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HOUSEHOLD SAVING, INTEREST RATES, INFLATION AND TAXATION: SOME CROSS-COUNTRY EVIDENCE

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HOUSEHOLD SAVING, INTEREST RATES, INFLATION AND TAXATION: SOME CROSS-COUNTRY EVIDENCE**

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Abstract

This paper reviews recent empirical evidence about household saving behaviour by using cross-country data from 17 OECD countries over the period 1979—1988. Despite large changes in household saving ratios in the 1980s saving behaviour can still be reasonably well modelled by using rather standard Euler equation and saving function specifications. With the pooled time series - cross section data inflation, real income growth and change in unemployment will affect the household saving ratio positively. There is also weak evidence that the nominal interest rate and the wedge between the borrowing rate and deposit rate will have a positive saving effect; these variables can be interpreted as describing complementary aspects of capital market imperfections. Finally, cross section evidence is mixed in terms of the life cycle hypothesis, but suggests that high marginal income tax rates tend to discourage household saving in the long run.

Keywords: household saving, interest rate wedge, taxation.

1 Introduction

After Modigliani and Brumberg had provided, in the early 1950s, seminal formulations of what has come to be known as the life cycle hypothesis of saving (LCH), it has been pursued by a number of authors, both at the theoretical level and for the analysis of empirical data (see Modigliani (1986) for a recent review of the approach). Early applications dealt with aggregate time series data, and later on it was argued that LCH is equally fruitful for an understanding of huge observed inter-country differences in the average household (and private) saving ratios. The approach was extended by Feldstein (1977) to account for social security and endogenous retirement age. According to the Modigliani-Feldstein hypothesis, the aggregate household (and private) saving ratio depends on the growth rate of income, various demographic variables, social security benefit variable and the labour force participation rate of the aged.

The early tests of LCH to account for inter-country differences in the average private saving - the sum of household saving and corporate saving - ratios were successful. Modigliani (1970) concluded his study with a sample of 36 countries from the 1950s by saying that ".. all the evidence supports both qualitatively and quantitatively the role of the two principal variables suggested by the life cycle model, productivity growth of income, and the age structure of the adult population" (Modigliani (1970), p. 219). Using a sample of 15 countries from the 1950s Feldstein (1977) introduced social security benefit and labour force participation rate of the aged - variables into the inter-country private savings ratio specification proposed by Modigliani. Feldstein's results provided support to this extended LCH (for a US time series evidence, see Feldstein (1974)).

Attempts to understand inter-country differences in saving ratios by using more recent data have been less successful. Using a sample of 12 countries from early 1970s Feldstein (1980) kept sticking to the 'social security depresses private saving' hypothesis by saying that ".. the new estimates support .. the conclusions .. that indicate .. the negative impact of social security benefits on private saving" (Feldstein (1980), p. 238). This claim, however, turned out to be very fragile to the specification details of the private saving ratio equation as indicated e.g. in Koskela and Virén (1983). Hence, the social security benefit variable's role in understanding international differences of the private saving ratios in the 1970s has remained moot.

A more recent research with the international cross section data from 23 countries both over the period 1968—1973 and the period 1978—1983 also casts some doubt on the ability of conventional life cycle and demographic variables a là Modigliani-Feldstein to account for the observed intercountry differences in household saving rates (see Koskela and Virén (1989)). Though it is possible to get a reasonable explanatory power, in particular, if sectoral saving substitution possibilities are taken into account there are sign, stability and insignificance problems, which seriously weaken the results.

As mentioned earlier, the time series data have also been used in studying saving behaviour since 1950s when LCH and the permanent income hypothesis (PIH) were proposed to explain the stylized facts presented originally by Kuznets. The conventional specification, where inflation played no role, worked reasonably well up to the 1970s. During that decade, however, high rates of inflation was accompanied by reduced real rates of return and high rates of household savings. Numerous theories were proposed to explain this phenomenon like the misperception hypothesis by Deaton (1977), the mismeasurement hypothesis (see e.g. von Ungern-Sternberg (1981), Jump (1980)) and the anticipated inflation hypothesis by Bulkley (1981).[1] It seems to be fair to say that despite considerable empirical research on the matter the issue of the relative significance of the above mentioned hypotheses was not resolved convincingly, though the inflation rate turned out to be an important explanatory variable.

The so-called Lucas-critique was important for the methodology of empirical research in the late 1970s. In the context of aggregate consumption Hall's (1978) contribution took the Lucas-critique seriously and was path-breaking. In particular he showed how under certain conditions the rational expectations hypothesis implies that only "surprise" in the permanent income should affect current consumption once lagged consumption is controlled for. Since then much research has been done in the specification and estimation of this so-called Euler equation approach to consumption behaviour, which links current and lagged consumption in the manner implied by the first-order conditions of a Fisherian intertemporal optimization problem. It is fair to say that the research done to date has not completely supported the econometric restrictions implied by the Euler equation approach. (See e.g. King (1985) and Hayashi (1985) for general surveys and Giovannini (1985) and Rossi (1988) for applications to developing countries.)

The dominance of the Keynesian perspective that consumption is determined largely by disposable income prevented the effect of the real

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[1]Deaton (1977) argued as follows: since no consumer is ever aware at any one instant of the prices which prevail for all goods he sometimes purchases and since consumer price indices are published after a delay, one can mistake an increase in the general price level for an increase in some relative prices. Hence, consumers purchase less of everything and unanticipated inflation results in (involuntary) saving. The observed relationship may largely be a statistical mirage, however. This is because income, as measured in national accounts, includes interest payments on financial assets, which is not really income at all during inflation. Thus measured savings tend to rise with inflation. One can also be shown that the practice of fixing nominal wages for a finite period can help to create a connection between household saving and anticipated inflation (Bulkley (1981)).

rate of return on saving from receiving much attention until well into the 1970s. Boskin's (1978) work sharply altered the debate over the interest elasticity of saving. He argued for the interest rate elasticity of .4, while additional studies (e.g. Fried and Hasbrouck (1983)) have found little or no effect. The econometric evidence has not, however, provided any clear concensus concerning the effect of the real after-tax rate of return on saving (for a recent survey, see Smith (1990), and Hall (1988)).

Another issue which is important for the design of tax policy is the question of whether the redistribution of taxes between corporations and individuals matter. This hinges on the question of whether there is a corporate veil or not. This has been studied e.g. by Feldstein (1973), Feldstein and Fane (1973) and Poterba (1987). Their conclusion from US and UK time series evidence indicates that although corporate saving is a substitute for personal saving, it is an imperfect substitute. The evidence from international data also supports this conclusion (see Koskela and Virén (1989)).[2] Another substitutability issue is whether there is a government veil or not. This has been discussed under the rubric of the Ricardian equivalence proposition which holds that the timing of government tax payments has no impact on an economy's level of national saving; if the government runs a budget deficit, consumers will anticipate the subsequent increase in taxes that will be necessary to repay the debt, and so will raise their saving. As a result private saving will rise to offset the decline in government saving leaving national saving unaffected. Empirically evaluation of the Ricardian equivalence has been difficult because there has been relatively little variation in deficits (see e.g. Carroll and Summers (1987), and Koskela and Virén (1985)). Most of the evidence, however, tends to refute the hypothesis suggesting that government saving is far from a perfect substitute for personal saving.

There are a few conclusions that can be drawn on the basis of this brief selective survey. First, cross-country studies have been carried out by not using the most recent data from 1980s. This data is particularly useful and interesting because capital market liberalization took place in many countries during that decade simultaneously with a fall in the inflation rate and a rise in the nominal and real interest rates. This period is also characterized in most countries by relatively large changes (decreases) in household saving rates. Second, the earlier research has been notable in the sense that it has not tried to incorporate taxes into the analyses of consumption and saving behaviour, though it is likely that taxation may affect via various channels. Finally, while liquidity constraints has been emphasized in the Euler equation literature (see e.g.

[2]Recently, by using US data Auerbach and Hassett (1989) have argued that previous tests for the existence of corporate veil have lagged proper focus, identifying influences of corporate saving on personal saving that are entirely consistent with a complete piercing of the corporate veil. Their Euler equation tests with US data reject the hypothesis of the existence of corporate veil.

Hall and Mishkin (1982), Flavin (1985)), it has not been emphasized very much in studies with international data (see, however, Jappelli and Pagano (1989)). In particular, the interest rate wedge - an important feature of capital market imperfection - may play some role in saving behaviour (see King (1986) for a theoretical analysis and some preliminary US and UK empirical evidence).

The purpose of this paper is to review recent empirical evidence on household saving behaviour by focusing on the question of how nominal and real interest rates, income taxes and eventual capital market imperfections as well as inflation have affected household saving behaviour in the 1980s. These factors are obvious candidates when searching for explanation for large decreases in household saving rates.[3]

The paper proceeds as follows. In Section 2 theoretical framework and specifications to be used are introduced and explained. The data and empirical results from annual cross-country data of 17 OECD countries over the period 1979—1988 are reported in Section 3. Finally, there is a brief concluding section.

[3]This is not to say that these are the only candidates. So e.g. the wealth effects associated with rising stock market and house values as well as improvements in the living standards of the elderly may have played an important role. Unfortunately, however, lack of international data prevents us from evaluating the potential role of these variables.

2 Theoretical Background for Empirical Analysis

Our approach in this paper is eclective in the following sense. Rather than trying to postulate a single "correct" model of household consumption and savings behaviour and fit complex structural models we use both the so-called Euler equation approach and the savings function specifications. The approaches are complementary to each other and by using both we avoid taking a stand in the question of what is the "correct" model to use. Though the Euler equation approach has certain advantages, the econometric evidence has not completely supported it. Therefore experimenting with another approach as well seems worthwhile.

2.1 The Euler Equation Approach

Assuming a constant real interest rate and a quadratic utility Hall (1978) showed that under the permanent income hypothesis consumption follows random walk; if rational agents maximize utility function, which is additive across periods, then all currently available information will already be included in current consumption. In the case of constant intertemporal elasticity of substitution ($u(c) = c^{1-(1/\sigma)}$, $\sigma > 0$) and allowing for a variable interest rate leads to

$$c_t = a_0 + a_1 c_{t-1} + a_2 r_t + u_t, \tag{1}$$

where c is the log of consumption, r the real rate of interest and u_t is the white noise error term. In (1) $a_1 = 1$ and $a_2 = \sigma =$ the intertemporal elasticity of substitution and should be positive. According to this agents defer more consumption when the reward for doing so is higher. This means that, ceteris paribus, higher interest rates last period reduce last period's consumption relative to current consumption, thereby raising the growth rate of consumption.

Much of the recent debate has centered on the observation by Flavin (1981) that consumption is excessively sensitive to anticipated changes in income in the sense that it has a positive and significant effect when included into the equation (1). This can be interpreted by supposing that some fraction of consumers face liquidity constraints. Consider an economy, where there are groups of agents, who receive income C_{1t} and C_{2t} and where the first group is liquidity constrained and consume their current income so that $C_{1t} = Y_{1t}$ and receive a fixed share λ of total income. If agents in the second group follow the Hall hypothesis, then the aggregate consumption can be written as

$$c_t = a_0 + a_1 c_{t-1} + a_2 r_t + a_3 \Delta y_t + u_t, \tag{2}$$

where $a_3 = \lambda$ and Δy indicates the log of real income and where $a_2 = (1-\lambda)\sigma$ (see e.g. Jappelli and Pagano (1989)). A problem with the income variable in equation (2) is that it is based on an assumption and does not directly measure liquidity constraints. The variable Δy_t can alternatively be interpreted as reflecting income innovations, which should affect consumption even in the presence of perfect capital markets. Finally, it should be pointed out that using the value of λ as an indicator of capital market imperfections is problematic. If $\lambda = 1$, we would basically have $\Delta c_t = \Delta y_t$ and, thus, the saving rate would be zero. But, on the other hand, one could argue for a strictly positive saving rate in this "liquidity constrained" situation. The presence of borrowing constraints will not in general lead to the simple Keynesian consumption behaviour $\Delta c_t = \Delta y_t$. Alternatively, one may use the unemployment rate U as a proxy for liquidity constraints (see e.g. Flavin (1985) and King (1985)).

Liquidity constraints, however, are not the only form of capital market imperfections. One can argue that the wedge between the borrowing rate and lending rate is potentially at least equally important and should be taken into account. This has been done recently by King (1986). More specifically, he assumes that agents' future endowments are uncertain and that lenders cannot observe the total amount borrowed by agents. By using otherwise similar assumptions than Hall (1978) King ends up with the nonlinear budget constraint which is characterized by the wedge between the borrowing and lending rate. Moreover, and importantly, since consumers are heterogenous in terms of future endowments, the "representative agent" assumption no longer holds; the aggregate Euler equation depends negatively on the wedge W and may be unstable over the business cycle when consumers may move from one regime to another.[4] In what follows we use the wedge as an additional

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[4]The idea here is simple. The wedge between the borrowing rate and the lending rate is a form of capital market imperfection; the higher this imperfection is, the lower is the willingness of consumers to borrow, ceteris paribus, and the higher is thus aggregate saving. In fact, the wedge is itself an endogenous variable. In what follows we do not, however, account for this complication. Recently, Charpin (1989a), (1989b) has also stressed the fact that particularly in the presence of capital market imperfections, heterogeneity of consumers (debtors, creditors and liquidity-constrained ones) prevents the modelling of aggregate consumption directly through a single representative agent. She has also presented numerical simulations of the life-cycle models with observed French labour income profiles representing several wage earner categories. The simulation results, reported in Charpin (1989b), support the wedge specification, while the perfect capital market specification leads to excessive indebtedness for all agents.

explanatory variable for simplicity and do not try to evaluate the possibility that coefficients of the aggregate Euler equation are functions of the wedge variable W.

Economic theory indicates that social security programmes - which vary widely across countries - may affect household saving in an number of ways, e.g. via taxes, wealth accumulation and retirement behaviour. Partly because there are some conflicting views about how social security should be modelled, economic theory does not give a clear answer concerning the effect of social security on household saving. Unfortunately, empirical analysis with international aggregate time-series and cross-section data has so far yielded unclear results (see e.g. Smith (1990) for a recent survey).

In order to control for potential social security programme effects we finally introduce social security variable S in a difference form as an additional explanatory variable. This can be interpreted as an innovation variable. Alternatively, to the extent that social security expenditures are known beforehand, i.e. they are perfectly predictable, then ΔS or the lagged S should not affect c in the Euler equation with perfect capital markets, while in the case of liquidity constraints predictable changes should affect consumption (see Wilcox (1989a)). Our data and framework does not allow us to distinguish between these two interpretations. One should also mention that if Ricardian equivalence holds, an even stronger conclusion follows: changes in social security benefits should have no effect on spending even if the changes are a surprise.

We can now write the extended Euler equation for consumption as follows

$$\begin{aligned} c_t = {} & a_0 + a_1 c_{t-1} + a_2 r_t + a_3 \Delta y_t + a_4 \Delta U_t + a_5 W_t \\ & + a_6 \Delta S_t + u_t, \end{aligned} \tag{3}$$

where U is the unemployment rate and where the following a priori signs can be expected: a_1, a_2, a_3, $a_6 > 0$ and a_4, $a_5 < 0$. As mentioned earlier, the sign of the ΔU term can result from the fact that a rise in unemployment means tightening liquidity constraints and thereby decreases consumption.

2.2 The Saving Function Approach

In addition to the Euler equation specifications we also use the saving function approach to shed additional light on saving and consumption behaviour. This means that we do not stop at the first-order conditions for utility maximization, but develop its qualitative implications for saving behavior. Here we start from the misperception hypothesis presented by

Deaton (1977). During the 1970s this turned out to be useful in understanding the relationship between the household saving and inflation. According to the misperception hypothesis economic agents have not sufficient information to distinguish between relative and general price movements, when both are changing simultaneously. Under these circumstances unanticipated inflation is misinterpreted as the rise in the relative prices of goods agents are currently buying, so that real saving increases. If we are prepared to assume constant real income and inflation expectations, then we can end up, after some steps, with the following basic specification

$$s_t = b_0 + b_1 s_{t-1} + b_2 \Delta y_t + b_3 \Delta p_t + e_t, \qquad (4)$$

where s is the households' saving ratio, p is the log of the price level, and e_t refers to the error term. In the specification (4) b_1, b_2, $b_3 > 0$ so that inflation and real income ("surprises") will have a positive effect on household saving ratio.

As we indicated earlier, the role of inflation in the household savings function can be justified in a number of other ways as well (see footnote 1). In the context of the Euler approach to consumption behaviour capital market imperfections of various types were proposed as important additional explanatory variables. The same goes here as well. Jackman and Sutton (1982) have shown how in the presence of liquidity constraints inflation should affect saving positively. The mechanism through which inflation can reduce consumption is by reducing the real amount of credit available in the economy. This happens if financial institutions do not adjust borrowing limits fully and instantaneously in line with inflation.[5]

Capital market imperfections may also have affected via other channels than via inflation. One can argue partly relying on King (1985) and on Wilcox (1989b) that the aggregate amount of liquidity constraint is associated with unemployment and nominal interest rate R. As either rises, liquidity constraints both bind more tightly on previously

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[5]This suggests that the role of inflation should depend negatively on the tightness of credit markets; the higher the fraction of liquidity constrained households, the higher should the coefficient estimate of inflation be in the savings function and vice versa! This is an interesting issue for further research. This suggests more generally, that there may be cyclical variations in the degree of credit rationing, which should be estimated by using variable - parameter estimation techniques. For an example of how to do this, see Ogawa (1990), who estimates cyclical variations in liquidity-constrained consumers by using aggregate time-series data from Japan. For recent micro evidence about liquidity constraints, see Zeldes (1989). Finally, one should mention, that household recognition that they may be subject to future constraints may also influence their current behaviour, even though they are not subject to binding liquidity constraints. Deaton (1989) has recently developed this view of savings as a "buffer stock" for contingencies, see also Koskela and Virén (1984).

constrained households and start to bind on more households; each aspect drives the consumption further below the unconstrained value obtained in the case of perfect capital markets. To the extent that financial institutions follow a practice of restricting consumer borrowing so as to keep current payments-to-current income ratios below some ceiling level, then a rise in the nominal interest rate and unemployment tend to increase the fraction of loan applications which are disapproved. The unemployment rate, particularly in a difference form ΔU, has another interpretation as a proxy for uncertainty (of course, this argument also applies to the Euler equation (3)).

Like in the case of the Euler equation approach we also control for the potential saving effects of social security programs by adding the change in social security variable ΔS into the savings function specification. This augmented savings function now reads

$$s_t = b_0 + b_1 s_{t-1} + b_2 \Delta y_t + b_3 \Delta p_t + b_4 R_t + b_5 \Delta U_t + b_6 \Delta S_t + e_t, \tag{5}$$

where b_1, b_2, b_3, b_4, $b_5 > 0$, while b_6 remains ambiguous a priori. If $b_4 = -b_3$, Δp_t and R_t can be replaced by the real interest rate, r_t.

Thus far we have neglected taxes altogether, though they may play a major role, in particular if we try to understand the long-term differences in the levels of household saving ratios across countries. Taxes may affect household saving at least via the after-tax rate of return on saving, via the tax deductibility of interest expenses on loans and by changing the after-tax income distribution.[6]

As for the rate of return channel, we have the conventional Slutsky equation ambiguity for savers; due to the conflicting substitution and income effects the rate of return and the tax rate affect saving a priori ambiguously. On the other hand, for borrowers, the substitution and income effects reinforce each other; a rise in the tax rate with deductibility will increase borrowing and thus have a negative effect on aggregate saving. Moreover, if the consumers are distributed into savers, borrowers and "from hand-to-mouth" consumers, a rise in the income tax rate - if it is interpreted as temporary - tends to decrease aggregate saving (see Koskela and Virén (1990) for details). The mechanism is the following one: a rise in the income tax rate will decrease aggregate savings by increasing willingness to borrow. It has an ambiguous or no effect on savers depending on whether the income tax rate affects the real after-tax rate of return or not. The effect clearly depends on the details of the tax code. Finally, a rise in the income tax rate tends to decrease

[6]For some evidence about the role of nominal interest rates in the US consumption function, see Blinder and Deaton (1985).

aggregate saving by shifting consumers from savers to "from hand-to-mouth" consumers, and from "hand-to-mouth" consumers to the group of borrowers. As a result, aggregate savings tends to decrease via these switching effects as well.

Unfortunately, it is difficult to incorporate all these considerations into the empirical analysis because of the lack of time-series data for some of the relevant variables. We do have some cross-section data on the degree of progressivity of the direct taxation available. So we can evaluate very crudely the saving effects of taxes by using the measure of progressivity as an additional explanatory variable in the cross-section specification for household saving. In the case of cross-section data (which we have from 14 OECD countries) we have to control for variables which vary widely across countries, but maybe be slowly moving in time-series. This kind of variable is the variable describing demographic structure of population. Another potentially important variable is self-employed persons as a percentage of total civilian employment. Self-employed persons often have an income level that varies to a greater extent than that of wage and salary earners. We would therefore expect to observe a higher saving ratio in a country with a higher fraction of self-employed persons. The household saving specification now reads

$$s_i = c_0 + c_1\Delta y_i + c_2\Delta p_i + c_3 P15_i + c_4 P65_i + c_5 OWN_i + c_6 TAX_i + v_i, \tag{6}$$

where P15 (P65) = the population aged 0—15 (65 and over) as a percentage of total population and OWN = self-employed persons as a percentage of total civilian employment. TAX describes the income tax variable and v_t is the error term. Now, Δy_t represents the growth effect of the LCH and Δp_t controls for (long-run) inflation effects like mismeasurement of saving under inflationary conditions. Now, we may assume that c_1, $c_2 > 0$ and while c_6 is generally ambiguous a priori and depends on the details of the tax code. It is likely, though, that $c_6 < 0$. It can be argued that saving should depend negatively on the ratio of retired person to total population as well as negatively on the ratio of the portion of population which has not yet reached working age to population (see Modigliani (1970)). On this account, both c_3 and c_4 should be negative. Finally, the effect of the self-employed persons' share should be positive (i.e. $c_5 > 0$).

After these considerations we next move on to consider empirical results using the specificatons (3) and (5) for time-series cross-section (pooled) data and the specification (6) for cross-section data.

3 Estimation Results

3.1 Data

Before turning to estimation results, some comments and explanation should be made about data and data sources we have used. Annual cross-country data from 17 OECD countries are used in this study. The data cover the period 1979—1988. The consumption and income variables are the following: CV = private consumption at current US dollar prices (national currencies are transformed to US dollars (USD) prices by using the sample average exchange rate as the denominator), C = private consumption at constant 1985 USD prices, P = the implicit price deflator of private consumption expenditure, i.e. P = CV/C, SH = households' net saving at constant USD prices, SG = the general government net saving in constant USD prices, SF = the corporate sector net saving in constant USD prices, YH = C+SH = households' (net) real disposable income at constant USD prices, YHT = YH+SF = households' real "broad" income at constant USD prices, c = ln(C), y = ln(Y); Y = YH or YHT, s = (SH/Y), and p = ln(P). The additional variables, in turn, are the following: U = the unemployment rate, S = the social security measure which is derived dividing the social security expenditure by GDP, R = nominal interest rate which corresponds to the government bond yield, r = the corresponding real interest rate which is simply R - Δp, W = RL-RD = the interest rate wedge RL being the borrowing rate and RD the deposit rate, POP = the estimate of mid-year population, P15 (P65) population aged 0—15 (65 and over) as a percentage of total population, OWN self-employed workers (i.e. employers and persons working on own account) as a percentage of total civilian employment, and, finally, the tax variables TAX1 the average income tax rate and TAX2 the Musgrave measure of income tax progressivity (see e.g. OECD Studies in Taxation (1990)).

The data sources are the following: for CV, C, SH, SG, SF, YH, YHT, and P: OECD National Accounts; Volume II: Detailed Tables (OECD 1990), for S: The Cost of Social Security; preliminary unpublished data for the 1980s (ILO 1990), for U, POP, P15, P65 and OWN: OECD Labour Force Statistics (OECD 1990), for R, RL, RD: International Financial Statistics: Yearbook 1990 (IMF 1990), and for TAX1 and TAX Income Taxation in OECD countries (OECD 1990).

3.2 Estimation Results

Before turning to consider estimation results of specifications (2), (3) and (6) we have to consider the issue of what is the proper income concept for the household sector in the light of empirical evidence. Clearly, an obvious candidate is the households' disposable income concept according to the standard System of National Accounts definition. It is not, however, quite clear whether we can simply disregard the saving which takes place in firms and in the public sector. It has been pointed out by Feldstein (1973) and Feldstein and Fane (1973) among others that corporate sector saving is to a large extent a substitute to personal saving. As pointed out by Koskela and Virén (1985), for example, a similar result might apply to public sector saving as well although the degree of substitution seems to be much smaller (see also discussion in Section 2).

This is why we first estimated a very simple old-fashioned consumption function of the type:

$$C_t = c_0 + c_1 YH_t + c_2 SF_t + c_3 SG_t + c_4 C_{t-1} + u_t, \tag{7}$$

where C denotes private consumption at constant prices (all prices being constant US dollar prices), YH households' real disposable income, SF corporate sector real saving and SG general government (i.e. public sector) real saving. The estimation results for this model given the cross-country data for 17 countries are reported in Table 1. The model was also estimated using individual country data. The corresponding results are reported in Appendix 1. The individual country results are qualitatively similar to those presented in Table 1. Still, it turns out the pooling restrictions in the case of pooled cross-country data with country dummies can be rejected. Unfortunately, the sample size with individual country data is so small that testing for pooling restrictions can be done only very roughly. Estimation is carried out by both the OLS and POOL estimators. In the latter case, a cross-sectionally heteroskedastic and time-wise autoregressive model is estimated (the autoregressive parameter is set either to zero or it is constrained to be equal for all countries).

The results indicate that the standard SNA concept of household disposable income does not seem to be the relevant concept. Here we have abstracted from potential mismeasurement of YH associated with inflation. Corporate sector saving seems to affect household consumption in the same way as personal income. The role of public sector saving is somewhat ambiguous. The effect is in some cases (in particular, when the data are weighted by population) negative. It is not at all clear what might explain this perverse result. One possible explanation has to do with taxes: an increase in income tax rate (which, ceteris paribus, increases public sector saving) might have a negative direct effect on private consumption (see Koskela and Virén (1990) for details).[7]

[7]Here we should point out the critique by Auerbach and Hassett (1989), see footnote 2. Thus, the results should be interpreted with caveats.

Although the results suggest that there is some amount of substitution between household saving, on the one hand, and corporate and public sector saving, on the other hand, one can clearly reject the hypothesis that this substitution is perfect. Thus, the parameter restriction $c_1 = c_2 = c_3$ could in all cases be decisively rejected.[8] However, the parameter restriction $c_1 = c_2$ managed much better. Still, in the case of the POOL estimator (and level-form data) also this restriction could be rejected. Therefore, we continue to work with SNA concept of household income (i.e. YH), but also in order to check the robustness of results we also carry out the analysis using the "broad" income concept YHT which equals to YH+SF.

The estimation results for the specification (3) are reported in Table 2a. The following features of the results merit attention. First, the equation fits the data very well and there are no obvious diagnostic problems. In particular, there seems to be no stability problems within the sample period 1979-1988 (cf. the coefficient estimates of the D84 dummy-variable). The coefficient of the lagged consumption is close to one. In fact, $(1\text{-}a_1)$ divided by the respective standard error is about 2 (in the case of the broad income concept the figure is still much smaller). Thus, it seems that the unit root restriction cannot be rejected. Therefore, we also present estimation results in terms of the growth rate of the consumption later on in Table 2b. Second, the coefficient of the real interest rate variable is positive and rather precisely estimated. As pointed out earlier, this lies in conformity with what one should expect on the basis of utility maximizing behaviour and means that the slope of the consumption growth path becomes steeper, when the real interest rate increases. In other words, the intertemporal elasticity of substitution is positive - the value of $(1\text{-}\lambda)\sigma$ being about 0.16 (however, if the private sector income innovations are used for Δy_t it is about 0.10). Thus, the "permanent income" consumers' elasticity of substitution σ is not completely insignificant as suggested by Campbell and Mankiw (1989). Third, the income variable - which can be interpreted either as a fraction of liquidity constrained consumers or as an income innovation term - is consistently positive and precisely estimated. The magnitude of the coefficient corresponds rather well to the results obtained by e.g. Campbell and Mankiw (1989, 1990) with postwar US data. The same is true for the difference in unemployment rate, which is consistently negative and mostly precisely estimated. Quite obviously, the use of OLS in estimating the coefficient of Δy_t is not appropriate and thus the tabulated coefficient estimates should be evaluated with proper care.

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[8] There is at least one serious problem with the cross-country results which are reported in Table 1. It is the fact when working with the level form data the implied long-run propensities to consume in some cases exceed unity. When the data are scaled by personal income this problem does not arise and, therefore, we tend to consider these scaled results as more reliable.

Table 1a. **Testing for the Relevant Income Concept: OLS Estimates**

	Aggregate data			Per capita data			Data scaled by YH		
	n.w.	√N	N	n.w	√N	N	n.w.	√N	N
YH	.605	.606	.570	.319	.535	.635	.283	.332	.345
	(18.914)	(19.173)	(17.685)	(7.380)	(13.349)	(18.527)	(7.370)	(7.681)	(7.530)
SF	.513	.521	.551	.277	.420	.483	.359	.507	.664
	(12.00)	(12.087)	(12.741)	(5.048)	(8.704)	(10.847)	(8.278)	(9.616)	(10.226)
SG	-.125	-.158	-.189	.125	-.085	-.157	.181	.007	-.165
	(-6.029)	(-8.650)	(-10.420)	(3.037)	(-2.766)	(-7.411)	(4.263)	(0.152)	(-4.334)
C_{t-1}	.436	.428	.457	.760	.562	.445	.712	.646	.618
	(13.45)	(13.692)	(14.608)	(18.726)	(14.260)	(13.366)	(16.721)	(13.431)	(12.180)
R^2	1.000	1.000	1.000	0.998	0.999	0.999	0.966	0.953	0.948
D-W	1.968	2.398	2.648	1.386	1.447	1.953	1.245	0.997	1.022
$\ln(\hat{L})$	-1645.64	-1796.78	-1974.76	149.46	138.93	46.67	507.14	467.93	348.67
$\hat{h}$	46.77	0.04	0.00	0.00	0.00	49.24	0.00	0.00	0.00
LRY	10.16	16.59	77.73	55.98	6.14	1.21	13.68	0.43	0.01
D84	-0.21	-0.90	-2.74	2.09	0.10	-2.11	5.05	7.17	8.86

Numbers in parentheses are t-ratios. $\ln(\hat{L})$ is the maximized value of the log likelihood function, $\hat{h}$ the percentage marginal probability of Durbin's h-statistic and LRY the percentage marginal probability for the null hypothesis $c_1 = c_2$. D84 denotes a t-test statistic for the coefficient of an additional dummy variable which is equal to 0 for 1979–1983 and 1 for 1984–1988. The dependent variable is private consumption expenditure at constant 1985 prices which is expressed either in aggregate (US dollar) form, in per capita (U.S. dollar form) or scaled by households' real disposable income (YH). All equations also include 17 country intercepts (i.e. dummies) which are not, however, reported. When the data are scaled by YH, the coefficient estimated of YH (which is reported above) is derived from the coefficient estimates of the country intercepts. n.w. indicates that the data are unweighted, √N that the data are weighted by the square root of population and N that the data are weighted by population.

Table 1b. **Testing for the Relevant Income Concept: POOL Estimates**

	Aggregate data		Per capita data		Data scaled by YH	
YH	.511	.510	.452	.408	.387	.314
	(15.514)	(15.457)	(11.185)	(10.762)	(10.410)	(9.100)
SF	.367	.366	.262	.269	.326	.354
	(9.770)	(9.726)	(6.896)	(8.147)	(7.636)	(9.418)
SG	-.048	-.466	.104	.083	.167	.170
	(-1.563)	(-1.521)	(2.569)	(2.222)	(3.726)	(4.074)
C_{t-1}	.555	.555	.623	.684	.596	.678
	(16.774)	(16.774)	(16.548)	(19.198)	(14.546)	(17.752)
R^2	1.000	1.000	0.999	0.999	0.944	0.967
D-W	1.320	1.329	1.579	1.230	1.493	1.138
$\hat{\rho}$	.008	0	.321	0	.370	0
$\ln(\hat{L})$	-1519.82	-1519.44	197.92	189.62	540.94	527.10
$\hat{h}$	0.17	0.21	18.83	0.06	2.46	0.00
LRY	0.53	0.13	0.13	0.84	21.06	37.04
D84	-0.47	-0.47	1.55	2.19	3.96	5.18

Notation is the same as in Table 1a. Now, only ρ is the first-order autoregressive parameter which is used in the Cochrane-Orcutt Procedure. R^2 is here Buse's R-square.

Table 2a. **Cross-Country Estimation Results for the Unrestricted Euler Equation**

	Narrow income concept					Broad income concept				
	n.w.	√N	N	POOL	POOL	n.w.	√N	N	POOL	POOL
c_{-1}	.969	.975	.977	.962	.963	.983	.989	.996	.974	.979
	(52.18)	(77.08)	(104.13)	(62.88)	(63.64)	(51.04)	(80.09)	(110.89)	(59.66)	(64.68)
r	.163	.155	.219	.162	.163	.108	.030	.089	.117	.120
	(3.17)	(3.73)	(6.41)	(3.53)	(3.57)	(1.94)	(0.68)	(2.24)	(2.29)	(2.40)
Δy	.409	.526	.596	.413	.413	.254	.413	.492	.277	.269
	(5.95)	(7.44)	(7.92)	(7.74)	(7.74)	(5.29)	(8.10)	(8.97)	(6.81)	(6.42)
ΔU	-.876	-.679	-.594	-.803	-.808	-.984	-5.94	-.509	-.877	-.917
	(6.11)	(5.28)	(4.57)	(7.87)	(7.94)	(7.00)	(5.94)	(4.02)	(8.31)	(8.78)
W	-.015	-.028	-.176	.014	.014	-.020	.027	-.072	.044	.041
	(0.19)	(0.35)	(1.75)	(0.25)	(0.25)	(0.24)	(0.35)	(0.75)	(0.64)	(0.62)
ΔS	-.013	.259	.675	.088	.092	.015	.226	.600	.081	.111
	(0.11)	(2.04)	(4.44)	(0.74)	(0.78)	(0.12)	(1.84)	(4.13)	(0.69)	(0.91)
$\hat{\rho}$	0	0	0	.020	0	0	0	0	.139	0
R_2	1.000	1.000	1.000	1.000	1.000	.999	1.000	1.000	1.000	1.000
SEE	1.361	1.084	0.882	..	..	1.389	1.058	0.847	..	..
D-W	2.043	2.041	2.190	1.840	1.815	1.697	1.848	1.823	1.843	1.680
h	27.49	37.67	1.08	37.55	39.15	2.12	17.83	22.04	35.93	25.01
t_s	-0.94	-2.34	-2.67	-1.27	-1.28	-1.03	-2.33	-3.33	-1.65	-1.81
D84	0.18	0.76	1.28	-0.31	-0.31	-0.23	0.07	1.63	-0.82	-0.73

Numbers in parentheses are t-ratios. The dependent variable is the log of private consumption (c) in per capita terms and in US dollars. t_s denotes the t-ratio for the lagged S-variable which is included in the estimating equation instead of ΔS. The narrow concept of income corresponds to households' real disposable income while the broad concept also includes corporate and public sector real saving. All equations also include 17 country dummies which are not, however, reported. The number of observations is 170. The coefficients of r, ΔU, W and ΔS have been multiplied by 100. Also the standard errors of estimate (SEE) have been multiplied by 100.

Table 2b. **Cross-Country Estimation Results for the Restricted Euler Equation**

	Narrow income concept					Broad income concept				
	n.w.	$\sqrt{N}$	N	POOL	POOL	n.w.	$\sqrt{N}$	N	POOL	POOL
r	.125	.131	.208	.113	.114	.084	.018	.085	.084	.091
	(2.67)	(3.25)	(6.05)	(2.76)	(2.80)	(1.70)	(0.40)	(2.20)	(1.83)	(2.05)
Δy	.415	.520	.579	.414	.415	.262	.417	.495	.280	.272
	(5.99)	(7.30)	(7.66)	(7.51)	(7.51)	(5.51)	(8.17)	(9.06)	(6.86)	(6.50)
ΔU	-.808	-.600	-.490	-.714	-.718	-.941	-.671	-.480	-.823	-.867
	(5.80)	(4.81)	(3.87)	(6.97)	(7.03)	(7.05)	(5.99)	(4.18)	(8.01)	(8.63)
W	-.043	-.050	-.184	-.013	-.713	-.036	.016	-.081	.026	.027
	(0.55)	(0.63)	(1.81)	(0.21)	(0.21)	(0.45)	(0.20)	(0.84)	(0.37)	(0.40)
ΔS	-.041	.217	.585	.040	.043	.000	.210	.589	.551	.086
	(0.36)	(1.72)	(3.92)	(0.33)	(0.36)	(0.00)	(1.72)	(4.18)	(0.46)	(0.71)
$\hat{\rho}$	0	0	0	.015	0	0	0	0	.134	0
R_2	.607	.687	.752	.715	.719	.595	.706	.777	.680	.718
SEE	1.372	1.094	0.896	..	..	1.392	1.123	0.849	..	..
D-W	1.898	2.055	2.167	1.831	1.812	1.715	1.854	1.812	1.865	1.700
t_s	-1.56	-2.79	-2.97	-1.56	-1.55	-1.30	-2.43	-3.08	-1.90	-1.99
D84	-0.92	-0.90	-1.25	-1.82	-1.81	-0.73	-0.56	0.61	-1.62	-1.42

Numbers in parentheses are t-ratios. The dependent variable is the log difference of private consumption (Δc). For other details, see Table 2a.

Unfortunately, because of the data, more appropriate IV estimation could not carried out.

Fourth, while the earlier results are sensitive neither to whether the narrow or broad income concept is used - though we marginally prefer the narrow concept - nor to the question of whether data is unweighted or weighted by population, the remaining results are slightly sensitive to the weighting procedure of country observations. The interest rate wedge variable is consistently negative, but not very precisely estimated. Its sign is, however, what one should expect a priori; the higher the interest rate wedge, ceteris paribus, the steeper the slope of the consumption path. Thus we have some evidence, though very weak, for the potential role of the wedge variable according to which the higher the wedge, the higher the household saving. Finally, as for the social security variable, it is also sensitive to the weighting procedure of country observations. It is mostly positive; a way to interpret this is to say that social security expenditures have a similar effect as households' real disposable income. Of course, we cannot say what is exactly the reason for this result - partly because we cannot say whether the nonzero social security effect is related to the behavior of the "permanent income" consumers or the "rule of thumb" consumers (see discussion in section 2.2). If the ΔS-variable is replaced by S_{-1} (i.e. by the lagged social security measure) the coefficient turns out to be negative, although not always statistically significant. The result is somewhat perverse (for instance, if it is compared with Wilcox's (1989a) results), though the roughness of the proxy for S should be kept in mind.

The estimation results, reported in Table 2b, where the dependent variable is the log difference of private consumption, are very similar to those presented in Table 2a.[9] But it is not completely obvious whether the results can be interpreted from the Euler equation point of view. The consumption and saving function specifications - as distinct from the first-order conditions for utility maximization - lead partly to similar specifications.[10] Therefore, it is useful to look at data from a slightly different angle. This is done by estimating the saving function specification (5). The respective results with pooled cross-country data are presented in Table 3. The results with individual country data, where the saving function includes s_{-1}, Δy, Δp and ΔU are reported in Appendix 2. They are qualitatively similar to those presented in Table 3. Unfortunately, due to the small degree of freedom, testing for pooling restrictions in this case is not very meaningful. The following features of results in Table 3 merit attention: first, the results indicate that household saving behaviour can reasonably well be modelled using the augmented saving rate equation (5). The only diagnostic caveat concerns parameter stability. Particularly the POOL estimation results suggest that household saving behaviour might have changed in the late 1980s after financial market liberalization, though the overall evidence is not very strong. Second, both inflation and real income growth are precisely estimated and affect the saving ratio positively. This is in line with the misperception hypothesis by Deaton (1977), but of course does not eliminate other interpretations for the inflation variable. The inflation rate seems at least partially to explain the fall in the saving ratios in the late 1980s, but the explanation is far from sufficient as one can see by looking at the individual country results. Third, the coefficient of the unemployment variable is significantly positive; it can be interpreted either as a proxy for income uncertainty, which should increase precautionary saving, or as a channel for liquidity constraints in the way which has been explained in Section 2.2. Fourth, and important, the nominal interest rate affects the saving ratio positively and is statistically significant. This also lies in conformity with the liquidity constraint interpretation; to the extent that financial institutions follow a practice of restricting consumer borrowing so as to keep payment-to-income ratios below some ceiling level, a rise in

[9]In addition to these innovation variables we also experimented with some demographic variables, P15, P65 and OWN but the coefficients of these variables turned out to be completely insignificant and thus they are not reported here. A complete set of results is available from the authors upon request.

[10]Take into account that (approximately) $s = \Delta y - \Delta c$. Thus, one should expect that there is a close relationship between the Euler equation and the misperception specification of the saving function.

nominal interest rates tends to increase the fraction of loan applications, which are rejected. Hence, the saving goes up. Notice also that the results do not support the idea that inflation and the nominal interest rate just represent the real interest rate variable. The respective parameter restrictions can be clearly rejected (cf. the LR_r test statistic). Finally, as for the social security variable, here as earlier in the context of the Euler equation approach, the results are sensitive to the weighting procedure of country observations; there is some weak evidence for the negative relationship between the household saving ratio and the social security variable.

Table 3. **Cross-Country Estimation Results for the Saving Function**

	Narrow income concept					**Broad income concept**				
	n.w.	√N	N	POOL	POOL	n.w.	√N	N	POOL	POOL
s_{-1}	.750	.652	.518	.706	.732	.768	.719	.643	.766	.789
	(18.31)	(17.17)	(14.74)	(17.83)	(19.72)	(19.72)	(18.31)	(19.68)	(21.59)	(24.78)
Δy	.548	.471	.462	.535	.529	.628	.502	.435	.601	.613
	(9.97)	(9.56)	(10.37)	(12.47)	(12.40)	(16.35)	(12.81)	(12.46)	(19.13)	(19.96)
Δp	.172	.225	.296	.188	.189	.152	.158	.223	.151	.155
	(4.61)	(7.80)	(14.04)	(5.80)	(6.17)	(3.97)	(4.48)	(8.38)	(4.62)	(5.00)
R	.074	.064	.068	.081	.062	.012	.024	.024	.020	.012
	(1.19)	(1.66)	(2.45)	(1.68)	(1.37)	(0.19)	(0.58)	(0.84)	(0.40)	(0.25)
ΔU	.606	.529	.557	.473	.496	.502	.348	.234	.387	.427
	(5.22)	(6.17)	(7.82)	(5.41)	(5.78)	(4.44)	(4.02)	(3.17)	(4.50)	(5.02)
ΔS	.065	-.152	-.352	-.021	-.059	.056	-.107	-.306	.025	-.019
	(0.72)	(1.78)	(3.97)	(0.25)	(0.67)	(0.61)	(1.18)	(3.31)	(0.28)	(0.21)
$\hat{\rho}$	0	0	0	.141	0	0	0	0	.188	0
R^2	.978	.982	.987	.977	.982	.972	.978	.986	.975	.983
SEE	10.63	7.33	5.08	..	..	10.63	7.85	5.33	..	..
D-W	1.741	1.929	2.123	1.822	1.650	1.578	1.605	1.692	1.768	1.530
h	5.47	40.83	14.39	40.51	28.05	0.09	0.16	1.40	42.42	7.72
t_s	-0.27	2.06	1.71	1.57	1.88	0.56	3.42	4.65	2.57	2.85
LR_r	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.04	0.02
D84	0.63	1.94	1.89	2.93	3.19	0.53	1.49	1.28	3.46	3.57

Numbers in parentheses are t-ratios. The dependent variable is the saving ratio (s). LR_r denotes a LR test statistic for the hypothesis that the coefficients of Δp and R correspond to the real interest rate variable (the reported numbers are percentage marginal probability values). For other details, see Table 2.

Earlier we discussed the potential role of taxation in the determination of household saving behaviour. Unfortunately, lack of time-series data prevents us from incorporating tax variables into the pooled time series-cross section data we have used. We have available limited cross section data from 14 OECD countries concerning the income tax variable.

In the case of aggregate data the average marginal tax rate would be the relevant income tax variable. In what follows we use both the average tax rate and Musgrave's progressivity measure[11] as alternative proxies for the average marginal tax rate. The estimation results from the cross section household saving specification (6) are reported in Table 4.

According to estimation results, demographic variables are both significant and of sign that can be expected a priori; the higher the fraction of both young and old population from the total population, the lower the household saving ratio, ceteris paribus. This finding lies in conformity with the prediction of LCH by Modigliani (1970), (1986). Similar finding is reported in Koskela and Virén (1989) from a larger sample of countries both in the early 1970s and in the early 1980s so that this seems to be a rather robust result. While the coefficient estimates of DEP and RET are of correct sign in terms of the LCH, they are unreasonably high, particularly if one intends to intrepret them as independent variables. But this is clearly not the case because DEP, RET and population aged 16–64 (as a percentage of total population) sum up to unity. Thus, in the data sample the coefficient of correlation between DEP and RET is -.71 which indicates a multicollinearity problem. If one of these variables is dropped the coefficient of the remaining variable decreases dramatically and the corresponding t-ratio fails to exceed the standard crititical values (see e.g. equation (2) in Table 4). Also the self-employed persons' employment share variable OWN behaves in an intuitively expected way. The corresponding coefficient is systematically positive suggesting that these persons tend to save more.

What does not lie in conformity with the prediction of LCH is the negative sign of the income growth variable, though here the evidence is relatively weak.[12] Similar effects with larger cross section data were found in Koskela and Virén (1989), (1990). Inflation does not work so well as in the case of pooled data; from the viewpoint of the misperception hypothesis this is understandable. There is no particular reason why inflation should matter in the long run. The weak inflation effect in the cross section data may have to do with the mismeasurement of real income under inflation. Finally, the income tax variable is

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[11]See Norregaard (1990) and OECD Studies in Taxation (1990). Musgrave's progressivity measure is based on the Gini coefficient and is defined as follows

$$EP = (1-G^a)/(1-G^b)$$

where G^a is the Gini coefficient of after-tax income and G^b is the Gini coefficient of before-tax income. By this measure, if EP > 1, the tax is progressive, the marginal tax rate being higher than the average tax rate.

[12]Thus this finding does not support Modigliani's (1986) claim that "By now it is generally accepted that growth is a major source of cross-country differences in the saving rate", Modigliani (1986), p. 303.

consistently negative, but in the case of Musgrave's measure of income progressivity it is not precisely estimated. Table 4 thus provides some weak evidence for the view, that the higher the marginal income tax, the lower the household saving. Similar type of evidence for the role of tax incentives for US and Canada savings have been presented by Carroll and Summers (1987). This suggests, while it does not fully demonstrate, that taxation which has thus far been mostly neglected, may be an important determinant of the cross country differences in the levels of household saving rates.

Table 4. **Saving Function Estimates with Cross Section Data**

	(1)	(2)	(3)	(4)	(5)	(6)
Const.	.813	.148	.866	1.010	.831	1.042
	(5.32)	(1.44)	(1.85)	(4.14)	(7.82)	(5.43)
P15	-2.191		-2.122	-2.543	-2.304	-2.721
	(4.70)		(3.51)	(3.87)	(7.80)	(5.85)
P65	-1.984	-.381	-2.299	-2.550	-2.160	-2.747
	(3.87)	(0.57)	(3.31)	(3.55)	(5.83)	(4.80)
OWN	.349	.334	.395	.221	.436	.162
	(2.33)	(1.26)	(1.75)	(0.86)	(6.43)	(0.68)
TAX	-.299	-.263	-.083	-.340	-.219	-.270
	(2.51)	(1.26)	(0.24)	(2.32)	(2.21)	(2.40)
Δy				-1.998		-1.775
				(1.39)		(1.39)
Δp				.189		.476
				(0.35)		(1.01)
R^2	.824	.390	.702	.862	.920	.938
SEE	2.557	4.51	3.33	3.33	1.37	1.37

Numbers in parentheses are t-ratios. The dependent variable is the saving ratio (s). The average income tax rate is used in equations (1)–(2) and (4)–(6) while Musgrave's measure of income tax progressivity is used in equation (3). The data are sample averages for 1979—1980. Unweighted data are used in equations (1)–(4) while with equations (5)–(6) the data are weighted by the square root of population.

4 Concluding Remarks

In this paper we have used cross-country data from 17 OECD countries over the period 1979—1988 to review recent empirical evidence about the determinants of household saving behaviour. We have estimated both the Euler equation and the saving function specifications by using the pooled time series-cross section data as well as the cross section data. In addition to conventional variables we have evaluated the potential role of the interest rate wedge, the nominal interest rate and proxy variables for liquidity constraints like income and unemployment. We have also made a preliminary evaluation of the role of income taxation as a long-term determinant of the household saving ratio.

The main features of results can be summarized as follows: First, despite large institutional changes in the functioning of capital markets as a result of liberalization the households consumption and saving behaviour in the 1980s can still be reasonably well modelled using rather standard Euler equation and saving function specifications. Second, as for the Euler equation results in the case of pooled data, the real rate of interest and the change in the real income affect consumption positively, while the change of unemployment negatively. This means that the slope of consumption path becomes steeper, when the real rate of interest rises.[13] The income and unemployment variables can be - but need not - interpreted as reflecting liquidity constraints. Very importantly we have used the interest rate wedge between borrowing and deposit rate as a proxy for capital market imperfection; week evidence has been found for the hypothesis according to which the higher the wedge, the higher the household saving.[14]

As for the saving function specifications both inflation and real income growth are precisely estimated and positive which is in line with the misperception hypothesis by Deaton (1977) but does not eliminate other interpretations.[15] The unemployment rate affects saving positively. The new finding here is that the nominal interest rate affects the

[13]According to the estimation results, the intertemporal elasticity of substitution is about 0.3. This finding implies that the uncompensated rate of return elasticity is negative. In the case of the saving function specification, however, the use of the real interest rate variable is not appropriate. See Sheshinski and Tanzi (1989) for another explanation of it.

[14]The issue of whether consumers are liquidity constrained or not is very important from the policy point of view. See e.g. Hubbard and Judd (1986) for an interesting analysis of some of the policy issues associated with the tax policy.

[15]For the Euler equation Koskela and Virén (1987) has presented evidence for the role of inflation as well. A way to interpret this is to introduce money in the utility function as in Charpin (1989a).

household saving ratio positively, which also lies in conformity with liquidity constraint interpretation; to the extent that financial insitutions follow a practice of restricting consumer borrowing so as to keep payment-to-income ratios below some ceiling level, a rise in nominal interest rate increases the rejected fraction of loan applications and thereby raises saving. Finally, the cross section-time series country data evidence is partly in line with LCH - in the case of the demographic variables - and partly contradicts it - in the case of the income growth variable. Moreover, cross section data provides some weak evidence for the hypothesis that the marginal income tax tends to affect the level of household saving negatively.

Appendix 1

Individual Country Estimation Results for Equation (7)

	Const.	C_{-1}	YH	SF	SG	R^2	SEE	D-W
Australia	-2.407	.515	.749	-.112	.071	.994	.033	3.306
	(4.31)	(6.75)	(6.51)	(1.27)	(1.08)			
Austria	.724	.527	.342	-.028	-.226	.977	.076	2.831
	(0.99)	(1.93)	(1.41)	(0.03)	(0.61)			
Belgium	2.356	.384	.219	.548	.193	.976	.062	2.660
	(2.03)	(1.25)	(1.27)	(2.67)	(0.81)			
Canada	-2.561	.684	.518	.534	-.213	.986	.099	3.252
	(2.84)	(2.65)	(1.79)	(3.92)	(1.28)			
Finland	-1.828	-.067	1.189	.323	.600	.992	.081	1.631
	(2.70)	(0.15)	(2.59)	(1.47)	(1.63)			
France	-2.003	.648	.548	.259	-.159	.995	.042	2.403
	(2.66)	(6.81)	(4.34)	(2.46)	(1.35)			
Germany	.013	.378	.524	.434	.500	.984	.065	1.614
	(0.02)	(1.34)	(2.59)	(1.14)	(1.58)			
Italy	-.115	.557	.406	.766	.503	.998	.029	2.528
	(0.21)	(8.23)	(4.42)	(6.74)	(3.06)			
Japan	-1.672	.134	.925	.031	-.069	.994	.058	2.240
	(1.73)	(0.56)	(3.24)	(0.07)	(0.29)			
Netherlands	-.945	.083	.921	.061	.630	.956	.058	2.715
	(1.08)	(0.37)	(4.65)	(0.39)	(3.14)			
Norway	-2.602	.596	.727	-1.085	.620	.964	.178	2.356
	(1.09)	(2.95)	(1.51)	(1.60)	(1.95)			
Portugal	-1.152	.690	.598	.226	.114	.983	.022	1.840
	(3.89)	(5.58)	(4.91)	(3.75)	(0.78)			
Spain	-1.218	.376	.849	.043	-.387	.988	.028	2.440
	(2.11)	(1.62)	(4.67)	(0.30)	(1.62)			
Sweden	-1.503	.627	.509	.493	.298	.950	.137	2.113
	(0.44)	(2.18)	(1.52)	(1.48)	(1.23)			
Switzerland	8.173	-.395	.519	.482	.343	.989	.052	2.424
	(3.93)	(1.13)	(3.47)	(2.30)	(1.43)			
U.K.	-1.722	.486	.718	.489	.433	.997	.053	2.331
	(1.49)	(1.93)	(1.97)	(3.09)	(1.10)			
U.S.A.	-.998	.528	.509	.632	-.278	.998	.052	3.067
	(2.12)	(3.01)	(2.61)	(2.63)	(2.90)			

Numbers in parentheses are t-ratios. The dependent variable is per capita consumption expenditure at constant 1985 prices (C). The sample size is 10 (i.e. 1979—1988) for all 17 countries. Because of the exceptionally small sample size the results should be evaluated with extreme caution. This is also true in terms of the Durbin-Watson autocorrelation test statistics (D-W) which are already otherwise biased due to the lagged dependent variable (C_{-1}).

Appendix 2

Individual Country Estimation Results for the Saving Function

	Const.	s_{-1}	Δy	Δp	ΔU	R^2	SEE	D-W
Australia	.005	.887	.346	-.110	.353	.953	.453	2.685
	(0.42)	(7.46)	(3.14)	(0.58)	(2.61)			
Austria	.028	.577	.551	.071	-.315	.726	1.203	2.273
	(0.82)	(2.19)	(1.88)	(0.22)	(0.37)			
Belgium	.081	.173	.804	.417	1.019	.963	.434	2.377
	(5.19)	(1.46)	(7.69)	(3.40)	(4.78)			
Canada	-.010	.785	.803	.238	1.129	.973	.602	2.683
	(0.54)	(7.08)	(5.13)	(2.74)	(4.90)			
Finland	-.060	1.363	.580	.219	.028	.939	.762	2.543
	(4.29)	(4.97)	(4.07)	(1.82)	(0.06)			
France	.006	.662	.421	.259	-.070	.986	.433	2.660
	(0.64)	(5.59)	(4.12)	(2.82)	(0.22)			
Germany	.034	.620	.357	.194	.197	.553	.698	2.139
	(0.62)	(1.27)	(1.00)	(1.28)	(0.23)			
Italy	.026	.573	.455	.286	1.289	.948	1.041	1.766
	(0.99)	(3.10)	(2.28)	(2.17)	(1.28)			
Japan	.087	.294	.521	.519	2.478	.931	.430	2.343
	(4.49)	(2.59)	(1.98)	(3.93)	(2.54)			
Netherlands	.041	.668	.387	-.152	.971	.836	.610	1.963
	(1.26)	(3.01)	(2.23)	(1.01)	(4.11)			
Norway	-.041	.773	.643	.272	3.241	.859	2.407	2.430
	(1.48)	(4.58)	(1.05)	(0.75)	(2.14)			
Portugal	.045	.609	.511	.285	.605	.893	.865	2.574
	(0.52)	(2.28)	(3.65)	(2.37)	(0.54)			
Spain	.028	.280	.426	.202	.291	.740	.467	2.168
	(1.26)	(1.02)	(1.73)	(1.66)	(0.87)			
Sweden	-.005	.878	.480	-.042	2.666	.713	2.019	1.996
	(0.26)	(2.66)	(0.97)	(0.26)	(1.10)			
Switzerland	-.048	1.170	.819	.422	.659	.964	.520	2.043
	(2.05)	(7.32)	(3.73)	(2.63)	(0.69)			
U.K.	-.036	1.241	-.131	.263	-.845	.971	.797	1.996
	(2.91)	(5.27)	(0.43)	(2.85)	(1.39)			
U.S.A.	-.003	.524	.676	.378	.590	.934	.470	3.311
	(0.20)	(3.31)	(3.29)	(4.71)	(2.11)			
OECD	..	.747	.541	.197	.657	.978	1.063	1.811
		(18.27)	(9.81)	(6.39)	(5.98)			

Numbers in parentheses are t-ratios. OECD denotes OLS estimates with pooled cross-country data using 17 country dummies. The dependent variable is the saving ratio (s). The sample size is 10 (i.e. 1979—1988) for all 17 countries. Because of the exceptionally small sample size the results should be evaluated with extreme caution. This is also true in terms of the Durbin-Watson autocorrelation test statistics (D-W) which are already otherwise biased due to the lagged dependent variable (s_{-1}). The standard errors of the estimate have been multiplied by 100.

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