. They then compare this with aggregate wealth to obtain an

estimate of the shares of wealth that are, respectively, self-accumulated and inherited.

Even though the age pattern of saving they use involves relatively little dissaving in old age, their estimate of the share of inherited wealth turns out to be rather small. For the years after 1974, it is around 25 percent, which agrees well with, and thus supports, the findings of my 1985 paper. For the years 1960 to 1973, the share they compute is somewhat larger, fluctuating between 30 and 40 percent. But this higher figure may, at least partly, reflect an upward bias in the A&K estimate of inherited wealth. The bias arises from the fact that the change in total wealth includes capital gains, while the change in the self-accumulated portion largely excludes them. In the period before 1974, capital gains were unquestionably significantly positive, and hence self-accumulation is underestimated and the share of bequests overestimated. In the years from 1973 to 1980, depressed conditions in the stock market reduce the significance of this effect, though this is partially offset by the boom in real estate values.

These estimates are conspicuously at odds with that presented in a provocative paper of Kotlikoff and Summers [1981] (hereafter K&S). They endeavour to estimate the share of bequests by two alternative methods: 1) from an estimated flow of bequests, as above, and 2) by an approach methodologically quite similar to that of Ando and Kennickell except that instead of allocating aggregate saving to households by age, they allocate labor income and consumption to individuals 18 and over by age. Through this procedure, they estimate the life cycle wealth, accumulated by every cohort present in a year. Using the first method, K&S reach an estimate of inherited wealth of over one half, while using the second - which they regard as more reliable - their estimate rises even higher, to above four-fifths.

In the 1985 paper, I have shown that the difference between all other estimates, including Ando and Kennickell, and their much higher ones can be traced i) to some explicit errors of theirs, for example, their treatment of the purchase of durable goods, and ii) to unconventional definitions, both of inherited wealth and of life cycle saving. I have shown that when one corrects the error and uses the accepted definitions, one of the K&S measures - that based on bequest flows - coincides very closely with all other estimates. Their alternative measure remains somewhat higher, but it is shown to be subject to an appreciable upward bias which could easily account for the difference.

K&S have suggested an alternative operational criterion of "importance" which should be independent of definitional differences, namely: by what percentage would aggregate wealth decline if the flow of bequests declined by 1 percent? The suggestion is sound but is very hard to implement from available observations. However, a rough measure can be provided by considering the response of the representative household confronted with a larger bequest, but subject to the steady state conditions that he must, in turn, increase his bequest by even more (by a factor equal to the rate of growth of the economy times the average gap between inheriting and bequeathing). He may be better or worse off as a result. If we suppose that he is neither, then one shows that the "importance" of bequests is measured by total bequests received by those

currently living - capitalized from date of receipt to the present - divided by total wealth. This happens to be the measure of the "share of bequests" advocated by K&S. But in reality, for realistic values of the return on wealth and of the growth of the economy one finds that the representative consumer can be expected to be notably better off. Under these conditions one finds that the relevant measure of importance is much closer to the standard measure of share (i.e., not capitalized) than to the K&S measure. Since the shares can be placed at below $1/4$, one can conclude that, for the US, a 10 percent decrease in the flow of bequests would be unlikely to decrease wealth by more than 2.5 percent, and could well have an even smaller effect.

The only other country for which one can find some information seems to be the United Kingdom. The share of inherited wealth there appears to be, again, close to $1/5$.

But how can one possibly reconcile the fact that the decumulation of wealth after retirement occurs rather slowly with the assertion that the share of inherited wealth is no more than 25 percent? Actually, this apparent puzzle can be readily clarified by means of two considerations. The first is to remember that one of the several ways by which we reached the above figure for the share relies precisely on estimating the flow of bequests from the observed holding of wealth by age: so, by construction, there cannot be any contradiction between the two observations.

The second and more fundamental substantive consideration is that, from the fact that bequeathed wealth is not much lower than the peak accumulation, one cannot conclude that most of the wealth ever accumulated is finally bequeathed. To see this, one need only realize that if one fixes the path of wealth from peak, around age 65, to death, there are still an infinity of possible paths from, say, age 20 to 65, and each of these paths implies a different amount of aggregate wealth. The quicker the average path approaches the peak value, the larger will be the wealth and hence the life cycle component. It can be shown that the observed path of wealth implies a much larger aggregate wealth than would correspond to the path chosen by a consumer scheduling to accumulate the observed average terminal amount of wealth while insuring for himself the highest feasible (constant growth) consumption path.

iii) *Sources of Bequested Wealth: the Precautionary Motive*

What accounts for the observed flow of bequests? One can distinguish two main motives which may also interact. The first is the precautionary motive arising from the uncertainty of the time of death. Indeed, in view of the practical impossibility of having negative net worth, people tend to die with some wealth, unless they can manage to put all their retirement reserves into life annuities. However, it is a well known fact that annuity contracts, other than in the form of group insurance through pension systems, are extremely rare. Why this should be so is a subject of considerable current interest and debate (see, e.g., Friedman and Warshawsky [1985a and b]). Undoubtedly, "adverse selection", causing an unfavorable payout, and the fact that some utility may be derived from bequests (Masson [1984]) - see below - are an important part of the answer. In the absence of annuities, the wealth left

behind will reflect risk aversion and the cost of running out of wealth (besides the utility of bequests).

This point has been elaborated in particular by Davies [1981] (see also Hubbard [1984]) who has shown that, for plausible parameters of the utility function including a low intertemporal elasticity of substitution, the extent to which uncertainty of life depresses the propensity to consume increases with age. As a result "uncertain life time could provide the major element in a complete explanation of the slow decumulation of the retired" (relative to what would be implied by a standard LCH model).

Bequests originating from the precautionary motive fit quite naturally in the LCH framework since they are determined by the utility of consumption and furthermore the surviving wealth must tend, on the average, to be proportional to life resources.

iv) *The Bequest Motive in the LCH*

The second source of inherited wealth is the bequest motive. Contrary to a common perception, there is no intrinsic inconsistency between a significant amount of bequests induced by a bequest motive and the LCH view of the world - in particular, implications 1 to 5.

First, it is obvious that no inconsistency arises if planned bequests are, on average, proportional to life resources. However, this possibility is uninteresting. The most casual observation suggests that the planning and leaving of bequests is concentrated in the upper strata of the distribution of life resources, by which we now mean the sum of (discounted) life-time labor income and bequests received. This observation suggests the following hypothesis, first proposed in MB-A (pp. 173-4):

BI. The share of its resources that a household earmarks, on the average, for bequests is a (non-decreasing) stable function of the size of its life resource *relative* to the average level of resources of its age cohort.

We might expect the share to be close to zero until we reach the top percentiles of the distribution of resources, and then to rise rapidly with income.

One can readily demonstrate (cf. Modigliani [1975]), that this assumption assures that Propositions 1 to 5 will continue to hold at least as long as:

BII. The frequency distribution of the ratio of life resources to mean life resources for each age group is also stable in time.

Indeed, under these conditions, if income is constant, wealth will also tend to be constant and, therefore, saving to be zero, even in the presence of bequests. To see this, note first that BI insures that bequests left (BL) are a fraction, say y , of life resources, \hat{Y} , $BL = \gamma(\hat{Y} + BR)$, where BR is bequests received. BII in turn insures that y is constant in time (and presumably less than one). Next, note that life savings, LS, is given by:

$$LS = BL - BR = \gamma\hat{Y} - (1-\gamma)BR \quad (5)$$

Thus, LS increases with \hat{Y} and decreases with BR, and is zero if $BR = [\gamma/(1-\gamma)]\hat{Y}$. But this last condition must hold in long run-equilibrium since, if BR is

smaller, then there will be positive saving which will increase BR, and reduce LS toward zero; and vice versa if BR is larger.

This generalization of the basic model has a number of implications, a few of which may be noted here.

- i) The age patterns of Figure 1 for a stationary society are modified, as bequests raise the average wealth path by a constant, equal to BR, beginning at the age at which bequests are received. The new path remains parallel to the old so that at death it has height $BL = BR$.
- ii) If labor income is growing at some constant rate, then average BR will tend to grow at this same rate and so will BL, but BL will exceed BR by a factor $e^{\gamma T}$, where T is the average age gap between donor and recipient. Thus, with positive growth, and then only, the existence of bequests involves life-saving, on top of hump-saving. Alternatively, bequests result in a higher wealth-income ratio, depending on γ , and, hence, a higher saving ratio, to an extent that is proportional to Q .
- iii) The share of life resources left as bequests could be an increasing function of the household's resources *relative* to the resources of his cohort. This, in turn, implies that at any age, the saving-income and wealth-income ratio for individual families could be an increasing function of *relative* (not absolute) income.

This last proposition, which is clearly inconsistent with PIH, is supported by a good deal of empirical evidence, from Brady and Friedman [1947] to Mayer [1972]. As for the first part of iii), and the underlying assumption BI, it receives strong support from a recent test by Menchik and David [1983]. In this imaginative contribution, the authors have assembled, from probate records, a large body of data on individual bequests which they have matched with income data from tax returns. Their sample covers persons born since 1880 (including a few before) and deceased between 1947 and 1978. They find striking evidence that a) bequests depend on the position of the household's life resources in the distribution of life resources of *its cohort*, b) that they are small for people whose estimated life resources fall below the 80th percentile in that distribution, but that c) beyond the 80th percentile, they rise rapidly with (permanent) income.

v) *The Quantitative Importance of the Bequest Motive*

It would be interesting to have some idea of how important is the role of the pure bequest motive - as distinguished from the precautionary one - in the accumulation of wealth. It should be apparent, in fact, that if one could conclude that it accounts for a very large fraction of total wealth, then the LCH and hump saving would lose considerable interest as an explanation of private accumulation. Unfortunately, at present, we know very little on this score and it is not even clear that we will even be able to acquire reliable knowledge. There is nonetheless a certain amount of evidence suggesting that the true bequest motive affects a rather small number of households mostly located in the highest income and wealth brackets.

The best known evidence is that coming from surveys conducted in the 1960s. In a 1962 survey (Projector and Weiss [1964]), only 3 percent of the respondents gave as a reason for saving, "To provide an estate for the family".

However, the proportion rises with wealth, reaching 1/3 for the top class (1/2 million 1963 dollars and over). Similar, though somewhat less extreme, results are reported for a Brookings study (Barlow, et.al. [1966]). Thus, the bequest motive seems to be limited to the highest economic classes.

This hypothesis is supported by the finding of Menchik and David that for (and only for) the top 20 percent, bequests rise proportionately faster than total resources, something which presumably cannot be explained by the precautionary motive. Actually, another very recent study (Hurd [1986]), yields results which are even more negative about the importance of bequests. It starts from the reasonable hypothesis that if the true bequest motive is an important source of terminal wealth, then retired households with living children should have more wealth and should save more (dissave less) than childless ones. It is found that in fact those with children have less wealth and, by and large, *dissave* the same fraction of wealth. The first result, as pointed out earlier, is fully consistent with the standard no-bequest LCH, because of the "cost" of children; but for this reason the rest may be biased. But the second result is indeed hard to reconcile with a significant bequest motive.

Considering that the overall share of inherited wealth can be placed below 1/5, we seem safe in concluding that the overwhelming proportion of wealth existing at a point in time is the result of life cycle accumulation, including in it a portion reflecting the bequest arising from the precautionary motive.

Aside from this quantitative evaluation, it is important to note that the model generalized to allow for bequests of all sources still satisfies Propositions (1) to (5). On the other hand, Proposition 6 must be generalized to allow for several forces, discussed in this section, that could affect the equilibrium wealth income ratio. These include the age structure not accounted for by steady-state population growth, rate of return on wealth, household access to credit, as well as the strength of the bequest motive. Another potentially important variable is Social Security, though its systematic effect on saving has so far proven elusive, a failure not convincingly accounted for by its having two offsetting effects on private saving (cf. section 11.3, iii, above). Pursuing the above implications opens up a vast area of research that so far has been barely scratched.

III. Policy Implications

Limitations of space make it impossible to pursue a systematic analysis of policy issues for which the LCH has implications that are significantly different from those derivable by the standard Keynesian consumption function or refinements thereof. I will, however, list some of the major areas of applications with a brief statement of the LCH implications:

1. Short run stabilization policy

i) *The monetary mechanism*: The fact that wealth enters importantly in the short run consumption function means that monetary policy can affect aggregate demand not only through the traditional channel of investment but also through the market value of assets and consumption. (See Modigliani [1971]).

ii) *Transitory income taxes*: Attempts at restraining (or stimulating) demand

through transitory income taxes (or rebates) can be expected to have small effects on consumption and to lower (raise) saving because consumption depends on life resources which are little affected by a transitory tax change (empirically supported). (See the literature cited in Modigliani and Steindel [1971] and Modigliani and Sterling [1985].)

2. Long run propositions

i) *Consumption Taxes*: A progressive tax on consumption is more equitable than one on current income because it more nearly taxes permanent income (quite apart from its incentive effects on saving.)

ii) *Short and long run effects of deficit financing*: Expenditures financed by deficit tends to be paid by future generations; those financed by taxes are paid by the current generation. The conclusion rests on the proposition that private saving, being controlled by life cycle considerations, should be (nearly) independent of the government budget stance (Modigliani and Sterling [1985]), and therefore private wealth should be independent of the national debt (Modigliani [1984].) It follows that the national debt tends to crowd out an equal amount of private capital at a social cost equal to the return on the lost capital (which is also approximately equal to the government interest bill).

This conclusion stands in sharp contrast to that advocated by the so called Ricardian Equivalence Proposition (Barro [1974]) which holds that whenever the government runs a deficit, the private sector will save more in order to offset the unfavorable effect of the deficit on future generations.

Of course, to the extent that the government deficit is used to finance productive investments, then future generations also receive the benefit of the expenditure, and letting them pay for it through deficit financing may be consistent with intergenerational equity.

In an open economy, the investment crowding out effect may be attenuated through the inflow of foreign capital, attracted by the higher interest that results from the smaller availability of investable funds. However, the burden on future generations is roughly unchanged because of the interest to be paid on the foreign debt.

Finally if there is slack in the economy, debt financed government expenditures may not crowd out investment, at least if accompanied by an accommodating monetary policy, but may, instead, raise income and saving. In this case, the deficit is beneficial, as was held by the early Keynesians; however, the debt will have a crowding out effect once the economy returns to full employment. LCH suggests that to avoid this outcome, a good case can be made for a so-called cyclically balanced budget.

