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Saving Decisions and Fiscal Incentives: A Spanish Panel Based Analysis*

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Abstract

The objective of this paper is to examine the response of fiscally incentivated savings to income, wealth and a series of individual characteristics. We use a multiple steps estimation strategy. Our dependent variable is double censored. Therefore, we first apply a Tobit technique to predict desired savings, year by year. Then we stack these predictions and build a system of simultaneous equations that is estimated taking into consideration individual effects and cross-equation correlations induced by panel temporal structure and measurement errors in the dependent variables.

1 Introduction

Empirical studies of household saving behavior have focused primarily on the total level of savings rather than its allocation among different types of assets. There are, however, a few empirical studies of the composition of household portfolios using individual data. For example, Blume and Friend (1975), Feldstein (1976), and Projector and Weiss (1966) used the 1962 Federal Reserve Board data and Uhler and Cragg (1971) used data from the 1960-62 Michigan Surveys of Consumer Finances. King and Leape (1984) use the 1978 Survey of Consumer Finances Decisions conducted by SRI International. Also, Venti and Wise (1986) analyze IRA savings with the 1983 Survey of Consumer Finances, and so do Feenberg and Skinner (1989), using the IRS/University of Michigan tax payer sample for income tax returns during 1980-84.

The purpose of this study is to find and quantify the relationship between fiscally incentivated savings and a set of explanatory variables such as disposable income, wealth, marginal tax rates and several household characteristics, for a comparatively large period of time[1].

Governments forego an important amount of taxes in order to stimulate certain types of household savings. In Spain, tax incentives are basically oriented to housing and life and retirement insurance related saving[2]. If one looks at the characteristics these assets have in common, it becomes clear that the focus of the policy is to encourage people to attain a certain level of income in the future, stimulating them to do some precautionary saving to face uncertainty; or simply to offset the impatience of certain households. The nature of the incentivated assets and particularly their lack of liquidity does not let us consider them as perfect substitutes of other types of assets. Their impact on the supply of loanable funds is also small compared to other assets.

Whether the consequence of tax incentives is simply the substitution between incentivated and non incentivated assets, or whether there is a net increase in total savings is a relevant question that has been addressed in several papers. If evidence is not found in favor of a net increase in savings, then it is possible that the social gains associated to that policy do not compensate for its fiscal cost as well as for the distortions in the asset market that it necessarily implies.

On the other hand, tax deductions on personal savings are meant to offset the negative effect of capital returns taxation on households average propensity to save

[1]Most of the studies cited above use cross-section data or short panels. The maximum length is five years in Feenberg and Skinner work.

[2]The government has also encouraged saving in certain types of securities, starting in 1987. More recently, returns from shares on investment funds also receive a special fiscal treatment, since they are taxed only as capital gains and only when they are sold.

out of disposable income. But the available empirical evidence is not conclusive at this point[3].

Our exercise does not allow us to address some of these questions, but it helps us to study the response of tax payers to the incentive, and which of these tax payers are likely to be the most benefited.

Although the decisions of how much to save and which assets to buy are simultaneous, it is convenient to think of them as two separate questions. Then, we may believe that first the household decides how much to save. Or what is the same, how much to consume. Second, the choice among different assets takes place.

According to the life-cycle/permanent-income (LC/PI) hypothesis, the first decision will depend on intertemporal preferences ,human wealth (measured as the expected present value of current and future after-tax labor income) and current asset wealth. The choice of assets has to be made taking into consideration their differences in returns.

We consider two types of assets (or savings). Once of them entitles families to an income tax rebate, the other does not.

The data used in the estimations consists of a panel of spanish income tax payers running from 1982 to 1990, and contains information on income , tax rates, and tax deductions for several concepts. In particular, we know -to certain extent- the amount of money allocated to some particular types of savings: purchases of houses, life insurance contracts, certain securities and retirement plans.

We have opted for an ad hoc formulation of the total savings function, since the assumptions that would be required to derive a testable equation based on the joint LC/PI and rational expectations hypothesis are too restrictive and often unrealistic.

In the next section we explain how to arrive to a reasonable model of total consumption (saving). The following section describes how the household discriminates among two types of saving instruments. The fourth section describes the data in some detail and the fifth one comments on the method used in the estimations. Finally, we report the results and draw some conclusions.

2 Modelization of the savings equation

The LC/PI hypothesis is forward-looking in nature. Since future is uncertain, one often requires quite sensible assumptions to be able to estimate the models based on that hypothesis.

[3]In the spanish case there is some evidence of a negative effect of tax rates on savings. See Zabalza and Andrés (1991) or Molinas and Taguas (1991) for evidence on time series data, and Monés, Salas and Ventura (1992) for panel data evaluation.

The fact that future labor is stochastic, makes not possible to explicitly derive a closed-form solution for the optimal level of consumption, even under rather demanding assumptions.

A quite usual starting point is to write the optimal consumption rule for a household as

$$c_i(t) = \gamma(W_i(t) + H_i(t)) \tag{1}$$

where $c_i(t)$ is total consumption of household i at time t, $W_i(t)$ is financial wealth (assets) of household i at time t, and $H_i(t)$ is human wealth (present discounted value of current and future after-tax labor income) of household i at time t. The γ parameter is the propensity to consume out of lifetime resources, and will usually depend on preferences and particularly on the age of the household head. This consumption function can be derived from a standard deterministic intertemporal utility maximization problem with time-additive preferences and instantaneous utility function of the CRA class. There permanent income is defined as the interest rate times the lifetime resources $(W_i(t) + H_i(t))$.

The main problem with this formulation is that neither human wealth nor permanent income is observable. Since they depend on the household's expectations about future labor income, any variable that helps predict it will show up significant in estimation. One could think of explicitly formulating the stochastic process for labor income and find a closed form representation for human wealth as a distributed lag of current and past after-tax labor income. But with panel data the number of lags that can be used in estimation is usually very small. On top of it, taxing policies are subject to changes that are difficult to foresee.

Also, income tax is a nonlinear function of the household's income. In particular, taxes paid depend also on capital income, which is a function of past savings. Therefore, after-tax future labor income will depend on the time path of savings. Human wealth then depends on current and past labor income (through the explicit formulation of an stochastic process for it), and also on assets.

Furthermore, the derivation of a expression like 1 assumes that the household has no subjective uncertainty about future after-tax labor income. Otherwise it is not possible to obtain a convenient closed solution like equation 1.

Finally, the rates of return of risky assets are stochastic. The derivation of equation 1 is based on the assumption that interest rates are fixed. Since this is not the case, the derivation of a similar closed-form solution becomes impossible unless one is willing to impose some extremely restrictive assumptions over the interest rates and labor income joint distribution.

The foregoing arguments suggest that any attempt to explicitly formulate the

optimal consumption rule as a function of the variables that are typically available in panel data is a difficult task and is bound to be misspecified. On one hand, is almost impossible to derive a closed form solution that takes into consideration the fact that interest rates are stochastic, that after-tax income is a non-linear function of savings, and that labor income is also uncertain. Add the fact that the lifetime span of an individual is also uncertain, and that utility functions can be household specific, depending on family composition, age of the head, and other unobservable variables. On the other hand, even if we could derive a closed form solution (which would require imposing some quite unrealistic assumptions), it would be difficult or impossible to find adequate data to estimate it.

At this point, it might be worthy to explore some alternative way of dealing with the problem. In this paper we follow the lead of Hayashi (1982) and do not attempt to estimate any "structural" equation for consumption deriving from the household's intertemporal optimization.

The idea consists of making optimal consumption plans be a function of the variables that are available in our data. The expression should be considered as the least squares projection of consumption on these variables. We write

$$c_i(t) = X_i(t)\beta + \epsilon_i(t) \tag{2}$$

where $X_i(t)$ is the matrix of available variables and $\epsilon_i(t)$ is uncorrelated with any predetermined variable in $X_i(t)$. The error term summarizes household specific components among other things. Equation 2 can be viewed as the *reduced* form representation of the optimal consumption for the household's intertemporal optimization problem. Because of the non-theoretical nature of the approach is difficult to give an economic interpretation to each of the regression coefficients. However, one thing is clear: $X_i(t)\beta$ is the optimal consumption for a typical household whose observed characteristic are summarized by $X_i(t)$.

Once a expression for consumption is found, savings can be obtained as the difference between disposable income and consumption. That is

$$s_i(t) = y_i^d(t) - c_i(t) = X_i(t)\gamma + \epsilon_i(t) \tag{3}$$

Here, the γ parameters are identical to the β ones with the exception of the coefficient of disposable income[4], which we named $y_i^d(t)$.

Next, we will distinguish between two types of savings according to whether they are fiscally incentivated or not.

[4]We implicitly assume that disposable income is included in the set of variables that explain consumption, $X_i(t)$.

3 Choosing where to save

Once the household has decided how much to consume and how much to save, it has to allocate these savings among several types of assets. Here we will consider only two kinds: instruments related to the fiscally incentivated savings, and the rest of instruments.

In that section we follow the standard Capital Asset Pricing Model (CAPM), and we make the decision of where to save depend on the differentials on returns and riskness of the two different types of composite savings.

Let $r_f(t)$ denote the risk-free asset return at time t, $r_1(t)$ and $r_2(t)$ being the returns on two alternative risky assets. Let $p_b(t)$ be the market price of risk at time t and $b_1(t)$ and $b_2(t)$ be asset 1 and asset 2 measure of risk, respectively. Under the CAPM assumptions and in a world without taxes, we can write

$$\begin{aligned} r_1(t) - r_f(t) &= b_1(t)p_b(t) \\ r_2(t) - r_f(t) &= b_2(t)p_b(t) \end{aligned} \tag{4}$$

That is, each asset's risk prime (the difference between the risk-free asset return and its own return) is proportional to its riskness.

The model can be relaxed to encompass the fact that the agents may take into consideration other aspects besides returns and riskness when choosing their portfolio. These other characteristics are incorporated in the preferences of the households and will have an additive effect on the above relationship between risk and returns. We now write, for a particular household,

$$\begin{aligned} r_1(t) - r_f(t) &= a_{1i} + b_1(t)p_b(t) \\ r_2(t) - r_f(t) &= a_{2i} + b_2(t)p_b(t) \end{aligned} \tag{5}$$

where a_{1i} and a_{2i} represent the effect of the agents preferences on the demand for assets 1 and 2 respectively.

Subtracting one equation from the other, we get

$$r_1(t) - r_2(t) = (a_{1i} - a_{2i}) + p_b(t)(b_1(t) - b_2(t)) \tag{6}$$

The CAPM says that 6 holds true for each individual. However, it is difficult to accept that everyone has the same preferences and therefore that the term $a_{1i} - a_{2i}$ is the same for all households. Furthermore, there are transaction costs associated

to buying and keeping the portfolio.

In general, the right hand side of equation 6 will be individual or household specific. Also, the left hand side can be different for each household. Two are the reasons for that assessment. First, it should be written in terms of expectations, and those can be individually different. Second, we should really deal with the after-tax returns, and those certainly are individual specific.

Therefore, a household should be indifferent between the two types of savings if

$$\{r_1(t) - r_2(t)\}\{1 - \tau_i(t)\} + \delta(t) - K_i(t) = 0 \tag{7}$$

where

$$K_i(t) = (a_{1i} - a_{2i}) + p_b(t)(b_1(t) - b_2(t))$$

Here $\tau_i(t)$ represents the marginal tax rate of individual i at time $t$and $\delta(t)$ is the maximum tax rebate allowed at time t. The return on asset 1 is $r_1(t)(1-\tau_i(t))+\delta(t)$, since new purchases of this asset entitle the owner to a tax rebate. The return of the other composite asset is simply $r_2(t)(1-\tau_i(t))$.

If 7 does not hold with equality, there is an arbitrage opportunity. Then the household will choose asset 1 when 7 is greater than 0 and asset 2 if the relationship is negative.

Summarizing, once total savings have been decided, the choice of the portfolio depends on their assets relative returns. We will write

$$S_{1i}(t) = F\left(\{r_1(t) - r_2(t)\}\{1 - \tau_i(t)\} - K_i(t) + \delta(t), S_i(t)\right) \tag{8}$$

The exact functional form is given in section 5.

4 Description of the data

We use a data set provided by the Instituto de Estudios Fiscales, a research organism dependent from the Spanish Ministry of Finances. It consists of a panel of income tax payers running from 1982 to our days and it contains all the information provided in the spanish income tax summary form. The number of individuals in the original panel is above 100,000 and is growing steadily in accordance to the population to be represented. From a sample of 2100 individuals, we select a subsample of 685 individuals which are observed *every* year from 1982 to 1990.

One of the advantages of our data set is that the reported income variables are more reliable than in other spanish panel data sets. Also, we can observe the same

household through several years, unlike other data sets[5]

On the other hand, given the nature of the data, we can not observe consumption or total savings like in other panels. We can neither observe the age of the head of the household. We are nonetheless able to extract a measure of fiscally incentivated savings and to discriminate between two groups of age. The age distinction is based on a tax credit that applies to individuals older than 69[6].

We now proceed to list and describe the main household information in the panel.

- Gross and net earned ordinary income, distinguishing among dependent labor, capital, entrepreneurial, professional and agricultural sources of labor income. There are two types of capital income: financial and real state[7].
- Non ordinary income. That is, basically, capital gains or losses indexed by inflation and the number of years of ownership of the asset.
- Current income, as the sum of ordinary and non ordinary income.
- Taxable income, which differs from current income because it allows tax payers to offset negative income from former exercises.
- Marginal and average tax rates before tax deductions.
- Tax deductions. The Spanish system establishes deduction for the following concepts[8].
  - Income accumulation in the family unit. This deduction applies when there is more than one income earner in the household[9].
  - Familiar charges. That includes number of children, ancestors and disabled persons in charge of the tax payers.
  - Old age. Tax payers over 69 are entitled to this kind of deduction.

[5]Such as the "Encuesta Continua de Presupuestos Familiares" , which is a panel with replacement in which the the same family is observed a maximum of eight quarters in which income is measured with a considerable amount of error. Another survey, the "Encuesta de Presupuestos Familiares" is not a panel.

[6]This implies that we are able to identify individuals aged 62 and older in 1982

[7]Real state income is either the imputed house rent (in case of owner occupied houses) or the actual rent perceived.

[8]We only mention the most important ones.

[9]Since 1988 married couples can fill the tax forms separately (see table 1). We have chosen to add the information to maintain the consistency of the data. That required reestimating marginal and average tax rates according to the sum of taxable incomes and the tax yields of the members of the household.

- Dividends. A household that has earned dividend income during the year is allowed to subtract a percentage of this income to reduce double taxation.
- Entrepreneurial investment. This is intended to stimulate the reinvestment of entrepreneurial profits.
- Savings. The spanish fiscal system currently favors three types of domestic saving instruments: housing, life insurance contracts and retirement plans[10]. Payment of life insurance premia and purchases of houses give right to a cut in taxes paid[11]. The tax incentive on retirement plans has a different nature: income allocated to these assets is tax free within a limit[12]. Table 2 shows the tax cuts percentages applied during the nine years of our sample.

- Disposable income. It is defined as the difference between current income and total taxes paid.
- Wealth. This variable is a proxy we build from information on capital income. We have capitalized net real state income at the rental value of the property scheduled for owner occupation[13][14]. Our estimates of fixed returns securities holdings are the result of subtracting earned dividends from total financial capital income. They have been capitalized at the yearly current rate of return on one year maturity government debt. Variable returns income is capitalized at half of the former rate.

In a system in which the dependent variable is fiscally incentivated savings, disposable income is an endogenous variable since it depends on the amount of the deduction to which they entitle. Therefore, it will be necessary to instrument it. To that purpose, we will use current before taxes income -which shows a very high correlation with disposable income- jointly with other exogenous variables included in the specification of the econometric model.

Table 4 presents the mean values of all these variables , by year. These variables are consistent with the fact that the spanish economy was in a recession up to 1984

[10]Retirement plans are a source of deduction only after 1987. Before that year, holding certain type of securities also gave right to deduction.

[11]There is a limit on the amount of the deduction, see Table 2.

[12]The tax payment is delayed until the moment of reception of retirement funds, when tax rates will be presumably lower.

[13]This rental value is estimated by the fiscal authorities as the 3% of the house value before 1987 and 2% thereafter.

[14]Although there is a different fiscal treatment of savings, according to whether they are allocated to fixed or variable returns securities, we can not observe them separately.

and that it was followed by a strong expansion. The increase in marginal tax rates is explained by increases in real income, fiscal drag[15], and several legal changes. The average tax rate has also increased, but less steadily. This is due to the combined effect of changes in the marginal tax rate and in the types and percentages of tax deductions. One can also observe an increasing wealth pattern.

The largest volume of incentivated savings is allocated to housing investment. Its decrease in the first years of analysis is due to the fact there was no limit to deduction before 1983, while after this date a joint upper limit for this and other types of savings was introduced. Its maximum was attained in 1987, when an economic boom that increased housing demand was combined with high tax cuts for purchases of non owner occupied houses.

Savings in securities reached their maximum in 1986. The deduction applying to bonds holdings disappeared in 1987, while variable returns securities lost the fiscal favor in 1988. Such tax cuts were replaced by an incentive to the purchase of retirement plans. Table 4 suggests that the new asset has not received much attention by investors.

Our dependent variable is the sum of the three types of fiscally incentivated savings: housing, life insurance and securities. It is censored upwards, due to the limits imposed by law to the right of deduction. More important, there is a high percentage of households with zero observed savings. Table 5 shows the number of family units for which these limits are effective.

5 Econometric considerations

The system of equations we want to estimate is:

$$\begin{aligned}
s_i(1) &= \beta_0 + \beta_1 [\rho(1)(1 - tm_i(1)) + \delta(1)] + \beta_2 yd_i(1) + \beta_3 w_i(1) + X_i(1)\Gamma + v_i(1) \\
s_i(2) &= \beta_0 + \beta_1 [\rho(2)(1 - tm_i(2)) + \delta(2)] + \beta_2 yd_i(2) + \beta_3 w_i(2) + X_i(2)\Gamma + v_i(2) \\
\vdots &= \qquad\qquad \vdots \\
s_i(T) &= \beta_0 + \beta_1 [\rho(T)(1 - tm_i(T)) + \delta(T)] + \beta_2 yd_i(T) + \beta_3 w_i(T) + X_i(T)\Gamma + v_i(T)
\end{aligned}$$

where

$s_i(t)$	represents total fiscally incentivated savings at time t,
$\rho(t)$	represents the difference between real before-tax marginal returns of the two kind of savings contemplated in this work,
$tm_i(t)$	is the marginal tax rate faced by household i at time t,
$\delta(t)$	is the maximum percentual tax-rebate allowed at time t,

[15]The tariff is not automatically corrected for inflation.

$yd_i(t)$ is disposable income (including the tax-rebate) of tax payer i at time t,

$w_i(t)$ is our estimate of asset wealth of household i at time t,

$X_i(t)$ is a vector of individual characteristics of tax payer i at time t - number of children, major source of income, entrepreneurial investment or old age among others-, and

$v_i(t)$ is a composite error including individual and time effects.

That is,

$$v_i(t) = \alpha_i + \nu(t) + u_i(t)$$

The differentials in returns will be estimated as time varying coefficients. The maximum value of the allowance parameter $\delta(t)$ does not change much over the sample time span, and could be jointly estimated with the time dummies if we choose to treat time effects as fixed effects.

The system becomes

$$s_i(1) = \beta_0 + \nu(1) + \beta_1\delta(1) + \theta(1)(1 - tm_i(1)) + \beta_2 yd_i(1) + \beta_3 w_i(1) + X_i(1)\Gamma + \alpha_i + u_i(1)$$

$$s_i(2) = \beta_0 + \nu(2) + \beta_1\delta(2) + \theta(2)(1 - tm_i(2)) + \beta_2 yd_i(2) + \beta_3 w_i(2) + X_i(2)\Gamma + \alpha_i + u_i(2)$$

$$\vdots \qquad\qquad \vdots \qquad\qquad \vdots$$

$$s_i(T) = \beta_0 + \nu(T) + \beta_1\delta(T) + \theta(T)(1 - tm_i(T)) + \beta_2 yd_i(T) + \beta_3 w_i(T) + X_i(T)\Gamma + \alpha_i + u_i(T)$$

Given that we will never observe negative fiscally incentivated saving (the only information available in the sample refers to current purchases of these savings instruments), the dependent variables should be treated as censored variables. Furthermore, since there is an upper limit to the amount of the deduction for savings, the variable is in fact double censored. That is, let $s_i^*(t)$ be the latent variable (desired level of savings), and write

$$\begin{aligned}
s_i^*(1) &= \beta_0 + \nu(1) + \beta_1\delta(1) + \theta(1)(1 - tm_i(1)) + \beta_2 yd_i(1) + \beta_3 w_i(1) + X_i(1)\Gamma + \alpha_i + \\
&+ u_i(1) \\
s_i^*(2) &= \beta_0 + \nu(2) + \beta_1\delta(2) + \theta(2)(1 - tm_i(2)) + \beta_2 yd_i(2) + \beta_3 w_i(2) + X_i(2)\Gamma + \alpha_i + \\
&+ u_i(2) \\
\vdots &= \qquad\qquad \vdots \\
s_i^*(T) &= \beta_0 + \nu(T) + \beta_1\delta(T) + \theta(T)(1 - tm_i(T)) + \beta_2 yd_i(T) + \beta_3 w_i(T) + X_i(T)\Gamma + \alpha_i + \\
&+ u_i(T) \qquad (9)
\end{aligned}$$

with observed savings as

$$
\begin{aligned}
s_i(t) &= 0 \quad if \quad s_i^*(t) < 0 \\
s_i(t) &= s_i^*(t) \quad if \quad s_i^*(t) \in [0, L_i(t)] \\
s_i(t) &= L_i(t) \quad if \quad s_i^*(t) > L_i(t) t = 1, 2, \ldots, T
\end{aligned} \tag{10}
$$

where $L_i(t)$ is the upper limit for savings and is proportional to taxable income.

Furthermore, individual effects might be important and should be taken care of.

If we could assume that the system explanatory variables are exogenous[16] relative to the composite error $\alpha_i + u_i(t)$, letting u_i be normally distributed and making use of 10, our system could be estimated by maximum likelihood. However, evaluation of the likelihood function would require computing multiple integrals of order T, which would result in a quite intractable problem[17]. It would still be possible to consistently estimate the parameters of interest by using some robust equation by equation method to get T first step estimates. They would then be combined by a minimum distance method in a unique estimator.

In our model, it seems more appropriate to consider that individual effects are not independent of the explanatory variables. Although a number of estimation techniques conditional on the individual effect could be tried[18], we choose a simpler method which relies on specifying the conditional distribution of the individual effects, given the explanatory variables[19].

Let 9 and 10 describe the system we want to estimate and assume that

$$
\alpha_i | Z_i \sim \mathrm{N}[\lambda_1' Z_{i1} + \lambda_2' Z_{i2} + \ldots + \lambda_T' Z_{iT}] \tag{11}
$$

Assume also that $u_i | Z_i \sim \mathrm{N}(0, \Omega)$. Here Z_i includes the variables used to instrumentalize disposable income, but not disposable income itself.

Next, use 11 to write

$$
s_i(t) = \pi_0 + \pi_1' Z_{i1} + \ldots + \pi_T' Z_{iT} + \epsilon_i(t) \quad t = 1, \ldots, T \tag{12}
$$

Under the above distributional assumptions, the vector $[\epsilon_i(1), \epsilon_i(2), \ldots, \epsilon_i(T)]$ is

[16] This is not the case in our model, since disposable income is endogenous.

[17] We could restrict the covariance matrix of u_i and write the likelihood function in a more convenient way, but computation of the solution would still be complicated and is would sensible to the specification of the covariance matrix.

[18] See for example Neyman and Scott (1948) , Andersen (1973) and Chamberlain (1984) on maximum likelihood estimation, or Manski (1987) on the method of scores. The maximum likelihood technique requires finding a sufficient statistic to obtain consistent estimates, and the method of scores does not allow us to obtain asymptotic standard errors in the usual form.

[19] See Chamberlain (1980)

jointly normally distributed. Although efficient estimation of the system is subject to the same computational problems we described before, we can find estimators of the β parameters based on consistent estimates of the π parameters, obtained from fitting each period's censored regression separately.

One possibility is to use Chamberlain (1980) minimum distance estimator. This amounts to minimizing

$$d(\beta,\lambda) = [\hat{\pi} - \pi(\beta,\lambda)]' V^{-1} [\hat{\pi} - \pi(\beta,\lambda)]$$

Here $\hat{\pi}$ is a consistent estimator of π and the optimal choice of V^{-1} is a consistent estimate of the asymptotic variance of $\hat{\pi}$.

However, direct minimization of the distance function presents several disadvantages. One has to jointly estimate the β and λ parameters when we are only interested in the β ones. Furthermore, we have to impose explicit restrictions on the π coefficients, and sometimes these will be nonlinear making necessary to resort to iterative estimation techniques.

An alternative approach , outlined in Arellano (1990), consist of applying the Tobit technique to equation 12 , year by year. The consistently predicted savings are then used in place of the censored dependent variable. Next, we calculate each variable's individual mean and substract it from the variable to eliminate the individual effects. We estimate the resulting individual-mean corrected system

$$\tilde{s}_i(j) = \tilde{\nu}(j) + \beta_1 \tilde{\delta}(j) + \frac{T-1}{T}\theta(j)(1 - tm_i(j)) - \sum_{t \neq j} \left(\frac{1}{T}\theta(t)(1 - tm_i(t)) \right) +$$

$$+\beta_2 \widetilde{yd}_i(j) + \beta_3 \tilde{w}_i(j) + \tilde{X}_i(j)\Gamma + \tilde{u}_i(j) \quad j = 1, \ldots, T$$

which can be rewritten as

$$\begin{aligned}
\tilde{s}_i(1) &= \alpha_0 + \frac{T-1}{T}\theta(1)(1 - tm_i(1)) - \sum_{t \neq 1} \left(\frac{1}{T}\theta(t)(1 - tm_i(t)) \right) + \\
&\quad \beta_2 \widetilde{yd}_i(1) + \beta_3 \tilde{w}_i(1) + \tilde{X}_i(1)\Gamma + \tilde{u}_i(1) \\
\tilde{s}_i(j) &= \alpha_0 + \zeta(j) + \frac{T-1}{T}\theta(j)(1 - tm_i(j)) - \sum_{t \neq j} \left(\frac{1}{T}\theta(t)(1 - tm_i(t)) \right) + \\
&\quad \beta_2 \widetilde{yd}_i(j) + \beta_3 \tilde{w}_i(j) + \tilde{X}_i(j)\Gamma + \tilde{u}_i(j) \quad j = 2, \ldots, T
\end{aligned}$$

where

$$\begin{aligned}
\alpha_0 &= \tilde{\nu}(1) + \beta_1 \tilde{\delta}(1) \qquad \text{and} \\
\zeta(j) &= \tilde{\nu}(j) + \beta_1 \tilde{\delta}(j) - \tilde{\nu}(1) - \beta_1 \tilde{\delta}(1) = \nu(j) - \nu(1) + \beta_1(\delta(j) - \delta(1)) \quad (13)
\end{aligned}$$

Since disposable income is an endogenous variable, we need to instrumentalize it. Furthermore, we are substituting the dependent variable by its estimation and this introduces measurement error. Demeaning the variables will then add error correlation across equations.

To account for these two facts, we will use the method of three stages least squares on the differenced variables system. We will also compare these estimates with the ones obtained with a method that does not take into consideration the cross equations correlations. To evaluate the importance of individual effects, we also present the coefficients of a system for which demeaning does not take place.

6 Results

The first stage estimation consists of cross-section Tobit regressions for every year of the sample. We then take the predicted values for savings and use them as dependent variables in subsequent stages of the estimation. Due to their merely instrumental character, we do not report the results of the Tobit regressions[20].

Tables 7 and 8 show two alternative sets of system estimates. The first one assumes that there are individual effects -correlated with the explanatory variables-, and we subtract individual means from all the variables to eliminate them. In Table 8 we do not consider individual effects.

Each of these tables reports also two types of results. The first two columns correspond to estimates of the coefficients and their t-statistics, and have been calculated taking into consideration cross-equation correlation. We have used the method of three stages least squares[21] (3SLS). The other two columns are obtained after applying an instrumental variables (IV) method that assumes that there is not heteroscedasticity or autocorrelation in the errors.

The intercept coefficient in the individual-mean corrected estimations is a mixture of year dummies and maximum deduction differences (see equation 13). It is not significant, as expected.

Fixed annual effects have also a very small explanatory power. The negative coefficient in 1987 is likely a consequence of the lose of the right to deduction on certain securities, but it also reflects a decrease in the average propensity of total (not just the fiscally incentivated) savings to disposable income.

As one could predict, disposable income shows the most significant coefficient.

[20] They are of course available upon request.

[21] The method is asymptotically equivalent to full information maximum likelihood, although is easier to implement. Satorra and Neudecker (1993) prove that full information maximum likelihood is optimal in these kind of setups.

The estimated marginal propensity to save out of disposable income is 0,15[22].

Wealth accumulation affects savings negatively. The sensitivity is nonetheless small, since an increase in wealth of one million pesetas yields a decrease in savings of less than five thousand pesetas[23]. This is consistent with the LC/PI hypothesis, which predicts that households will save to hedge themselves from a decrease in labor income in the last periods of their lives. Wealth therefore will increase until it reaches the desired level, and savings will become negative thereafter.

The LC/PI hypothesis is also corroborated by the significantly negative coefficient of the elder group dummy.

The coefficients of the variables labeled MARGINAL82 to MARGINAL90 demand for some explanation. Each one of these variables is defined as one minus the marginal tax rate faced by the household. Their coefficients are the product of a parameter and a real before taxes interest rates differential. Since we do not observe the latter, we have to estimate them jointly with the β parameter. The estimates have a positive sign (except for 1982), which indicates that for a given difference in return rates in year t, an increase in the marginal tax rate induces a decrease in incentivated savings. To emphasize the importance of these variables in explaining those savings, we have omitted them in the estimations reported in Table 9. The results show a poorer fit and sensible differences in coefficients, thus indicating a significant role of the marginal tax rates on savings decisions.

The dummies that allow us to distinguish among different main sources of income are mostly significant. Entrepreneurs, professionals, farmers and earners of housing related rents exhibit a higher propensity to save than the excluded socio-professional category, dependent labor.

The perception of dividends does not help to explain these type of savings, and neither does entrepreneurial investment. The number of children does not seem to be important either. Having ancestors in charge is responsible for some negative effect on the family's saving record. This might be due to an age factor. The period in which most households report children in charge coincides with the one in which labor income is reaching its maximum.

One also observes that individual effects are important in order to explain savings. Looking at tables 7 and 8, we realize some differences in the value and significance of the coefficients. The values and t-statistics of variables such as disposable income, wealth , or marginals are larger when no individual effects are considered, but the rest of estimates are very sensible to the specification of the

[22]Average propensity to save out of disposable income has been a little above 11% until 1986 and lower afterwards.

[23]The values range between 1343 and 4891 pesetas, depending on which estimation method we use.

model. Basically, all the socio-professional and family characteristics change, their sign included.

These two tables allow us to evaluate the importance of correcting the estimations for cross-equation error correlation. An instrumental variables technique was applied with and without correcting for individual effects. The income, wealth and marginal tax rate coefficients are very similar although a little larger in absolute value when IV estimation is implemented. Again, some socio-professional and family characteristics dummies change value and even sign. Given that our dependent variable is measured with error, cross-equation correlation is present when we use an individual-mean correction to eliminate the individual effects. We performed the following test: we calculated the individual effects for each household as average predicted savings minus the average explanatory variables vector times the estimated coefficients of Table 7. Then we did a regression of these individual effects on all the explanatory variables of the system and tested the null hypothesis that the coefficients of that regression

were all 0. The hypothesis was easily rejected[24]. Table 6 shows the correlation matrix that results from applying two stages least squares to each equation separately. It can be observed that correlation is present and quite strong, specially among the last years equation errors.

7 Concluding Remarks

Our results show that for a given value of disposable income, higher marginal tax rates or higher wealth levels reduce tax incentivated savings.

The former result might seem counterintuitive at first. One would believe that the tax incentive should operate more strongly at higher marginal tax rates. However, we should realize that this is not the correct interpretation. Higher disposable income is associated to higher marginal tax rates. But once the disposable income effect is taken care off, the positive coefficient on marginal rates could be reflecting the fact that at some point households are interested in diversifying their portfolios, and fiscally incentivated saving looses part of its initial attractiveness.

Wealth accumulation plays a negative role on incentivated savings. The result can be understood as a corroboration of the LC/PI hypothesis. Nonetheless , it is also plausible that rich people savings are allocated preferably to non incentivated saving. In fact, wealthy people already own a house, and does not have that much need for life or retirement insurance.

Older households show a lower saving profile than the rest of the sample. Again,

[24]The F statistic was 1327 with 595 degrees of freedom.

this result is conditioned by the type of savings being examined. Particularly, it is sensible to expect that people over 62 of age are not oriented into buying a house or a retirement plan.

Additional variables included in the system have little explanatory power, except for the main sources of income dummies. Entrepreneurs and professionals show a higher propensity to save on incentivated assets than the employees. One possible interpretation relies on the fact that entrepreneurs and professionals are subject to more uncertainty about future labor income.

In summary, the marginal propensity to save on incentivated assets out of disposable income is high, but the nature of these assets puts a limit on the amount of savings devoted to them. Once a household owns a house and pays a reasonable annual premium for life and retirement insurance, extra savings are going to be oriented to the purchase of more liquid assets to adjust to a more diversified portfolio composition. This argument would explain the negative sign of both variables WEALTH and ELDER.

Also, we should take into account that individual preferences play an important role since people may have different feelings about these particular types of assets.

Regarding the methodology used in estimation, we have presented some evidence in favor of considering individual effects that are correlated with the explanatory variables and of correcting for cross-equation correlations.

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Table 1: **Tax payers according to type of form**

Year	Form Type	G=0	G=1	G=2	Subtotal Forms
82	D=0	166	24	-	190
	D=1	379	116	-	495
	Sum	545	140	-	685
83	D=0	194	30	-	224
	D=1	360	101	-	461
	Sum	554	131	-	685
84	D=0	260	37	-	297
	D=1	303	85	-	388
	Sum	563	122		685
85	D=0	133	20	-	153
	D=1	432	100	-	532
	Sum	565	120	-	685
86	D=0	115	21	-	136
	D=1	452	97	-	549
	Sum	567	118	-	685
87	D=0	124	20	-	144
	D=1	444	97	-	541
	Sum	568	117	-	685
88	D=0	95	23	28	146
	D=1	415	95	29	539
	Sum	510	118	57	685
89	D=0	75	27	36	138
	D=1	399	96	52	547
	Sum	474	123	88	685
90	D=0	74	24	50	148
	D=1	384	97	56	537
	Sum	458	121	106	685

Note: D=0 means ordinary tax form, D=1 means simplified tax form. G=0 means jointly filled form, G=1 means individually filled form. After 1988, G=2 means separated tax form.

Table 2: **Table of Legal Deductions**

Concept	82	83	84	85	86	87	88	89	90
Current house[1]	.15	.15	.15	.15	.15	.15	.15	.15	.15
Other houses[3]	-	-	-	.17	.17	.17	.10	.10	.10
Fixed returns securities[2]	.15	.15	.15	.15	.15	-	-	-	-
Variable returns securities[4]	.15	.15	.15	.17	.17	.10	.10	.10	
Life Insurance		.15	.15	.15	.15	.10	.10	.10	.10

Notes:

1. In 1982 there is no limit the the amount of housing deduction practiced. The limit on deductions based on the securities concept was a 25 % of taxable income. The limit on life insurance based deductions was 45,000 pesetas. This last limit holds also in 1983 and 1984, but the joint limit on housing (both types) and securities (also both types) is equal to the 30 % of taxable income.

2. After 1985, the deductions based on the concepts of this table had a joint limit of a 30 % of taxable income.

3. Between 1985 and 1987, the 17 % percentage of deduction is applied not only to non current houses, but also to newly purchased current houses.

4. After 1987, this deduction is meant for Retirement Plans. Variable returns securities are no longer a source of tax rebates. Retirement plans entitle to another type of rebate. They are considered a earning income related expenditure and they are not part of taxable income.

Table 3: **Definition of Variables**

Variable Name	Variable Description
D83 to D90	Time dummy variables.
MARGINAL82 to MARGINAL90	Defined as 1 minus the marginal tax rate, from 1982 to 1990.
DISP. INCOME	Disposable Income
WEALTH	Computed wealth
ENTREPRENEURIAL	Dummy variable for major source of income
AGRICULTURAL	Dummy variable for major source of income
PROFESSIONAL	Dummy variable for major source of income
SECURITIES	Dummy variable for major source of income
HOUSING	Dummy variable for major source of income
DIVIDENDS	Dummy variable for earners of dividends
ENT. INVESTMENT	Dummy variable for investment by entrepreneurs
CHILDREN	Number of children in the household
OLD IN CHARGE	Number of low-income ancestors in the household
EARNED INCOME	Total net income before taxes
AGE70[1]	Dummy variable for households older than 70 in 1987
DEPENDENT LABOR	Dummy variable for major source of income
INCENTIVATED SAVING	Sum of deduction entitling savings
SECURITIES SAVING	Saving in fixed and variable securities[2]
HOUSING SAVING	Saving in housing assets
LIFE INSURANCE SAVING	Saving through life insurance instruments
SECURITIES INCOME	Financial capital income
HOUSING INCOME	Home imputed value and other real estate capital income
ELDER	Dummy variable that identifies heads of household that were older than 69 in 1990

1. The proportion of members belonging to that group is 16.9% in our sample.
2. It includes retirement plans savings after 1987.

Table 4: **SAMPLE MEANS. Sample Size = 685, Units= Pesetas of 1987**

Variable Name	82	83	84	85	86	87	88	89	90
Marginal Tax Rate	0.2083815	0.2201621	0.233718	0.2645171	0.2723685	0.2755268	0.2946647	0.3105977	0.3185787
Average Tax Rate	0.0962721	0.1023292	0.116470	0.1035265	0.1157337	0.1230748	0.1048096	0.1151811	0.1228677
Dependent Labor[1]	0.8658892	0.8527697	0.855685	0.8571429	0.8556851	0.8556851	0.8556851	0.8469388	0.8483965
Securities[1]	0.0306122	0.0364431	0.039358	0.0364431	0.0247813	0.0335277	0.0320700	0.0393586	0.0437318
Housing[1]	0.0102041	0.0087464	0.011661	0.0145773	0.0174927	0.0160350	0.0131195	0.0131195	0.0145773
Professional[1]	0.0247813	0.0306122	0.024781	0.0189504	0.0233236	0.0233236	0.0218659	0.0233236	0.0174927
Entrepreneurial[1]	0.0655977	0.0626822	0.056851	0.0655977	0.0728863	0.0670554	0.0685131	0.0699708	0.0699708
Agricultural[1]	0.0029155	0.0087464	0.011661	0.0072886	0.0058309	0.0043732	0.0087464	0.0072886	0.0043732
Ent. Investment[2]	0.0043732	0.0058309	0.004373	0.0145773	0.0233236	0.0189504	0.0116618	0.0072886	0.0102041
Dividends[2]	0.0976676	0.1020408	0.099125	0.1078717	0.1137026	0.1180758	0.1341108	0.1486880	0.1413994
Children	1.3702624	1.3906706	1.422740	1.4067055	1.3804665	1.3338279	1.2878677	1.2437584	1.1993440
Old in charge	0.0306122	0.0524781	0.087463	0.0903790	0.0903790	0.0845481	0.0932945	0.0945635	0.0942629
Incentivated Saving[3]	119953.90	118559.80	112019.9	137783.22	157241.81	129891.96	116489.14	123179.14	122499.34
Securities Saving	32168.05	38146.87	40663.4	57856.58	76195.23	13517.92	3195.70	7752.89	9041.78
Life Insurance Saving	3413.05	3447.70	2674.0	6743.81	8895.76	19209.94	21298.02	22841.08	23411.47
Housing Saving	84372.81	76965.23	68682.5	73182.84	72150.82	97164.10	91995.42	92585.18	90046.08
Securities Income	112899.64	109109.75	105891.2	105496.25	99110.71	115632.34	142727.22	167993.49	217945.34
Housing Income	28411.19	31025.63	37274.8	42116.28	48242.33	30649.28	32391.33	44356.09	36101.47
Current Income	1803022.03	1784638.44	1795641.35	1808326.58	1906374.61	1987650.25	2093668.38	2320172.64	2573867.82
Disposable Income	1590107.17	1555909.79	1537439.95	1564580.42	1622624.70	1670944.52	1792119.40	1959923.27	2159698.98
Wealth	2038042.22	2114487.49	2198360.15	2496910.50	2843242.54	3099313.22	3531318.36	4293030.12	4137338.95

1. These variables are dummies. They take the value of 1 when the major source of income is related to that particular activity.
2. These are dummy variables too. For instance, the variable Dividends takes the value of 1 when the household has earned dividends that particular year, 0 otherwise.
3. This is the sum of the next three variables.

Table 5: **Saving Intervals Distribution**

Interval	82	83	84	85	86	87	88	89	90
Left censored	454	423	418	369	339	374	384	381	364
Not censored	155	187	198	243	316	277	295	303	318
Right censored	76	75	69	73	30	34	6	1	3

Table 6: **Cross Model Correlation, from 2SLS Individual-mean corrected estimations**

Corr	82	83	84	85	86	87	88	89	90
82	1	-0.303	-0.077	-0.047	0.056	-0.419	-0.326	-0.229	-0.469
83	-0.303	1	0.492	-0.150	-0.365	0.290	0.141	-0.024	0.405
84	-0.077	0.492	1	0.019	-0.301	-0.069	0.003	-0.123	0.245
85	-0.047	-0.150	0.019	1	0.042	-0.103	-0.250	0.081	-0.166
86	0.0563	-0.365	-0.301	0.042	1	-0.478	-0.562	-0.580	-0.584
87	-0.419	0.290	-0.069	-0.103	-0.47	8 1	0.629	0.442	0.554
88	-0.326	0.141	0.003	-0.250	-0.562	0.629	1	0.638	0.641
89	-0.229	-0.024	-0.123	0.081	-0.58	0 0.442	0.638	1	0.624
90	-0.469	0.405	0.245	-0.166	-0.584	0.554	0.641	0.624	1

Table 7: **Individual-mean corrected regression model**

Method	3SLS		IV	
Variable Name	Coefficient	T-statistic	Coefficient	T-statistic
INTERCEPT	1282.83	0.275	8209.41	0.962
D83	-17772	-1.201	-7387.54	-0.372
D84	7941.24	0.550	12888	0.693
D85	-25470	-1.326	-55795	-2.634
D86	22356	0.454	-29212	-0.417
D87	-40475	-2.508	-37642	-1.727
D88	-13354	-0.993	-13309	-0.683
D89	28356	1.889	15193	0.705
D90	17541	1.456	-10945	-0.579
MARGINAL82	-244034	-5.560	-44401	-0.781
MARGINAL83	68944	1.669	266113	4.620
MARGINAL84	*87747*	*2.084*	*297150*	*5.102*
MARGINAL85	221587	4.777	468803	7.633
MARGINAL86	110464	1.437	379086	3.981
MARGINAL87	216826	5.067	424400	6.85[illegible]
MARGINAL88	157606	3.742	369024	5.979
MARGINAL89	96880	2.250	317781	5.051
MARGINAL90	116845	2.774	346348	5.577
DISP. INCOME	0.154296	26.371	0.193068	24.371
WEALTH	-0.001343	-4.663	-0.002031	-5.526
ENTREPRENEURIAL	104808	5.143	114608	4.261
AGRICULTURAL	43493	1.086	-27854	-0.477
PROFESSIONAL	125792	4.809	58876	1.608
SECURITIES	23866	1.202	88796	3.321
HOUSING	205916	6.276	-14484	-0.328
DIVIDENDS	18178	1.359	-22084	-1.206
ENT. INVESTMENT	-14549	-0.582	-57428	-1.531
CHILDREN	494.08	0.094	-16563	-2.646
OLD IN CHARGE	-20034	-1.982	-13430	-0.978
System Weighted R^2	-	0.0965	-	-
System Unweighted R^2	-	-	-	0.1223
Root MSE	-	1.1973	-	393171

Table 8: **Regression model with no individual-mean correction**

Method	3SLS		IV	
Variable Name	Coefficient	T-statistic	Coefficient	T-statistic
INTERCEPT	-711572	-18.098	-1012441	-24.929
D83	-38872	-2.030	-22028	-0.988
D84	7026	0.372	14431	0.721
D85	-91674	-3.831	2126	0.070
D86	-48376	-0.717	-51170	-0.744
D87	-52574	-2.636	-5545	-0.236
D88	461	0.025	-3368	-0.168
D89	8699	0.480	44468	1.994
D90	13716	1.092	2786	0.194
MARGINAL82	-97762	-2.077	218589	4.372
MARGINAL83	280235	5.889	584870	11.665
MARGINAL84	290794	6.087	613497	12.344
MARGINAL85	511560	9.646	756542	12.810
MARGINAL86	407653	4.348	751696	7.819
MARGINAL87	445539	9.033	728006	13.345
MARGINAL88	350773	7.150	694133	13.183
MARGINAL89	317340	6.465	615828	11.387
MARGINAL90	312807	6.683	660288	13.177
DISP. INCOME	0.199246	43.481	0.235736	55.544
WEALTH	-0.004286	-18.885	-0.004891	-23.554
ENTREPRENEURIAL	-47435	-3.126	-157874	-11.996
AGRICULTURAL	-297127	-7.937	-459612	-12.652
PROFESSIONAL	100544	4.291	179566	8.428
SECURITIES	-199873	-11.326	-326842	-19.765
HOUSING	73711	2.341	-137349	-4.456
DIVIDENDS	86293	7.760	141055	14.108
ENT. INVESTMENT	-33103	-1.229	-119657	-3.968
CHILDREN	5432	1.713	6965	2.830
OLD IN CHARGE	2154	0.227	20156	2.194
ELDER	-45929	-3.946	-30662	-3.662
System Weighted R^2	-	0.2871	-	-
System Unweighted R^2	-	-	-	0.3311
Root MSE	-	1.2508	-	451271

Table 9: **No individual-mean correction. Differential rates omitted**

Method	3SLS	
Variable Name	Coefficient	T-statistic
INTERCEPT	-483552	-40.077
D83	25672	2.065
D84	48656	3.371
D85	185679	15.169
D86	68228	2.267
D87	98557	8.757
D88	71342	6.301
D89	74011	7.288
D90	43206	4.869
DISP. INCOME	0.181561	49.373
WEALTH	-0.004322	-18.732
ENTREPRENEURIAL	6707	0.437
AGRICULTURAL	-243044	-6.389
PROFESSIONAL	133185	5.594
SECURITIES	-163247	-9.290
HOUSING	169366	5.338
DIVIDENDS	88949	7.865
ENT. INVESTMENT	7276	0.273
CHILDREN	7803	2.420
OLD IN CHARGE	2959	0.307
System Weighted R^2	-	0.2219

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