DETERMINANTS OF SAVING:
THEORY AND EVIDENCE

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INTRODUCTION

By accounting identity the national saving ratio equals the weighted average of the saving ratios in the three principal subsectors of the economy: private households, business, and general government. The weights are the respective sector shares in national disposable income. A comprehensive study of the national saving ratio would thus require an analysis of the determinants of sectoral saving ratios as well as sectoral income shares. Nevertheless, the vast majority of studies on saving behaviour concentrate on household saving. The rationale for doing so is the dominant importance of household saving in the determination of national saving. Some studies aggregate household and business saving into private saving. This procedure can be justified on theoretical grounds because the effect on aggregate household wealth is independent of whether (privately owned) business withholds profits and thereby causes an increase in equity values (capital gains for equity holders) or whether all profits are distributed as dividends and then reinvested (i.e. saved) by the recipient households\(^1\). Government saving is usually excluded from the analysis of saving behaviour on the assumption that it is based on policy decisions and thereby subject as much to political as to economic considerations\(^2\). In a general sense this applies both to the structural and the cyclical component of government saving: the latter depends largely on the operation of built-in stabilisers, the design of which is also subject to deliberate policy decisions.

I. SAVING MOTIVES OF INDIVIDUAL HOUSEHOLDS

From the household’s point of view saving represents a decision not to consume current income. Three major motives leading to such a decision can be distinguished.

i) Saving for retirement, i.e. the build-up of assets to finance consumption after retirement when current earned income is reduced or even becomes zero.
ii) Precautionary saving; given the uncertainty about the future developments, the household may wish to hold assets to meet possible emergencies, such as unemployment or sickness.

iii) Saving for bequest, i.e. the build-up of assets to bequeath to a subsequent generation\(^3\).

In addition there is also target saving for the acquisition of tangible assets. Obviously these motives are not mutually exclusive, and actual saving will normally be jointly determined by all the various motives. These are discussed briefly in the subsequent paragraphs. In a rational society, saving decisions should be based on some kind of optimising behaviour by which the levels of consumption and saving are chosen so as to equalise the marginal benefits of these alternative uses of income\(^4\).

A. Retirement saving

Saving for retirement – generally considered quantitatively the most important saving motive – forms the basis of Life Cycle Hypothesis (LCH) models of household consumption behaviour\(^5\). Models based on the LCH generate the time profile of consumption over the economic life-time of the household, the underlying assumption being that the household maximises its utility from the intertemporal consumption stream subject to an available resource constraint. This requires that at any time the discounted present value of all future consumption equals the sum of present net wealth plus the discounted present value of all future earned income. The main features of the model can be conveniently presented graphically. As can be seen from Chart A, the household accumulates wealth (i.e. saves) during the pre-retirement period by consuming less than its disposable income. Consequently wealth reaches its maximum at retirement age, following which it is gradually decreased to finance current consumption. This implies that saving are positive during the pre-retirement phase of the household life cycle, and negative thereafter, averaging zero over the entire life span if bequests are neither made nor received. The time profile of household consumption (and thereby saving) will depend on various factors, among which the market interest rate, the individual’s rate of time preference and degree of risk-aversion, and the functioning of capital markets are considered to be the most important\(^6\). The household saving ratio during the earning period of the life cycle will also be strongly affected by the length of the retirement span relative to the income earning period. Thus both the (expected) life time and the retirement age should be important determinants of individual saving behaviour.

A major tenet of the "pure" LCH model of household consumption, namely that households dissave during retirement, is however not supported by the
evidence of US household budget studies (cf. Miler, 1979). Similarly, it was found that the LCH is unable to account for the observed size distribution of wealth in the United Kingdom (cf. Atkinson, 1971) and in the U.S. (cf. Wolff, 1981). It therefore seems necessary to introduce additional saving motives in order to explain satisfactorily observed household saving and wealth holding behaviour.

B. The bequest motive

One way in which observed household saving behaviour can be reconciled with the LCH is by allowing for a bequest motive, i.e. to assume that
households accumulate wealth beyond the levels required to finance retirement consumption. As is the case with most saving determinants, a bequest motive changes the size of the saving ratio only in an economy expanding due to population growth, productivity growth or both. In a stationary economy the bequest motive would simply lead to the transferance of a constant level of assets from one generation to the next, with no effect on the (zero) saving ratio. In a growing economy the bequest transferred between generations is growing, requiring positive lifetime saving of each generation to guarantee heirs a constant ratio of inherited wealth to initial income. The quantitative impact of the bequest motive on the household saving ratio depends on the interest rate and the size (relative to income) of the bequest. Simulations by Farrell (1970), imply that a bequest equalling the annual income of a new entrant to the labour force) would increase the steady-state saving ratio by 5 percentage points for a real interest rate of 3 per cent and real income growth of 4 per cent per annum. While intergenerational gifts or bequests are indeed common, it is not clear whether they originate from the desire to leave bequests or from the fact that due to the uncertainty about the date of death there may have been unspent retirement and precautionary savings.

C. Precautionary saving

In the basic LCH model the household bases its decisions on events the dates and magnitudes of which are assumed to be known with certainty – the future income stream, the date of death, and the interest rate in each period. But in reality future events are uncertain, and it is therefore relevant to ask whether and how individual behaviour will be modified by such uncertainty. Yaari (1965) investigated the question of uncertainty with respect to lifetime. He concludes that if households have access to a competitive insurance annuities market the optimal life cycle plan is basically unchanged, with saving decisions based on expected lifetime and saving held in the form of annuities. Where such an annuities market does not exist, or is not used, uncertainty about the date of death can be expected to lead to increased saving if the household concerned prefers the possibility of an unintended bequest to “bankruptcy”.

Uncertainty relating to the future income stream has been investigated by Leland (1968) within a two-period income-consumption framework. In such a model increased income uncertainty increases the demand for precautionary assets (for conventional utility functions), a finding which is supported by evidence. Nagatani (1972) analyses income uncertainty in the setting of a continuous time life-cycle model and finds that it . as the following double effect:
a) the life time consumption profile will become dependent on the household income profile (rather than growing at a constant rate as in a LCH model without uncertainty);

b) the life time consumption profile is twisted towards increased age, implying a more rapid build up of assets (and higher consumption levels during retirement) than in the absence of uncertainty.

In a growing economy both effects imply an increase in the aggregate saving ratio, given the predominance of age-income profiles which typically reach their maximum in the latter part of people’s earning life span.\textsuperscript{9}

While there is little disagreement in principle on the augmenting effect of uncertainty on the demand for precautionary assets and thereby saving, it is difficult to quantify this relationship. In the first place there are no readily available operational quantitative measures of uncertainty. Customarily in empirical research income uncertainty is measured indirectly by proxy variables such as the rate of inflation, the rate of unemployment, or some transformations of these. Given the difficulty of measuring uncertainty directly and objectively it is difficult to judge the extent to which precautionary saving contribute to the observed overall level of saving. The impact of interest rate uncertainty on saving depends on the sign of the interest elasticity of saving. As most empirical evidence suggests that the interest elasticity is rather low, uncertainty attaching to interest rate expectations is unlikely to lead to significant additional precautionary saving.\textsuperscript{10}

D. Other motives

The purchase of “big ticket” consumer items is often preceded by an accumulation of savings. While such “target saving” is most common with respect to consumer durable purchases, it can of course also occur for current consumption expenditure, such as wedding celebrations, vacation spending and education.\textsuperscript{11} For the period in which the planned expenditure materialises the household will reduce saving correspondingly.\textsuperscript{12} Basically such alternating periods of target saving and dissaving during the lifetime of the individual household are due to the imperfect synchronisation of income receipts and consumption expenditure. An alternative way of acquiring consumer durables would be to buy the big ticket item first (by accumulating net liabilities if necessary) and make the necessary saving later in the form of gradual debt repayment.\textsuperscript{13} These alternative ways of acquiring consumer durables (or housing) may influence the measured aggregate household saving ratio quite differently, as discussed below in Part II. Which method predominates in a given country will depend in part on the social habits and/or the functioning of capital markets of the country in question, a topic discussed in Part III.
The imperfect synchronisation of income receipts and consumption expenditures is not necessarily restricted to durable purchases. This gives rise to a household’s transaction demand for (liquid) assets which are periodically replenished when income is received and then gradually run down as they finance current consumption. Though the various determinants of the average level of transactions balances can easily be identified, they are not discussed here in detail: the transactions demand for liquid assets is likely to determine the composition of household net worth rather than its level, and will thereby leave the saving ratio unchanged, though within an income payment period (i.e. a month) total wealth will depart from its average level in a predictable pattern.

II. HOUSEHOLD AGGREGATION

A. Rate of growth effects

The preceding section discussed the various saving motives of individual households. By aggregating over individual household units the implications of this micro-analysis for aggregate household saving can be derived. The first basic observation is that the various saving motives will lead to positive aggregate household saving only in a growing economy. In stationary equilibrium the positive retirement saving of “young” (i.e. pre-retirement) households will be offset by dis-saving of households in retirement age\(^{14}\). Furthermore, the bequest motive does not generate any net saving in stationary steady state: it will be satisfied by transferring a constant level of assets (inheritance) from generation to generation. Similarly, the precautionary demand for assets does not generate positive net saving because its target level (a constant proportion of equilibrium income) — once reached — will remain constant\(^{15}\). There exists thus a noteworthy symmetry between the demand for and the supply of savings: only a growing economy requires positive net saving to maintain a constant or increasing capital-labour ratio, and likewise only in a growing economy will utility-maximising household behaviour generate net saving.

Households finance their purchases of consumer durables (including housing) by a mixture of initial down-payments from previously accumulated savings and consumer or mortgage credit, to be repaid subsequently\(^{16}\). In a stationary economy there will be no effect of the financing mode on the zero aggregate household saving ratio. Target saving by some households will be offset on average by dissaving of households buying “big ticket” items. Similarly dissaving from newly-incurred consumer credit will be offset by debt
repayments (saving) of previous borrowers. The (constant) average level of household net worth will, however, be bigger the smaller the share of credit financing of consumption. If the economy is growing, household saving equals the equilibrium growth rate times net worth\(^{17}\). The saving ratio will thus depend on the financing mode of durable purchases, and be the lower the more — *ceteris paribus* — consumer credit is used. Because real estate purchases do not change the net wealth position of households — whether financed by savings or mortgage credit — their mode of financing will change the household saving ratio if, and only if, it changes the overall level of assets demanded by households and/or the time profile of saving over the life cycle of individual households. Capital market imperfections may indeed force a household to accumulate wealth earlier in the life cycle than would happen otherwise. In the aggregate this would translate into an increase in the saving ratio if the economy is growing. If easy mortgage credit increases the incidence of home ownership, and real estate is not considered a close substitute for liquid wealth, desired total net worth will be higher, leading to an increase in the saving ratio in a growing economy\(^{18}\).

An important implication of the preceding discussion for empirical research is that the growth rate should not enter additively into the saving function. This is a specific detail of the general point mentioned before, and elaborated in the Technical Annex, that the aggregate saving function resulting from utility-maximising behaviour of individual households is strongly non-linear (both in parameters and explanatory variables) so that the quantitative effect of any saving determinant depends on the level of other determinants. Modigliani and Brumberg (M-B, 1954) derived a linear aggregate consumption function based on the LCH only by adopting sweeping simplifying assumptions\(^{19}\). The fact that their original LCH model was able to predict the US saving ratio rather well on the basis of the growth rate of disposable personal income has probably contributed to the rapid acceptance and indeed popularity of the theory\(^{20}\). Subsequent research has demonstrated that the astonishing ability of the simple M-B model to predict the US saving ratio from disposable income growth was a coincidence based on the mutual cancellation of offsetting errors\(^{21}\). Varying some (either singly or jointly) of the simplifying M-B assumptions can lead to radically different saving ratio predictions (including negative values) from the LCH, and any observed saving ratio can be simulated by a large number of alternative parameter combinations.

Steady-state growth may be extensive (i.e. based on a proportional expansion of the labour force and the capital stock) or intensive (i.e. based on labour-augmenting technical progress and increasing capital intensity) or a combination of the two. The implications of the different types of growth for the aggregate saving ratio may be quite different, depending on how individual households form their income expectations. If for example growth is based
mainly on productivity advances, and this is correctly anticipated by the individual household, the latter may want to borrow initially to transfer consumption from the relatively prosperous future to the (relatively) pauper present. In terms of Chart A above consumption expenditure would exceed income both during the initial and the retirement phase of the household’s life cycle\textsuperscript{22}. Saving ratios would therefore be expected to differ depending on the sources and nature of economic growth\textsuperscript{23}.

\section*{B. Demographic variables}

As can be readily seen from the derivation of the aggregate consumption function based on the LCH a number of demographic (or quasi-demographic) variables can be expected to have a direct bearing on the aggregate saving ratio. Once economic growth is assumed, and the saving ratio is non-zero, several demographic variables will co-determine the saving ratio:

\begin{itemize}
  \item [a)] \textit{Life expectancy:} An increase in life expectancy will ceteris paribus increase the household saving ratio (of a growing population) because each person requires higher wealth accumulation to finance a constant consumption stream over a longer retirement span.
  \item [b)] \textit{Retirement age:} A decline in retirement age will ceteris paribus increase the household saving ratio for similar reasons: each person requires a larger stock of wealth (relative to life-time income) to finance consumption over the expanded retirement period.
  \item [c)] \textit{Age distribution.} The generalised LCH implies that an individual household’s saving ratio depends ceteris paribus on the age of the household (cf. Chart A and the Technical Annex). Thus the aggregate household saving ratio depends on the relative share of households of certain ages in the total number of households, i.e. the age distribution of (heads of) households\textsuperscript{24}.
\end{itemize}

Besides these demographic variables which explicitly enter the consumption function based on the LCH there are additional household characteristics which are likely to affect saving behaviour:

\begin{itemize}
  \item [a)] \textit{Family size.} In the LCH the decision unit is treated as consisting of a constant number of people, whereas in fact the normal household will have a varying membership over the life cycle, which is likely to influence the time profile of consumption and thereby saving\textsuperscript{25}.
  \item [b)] Closely related to this variable is the average age of entry into the job market of young people, or the normal period of formal education. An increase in the latter tends to prolong the duration of family membership of young adults, thereby influencing the time profile of
household consumption and _ceteris paribus_ the aggregate saving ratio.

c) _Female participation ratio._ _Ceteris paribus_ the female participation ratio will determine the number of households with two income earners. It has been argued that the latter characteristic has an important effect on household consumption behaviour, most likely in the direction of reducing the saving ratio.

Statistical tests based on international cross-section data of the significance of various demographic variables in determining saving ratios are discussed below in Part IV. Due to the relatively slow change of demographic variables over time it is generally difficult to discern demographic influences on saving from time series data.

C. _General equilibrium considerations_

Empirical research on household saving is usually based upon _partial equilibrium_ models which take important variables like household earnings and the interest rate as exogenously given. While this is acceptable when analysing individual household behaviour, it is highly problematic when the implications of changes in important variables or parameters for aggregate household saving are being investigated. By analysing saving motives and their implications, only the supply side of saving is considered, while in general equilibrium saving will be the result of interactions between capital demand and supply. This suggests that realistic estimates of the quantitative importance of various determinants of aggregate saving require a simultaneous equations approach to estimation and simulation. While this would go beyond the scope of this paper, some rudimentary insight into the determination of saving under general equilibrium conditions can be obtained from optimal growth models.

The basic prototype of this class of models is a highly aggregate single sector model. The optimal _national_ saving ratio is determined by maximising the discounted present value of a (social) utility function. Utility at each moment depends only on the level of per capita consumption. In this model the only saving motive is the desire to change the capital-output ratio gradually from its initial value towards its optimal (steady state) value and/or to maintain it at this level. At each point along the optimal growth path the marginal (opportunity) cost of saving (i.e. foregone consumption utility) will be equal to the discounted present value of all future utility obtained from the increase in future consumption gained from a present marginal increase in the capital stock. The necessary condition for attaining such a path implies an expression for the optimal saving ratio which embodies the following determinants:
-- the rate of (social) time preference;
-- the natural rate of growth (i.e. the sum of the growth rates of the
labour force and productivity);
-- the degree of (social) risk aversion.

These saving determinants are already familiar from the preceding analysis of
the supply of saving. In addition the optimal saving ratio is influenced by the
following variables which represent the demand for capital:

-- the capital-output and capital-labour ratios;
-- the competitive (or imputed) share of profits in national income;
-- the marginal productivity of capital.

Thus, even at such an abstract and highly aggregative level, there are
numerous parameters and/or variables — some of them extremely hard to
measure — which may explain international differences in saving ratios or
changes in national saving ratios over time. The question may be raised
whether it is useful to discuss the determinants of aggregate saving at such an
abstract and highly aggregate level, which might seem more appropriate for a
centrally-planned and administered economy. It should be noted, however,
that the optimal growth model discussed here is one of the few (if not the only)
general equilibrium model of optimal saving behaviour. Furthermore, recent
developments in macro-theory assuming ultra-rational behaviour of individuals
imply that a decentralised competitive economy would behave in such a way as
to direct the national saving ratio towards the optimal path level as defined
above. Finally — as will be shown in the discussion of empirical research
(Part IV) — the analytic results sketched here are helpful in explaining some of
the shortcomings of existing empirical research on international differences in
saving ratios.

III. INSTITUTIONAL AND OTHER FACTORS

A. Financial intermediation and capital markets

Financial intermediation is the process of channelling loanable funds from
savers to borrowers. The efficiency and the institutional characteristics of
financial markets where this intermediation takes place are likely to influence
the type and probably also the volume of assets savers opt to hold when
foregoing present consumption. Differences in saving ratios — either across
countries or within a country over time — may therefore be partly explained by
differences or changes in the functioning of financial markets. If these markets
were perfect, the rate of return to the saver would differ from the risk-adjusted
### Table 1  Empirical estimates of the interest elasticity of household saving in the United States

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<tr>
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<th>Weight</th>
<th>Methodist</th>
<th>Labor</th>
<th>Heath</th>
<th>Wheat</th>
<th>Other</th>
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<td>0.2</td>
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<td>1.76</td>
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<td>NEG</td>
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<td>NS</td>
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<td>0.3</td>
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<td>2</td>
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<td>SAV</td>
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a) PDS = Positive NEG = Negative (No numerical estimates can be obtained) NS = Not statistically significant
b) CON = Consumption function SAV = Saving function
c) NOM = Nominal REAL = Real
d) OLS = Ordinary least squares INST = Instrumental variables NON = Nonlinear ML = Maximum likelihood
e) With Cochrane-Orcutt autocorrelation correction where necessary
f) ANN = Annual QRT = Quarterly
rate of return on investment only by the unavoidable resource cost of intermediation.

In such theoretically perfect financial markets a household’s consumption in any one period would be constrained only by its total net worth, including both non-human and human wealth (i.e. discounted future labour income). Additional constraints on household consumption arise when some types of wealth (‘illiquid’ or non-marketable assets) cannot be readily transformed into liquid wealth, or if this asset transformation implies a large penalty (e.g. excessive transaction costs). Liquidity constraints normally apply even at positive levels of non-human net worth: households typically can borrow (or borrow without penalty) only a fraction of the market value of their assets.

Well-developed capital markets provide a wide range of alternative financial assets differentiated according to risk, liquidity, and rate of return. Yet imperfections exist in even the most efficient capital markets, partly due to government regulations. There are two possible consequences – which are not mutually exclusive:

a) the rate of return on savings is reduced (and/or the cost of capital to net borrowers is increased);

b) access to credit is limited according to non-human net worth and other eligibility criteria.

How the first implication will affect saving depends on the interest elasticity of the demand for and the supply of capital. There are strong a priori reasons to expect a negative interest elasticity of investment, and there is considerable supporting evidence. The response of saving, household saving in particular, to changes in the interest rate is less straightforward, as already noted.

A priori the effect of variations in the interest rate on saving is ambiguous: such a change will have both an income and a substitution effect, which operate in opposite directions. Given the importance of the interest elasticity of saving (e.g. for evaluating the effectiveness of monetary policy) a growing number of empirical studies in the last ten years have focussed on this key economic relationship, especially in the United States. Table 1 summarises the results of recent major studies. Many, but by no means all, support the view that the rate-of-return elasticity of aggregate personal saving is positive. It has been pointed out, however, that many of the results indicating a positive interest elasticity are quite sensitive to the period analysed, the lag structure of explanatory variables in the equation, and perhaps most importantly, to the way in which the rate of return series is specified. Empirical studies usually represent the rates of return on various assets by a single average rate of return on aggregate personal saving. However, this masks the impact of interest changes (in combination with asset specific capital income taxation) on the
composition of household portfolios, including real estate and consumer durables. A more disaggregated analysis may be necessary, in order to obtain more convincing empirical evidence on this crucial elasticity\textsuperscript{35}.

How credit availability will affect the saving ratio will depend on the household’s optimal consumption path in relation to the actual time profile of its income. It has been argued (Thurow, 1969) that with no credit limitation young households would probably be net borrowers given their relatively low levels of income and high expenditures related to household formation\textsuperscript{36}. In practice borrowing against future income in the absence of marketable assets to act as collateral is severely limited. The more stringent these borrowing constraints are, the higher \textit{ceteris paribus} can the aggregate saving ratio be expected to be\textsuperscript{37}. The recent decline in the U.S. saving ratio has indeed been linked to increased credit accessability by private households (cf. OECD, 1979) due to increased use of personal credit cards, increased credit ceilings for a growing number of two-income earner households (reflected by increasing female participation ratios), and the introduction of government guaranteed student loans. To judge the importance of differential credit accessibility for inter-country saving ratio discrepancies requires comparable figures on consumer credit relative to household income for the countries concerned. Consumer credit figures (as opposed to other credit to the household sector) are hard to come by for most countries, and it is even more difficult to render the available statistics comparable. The partial evidence available nevertheless suggests that the above average use of consumer credit in the United States may account partly for the relatively low saving ratio in this country\textsuperscript{38}.

B. Compulsory public pension schemes

Saving for retirement is generally considered the quantitatively most important saving motive of private households during the earning period of their life span. The existence of a compulsory public pension scheme which greatly affects retirement finances can therefore be expected to affect saving significantly. The effects of public pension schemes on household saving can be analysed in the framework of the life cycle theory of saving outlined above\textsuperscript{39}. A public pension scheme financed through payroll taxes will affect the household’s life-time budget constraint in two ways: first, life time disposable income will be decreased by the amount of payroll taxes paid as contributions to the public pension scheme. Second, life-time disposable income will be increased by the amount of pension payments received after retirement. If the discounted present value of these two amounts is equal (i.e. if we are dealing with an actuarially “fair” or “balanced” system) the household’s budget constraint is unchanged, and thus consumption behaviour should not be affected\textsuperscript{40}. In economic terms, nothing has changed for the household:
institutionally-private retirement saving has merely been replaced by the public pension scheme\textsuperscript{41}.

The observations made in the preceding paragraph are based on the assumptions that:

- **i)** public pension schemes are actuarially "fair", and that
- **ii)** public pension fund wealth and private household wealth are perfect substitutes.

Assumption (ii) does not hold whenever the discounted present value of pension benefits exceeds that of contributions for a household participating in the scheme. In such a case, the household budget constraint would be eased by the public pension scheme. Apart from the purely measurement-related changes referred to in footnote \textsuperscript{41}, this would cause changes in household saving behaviour in opposite directions. First, consumption in each period would be higher because of increased life-time resources, and this would reduce both the level and the ratio of an individual household’s saving. Second, if retirement leisure is a normal or superior good (i.e. its income elasticity of demand is positive) the increase in life-time resources might encourage heads of households to retire earlier and thereby lengthen the retirement period\textsuperscript{42}. This incentive to retire earlier would strengthen the motive to save for retirement. The overall effect on the household saving ratio is therefore indeterminate, because the increased wealth effect and the early retirement effect pull the saving ratio in opposite directions\textsuperscript{43}.

Pension fund wealth and private household wealth have different degrees of liquidity, and consequently the two wealth components will be less than perfect substitutes. Hence even if the assumption of actuarial fairness holds, household saving would tend to be higher because public pension scheme wealth is less liquid\textsuperscript{44} than private household wealth. On the other hand, if public pension schemes are considered to be safer than private investments as far as future income claims are concerned, the precautionary saving motive of households would be weakened.

The effect of a public pension scheme on national rather than household saving will depend mainly on whether, and how, public pension funds and the other private retirement saving schemes which they replace are "funded". A pension fund (either public or private) is fully funded if the discounted present value of all future payment obligations (i.e. accumulated pension claims) is always matched by the net value of assets owned by the fund\textsuperscript{45}. The common alternative to a funded pension scheme is a "pay-as-you-go" scheme in which the discounted present value of future payments is matched not by net assets but rather by the discounted present value of future contributions. If a private retirement saving scheme which is equity funded is replaced by a public pension scheme financed on a pay-as-you-go basis\textsuperscript{46} the national saving ratio

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<td>CON</td>
<td>CON</td>
<td>SAV</td>
<td>SAV</td>
</tr>
<tr>
<td>2</td>
<td>Regression coefficient on gross Social Security wealth variable (t-value)</td>
<td>0.021</td>
<td>0.029</td>
<td>0.030</td>
<td>0.058</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3.4)</td>
<td>(0.83)</td>
<td>(1.60)</td>
<td>(1.40)</td>
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<tr>
<td>3</td>
<td>Estimated depressing effect on personal saving (as a percentage of actual saving, approximate average value)</td>
<td>50% or higher</td>
<td>Much weaker (and statistically insignificant) effect than Feldstein (1974) results</td>
<td>No effect</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> Representative results have been chosen according to Esposito (1978)

<sup>b</sup> CON Consumption function, SAV Saving function

<sup>c</sup> Excludes the period 1941-1946
will decline in the transition period as the equity holdings of the private scheme are gradually liquidated in order to meet the remaining pension obligations. There will also be a permanently-lower national saving ratio if the economy is growing because the pay-as-you-go pension fund will not build up (equity) assets to match future pension claims increasing in line with total income\textsuperscript{47}.

The depressant effect on the capital stock and — in a growing economy — on the saving ratio resulting from an unfunded pension scheme (either public or private) would not occur in a world of rational individuals in which overlapping generations are linked by a chain of operative inter-generational transfers (bequests). As Barro (1974) has pointed out, under such circumstances the voluntarily chosen bequest implies an optimal (i.e. desired) inter-generational distribution of income from the point of view of the current wage earners. Any Government action which disturbs this optimum (i.e. the introduction of an unfunded pension plan) would simply be offset by private households through an increase in their gifts and/or bequests to the younger generation\textsuperscript{48}. Similarly, the younger generation can offset a resource transfer to the older generation imposed by a compulsory pay-as-you-go pension scheme to the extent that it reduces previous voluntary transfers (i.e. young people looking after their parents)\textsuperscript{49}. Thus, the question of whether a compulsory public pension scheme financed on a pay-as-you-go basis affects the supply of capital and the saving ratio cannot be answered unambiguously on a priori grounds. Theory suggests only that the capital replacement effect of the scheme is somewhere between zero and one\textsuperscript{50}; what the actual size of the net effect will be for each country is an empirical matter.

Research to determine quantitatively the impact of mandatory public pension schemes on saving behaviour is based on three kinds of data:

- individual country time series;
- international cross section data;
- individual country cross section data.

Representative results for several studies based on the first type of data — national time series — are presented in Table 2. While there are differences of detail, these studies typically estimate an aggregate time series consumption function, including "social security wealth"\textsuperscript{51} together with other relevant variables on the right hand side of the equation. Typically a positive coefficient is estimated for the social security wealth variable, which implies a more or less pronounced depressant effect on household saving\textsuperscript{52}. These coefficient estimates are, however, usually not significantly different from zero at the accepted levels of significance, and the size of the coefficients and their statistics are sensitive to the inclusion or exclusion of other explanatory variables in the estimation equation. Esposito (1978), after a detailed
Table 2.2  Time series estimates of the effects of mandatory public pension schemes on household saving (consumption)
Other OECD countries

<table>
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<tr>
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<td>SAV SAV</td>
<td>SAV SAV</td>
<td>SAV SAV</td>
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<tr>
<td>Regression coefficient on Social Security variable (t-statistic)</td>
<td></td>
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<tr>
<td>i) Social Security wealth</td>
<td>0.028</td>
<td>-0.008 d</td>
<td>-0.031 e</td>
<td>Pos/Neg f</td>
<td>-</td>
</tr>
<tr>
<td>(1.9)</td>
<td>(-0.85)</td>
<td>(-1.79)</td>
<td></td>
<td>-0.199</td>
<td>-111.65 g</td>
</tr>
<tr>
<td>ii) Social Security benefits</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>iii) Social Security contributions</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Implied depressing effect on savings (as per cent of actual saving, approximate)</td>
<td>40%</td>
<td>h</td>
<td>h</td>
<td>15%</td>
<td>30% i</td>
</tr>
</tbody>
</table>

a) Representative results
b) CON Consumption SAV Saving
c) Serious misspecification reduces usefulness of results (important explanatory variables are missing from regression equation)
d) Canadian Pension Plan wealth
e) Old age security wealth
f) Both positive and negative coefficients (all statistically insignificant at 95 per cent level) were obtained for different combinations of additional explanatory variables
g) The benefit variable used is an estimate of the contribution of expected future pensions to permanent income; cf. Markowski/Plamer (1979) for a detailed description of the variable
h) Information given insufficient to calculate this figure
i) According to the authors the depressing effect on personal saving was more than compensated by asset formation of the Social Security fund so that net effect on national saving was positive
discussion of U.S. time series studies of a social security effect on household saving, concludes that either U.S. time series data do not permit the isolation of the effect of social security programmes on private saving, or that there is no significant effect of these programmes on private saving in the United States. The same conclusions seem to apply to other countries, and more fundamental considerations also suggest that time series regressions are not the appropriate way to analyze the complex stock-flow relationships determining lifetime saving: time series observations do not represent observed (long run) equilibrium values. Their fluctuations are a combination of cyclical movements, lagged disequilibrium adjustments, transition from old to new equilibrium growth paths, and measurement errors. It is hard to see how the resulting coefficients can be interpreted unambiguously, even if they are statistically significant and robust.

The preceding reservations concerning the use of regression analysis are less strong in the case of international cross section samples where the individual observations represent averages over several years, thereby eliminating (or at least reducing) cyclical and lagged adjustment effects. Such studies are therefore more likely to reveal the long-run effects of changes in explanatory variables on saving behavior. Unfortunately they too are not without problems: institutional differences between countries make it difficult to construct a homogenous sample of sufficient size to estimate simultaneously the coefficients of a large number of explanatory variables. There have been five major empirical studies which use international cross section data to determine the effect of public pension schemes on saving behavior. The results are summarised in Table 4, Part IV below. Unfortunately, they are not consistent with each other: while Feldstein (1977 and 1980) finds empirical support for his hypothesis of a negative impact, the other studies find either no effect, or even a positive influence, of social security wealth on saving. The studies quoted differ in too many respects (countries and period covered, equation specification, choice of dependent and independent variables, etc.) to identify precisely the reasons for the different results.

The third kind of data which has been used to investigate the effect of public pension schemes on household or private saving has been cross section studies from household budget surveys in individual countries, mainly the United States. Representative of this type of research are the studies by Munnell (1976), Feldstein and Pellecchio (1979), and Kotlikoff (1979). The majority — though not all — of these studies conclude that *ceteris paribus* within a cross-section sample (i.e. for a fixed aggregate level of income and social security wealth) households with higher social security wealth (i.e. higher expected pensions) will save less. To conclude from the cross-section evidence — even if it were unambiguous — that an increase in total public pension wealth over time will cause the saving ratio to decline would, however, constitute a
fallacy of composition. Cross section studies test whether relative pension benefits affect relative consumption. They cannot, by their design, establish whether an increase in overall benefits (and a corresponding increase in contributions) will affect aggregate consumption and saving because the key variables — the levels of aggregate consumption and social security wealth — are fixed in the sample.

C. Inflation

Given the rather low and steady rates of inflation during the post-war period up to the end of the sixties, there was little interest in analysing and only limited opportunity to test empirically, the effect of inflation on saving. The conventional wisdom was that inflation would probably reduce the saving ratio (at least temporarily) due to advance purchasing of consumer goods, particularly durables. A negative influence of inflation on saving would indeed be consistent with two alternative hypotheses:

a) If the change in inflation was unexpected, increases in money income could well be (mis)interpreted as real income growth, thereby leading to increased real consumption. This argument, first developed by Branson and Klevorick (1968), represents a specific type of money illusion leading to (involuntary) dis-saving;

b) If interest rates do not adjust instantaneously to changes in the inflation rate, the relative rates of return on financial and real assets will change, and people will rearrange their portfolios, increasing their holdings of real assets at the expense of financial assets. Because real assets include consumer durables, this will affect the measured saving ratio.

Consequently the effect of inflation on the saving ratio appears to depend crucially on whether the change in inflation is expected and whether it is accompanied by changes in real interest rates on financial assets.

With the significant acceleration of inflation in the early 1970s and persistent high levels thereafter the effect of inflation on consumption and saving has attracted increasing attention. This renewed interest in the inflation-saving link was reinforced by the observation that — contrary to the conventional wisdom of the time — the measured household saving ratio increased rapidly when inflation accelerated. To explain this the following possible effects of inflation on household consumption have been suggested:

a) An increase in the inflation rate adds to income uncertainty. If households are risk-averse, this will lead to an increased demand for precautionary assets and thereby a permanently-higher saving ratio.
In such a case, the attempt to raise the asset/income ratio to the new desired level would provide an additional boost to the saving ratio during the adjustment period (cf. Juster and Wachtel, 1972).

b) Given the (positive) cost of information, consumers will usually not be perfectly informed about general price developments. Hence they may occasionally (mis)interpret inflation-caused price increases of individual items as increases in relative prices and refrain from buying. In the aggregate this leads to an (involuntary) increase in the saving ratio, due to this particular type of money illusion (cf. Deaton, 1977).

c) More recently it has been hypothesized that the most powerful channel through which inflation influences consumption is via inflation effects on real financial wealth. Inflation reduces the real value of financial assets denominated in money terms. If households have a target wealth/income ratio, this will lead to increased saving in order to re-establish the desired target ratio. The first of these arguments implies that it is not inflation itself which influences saving, but rather the increased income uncertainty that tends to accompany higher rates of inflation. In empirical studies the latter serves only as a proxy variable for income uncertainty. The second argument implies that money illusion in combination with unexpected inflation leads to a decline in the saving ratio, i.e. an effect opposite to that found by Branson and Klevorick for the United States. The explanation of this apparent contradiction is that unexpected inflation can cause money illusion with respect to both real income and relative prices. The (relative) price-related money illusion tends to increase saving: this is the effect recognised by Deaton. The income-related money illusion tends to lower the saving ratio: this is the effect recognised by Branson and Klevorick. The total effect of money illusion due to unexpected inflation is therefore ambiguous, but would in any case only be transitory: because the saving or dissaving resulting from unexpected inflation are involuntary they will lead to an undesired change in assets. The household can subsequently correct this, so that neither hypothesis can satisfactorily explain a persisting change in the saving ratio.

The third argument depends crucially on how income and saving are measured. If the standard income measure were appropriately adjusted for inflation effects on real asset values and interest earnings, inflation would have no long-run effect on the saving ratio on account of the real balance effect, though short-term fluctuations might still result if consumers tend to compensate inflation-caused capital losses only gradually.

A theoretical explanation for the frequently-observed positive correlation between the personal saving ratio and changes in the rate of inflation has recently been provided by Bulkley (1981). Such a relationship will be observed
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<td>POS</td>
<td>NEG</td>
<td>POS&lt;sup&gt;b&lt;/sup&gt;</td>
<td>POS&lt;sup&gt;d&lt;/sup&gt;</td>
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<tr>
<td>2</td>
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<td>SAV</td>
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<tr>
<td>3</td>
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<td>ACT</td>
<td>ACT-EXP</td>
<td>ACT-EXP</td>
<td>EXP</td>
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<td>EXP</td>
<td>EXP</td>
<td>EXP</td>
<td>ACT-EXP</td>
<td>ACT-EXP</td>
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<tr>
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<td>OLS</td>
<td>OLS</td>
<td>OLS</td>
<td>OLS</td>
<td>OLS/INST</td>
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<tr>
<td>5</td>
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<sup>a</sup> POS Positive, NEG Negative, INCON Inconclusive
<sup>b</sup> These effects are attributed primarily to uncertainty by the authors
<sup>c</sup> CON Consumption function, SAV Saving function
<sup>d</sup> ACT Actual, EXP Expected
<sup>e</sup> OLS Ordinary least squares, INST Instrumental variables
<sup>f</sup> Cochrane-Orcutt autocorrelation correction used when necessary
<sup>g</sup> QRT Quarterly, ANN Annual
whenever nominal wages are not instantaneously adjusted to the change in inflation. Real earnings are thereby gradually eroded by inflation following each nominal pay increase. If the individual attempts to maintain a steady real consumption flow, his saving will follow the sawtooth pattern of his real income flow. Aggregation over individuals with overlapping contract periods will then yield an increase in the aggregate saving ratio, if inflation is accelerating: the extra saving of those whose income has recently been adjusted will exceed the decline in saving of those approaching the end of their contract period. The effect is symmetric with respect to the change in the inflation rate. An underlying upward trend in real incomes will exacerbate an increase in the saving ratio caused by accelerating inflation and dampen a decline if inflation is decelerating.

While there are numerous channels through which inflation may influence saving behaviour, it is important to note that most of the inflation effects analysed above are short-term or cyclical in nature: unexpected and/or accelerating inflation are by definition disequilibrium phenomena, inconsistent with long-term equilibrium (steady state) growth. As for fully-anticipated inflation, some of its effects, too, are transitory (stock adjustment) and should disappear once the economy has adjusted to faster steady-state inflation. The reason that the impact of inflation on saving behaviour has been discussed in some detail despite the predominant interest in long-term saving determinants is that many of the drastic changes in saving ratios over the last decade seem to have been due in significant part to variations in the inflation rate. What constitutes a "transitory effect" in economic theory may well be a medium or even long-term phenomenon from the point of view of economic policymaking.

Given this, there are only few inflation effects which can be expected to affect saving ratios permanently: one results from the interaction of (nominal) tax rules with inflation, to be discussed in more detail below. Another is an increase in precautionary asset holdings if the inflation rate is indeed correlated positively with (perceived) real income uncertainty. The most important long-run effect, however, is due to prevailing SNA definitions: by excluding capital gains or losses from the definition of income, the part of nominal interest earnings which compensates for inflation will increase the measured saving ratio when reinvested to maintain the real value of financial assets$^{62}$.

Table 3-1 presents a synopsis of studies concerning the saving-inflation relationship in the United States. Not surprisingly, the results differ widely and appear to be strongly model-dependent, i.e. sensitive to the choice and measurement of variables, specification, and sample period$^{63}$. In interpreting the results reported in Table 3-1 it should be appreciated that the inflation impact refers to direct inflation effects. Many of the consumption or saving
Table 3.2  Inflation and Saving: Results of Empirical Studies for other OECD Countries

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<td>ACT-EXP</td>
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<td>QRT</td>
<td>ANN</td>
<td>QRT-ANN</td>
<td>QRT</td>
</tr>
</tbody>
</table>

<sup>a</sup> g1  See Table 3.1

<sup>b</sup> No inflation variable is explicitly included in the regression equation, but the income measure used as explanatory variable is adjusted for inflation-induced changes in financial wealth.
equations represented include a real wealth variable which captures the indirect (usually positive) effect of inflation on the saving ratio as conventionally measured.

For no other country has the inflation-saving link been studied as comprehensively as for the United States, and most published empirical work on consumption functions in other OECD countries excludes inflation variables. A notable exception is the United Kingdom where the work of Deaton (1977) and Davidson et al. (1978) shows a strong and positive relation between saving and inflation, explained by money illusion and real balance effects respectively. While there are no cross section studies of the inflation effect on consumption, Howard (1978) presents an interesting parallel time series analysis of consumer behaviour in major OECD countries. A standardised per capita saving function is estimated for five countries\(^{64}\), including as explanatory variables permanent and transitory per capita disposable income, per capita liquid assets, the nominal interest rate, actual and expected inflation rates, and the level and change of the unemployment rate. The most important finding in the present context is that the indirect (positive) effect of inflation on saving (through the real balance effect) is significant for all countries, while the evidence on direct inflation effects is much less clear-cut: only for Japan and the United States are the inflation coefficients significantly different from zero, but — in the case of expected inflation — they are of opposite sign.

D. Saving, taxation and inflation

As in the case of inflation the channels through which taxes affect national saving are manifold. This section first considers how various taxes affect household saving behaviour, using the life-cycle hypothesis as the basic analytic framework. In this context the effects of the interplay between inflation and the tax system on household saving will also be examined. The brief review of existing research on the rate of return elasticity of saving given above is of key importance in analysing the effect of capital income taxes on saving. Finally, the effects of taxes on business saving are considered, including some implications for household saving behaviour. The overall effect of taxes on national saving also depends on how the government employs the resources transferred to the public sector in the form of tax revenue. If the Government’s marginal propensity to consume is higher than that of the private sector, an increase in taxation will reinforce a depressant effect on the national saving ratio\(^{65}\).

In the LCH framework, tax variables appear in the household’s budget constraint\(^{66}\) as drains on lifetime resources. Those taxes may be classified as:
a) taxes on earned income,
b) taxes on capital income, and
c) taxes on consumption\textsuperscript{67}.

The prevailing income tax systems are a combination of (a) and (b).

In the simple LCH framework, the effects of a tax on earned income and that of a tax on consumption are equivalent from the household’s point of view: they both effectively reduce the real purchasing power of lifetime resources, and thereby the level of the real consumption and saving streams\textsuperscript{68}. While this is true for the aggregate household sector, the substitution of a (proportional) consumption tax for a progressive income tax is likely to have an important effect on after-tax income distribution across households. Whether or not this affects household saving depends on whether the marginal propensity to save differs between income groups. If the marginal propensity to save rises with income, such a tax change will tend to increase aggregate saving\textsuperscript{69}. However, the conventional theories of household behaviour do not necessarily imply that a household’s saving ratio increases with income (either absolute or relative), and empirical research has not so far been conclusive (cf. Section (E) below).

In addition a tax on earned income (or on consumption) affects household saving through its impact on the work-leisure choice, which is not explicitly recognized in the basic LCH framework. An increase in the marginal tax rate on earned income will reduce work effort and income if the negative substitution effect from a lower after-tax marginal income is greater than the positive income effect\textsuperscript{70}. In this case, the level of saving will fall if there is no offsetting rise in the saving ratio. The direction of the change in the latter cannot be determined \textit{a priori} because a reduction in work effort could imply both fewer working hours before retirement and/or earlier retirement. The latter increases the need to save, while the effect of the former depends on whether leisure and consumption are substitutes or complements.

Viewed in the context of the LCH, a tax on capital income affects the trade-off between present and future consumption by altering the net rate of return on saving. This applies both to corporate taxes and to taxes on households, because the former – if they are not shifted into higher prices or compensated by lower wages -- will ultimately reduce the rate of return to holders of financial assets. The lower the expected after-tax return on saving the weaker the incentive to postpone consumption and save (the substitution effect). However, since a decline in this rate of return will also increase the household’s need to save in order to finance future consumption, there will be an income effect in the opposite direction. Thus, \textit{a priori}, the net effect of a fall in the net return to saving caused by a tax on capital income is indeterminate\textsuperscript{71}. In practice the quantification of these effects is difficult, given the existence of a
large variety of assets, each associated with a different rate of return, risk and tax rate.

Further complications arise from the interactions between taxation and inflation. Inflation premia built into interest payments are tax deductible at the firm level as a business expense, while they are treated as taxable income of the asset holder. The ultimate effect on the rate of return depends on a number of factors such as the debt-equity ratio and the relative size of the marginal tax rate on household interest income, business profits (both retained and distributed), and capital gains. Furthermore, the equilibrium debt-equity ratio may be changed in response to inflation. Concerning equity, in most countries inflation tends to depress corporate profitability by raising the effective tax rate on corporate profits under the prevailing accounting rules for capital depreciation at historic costs and inventory evaluation at current prices. However, there are offsetting effects from, for example, the reduction in the real value of debt. This in turn reduces the real net worth of households owning corporate bonds. Although scattered evidence suggests that the interplay of inflation and the tax system has adversely affected the after-tax return to savings — at least in the United States — the impact on saving itself depends on the sign and the magnitude of the rate-of-return elasticity of saving.

Provided that the tax on business profits is not shifted, after-tax profits are reduced by the amount of the tax. This may in turn either reduce business saving by lowering retained earnings, or it may be reflected in reduced dividends. Where the marginal payout ratio falls short of one, an increase in the business profits tax reduces business saving levels. The impact of an unshifted business profits tax on total private saving (business and households) is less predictable. As noted above, the reduction in dividends and capital gains (reflecting the reduced profits of the firm) resulting from an increase in the above tax may induce households either to save a larger or a smaller fraction of their income, depending on the relative sizes of the substitution and income effects. If household saving rises, it partially offsets the reduction in business saving.

A change in the tax on business profits may also affect total private saving by changing the payout ratio of the firm. A tax system favouring retention leads to increased business saving. The effect on total private saving depends on the household’s reaction. If, as seems likely, the household’s marginal propensity to save out of capital gains is higher than that out of dividend income, the increase in business saving will be only partially offset by a reduction in household saving, leading to a rise in total private saving.
E. Income distribution

Whether and how the distribution of income influences the aggregate saving ratio is controversial in the theoretical and empirical literature. Whether there is a causal link between income distribution and national saving levels is of course of great practical importance for the design of saving- and investment-promoting policies. In this context, two types of income distribution are usually distinguished:

a) the personal (or size) distribution of income, which determines differences in total household incomes, independent of its composition; and

b) the functional distribution of income, which determines the relative shares of different types of income (e.g. wages, transfers, property and entrepreneurial income).

While there is no a priori causal relationship between these two types of distribution it is frequently assumed that the prevailing distribution of wealth entails diminishing equality in the size distribution of income when the share of property and entrepreneurial income increases, and vice versa\textsuperscript{78}.

Obviously the distribution of income can affect aggregate saving only if a systematic difference exists between the marginal saving ratios of high and low income recipients. The saving motives discussed above imply such a systematic relationship only if bequest is a superior good, i.e. the (life-time) income elasticity of bequest is greater than unity\textsuperscript{79}. In most theoretical work such a possibility is usually excluded in order to reduce the mathematical complexity of the models considered\textsuperscript{80}, and results of existing empirical work are inconclusive: both Metcalf (1972) and Blinder (1975) conclude from postwar data for the United States that equalizing the income distribution will – if anything – slightly reduce aggregate consumption\textsuperscript{81}. A subsequent international cross-section study by Della Valle and Oguchi (1976), using domestic output levels and several alternative size distribution measures for 37 countries, likewise found no systematic relationship between aggregate consumption propensities and measures of income inequality\textsuperscript{82}. Musgrove (1980) refined this cross-section study by using both more appropriate data (i.e. disposable income rather than GDP) and a more sophisticated model of consumption for a sample of 30 countries. His findings, however, are similar: the distribution of income has little or no effect on the average propensity to consume\textsuperscript{83} when all countries are included in the analysis. For the sub-sample of countries with per capita income above 500 $ the distributional variables are significant, however. On the other hand, Kopits and Gotur (1981) find no effect of income distribution on saving for their sub-sample of industrialised countries. All the authors discount the reliability of their results due to data imperfections.
Data problems are less severe with respect to the functional distribution of income. For most countries disposable income can be decomposed into (at least) three components: wages and salaries, transfers, and income from property and entrepreneurship\textsuperscript{84}. The hypothesis that the functional distribution of disposable income influences the aggregate level of consumption can thereby be tested either by introducing the income components separately into the consumption function and checking whether the estimated coefficients are significantly different, or by introducing income shares as additional explanatory variables into the consumption function\textsuperscript{85}. The latter method was used in a recent OECD Secretariat project to estimate aggregate consumption functions, but the estimated coefficients for the income shares were insignificant for all countries considered. Juster and Taylor (1975) have estimated an aggregate saving function for the United States in which disposable income is disaggregated into its various components. The results are more puzzling than illuminating with respect to the distribution question: typically the estimated coefficients for labour income and "profits" (income from property and entrepreneurship) are not significantly different\textsuperscript{86}. The estimated coefficient on transfer income is more than twice as high as that for other types of income and is highly significant. This is surprising both in the light of the basic LCH and the fact that the bulk of transfer incomes goes to the low rather than high income households\textsuperscript{87}. No plausible explanation is offered by the authors for the high marginal propensity to save out of transfers, which is inconsistent with the "intuitive wisdom" that equalising the income distribution will reduce saving.

IV. RESULTS OF INTERNATIONAL CROSS-SECTION ANALYSIS

The review of theoretical and empirical work in the preceding chapter provides the background for examining more closely some of the intriguing questions raised by an international comparison of saving ratios or their trend changes. Research on the causes of saving ratio differentials faces a number of technical and practical problems:

\textit{a)} Many of the variables identified as potential determinants of saving are correlated with each other, making quantification of causal relationships between the saving ratio and its individual determinants difficult irrespective of whether the correlation between explanatory variables is spurious or based on causal links.

\textit{b)} While in principal this problem of multicollinearity can be mitigated by increasing the sample size, this is difficult to do because there is only
<table>
<thead>
<tr>
<th>Table 4</th>
<th>Results of international cross section studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of countries included</td>
<td>28</td>
</tr>
<tr>
<td>Explained inter-country variation (R²)</td>
<td>0.79</td>
</tr>
<tr>
<td>Dependent variable</td>
<td>S_r/YND</td>
</tr>
<tr>
<td>Explanatory variables:</td>
<td>Estimated coefficients (standard error)</td>
</tr>
<tr>
<td>Average annual growth of</td>
<td>1.31</td>
</tr>
<tr>
<td>Total income</td>
<td>(0.28)</td>
</tr>
<tr>
<td>Labour productivity</td>
<td>0.88</td>
</tr>
<tr>
<td>Socio-demographic variables</td>
<td>(0.28)</td>
</tr>
<tr>
<td>Retired population/working age population</td>
<td>0.20</td>
</tr>
<tr>
<td>Population under 20/working age population</td>
<td>(0.05)</td>
</tr>
<tr>
<td>Participation ratio of population over 55</td>
<td>0.09</td>
</tr>
<tr>
<td>Length of retirement span</td>
<td>0.046</td>
</tr>
<tr>
<td>Unemployment ratio</td>
<td>0.007</td>
</tr>
<tr>
<td>Social security variables</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Benefit replacement ratio</td>
<td>Social security pensions/disposal income</td>
</tr>
<tr>
<td>Other social security expenditure disposal income</td>
<td>(0.05)</td>
</tr>
<tr>
<td>Age of social security system</td>
<td>0.092</td>
</tr>
<tr>
<td>Other explanatory variables</td>
<td>0.046</td>
</tr>
<tr>
<td>Real interest rate (after tax)</td>
<td>0.70</td>
</tr>
<tr>
<td>Government consumption</td>
<td>-0.29</td>
</tr>
<tr>
<td>1/GDP</td>
<td>0.044</td>
</tr>
<tr>
<td>GDP_r / (GDP_r)</td>
<td>0.01</td>
</tr>
</tbody>
</table>

- The growth rate refers to the average real private income growth over the period 1960-1970.
- Social security pensions: population over 65/GDP per capita.
- Ratio of over 65 years old to total population.
- Average social security pension: average income of workers.
- Pension benefits of newly retired couple: average earnings in manufacturing.
a small number of countries for which the explanatory variables (or
for that matter the dependent variable) exist on a comparable basis.
Limiting the analysis to these countries only and including all
potential saving determinants might well reduce the degrees of
freedom of the analysis to zero. A compromise has thereby to be
struck between the number of countries and the number of
explanatory variables included in the cross-section analysis.
c) In addition there are problems of simultaneity (between the saving
ratio and some of the explanatory variables) and the non-linearity of
the underlying structural relationships (i.e. the saving function) which
have been discussed above.

Despite these formidable difficulties a number of empirical studies have
attempted to analyse the causes of international differences in saving ratios.
Representative results of the most important published studies are summa-
rised in Table 4. All but one of these studies take medium- or long-term
averages of the dependent and explanatory variables in order to eliminate
cyclical fluctuations from the data. The results of these regressions suggest
that differences in the various saving determinants between countries are
able to explaining the major part of the observed international saving ratio
discrepancies: the R-squared reported for the various equations varies
between 0.689 and 0.9. This result seems quite impressive, considering
that:

a) the international saving ratio discrepancies “explained” by these
regressions refer to unadjusted saving ratios which — as discussed in
Blades (1983) — exaggerate the “true” differences due to measure-
ment and conceptual problems;
b) out of the large number of potential explanatory variables these
regressions choose only a limited subset in order to avoid multicol-
linearity problems or because of measurement difficulties80.

While the observed inter-country differences in saving ratios can be quite
satisfactorily explained, in a statistical sense, by the joint effect of various
saving determinants it is much more difficult to quantify with certainty the
impact of any individual explanatory variable. Indeed, while all the equations
reported in Table 4 have a rather high R2, the estimated coefficients of
individual explanatory variables are highly model-dependent and may alter
significantly — both in size and statistical significance, depending on the
country and explanatory variable subset used. Some of the key explanatory
variables are depicted in Table 5.

Even for a given variable set estimation results are quite sensitive to the
specification of the estimation equation. This seems especially true for those
variables which are most interesting from the point of view of economic policy,
Table 5  Selected saving determinants  

<table>
<thead>
<tr>
<th>Country</th>
<th>Private saving ratio</th>
<th>Average annual growth of real private income</th>
<th>Ratio of retired people over 65 to population age 20-65</th>
<th>Ratio of persons under 20 to population age 20-65</th>
<th>Labour force participation ratio among people over 65</th>
<th>New retiree replacement ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>17.7</td>
<td>3.9</td>
<td>24.8</td>
<td>57.5</td>
<td>8.0</td>
<td>61.0</td>
</tr>
<tr>
<td>Canada</td>
<td>12.7</td>
<td>4.8</td>
<td>13.1</td>
<td>74.9</td>
<td>23.6</td>
<td>46.4</td>
</tr>
<tr>
<td>Denmark</td>
<td>6.5</td>
<td>2.7</td>
<td>26.9</td>
<td>52.8</td>
<td>21.9</td>
<td>43.2</td>
</tr>
<tr>
<td>France</td>
<td>15.7</td>
<td>4.9</td>
<td>24.0</td>
<td>55.8</td>
<td>10.6</td>
<td>60.6</td>
</tr>
<tr>
<td>Germany</td>
<td>16.4</td>
<td>3.4</td>
<td>24.0</td>
<td>51.7</td>
<td>11.0</td>
<td>50.6</td>
</tr>
<tr>
<td>Italy</td>
<td>19.9</td>
<td>4.7</td>
<td>13.2</td>
<td>55.1</td>
<td>13.4</td>
<td>66.0</td>
</tr>
<tr>
<td>Japan</td>
<td>24.6</td>
<td>9.1</td>
<td>9.1</td>
<td>51.7</td>
<td>49.5</td>
<td>46.1</td>
</tr>
<tr>
<td>Netherlands</td>
<td>19.4</td>
<td>4.3</td>
<td>17.8</td>
<td>66.1</td>
<td>11.6</td>
<td>52.2</td>
</tr>
<tr>
<td>Norway</td>
<td>9.2</td>
<td>3.9</td>
<td>20.4</td>
<td>58.4</td>
<td>25.7</td>
<td>52.4</td>
</tr>
<tr>
<td>Sweden</td>
<td>8.7</td>
<td>2.6</td>
<td>24.2</td>
<td>46.8</td>
<td>12.6</td>
<td>61.0</td>
</tr>
<tr>
<td>Switzerland</td>
<td>20.9</td>
<td>3.6</td>
<td>16.0</td>
<td>52.7</td>
<td>31.7</td>
<td>50.4</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>8.7</td>
<td>1.6</td>
<td>20.9</td>
<td>55.6</td>
<td>19.3</td>
<td>34.4</td>
</tr>
<tr>
<td>United States</td>
<td>9.5</td>
<td>3.5</td>
<td>16.8</td>
<td>64.3</td>
<td>20.8</td>
<td>52.4</td>
</tr>
</tbody>
</table>

\[a]\text{Columns 1, 3 to 6: average for 1969-1975}
\[b]\text{Column 2: average for period 1960-1975}
\[c]\text{Ratio of public pension benefits of newly retiring couples to average wage in manufacturing}
\[Source: Feldstein (1980); figures for Japan compiled by OECD according to methodology described in Feldstein (1980)}

The evidence is less contradictory about the effect of productivity growth and major demographic variables: all studies reviewed confirm the basic implication of the LCH and the neo-classical optimal growth model that more rapid growth entails higher saving ratios, though the estimated coefficients differ considerably in size. Similarly, all studies agree on the effect of key demographic variables on saving: high dependence ratios, both for young and for old people, tend to lower the saving ratio, while the labour participation ratio of old people influences aggregate saving in the opposite direction. As before, however, coefficient-size depends importantly on how the estimation equation is specified.

**SUMMARY**

The comparative saving behaviour of individual countries as reflected in standard national accounts statistics covering the period since 1960 shows very marked differences with respect to levels, trend developments and sectoral composition. This paper interprets the theoretical and empirical
literature relevant for explaining the observed international differences in saving ratios. Given the predominance of household saving in the determination of national saving, much of the relevant literature on saving behaviour concentrates indeed on the household sector.

As far as the saving motives of individual households are concerned, saving for retirement, bequest, and as a hedge against uncertainty, are identified in Part I as the major determinants of long-term saving. In the short to medium run intermittent saving and dis-saving occur because of the lumpiness of expenditure on consumer durables. Assuming rational optimising behaviour, the individual household's saving propensity depends on the age structure of the household members, the expectation formation process, the household's wealth, the interest rate and several other parameters such as the rate of time preference and the degree of risk aversion. As regards the implication of individual household spending behaviour for aggregate saving ratios, it is interesting that the various motives will generate positive saving only in a growing economy. Population and productivity growth determine the age distribution of the population and the rise in total income, and thereby — given age-specific saving ratios — the average saving ratio for the aggregate household sector.

Institutional characteristics may interact with household utility maximisation and thereby affect aggregate saving ratios. Limited access to consumer credit, for instance, would tend to increase aggregate saving. Other capital market imperfections such as the imposition of interest rate ceilings would, on the other hand, lower it if the interest elasticity of saving is positive, which cannot, however, be taken for granted given the theoretical ambiguity and the weak and partly contradictory empirical evidence on this question. The uncertainty about the interest elasticity of saving also makes it difficult to judge the effect of profit and interest taxation on the level of saving. There is, however, strong evidence that differential tax rates on different types of assets (or their returns) have important effects on the composition of portfolios and saving allocation, including the choice between real and financial assets.

Although mandatory public pension schemes might seem likely to affect saving behaviour, analysis suggests that the impact on the saving ratio is uncertain on a priori grounds, both with respect to its size and its direction. Unfortunately, empirical evidence is unable to resolve this ambiguity: the statistical problems encountered in testing the relevant hypotheses are formidable, rendering any results obtained — even if they appeared unambiguous — questionable.

Inflation may affect saving in several ways, but there seem to be two channels through which a permanent and statistically-significant influence will be exerted: inflation erodes the real value of financial assets (excluding equity) and this stimulates saving if households aim at a target ratio of financial wealth
to income. This is true whether the inflation is expected or not, but in the former case nominal interest rates incorporate an inflation premium (treated as income in the national accounts) which compensates for the loss of real wealth. The second channel through which inflation seems to affect saving is by raising the uncertainty about real income flows, thereby inducing increased precautionary saving.

There are no convincing theoretical reasons why the personal (or size) distribution of income should affect aggregate saving propensities, unless it is positively correlated with the strength of saving motives (e.g. the bequest motive). Available evidence does not support the hypothesis that this is indeed the case. Concerning the functional distribution of income, it is difficult to establish empirically a significant difference between the marginal propensities to save out of labour and capital income, although this would seem plausible on a priori grounds, given the greater variability of the latter. A puzzling high marginal propensity out of transfer income emerges from empirical analysis, which is not only at variance with the hypothesis that low income households have relatively low marginal saving ratios, but is also difficult to reconcile with the basic life cycle hypothesis.

The empirical work reviewed demonstrates that the observed international differences in saving ratios can be explained quite satisfactorily if the effects of various explanatory variables are combined. Due to multicollinearity problems, the causal links between the saving ratio and individual saving determinants are, however, difficult to quantify. Non-linearity and simultaneity problems compound the difficulties of obtaining reliable individual coefficient estimates. Despite these problems, empirical results strongly support the hypothesis that the rate of growth of income and the overall participation ratio (itself strongly dependent on the age distribution) have significant positive effects on saving.
Technical Annex

A. THE LIFE CYCLE THEORY OF SAVING

i) The basic model

The basic life cycle hypothesis of household consumption behaviour referred to in the main body of the paper can be formally stated as follows:

(1) \[ \text{Max } U^T (c_{i,1}, \ldots, c_{i,L,T}) \]

Subject to:

(2) \[ a_t^T + \sum_{i=1}^{t+L-T} y_t^i (1+r)^{i-t} = \sum_{i=1}^{t+L-T} c_t^i (1+r)^{i-t} \]

where: \( U^T \) = utility function of a (representative) household of age \( T \);
\( a_t^T \) = household net worth at the start of period \( t \);
\( c_t^i \) = household consumption in period \( t \);
\( y_t^i \) = the household's earned income in period \( t \) (income excluding returns on \( a_t^T \));
\( r \) = the discount rate used in period \( t \);
\( L \) = total life span of the household;
\( T \) = age of household in period \( t \).

Ando and Modigliani require the household utility function to be homothetic. Yaari (1964) and Thompson (1967) have shown that this assumption implies a utility function of the form

(3) \[ U^T = \sum_{i=t}^{t+L-T} U (c_t^i) (1+p)^{i-t} \]

where:

(4) \[ U (c_t^i) = \left[ 1 \left/ \left( 1 - d \right) \right. \right] \left( c_t^i \right)^d \]

and

\( p \) = rate of time preference;
\( -d \) = elasticity of marginal utility with respect to consumption (i.e. a measure of the curvature of the utility function), and \( d > 0 \) for all strictly concave utility functions.

Maximising this utility function subject to budget constraint (2) produces the first order condition:

(5) \[ c_{t+1}^i / c_t^i = \left[ \left( 1+r \right) / \left( 1+p \right) \right]^{1/d} \]

which describes the life cycle consumption path, the level of which is determined by the amount of resources available, i.e. the right-hand side of equation (2). Substituting the first order condition (5) into the budget constraint (2) thus gives the household consumption function:

(6) \[ c_t^i = \left[ a_t^T + \sum_{i=1}^{t+L-T} y_t^i (1+r)^{i-t} \right] / \Delta_T \]
where

\[(7) \Delta T := \sum_{i=1}^{t} \left[ \frac{(1 + r_t) / (1 + p_t)}{r_t / d_t} (1 + r_d) \right] \]

An aggregate household consumption function can be derived from the model of individual household consumption behaviour by a two step aggregation procedure. Firstly, an aggregate consumption function for all households of specific age \(T\) (numbering \(M^T\)) can be computed as follows:

\[(9) C^T = \sum_{M^T} \left[ a^T_i + \sum_{i=1}^{t} y^T_i (1 + r)^{i,t} \right] / \Delta_T \]

Secondly an overall aggregate consumption function is derived by summing equation (9) over all age groups \(N^T\):

\[(12) C_T = \sum_{N^T} \sum_{M^T} \left[ a^T_i + \sum_{i=1}^{t} y^T_i (1 + r)^{i,t} \right] / \Delta_T \]

or

\[(13) C_T = \sum_{H} \left[ a^H_H + \sum_{H} y^H_H (1 + r)^{i,h} \right] / \Delta_{H,T} \]

where \(H\) represents an individual household index. This equation implies an aggregate linear homogenous consumption function of the form:

\[(14) C_T = a_1 Y_T + a_2 A_T \]

only if the age distribution of the population remains constant over time, in addition to the three simplifying assumptions \(i, ii, iii\) specified in the preceding footnote. Because in general neither of these conditions will be met in the real world, the "correct" aggregate consumption function (i.e. the one fully consistent with the LCH) will be the complicated non-linear relationship in (13).

\[ii) \text{Extensions to the basic model}\]

Including a bequest motive and various fiscal policy parameters into the analysis would change the objective function and the resource constraint in the life cycle model of saving in the following way:

\[(15) \text{Max. } U^T(c_t, c_{t+1}, \ldots, c_{t+L}; a_{t+L,T+1}) \]

Subject to

\[(16) a^T_t (1 - k_1) + \sum_{i=1}^{t} y^T_t (1 - k_2) (1 + r)^{i,t'} + \sum_{i=t}^{L} s_i (1 + r)^{i-l} = \]

\[\sum_{t,t+1} c^T_t (1 + k_3) (1 + r)^{t-l} + (1 + k_4) a^T_{t+L,T+1} (1 + r)^{T+L} \]

The additional variables are defined as follows:

- \(a_{t+L,T+1}\) bequest left by household of age \(T\) at death in \(L-T\) years;
- \(k_1\) wealth tax rate;
- \(k_2\) income tax rate (including social security taxes);
$k_3$ consumption tax rate;
$k_4$ inheritance tax rate;
$s_i$ periodic pension payment during retirement period;
$R$ retirement age.

The analysis in Part III, Section D of the effects of the various types of taxation on (household) saving is based on the above constrained maximisation framework.

B. SAVING IN A ONE SECTOR OPTIMAL GROWTH MODEL

The optimal growth approach to saving determination referred to in Part II, Section C can be formally stated as follows:

$$\begin{align*}
(1) & \quad \text{Max} \int_0^\infty U(c_t) e^{-pt} dt \\
& \text{Subject to} \\
(2) & \quad c_t = f(k_t) - nk_t - \dot{k}_t
\end{align*}$$

Where:

$U(\cdot)$ the utility function;

$c$ per capita (or per worker) consumption;

$x$ time derivative of variable $x$;

$f'$ derivative of function $f$;

$p$ rate of time preference;

$k$ capital-labour ratio;

$n$ the "natural" rate of growth (i.e. the sum of the rates of growth of the labour force and labour productivity);

$f(k)$ the per capita value added (or net production) function.

For a closed economy equation (1) implies that per capita saving (and/or investment) is $nk + k$, and the national saving ratio equals $(nk + k)/f(k)$. If both the utility and the production function display customary neoclassical properties the necessary and sufficient condition for intertemporal utility maximisation is:

$$\begin{align*}
(3) & \quad f' = n + p - \left(\frac{U''}{U'}\right)c \\
\end{align*}$$

which implicitly defines an optimal long run (i.e. steady state) equilibrium capital-labour ratio ($\hat{k}$) and a corresponding optimal steady state saving ratio (cf. Chart B).

$$\begin{align*}
(4) & \quad \hat{s} = \frac{nk}{f(k)} \\
\end{align*}$$

where $\hat{x}$ corresponds to the steady state value of variable $x$.

For positive rates of time preference ($p > 0$) the optimal steady state saving ratio will be lower than the competitive share of profits:

$$\begin{align*}
(5) & \quad \hat{s} = \frac{f'(k)}{k/f(k)} - \frac{p^k}{f(k)} \\
& = \pi - p\hat{x}
\end{align*}$$

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CHART B

INCOME, CONSUMPTION AND SAVINGS IN AN OPTIMAL GROWTH MODEL

Output p
Savings p

Slope n + p

\( f(k) = y \)

\( (n + p)k \)

\( nk = \ddot{S} \)

(steady state savings)

Optimal growth path

Consumption p c

\( \bar{c} = f(k) - nk \), steady state consumption

Golden rule (f' = n)

Optimal steady state (f' = n + p)

Initial condition

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where:
\[ \overset{\wedge}{\pi} = \text{competitive (imputed) share of profits}; \]
\[ \overset{\wedge}{\chi} = \text{capital output ratio}. \]

Equation (5) follows from equation (3) by setting \( c \) equal to zero (steady state), multiplying both sides of the equation by \( k/f(k) = \chi \), and solving for \( n.k/f(k) = s \).

For an economy which approaches the (optimal) steady state “form below” (i.e. \( k < \overset{\wedge}{k} \)) the observed saving ratio would be:

\[ s = \pi - \chi \left[ \rho - R \left( \dot{k}f' - n \right) - \dot{k} \right] \frac{\dot{k}}{k} \]

where \( R = \text{degree of risk aversion (measure of the curvature of the utility function, } U''/U') \).

Equation (6) is the source for the list of aggregate saving determinants quoted in the main body of the paper (cf. Part II, Section C).
NOTES

1. In practice, household and business savings are less than perfect substitutes from the household’s point of view because of their differing degree of liquidity and — more importantly — differential tax treatment of retained earnings (and capital gains) and household dividend earnings. This is discussed in detail in the section on tax effects on saving behaviour in Part III below.

2. Two diametrically-opposed views can presently be found in the economic profession concerning the role of Government saving: one school, loosely definable as “Neo-Keynesian”, maintains that the appropriate role of Government is to determine public sector saving so as to reach an optimal national saving ratio, given the saving behaviour of the private sector. The second view, combining various propositions of what is generally identified as the “Rational Expectations School”, argues that private individuals have a clear idea what the optimum saving ratio is and reveal it by their economic decisions. Any attempt by the Government to modify the resulting saving ratio will simply be annulled by offsetting changes in private saving behaviour.

3. Empirical evidence suggests that bequests are quantitatively important either because of the desire to transfer wealth to children or because of uncertainty regarding age at death. The existence of voluntary (private) intergenerational transfers has in turn important repercussions on the net effect of compulsory public pension schemes, cf. the discussion in Part III below.

4. Besides the saving functions derived from models assuming optimising behaviour there are some “theories” of saving which are based on intuitive insight and/or a priori beliefs, e.g. the simple Keynesian consumption function (“absolute income hypothesis”) and the Kaldor-type saving function in which saving depend on the current level of income and its functional distribution. Most of these ad hoc saving models are special cases of the general models based on optimising behaviour, and hence are covered by the subsequent analysis.

5. A more detailed and technical presentation of the life cycle hypothesis, and its implications for micro- and aggregate consumption functions, can be found in the Technical Annex, Section A.

6. See the Technical Annex, Section A, for details. The time profile of household income (rather than its discounted present value) will affect the time profile of consumption only under uncertainty and/or if capital markets are imperfect. Of course, if the time profile of consumption remains fixed the saving ratio will change in response to changes in the income time profile.

7. The saving function derived from the LCH implies that all the explanatory variables are interdependent, so that the quantitative effect of a bequest of given size (in relation to income) on the saving ratio will also depend on the size of the other saving determinants implied by the LCH. The figures quoted above refer to the “baseline” simulation in Farrell’s paper.

8. It has long been observed that the saving ratio of professional groups is positively correlated with the variability of their income receipts, cf. Fisher (1957).

9. The typical result of increased saving as a reaction to income uncertainty hinges on the assumption of risk aversion. A consumer is risk-averse if the expected utility from an uncertain consumption level is less than the utility from the corresponding certainty equivalent level of consumption, i.e. if the utility function is concave.

10. Cf. Part III below for a more detailed discussion of the interest elasticity of household saving and a summary of empirical results.

11. In principle retirement saving and bequests also represent “target saving”, but due to their analytical particularities captured in the LCH they have been treated separately.

12. When purchases of consumer durables are reclassified as investment, this “dissaving” will be distributed over the lifetime of the durable good as “imputed durable consumption”, cf. the discussion in Blades (1983). Renting durables rather than buying them will have a similar effect on
household consumption as measured in the System of National Accounts (SNA) as such a reclassification.

13. This mode of acquisition is customary for the purchase of houses.

14. Strictly speaking this statement is correct only when comparing steady state equilibria. Disequilibrium adjustment processes may generate temporary non-zero saving even in a stationary economy.

15. This does of course not exclude the possibility that—as in the case of retirement saving—individual households vary their holdings of precautionary assets (i.e. save and dis-save) over the life cycle.

16. Because expenditure on consumer durables is treated as a consumption outlay in the national accounts, contracting consumer credit to buy durables will be recorded as household dissaving, while mortgage credit to buy houses will leave both saving and real net worth unchanged, though it will change the composition of the household’s portfolio.

17. Strictly speaking this statement holds only for long run (steady state) equilibrium growth.

18. The same would obviously hold for consumer durables if the latter were reclassified as assets, i.e. if household net worth included the (net) stock of consumer durables.

19. Cf. Technical Annex, Section A.

20. Given an annual growth factor of 1.04 of real disposable personal income, M-B computed a saving ratio of between 0.13 and 0.14 which corresponded closely to observed values of this variable in the United States at the time.


22. Farrell (1970) has demonstrated that fully-anticipated productivity growth may indeed lead to negative aggregate household saving ratios (in the framework of partial equilibrium analysis where income and interest rates are exogenous). In reality such a result is rendered unlikely by (i) imperfect capital markets preventing young households from going heavily into debt and (ii) imperfect foresight in combination with uncertainty and/or risk aversion, which prevents households from borrowing against future productivity-induced income increases. To the extent that households do go into debt during the early phase of the life cycle, this is frequently due to the acquisition of consumer durables (and/or real estate), which in an economic sense does not represent dissaving, cf. the discussion in Blades (1983).

23. The Ando and Modigliani (1963) result that only the speed, and not the type, of growth matters for the determination of the aggregate saving ratio holds only for the rather implausible assumption that households persistently fail to predict future productivity increases, instead assuming income to remain constant for the remainder of their earning period, despite a steady increase experienced in the past; cf. Farrell (1970).

24. Note that the age distribution of the population is not independent of other demographic variables already mentioned: in steady state a given population growth rate and life expectancy will uniquely determine the equilibrium age distribution, though it may take a long period of constancy of these two variables before the equilibrium age distribution is actually attained. It is (only) through its effect on the age distribution [a shift from (old) dissavers to (young) savers] that an increase in the population growth rate exerts a positive effect on the aggregate saving ratio in the LCH framework.

25. For empirical evidence that family size has a statistically significant effect on the saving ratio see Leff (1969).

26. The principal reasons for expecting this effect are:
   - increased access to consumer credit;
   - less need for precautionary assets;
   - substitution of home produced output for commercial goods and services; cf. OECD (1979).

27. A more technical presentation of the standard neo-classical optimal growth model on which the following argument is based is presented in the Technical Annex, Section B.

28. The exact formula for the optimal saving ratio, which is a non-linear second order differential equation, is given in the Technical Annex, Section B.
29. The difference between the rate of return on saving and the rate of return on investment (including the risk premium) would also depend on the risk-sharing and differential risk perception between the saver (lender) and the investor (borrower).


31. Typically human wealth is such an illiquid asset because creditors are unwilling to lend to households which have a negative or zero non-human net worth position, even if it is offset by the value of future labour income.

32. Monetary policy co-determines the extent to which such liquidity constraints are being operative: under "easy money" conditions eligibility criteria for consumer credit soften; lenders' margin requirements (including "penalties" for unsecured credit) decline, and down-payments are reduced. In "tight money" periods lending conditions move in the opposite direction.

33. The major areas of regulation include the following:
   - price controls in the form of maximum deposit rates (Regulation Q in the United States) and/or maximum lending rates (usury laws);
   - quantity controls on the amount of credit available from certain institutions;
   - limited entry into banking due to licensing and other barriers, creating monopoly rents and/or inefficient operating methods;
   - legal reserve requirements, imposing restrictions on banks on the amount of deposits which can be used to acquire interest-earning assets.

34. The substitution effect refers to the change in saving induced by the shift in the relative price of future consumption to present consumption when interest rates change. The income effect refers to the change in present saving requirements to reach a future consumption target if interest rates change. The two effects will affect saving in opposite directions.

35. The analysis of "loanable-funds saving" in the work by Howrey and Hymans (1978) can be seen as an effort toward such disaggregation. Despite their improved methods the authors are unable to find a significant interest elasticity of personal saving.

36. Much of this expenditure is, however, applied to the purchase of consumer durables, and a reclassification of such expenditure as saving would modify the above statement accordingly: cf. the discussion in Blades (1983).

37. An important, but unobservable, additional element in the demand for credit, particularly when making comparisons between countries, is social attitudes towards saving and debt (see, for example, Strumpel, 1975). These attitudes may in turn lead to legal restrictions on access to debt, reinforcing the underlying saving behaviour.

38. Relatively high levels of consumer credit in the United States do not by themselves reveal whether they are due to different behavioural parameters, different degrees of legal restrictions, or -- most probably -- a combination of both.

39. The pioneering work in this area is by Feldstein, (1974). Subsequent research by Leimer and Lesnoy (1980), however, has shown that the negative effect of the social security system on saving originally found by Feldstein was strongly overstated due to a computational error.

40. Strictly speaking this is correct only if the compulsory pension fund contribution does not exceed previous voluntary retirement saving, because otherwise the household will be forced to reduce its consumption.

41. Given present SNA accounting procedures, however, the measured household saving ratio will decline for pre-retirement households and increase for retired households, because public pension fund contributions (benefits) are deducted from (added to) disposable income. The net effect on the aggregate household saving ratio will depend on the shares of the relevant age groups in the total number of households. The quantitative importance of this measurement effect has been explored by Blades (1983).

42. If daily or weekly work hours are not fixed institutionally, a similar reduction should occur with respect to pre-retirement working time. In this case the effect on the saving ratio is ambiguous, and depends largely on whether leisure and consumption are substitutes or complements; in the latter case reduced work hours would increase consumption and thereby reduce the saving ratio.

43. Note, however, that a net increase in the saving ratio implies present consumption to be an inferior good, which would seem unlikely.
44. This is generally true because public pension wealth can neither be spent in emergencies before retirement, nor be used as collateral for obtaining bank credit.

45. Note that this concept of actuarial funding does not necessarily imply increased real capital formation in response to increased pension fund contributions. If the latter are invested in Government bonds, the proceeds of which are used to finance additional public consumption rather than public investment, there will be no matching increase in real capital formation.

46. Or funded by Government bonds which finance current public sector deficits.

47. In a stationary steady state the question of equity funding will have no effect on the (zero) saving ratio, but the equilibrium capital stock level will differ with the amount of equity funding.

48. Note, however, that if an older generation wanted to leave a negative bequest (i.e. have its retirement consumption financed by the younger generation) the introduction of a compulsory pay-as-you-go pension scheme would enable it to enforce such an inter-generational transfer from the young to the old, and would thereby effectively reduce the supply of capital.

49. Technically the Barro Model differs from the life cycle model referred to above by including the welfare of subsequent generation(s) in the utility functions of present wage earners, and - consequently - the income and consumption streams of future generation(s) in the relevant budget constraint. The observed prevalence of inter-generational gifts, bequests and other voluntary transfers suggests that utilities of successive generations are indeed interdependent, recommending the Barro model as the more realistic. Similar results as those obtained from the Barro model can be derived from the life-cycle model by introducing a bequest motive.

50. Under several special assumptions it is conceivable that the net effect on capital supply is positive. While intellectually intriguing, such a combination of circumstances does not seem realistic and the idea is not pursued here.

51. Gross social security wealth is defined as the discounted present value of expected future benefits.

52. An early study by Feldstein (1974) received considerable attention by policy makers due to its alarming result that the US pay-as-you-go social security system had reduced household saving by as much as 60 per cent. This result contrasted oddly with the observed long run stability of the US household saving ratio, implying that the latter would have increased dramatically without the introduction of social security. Results of subsequent research (by other authors, cf. Table 2) were both quantitatively less dramatic and/or statistically less significant than Feldstein's results, which subsequently were found to be invalid due to a computational error in the original research, (cf. Learner and Lesnoy, 1980).

53. Cf. Dolde/Tobin (1980), where the argument summarised here is discussed in more detail.

54. Earlier studies by Aaron (1967) and Pechman. Aaron and Taussing (1968) did not use averaged data for their cross country comparison, making their results as problematic as those from time series studies.

55. The early Feldstein (1977) study is compared in detail with the subsequent study by Barro and MacDonald (1979) in an Annex (by Harioka) to Feldstein's (1980) second cross section study. The Barro and MacDonald study pools the time series data of various countries in a combined cross-section time-series analysis, which makes it subject to many of the reservations evoked earlier with regard to pure time series studies.

56. The mistake would be analogous to the now well-understood error of inferring from different cross section propensities to consume that there will be a change in the aggregate propensity when all incomes increase proportionally over time.

57. This actually reduces to the trivial proposition that higher life-time income implies higher life time consumption; cf. Barro and MacDonald (1979), p. 288.

58. Another implication of this portfolio adjustment is that the increased demand for real assets (e.g. real estate) drives up the prices of these assets by more than the general price level increase, leading to capital gains for home owners. These holding gains constitute an addition to household net worth and may thereby depress saving ratios as conventionally measured.

59. The target ratio for various types of assets may of course in turn be sensitive to the inflation rate for reasons discussed above, cf. the preceding paragraph, point(b).
60. The argument can be conveniently demonstrated using a stylised demand function (cf. OECD, 1979)

\[ q = f(p/P, Y/P); f_1 < 0, f_2 > 0 \]

where \( q \) and \( p \) are the quantity and price of the product demanded, \( Y \) is money income, and \( P \) is the general price index. When shopping for \( q \), the individual will know his money income and will learn the exact price of \( q \). He will deflate both by \( P \), his expected general price level (the expected inflation index). If actual is higher than expected inflation, he will think (i) that the product \( q \) has become relatively more expensive which ceteris paribus should induce him to buy less (the Deaton or substitution effect of money illusion). But logically he should also think that his real income is higher than expected, which ceteris paribus should induce him to buy more (the Branson/Klevorick or income effect of money illusion). The net effect will depend on the relative size of the two effects.

61. See Hibbert (1983) for a more detailed discussion of inflation-induced holding gains or losses and household saving ratios.

62. This phenomenon has been extensively discussed in the context of inflation-induced real net worth effects by Jump (1980). In a closed economy, there is a symmetrical effect for the business and public sector net worth. The resulting effect on the saving ratios of these sectors need, however, not be symmetric, because the various sectors may - and are indeed likely to - react differently to symmetric changes in real wealth.

63. For a striking example of how sensitive empirical results may be to these factors compare the critical review by Campbell and Lovati (1979) of the Juster/Wachtel studies cited in Table 3-1.

64. Canada, Germany, Japan, the United Kingdom and the United States.

65. This truism hides the relevant question(s) of the causal relationship between government spending and tax revenues, the discussion of which is, however, beyond the scope of this paper.

66. See Annex Section A for the outline of a formal treatment of the following analysis in the LCH framework.

67. Other types of tax are not discussed explicitly in this study. However, in the LCH framework, a tax on bequests is equivalent to a tax on consumption in that it is a tax on the use of income, while a general wealth tax is equivalent to a tax on capital income which reduces the effective rate of return on household wealth.

68. The effect on the measured household saving ratio will nevertheless differ between those taxes, due to the SNA definition of the household saving ratio. The measured saving ratio under an income tax will exceed the saving ratio under an equal-yield consumption tax by \( t \) percent, where \( t \) is the rate of the income tax. This occurs because the denominator of the measured saving ratio is disposable income after direct taxes. (See Blades (1983) for a discussion of the importance of this effect in explaining cross-country differences in the household saving ratio.)

69. See, for example, Baxi (1974), p. 195 for estimates of the differential impact of various taxes on aggregate saving.

70. The interaction of inflation and a progressive tax structure exacerbates this effect.

71. An additional ambiguity arises from the fact that a tax on a single input alters the pre-tax rate of return to the taxed factor due to factor substitution. The effect on saving depends – inter alia – on the elasticities of factor substitution in production, and the supply elasticities of the various factors: cf. Feldstein, Poterba, Dicks-Mireaux (1981), for discussion and an estimate of this effect in the United States.

72. Moreover, the linkage between the distributable surplus at the level of the firm and the expected rate of return on equity at the shareholder level does not seem to be close, and it is the latter which is relevant for the household saving decision.

73. For the United States, Feldstein and Summers (1979) estimate the change in tax payments on corporate income caused by inflation, both at the level of the firm and the shareholder. Their estimates suggest a substantial decline in the real after-tax rate of return. Also see Feldstein, Poterba and Dicks-Mireaux, (1981), as well as Department of Finance, Canada (1980) and references quoted therein.
74. As shown by Tobin (1980), in a simple partial equilibrium framework a tax cut on saving (relative to consumption) will increase household saving only if the rate-of-return elasticity of saving is positive and exceeds the marginal propensity to consume.

75. In fact, much the larger part of gross business saving consists of capital consumption allowances. However, because the profits tax is imposed after the deduction of depreciation, this portion of business saving is not reduced by the tax. Only the timing of depreciation (and thereby taxes) is changed through such schemes as accelerated depreciation.

76. The business saving ratio is unity by definition.

77. See Break, (1974) pp. 194-197 for evidence on such an offsetting change in household saving. Note that the life cycle theory of saving implies equal marginal propensities to save out of all sources of income, and that the allocation of business profits between dividends and retained earnings would have no effect on total private saving under such conditions. See Feldstein and Fane (1973) for a discussion of alternative models of interaction between household consumption behaviour and capital income.

78. The precise relationship between the two types of income distribution is far from understood and is itself subject to economic policy parameters (i.e. the tax structure). Indeed even unambiguous measures of “equality” do not exist, and the various measures are sensitive to the length of the time period to which they are applied (both due to asymetric cyclical effects on distribution, and different time profiles of income over the life cycle for different households).

79. See Blinder (1975) for a formal proof. In technical terms this implies a non-homothetic utility function.

80. One implication of a non-unitary wealth elasticity of bequest would be the non-existence (or only asymptotic existence) of a steady state.

81. The intuitive explanation for this result given by Blinder is a reduced demonstration effect, i.e. relatively poor people trying to imitate the consumption patterns of the relatively rich. More convincingly he also argues that the measure of distribution used, by referring to income-earning people rather than total working-age population, may not be appropriate to test the hypothesis, given the important changes in participation ratios of different age-sex groups in the post-war United States.

82. Restricting their analysis to ten OECD countries, inequality seemed to affect aggregate consumption propensities negatively (as expected); the authors attribute this result to greater homogeneity of data within this sub-sample.

83. Coefficients of the distribution variable are of the expected sign but generally not statistically significant.

84. This latter component is still a rather heterogenous aggregate of (imputed) labour income of self-employed, property income, and entrepreneurial rents.

85. As pointed out above, this is not equivalent to testing that the size distribution of income influences aggregate consumption due to the uncertain relationship between the two distributions.

86. This corresponds to similar results obtained earlier by Taylor (1971).

87. According to Blinder (1975) about 66 per cent of all transfer payments went to income recipients in the lower half of the income distribution, who earned 17 (16) per cent of labour (property and entrepreneurial) income respectively.

88. The exception is the study by Barro and MacDonald (1979) which is based on regression analysis using pooled time series and cross-section (i.e. different-country) data. It is therefore the only study which includes cyclical indicators (e.g. the unemployment rate or annual GDP growth) as explanatory variables for the annual (rather than averaged) saving ratios.

89. This relatively low R², obtained by Barro and MacDonald, almost certainly reflects the fact that the pooled time series/cross-section data contain a certain amount of cyclical fluctuation and other time-series noise that is poorly explained by the right-hand-side variables.

90. The absence of a wealth-income ratio from all of the equations in Table 21 seems particularly disturbing unless it is assumed – as implied by the basic LCH – that there is a one-to-one relationship between the age distribution of households and the aggregate wealth/income ratio of the household sector.
91. This presentation of the life cycle hypothesis and its implication for an aggregate consumption function largely follows Ando and Modigliani (1963); the notation used is partly adapted from White (1978).

92. Equation (6) can be re-written as

\[ C_t^T = k^T v_t^T \]

where \( k^T = 1/\Delta_t \) is a variable which depends on the parameter set \( (p, r, d, T) \) and \( v_t^T \) is the discounted present value of all resources available to the household of age \( T \) at time \( t \). This is the presentation chosen by Ando-Modigliani, (1963), p. 57.

93. At this stage of aggregation Ando-Modigliani (1963) make the following simplifying assumptions:

i) households have the same utility functions and use the same discount rate (i.e. \( p, d, r \) are the same for all households);

ii) present and expected future earned income is constant and the same for all households;

iii) no bequest is either received nor left.

From this it follows that \( a_t^T \) is the same for all households of age \( T \), and equation (9) can be rewritten as

\[ C_t^T = k^T \left[ M^T a_t^T + M^T \left( Y_t^T \sum_{i=t}^{t+L-T} (1+r)^{t-i} \right) \right] \]

or simply

\[ C_t^T = k(T) A_t^T + b(T, r) Y_t^T \]

i.e. aggregate consumption of all households of age \( T \) is a homogenous linear function of aggregate wealth \( (A_t^T) \) and aggregate income \( (Y_t^T) \) of this group of households.

94. Ando-Modigliani (1963) propose an aggregate consumption function as (14) to test the LCH using US data. Given the significant change in the age composition of US households over the estimation period this specification does not correctly represent the LCH, apart from the question whether the other simplifying assumptions are justified or not. Cf. White (1978), p. 549.

95. Cf. Wan (1971), for a concise exposition of neoclassical growth theory.

96. These properties can be summarised as follows:

a) \( U' > 0, \ U'' < 0, \ U'(o) \rightarrow \infty \)

b) \( p' > 0, \ p'' < 0, \ p'(o) \rightarrow \infty \)

97. Where the two are equal, the corresponding steady state is known as the “Golden Rule” in the literature, cf. Phelps, (1966). The “Golden Rule” saving ratio maximises per capita consumption, but not necessarily per capita utility, in steady state.
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