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LABOUR SUPPLY STATUS AND INTERTEMPORAL BEHAVIOUR: EVIDENCE FROM SPANISH PANEL DATA

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Abstract.
In this paper, we estimate the intertemporal substitution for consumption and leisure in Spain. We use the standard intertemporal optimisation consumption model with an intratemporally separable utility function, using different population groups: employees, self-employed, unemployed or retired people. Further, we analyse if the elasticity of intratemporal substitution for leisure is affected by the individual labour status (temporary workers vs fixed-term contract workers). For this purpose, we use the panel of the Spanish Survey on Household Finances (*Encuesta Financiera de las Familias,* SHF), covering the period 2002- 2017. The results we obtain confirm that both intertemporal substitution elasticities for consumption and leisure are different depending on individuals' labour status and the labour contract's characteristics, such as the duration of the contract (temporary versus fixed-term) or the degree of uncertainty about the future.

Keywords: Euler Equation, Instrumental variables, Intertemporal Substitution for consumption and leisure, Panel data.

JEL Codes: C23, C26, D12, D15, J22

1. Introduction.

The empirical research on aggregate consumption and labour supply has traditionally focused on the estimation of Euler equations derived from an individual utility maximization program. This theoretical framework has conditioned the empirical research as it places important restrictions on the samples under analysis, to ensure that the individuals meet the highly demanding theoretical behavioural assumptions. This implies a lack of generality in the estimates of the structural behavioural parameters obtained.[1]

In general, this literature analyses the intertemporal behaviour of an active representative agent who always participates in the labour market. These approaches do not consider any change in the labour status of the individual. The samples used in the empirical analysis are defined according to this criterion. It is important to note that this is equivalent to considering that intertemporal decisions are fully insured, i.e. that markets are complete. Thus, if this was not the case, the empirical results obtained using this approach would be particularly sensitive to cyclical shocks.[2]

The elasticities of intertemporal substitution for consumption and leisure are two key parameters to study individual intertemporal behaviour and have been comprehensively investigated. However, some aspects of intertemporal behaviour have not been sufficiently analysed yet (Thimme, 2017; Keane, 2011). In particular, there is a lack of comprehension on how these elasticities change with age, with specific individual labour status, or with some important features of the labour contract. These gaps exist

[1] The question that arises is why to apply this stringent sample selection criteria to test the model if the goal is to describe the entire economy, as if variations in labour status were unimportant.

[2] The greater the natural rate of unemployment or the more variable unemployment is across the cycle, as is the case in some economies, like Spain, the more significant this issue will be.

despite the scarce relevant empirical works that study changes in economic behaviour related to individuals becoming unemployed (Dynarsky and Sheffrin, 1985; Gruber, 1997), or retiring (Olafsson and Pagel, 2018; Redmon and McGuinness, 2020; Labeaga and Sanchez-Robles, 2021, for the case of Spain), or even when the labour status variables are highly correlated with age, income, education and uncertainty, which are factors that most studies have found to have a significant impact on households consumption/saving (Yuh and Hanna, 2010).[3]

In previous studies, the estimation of the Euler equation for consumption usually includes dummies to capture the individual's employment status, or variables related to labour supply, confirming the existence of significant effects of these labour related variables on consumption growth. Nevertheless, we consider that this research strategy might suffer from some limitations as the tests of the Euler equation are weak tests for any of the hypotheses involved in its derivation. That is, these tests will accept or reject the model as a whole, without identifying the specific reason behind a hypothetical rejection.

In this work we assess the appropriateness of this empirical strategy by comparing the results of estimating the Euler equation, derived from the same standard intertemporal optimization model with an intratemporally separable utility function, using population samples that differ in their labour supply status.[4] Our working hypothesis is that the

[3] Furthermore, studies on the significance of age in decisions about savings and consumption have increased as a result of the current ageing process in developed countries. In this regard, Wesley Carpenter et al. (2021) examine the interplay of retirement and ageing on individuals' intertemporal decision-making. They discover that older age correlates with poorer performance in this regard, which has important implications for policy and consumer decisions.

[4] This empirical strategy follows Christelis et al. (2020), although the data they use allow to study the expected consumption growth (rather than the realized consumption growth), as customarily in the literature. In a theoretical work, King et al. (1988) show that for achieving a balanced economic growth, it is necessary to assume an additively separable utility function between consumption and leisure. This

intertemporal substitution of consumption and leisure (and the corresponding elasticities of intertemporal behaviour), are affected by the individual's labour status, even if the agents consider separately their consumption and leisure decisions. In particular, we will consider the following groups: employees, self-employed, unemployed or retired individuals.

Additionally, and related to our working hypothesis, we analyse if there exist differences in intertemporal consumption behaviour across specific subgroups of workers, such as are temporary versus permanent contract employees. These differences might be relevant if markets are not complete, as there are reasons to expect a different intertemporal behaviour for individuals according to some features of their labour relationship, such as tenure, investment in human capital in the workplace, prospects of promotion, etc.[5] This is the first attempt to study this issue, and we consider that it might be relevant for the Spanish economy, provided the high rate of temporary workers observed in comparison to the European countries.

The empirical work outlined above will use the Spanish Survey on Household Finances (SHF), for the period 2002-2017. To anticipate our results, we obtain that the estimated intertemporal elasticities, obtained using a panel of workers drawn from the SHF, are in line with those obtained using other Spanish individual data surveys. Further, the results we obtain indicate that the intertemporal elasticities for consumption and leisure change across different labour supply statuses. Additionally, we uncover the existence of differences in intertemporal behaviour between permanent and temporary

assumption will pose important restrictions in the relative risk aversion parameter (and so on the elasticity for the consumption intertemporal substitution) and on the income and substitution effect.

[5] Distinguishing between permanent and temporary jobs seems also to be relevant to study intertemporal substitution, given the apparent higher uncertainty associated to temporary jobs (Dolado et al., 2002; Amuedo-Dorantes and Serrano-Padial, 2007, among others).

workers, suggesting that the elasticities of intertemporal behaviour vary according to the type of contract workers hold.

The rest of the paper is organized as follows. In the second section, we present the theoretical model and the equations used to test and outline the different empirical exercises proposed in the paper. In section 3, we describe the characteristics of the data we use and some other empirical and econometric issues. In section 4, we present the main results and in section 5, we conclude.

2. The method and the Life-Cycle model.

The empirical analysis of intertemporal consumption (or leisure) has been traditionally undertaken independently of the intertemporal behaviour of the other, by assuming that the intratemporal preferences are separable. Further, many of the empirical studies try to avoid potential complications related to differences in labour market status by splitting the samples, simply focusing on specific groups of individuals (workers, retirees or unemployed).

An alternative and promising estimation strategy would be estimating the same canonical model for the considered groups, to compare and verify the differences across in terms of the estimated intertemporal elasticities. To the best of our knowledge, previous works have not used this approach as most of the studies focus in the intertemporal behaviour of these specific broad groups, either workers or retirees, and very occasionally, unemployed.[6]

[6] It is important to consider the relevance of the values of the intertemporal elasticities of substitution for economic growth, as showed in the real business cycles research. There is a large number of theoretical

In this framework, and considering the shortcomings raised, we start using an intratemporal separable utility function between consumption and leisure. We will estimate the model on different samples of individuals with different labour market statuses, which will allow comparing the intertemporal elasticities of substitution across different groups. As we estimate the same model for all the samples, the differences found in the estimated elasticities can be attributed to the different labour market statuses of the individuals. This approach follows Zeldes (1989) to test the effect of liquidity constraints on consumption using a sample of presumably constrained individuals. The argument of different elasticities for different population groups is also related to the idea that non-stockholders or not-asset holders should display a lower elasticity of intertemporal substitution for consumption than stockholders or asset holders, given that there is no reason why their consumption has to react to changes in the rate of return. [7] Additionally, there is plenty of formal and informal evidence of heterogeneous behaviour in consumption.[8]

In this paper we follow MaCurdy (1981 and 1983), which is the usual approach to analyse intertemporal substitution. We will assume that individuals choose consumption and leisure in each period to maximize their expected life cycle utility function:

works that highlight the relevance of the assumptions for the utility function and the value of the relative risk aversion for real business cycle models. See de Hek (1998), Jones et al. (2005), or Barañano and Moral (2013), among others.

[7] Mankiw and Zeldes (1991) found that the consumption of stockholders varied more strongly with excess equity returns and was more volatile than total aggregate consumption. Further, Vissing-Jϕrgensen (2002) found differences in estimates of the elasticity between asset holders and non-asset holders, and this was increasing with the size of the asset held.

[8] See, for example, Dynan et al. (2004) and Kueng (2018). Quitana-Domeque and Wohlfart (2016) also find differences in intertemporal consumption between rich and non-rich households.

$$\underset{C_{i,t},L_{i,t}}{\text{Max}}\ U = E_t \sum_{j=0}^{T-1} \beta^j\, u\big(C_{i,t+j}, L_{i,t+j}\big) \tag{1}$$

where $C_{i,t}$ and $L_{i,t}$ are non-durable consumption and leisure of individual i in time t, respectively. We assume that the utility function U is intertemporally separable, and $u(.)$ corresponds to the utility in a specific period (assumed to be increasing and concave in its arguments). E_t is the mathematical expectations operator conditional to the information set available in period t, and β is the discount rate. This maximization is subject to the usual budget constraint:

$$A_{i,t+j+1} = R_t\big[A_{i,t+j} + W_{i,t+j}N_{i,t+j} - P_{i,t+j}C_{i,t+j}\big] \tag{2}$$

where $A_{i,t}$ is the individual's financial non-human wealth; R_t is the nominal interest factor, or gross interest rate, $R_{,t}=1+r_t$, being r_t is the nominal interest rate;[9] $W_{i,t}$ is the wage per hour and $N_{i,t}$ is the number of hours an individual works in t; $C_{i,t}$ is the individual real consumption in period t; and, $P_{i,t}$ is the nominal price of a unit of $C_{i,t}$. We also assume, as customarily, no legacies ($A_{i,T}=0$), and complete capital markets. Note that we are assuming individual variability in the nominal price.

According to the Bellman's optimality principle, to solve the previous optimization problem is equivalent to maximize a value function V, representing the maximum utility expected by an individual in t, with respect to consumption and leisure:

$$V\big(A_{i,t}\big) = \max_{C_{i,t},L_{i,t}} \big\{u\big(C_{i,t}, L_{i,t}\big) + \beta E_t V\big(A_{i,t+1}\big)\big\} \tag{3}$$

This maximization provides three first-order conditions: two intertemporal equations, one for consumption and one for leisure, that establish how the individual

[9] We generically name R_t as the interest rate.

substitutes between consumption and leisure intertemporally; and, one intratemporal equation that relates consumption and leisure in the same period (see Mankiw et al. 1985).

Optimising the previous value function, and assuming that *u* is separable, we get the following first order conditions for the intertemporal behaviour of consumption and leisure:

$$E_t \beta \frac{\partial u / \partial C_{i,t+1}}{\partial u / \partial C_{i,t}} \frac{P_{i,t} R_t}{P_{i,t+1}} = 1 \tag{4}$$

$$E_t \beta \frac{\partial u / \partial L_{i,t+1}}{\partial u / \partial L_{i,t}} \frac{W_{i,t} R_t}{W_{i,t+1}} = 1 \tag{5}$$

This first order conditions for consumption (leisure) would depend on leisure (consumption), if we had considered that the utility function was not intratemporally separable. Then these two equations would be quite similar between them (and similar to the intratemporal condition), what would imply facing an identification problem. Mankiw et al. (1985) overcame this identification problem by estimating a system of equations integrated by all the first order conditions (2 intertemporal conditions and one intratemporal) using U.S. time series. However, their results were quite disappointing. Further, Eichenbaum et al. (1988) also considered the non-intertemporally separable utility case, for which they had to determine the exact form of the stochastic time processes for consumption and leisure, whose simplest expressions provide quite complex empirical equations to test the model. The difficulties encountered by these pioneering studies explain why the subsequent empirical literature with individual data considered separable preferences.[10]

[10] One additional problem for the empirical analysis with individual data is the lack of surveys with the required level of information for consumption and leisure.

In our work, we also consider that the utility function is separable between consumption and leisure. The aim of our research is verifying if the individuals labour supply status affects their intertemporal substitution between consumption and leisure, even if they consider separately both economic decisions. Many of the previous studies have estimated the intertemporal conditions separately including some ad-hoc extra variables (for example, dummy variables capturing the individual's labour status, or other variables related to labour supply) that would only be included in a non-separable setting. For example, leisure should be in the consumption condition if one considers a function intratemporally non-separable. This empirical strategy has been used to test for separability, although it has some caveats. First, it is a weak test for any of the hypotheses of the model considered separately, given that it constitutes a test of the theoretical model under the rational expectations hypothesis. So, a rejection of the model does not allow identifying the reason behind it (either the failure of the model or the rational expectations hypothesis). Second, the specific expression used in the test depends on the assumed mathematical expression for the utility function, and thus the specific functional form of the test would change with different utility functions.[11]

The approach we use circumvents these problems as we directly test for the intertemporal condition across different labour market status individuals. In principle, given that the elasticity of intertemporal substitution measures the response of consumption and/or leisure to the real interest rate, the estimates obtained for the different groups should not change if markets are complete. However, if they differ, this will provide evidence that the different individuals' labour market status matters in their

[11] We believe that given the overwhelming empirical evidence of the excess sensitivity of consumption to income and the widespread empirical failure of the intertemporal canonical model, which is what led to the recent discussion of myopic consumption behaviour, it is remarkable that this empirical approach was not questioned earlier.

intertemporal consumption and leisure decisions. Thus, our null hypothesis can be interpreted as follows: changes in individuals' employment statuses do not affect the intertemporal elasticity of substitution of their consumption or labour supply.

To derive the testable expressions, we need to specify a utility function. We follow MaCurdy (1983) and Mankiw et al. (1985), who propose a generalization of the CRRA utility function, widely applied in the empirical analysis of consumption, to incorporate leisure as an additional argument. From this function, and given that we aim at testing the model with individual data, we add the effect of demographic variables (the vector θ_t) using an exponential term, as follows:

$$\mathrm{u}(C_t, L_t) = \frac{1}{1-\gamma}\left[\frac{C_t^{1-\alpha}-1}{1-\alpha} + \frac{L_t^{1-\phi}-1}{1-\phi}\right]^{1-\gamma} e^{\lambda\theta t} \qquad (6)$$

where γ, α, ϕ, λ and d are all parameters to be estimated. This utility function becomes additively separable in consumption and leisure when $\gamma = 0$, which is the case we consider. In this setting, $1/\alpha$ is the elasticity of intertemporal substitution for consumption and $1/\phi$ is the elasticity of intertemporal substitution for leisure.

From the utility function (6) in the separable case (γ=0), taking logs and applying the rational expectations assumption, the first-order conditions (4) and (5) become the following testable expressions:

$$\Delta ln(C_{it+1}) = k_{ioC} + k_{1C} ln\left(\frac{P_{Cit}R_t}{P_{Cit+1}}\right) + k_{2C}\Delta\theta_{it+1} + \varepsilon_{iCt+1} \qquad (7)$$

$$\Delta ln(L_{it+1}) = k_{ioL} + k_{1L} ln\left(\frac{P_{Lit}R_t}{P_{Lit+1}}\right) + k_{2L}\Delta\theta_{it+1} + \varepsilon_{iLt+1} \qquad (8)$$

where ε_{iCt+1} and ε_{iLt+1} are two error terms independent of all variables dated in t or before. In expressions (7) and (8), $k_{1C}=1/\alpha$ and $k_{1L}=1/\phi$ are the intertemporal elasticities of

consumption and leisure, respectively. These two expressions measure the response of their respective growth rates to the real interest rate, which theoretically should not change concerning differences in the individual's labour market status.

Although we estimate equations (7) and (8) separately, we perform a final exercise consisting of estimating the complete system of first-order intertemporal equations for the sample of employees, to minimize the possibility of corner solutions. For this purpose, we need to add to the first order conditions, the intratemporal condition:

$$ln(C_{it}) = k_o + k_1 ln(L_{it}) + k_2 ln\left(\frac{W_{it}}{P_{it}}\right) \quad (9)$$

The estimation of this system of equations would allow verifying whether the results obtained change when using a single equation to estimate the intertemporal conditions. If this were the case, the disparities could be attributed to the fact that the intertemporal decisions of consumption and leisure are jointly estimated or, at least, are interlinked.[12,13] To the best of our knowledge, this is the first attempt to estimate the system of equations with panel data. Mankiw et al. (1985) carried it out this exercise with U.S. time series, but their results they obtained were not satisfactory. And Cutanda and Sanchis-Llopis (2021, 2023) performed the estimation using Spanish pseudo-panel data. Taking into consideration the restrictions between the parameters in the three equations in the system could explain differences in the results obtained with the estimation of the two intertemporal equations (7) and (8) in isolation.

[12] Mankiw et al. (1985) point out that one of the main drawbacks in estimating the Euler equation (6) is the fact that it ignores information contained in equation (7). However, there are reasons that explain that its inclusion in the system does not provide satisfactory results, given that it relates the levels of consumption and leisure in the same period, what does not seem appropriate to explain intertemporal behaviour.

[13] Another point that could be relevant in the system estimation, is that equation (7) does not contain the discount rate and it does not require econometric techniques to consider it, differently to what happens in equation (6).

It is relevant noting that our empirical model is static, as the dependent variables in equations (7) and (8) are the growth rates of consumption and leisure, respectively (see Zeldes 1989 and Runkle 1991). Further, all time invariant demographic variables will vanish as the vector of demographic variables (θ_{it}) enters in each of the specifications in first differences. We treat k_{ioC} and k_{ioL} as individual fixed effects, provided that these terms include the unobservable discount rate, that might be potentially correlated with the regressors. Thus, this implies the need to use robust estimation techniques to account for this potential correlation. In our specifications we will include a constant term in both equations, that could be interpreted as the *autonomous* discount rate, common to all the individuals in the sample. Finally, we will estimate Frisch elasticities, as these are considered the appropriate elasticities to analyse individuals' intertemporal behaviour (a similar approach can be found in Mankiw et al. 1985). Keane (2011) and or Thimme (2017), provide surveys of the results obtained in empirical research on the intertemporal elasticity of leisure and consumption, respectively.

3.-Data and empirical issues.

The objective of this research is to verify whether there are differences in the intertemporal behaviour of consumption and leisure for different groups of individuals, depending on their situation about the economic activity. This is an important aspect traditionally ignored by the empirical research, since most of the studies focus on verifying whether the evidence supports the empirical implications of the intertemporal optimisation model for specific groups of individuals, to assure a homogeneous behaviour of the individuals composing the samples. In our empirical approach, we will estimate the same intertemporal equations for the diverse groups considered, aiming at identifying

differences in the estimated elasticities of intertemporal substitution. The related empirical literature has uncovered several problems in the adjustment of the intertemporal canonical model for some of these groups we mentioned, although, differently to the present work, none of these studies has focused in detecting differences in the elasticities of intertemporal substitution of consumption and leisure.[14]

Further, the previous empirical research has neither addressed whether relevant differences in the characteristics of the employment relationship affect the employees' intertemporal behaviour. This issue has been gaining more interest as the temporary contracts rate has been increasing in some economies. This debate has been especially intense in those countries where, as in Spain, this increase has been higher (see Dolado et al. 2002). Thus, in our empirical exercises, we will search for differences in the elasticities of intertemporal substitution of leisure and consumption by estimating the intertemporal conditions (7) and (8) for the total sample of employees and the subsamples of fixed-term and temporal contract employees. The main reason to expect differences in the elasticities of intertemporal substitution between these two groups is the higher rate of uncertainty associated to temporal contracts as compared to fixed-term contracts. Lugilde (2018) has found, using the total sample of the SHF, that an increase of 1% of income uncertainty reduces Spanish expenditure about 5-7%.[15]

Another group traditionally excluded from the empirical analysis of intertemporal consumption and leisure is the group of individuals self-employed. The reasons for this

[14] For example, Banks et a. (1998) found a sharp decline in consumption during the first years of retirement, what they coined the *retirement consumption puzzle*, a phenomenon also confirmed by other researchers, see Olaffson and Pagel (2018) or Redmon and McGuinness (2020). In a similar way, Dynarski and Sheffrin (1987) found that changes in consumption following unemployment are large, especially for white-collar workers. Finally, for the effects of unemployment benefits on consumption, see East and Kuka (2015) or Ganong and Noel (2019).

[15] Although the effect of uncertainty on intertemporal behaviour of consumption has been deeply analysed since Skinner (1988), its effect on the intertemporal behaviour of leisure has not.

are: on the one hand, their presumed different intertemporal economic behaviour concerning the group employees;[16] and, on the other hand, their reduced number in the population samples, which makes that the size of this subsample is quite reduced and with a lot of attrition, what might complicate the econometric requirements. There are some studies focused on this group, such as Parker et al. (2005), who found that wage uncertainty is a key determinant of self-employed labour supply. Self-employed is probably one of the groups more affected by uncertainty, what makes it highly appropriate to study intertemporal economic behaviour. In relation to this, Christeslis et al. (2020) found that the expected consumption risk is positively correlated with self–employment.

In our study, we use the same procedure applied for estimating the employees' wage per hour, to obtain an expression for the hourly earnings of the self-employed, i.e., by dividing their income by the hours worked, given that this information is available in the SHF, exactly in the same manner than for the group of employees.[17] In this way, we can estimate the elasticity of intertemporal substitution of leisure for the sample of self-employees using the real interest rate obtained with their hourly earnings inflation rate, which we will compare with the estimated elasticity obtained for the sample of employees.

For the data, in this work, we use a panel data set drawn from the Spanish Household Finances Survey (SHF) for the period 2002-2017, elaborated by the Bank of Spain. The SHF is a unique statistical source for Spanish households, with information on expenditure, income, labour supply, assets and liabilities. It is similar to the Italian

[16] This group has some peculiarities in their economic behaviour. See, for example, Mastrogiacomo and Alessie (2014) or Rossi and Sansone (2018).

[17] This is the usual procedure to measure wages in microeconomic surveys, which usually contain information in income and hours worked, but not in wages. This would make necessary using econometric techniques that consider measurement error.

Survey on Household Income and Wealth (SHIW) of the Bank of Italy and to the Survey of Consumer Finances (SCF), of the U.S. Federal Reserve. The SHF collects information every three years and started being surveyed in 2002. Thus, there are six waves of data available, that cover a complete cycle of the Spanish economy.[18,19]

The SHF is a rotating unbalanced panel interviewing about 6000 individuals in each wave.[20] There are 34,829 observations in total. However, we drop individuals with missing values in relevant information. After removing those individuals with zero total nod-durable-expenditure, zero expenditure in food and zero total household income, we end up with a sample of 34,661 observations. From this total sample, we will end up with a working sample of 10,804 observations, corresponding to 2685 individuals who collaborate a minimum of 4 times during the sample period. [21] We consider this sample as sufficient to empirically analyse individual intertemporal behaviour.[22] In Table 1 we present the number of individuals considered for estimating our specifications for each of

[18] The survey was designed to collect information about households' assets and savings. So, wealthier households are over-sampled, based on the information available from the wealth tax records for Spain in 1999. Martínez (2017) examines the SHF data set and compares it with other sources of information, concluding that the SHF would be appropriate to study individual's behaviour.

[19] The Bank of Spain uses a multiple imputation procedure to fill the "don't answer/don't know" gaps in the original recording files of this survey. This seems an especially serious problem for some of the questions, most probably related to fiscal avoidance. The procedures applied are the multiple imputation programs (see Kennickell 1991 and 2017). So, for each of the survey waves there are five identical files of imputations available. In order to use this information in the empirical analysis we average the 5 imputations.

[20] The number of individuals interviewed in 2002 was lower (5141) and higher in 2017 (6413).

[21] In order to obtain our working sample, and given the especial economic characteristics of the survey, we discard observations for households in the upper 5% of the income distribution. This was equivalent to discarding households with gross total income larger than 150000 €. We analyse in the empirical work this issue in detail.

[22] MaCurdy (1981) analyses a panel of 513 individuals from the PSID, and MaCurdy (1983) a sample of 121 individuals. Ziliak and Kniesner (1999) estimate a panel of 532 individuals from the PSID, and Rossi and Trucchi (2016) use a sample of 544 observations, with around 150 individuals.

the samples analysed.[23] Visual inspection of Table 1 indicates that the number of individuals with more than 3 interviews in the survey falls very significantly since 2011.

Table 1 around here

In Table 2 we present the number of individuals with fixed-term contracts and with temporary contracts. As it can be seen, the fixed-term contract employees' group is overrepresented by this sample. They represent about 15% of the total number of employees in the Spanish economy during those years. The more reduced sample corresponds to that of employees with temporary contracts, although we consider it is still valid to check if there are differences between these individuals and fixed-term contract employees.

Table 2 around here

Given these particularities, it seems relevant to analyse the information about certain relevant economic and demographic variables in the SHF for our working samples. We present this information in Table 3. We would like to point that among the expenditure variables we consider, we do not include any expenditure in real state or in housing, so the figures reported might underestimate the volume of savings. With respect to the total population surveyed, total income amounts to 37,156 €, while total nondurable and durable expenditure are 14,175 and 2,506 €, respectively. [24] The average age of the head of the household is about 54 years old, while the number of members and adults in the households are 2.55 and 2.28, respectively.

[23] We do not use information for observations prior to 2011, due to the need of taking differences and lagged instruments.

[24] The nondurable expenditures category includes "all the expenses, excluding expenses in durable goods, that includes rent of the house, mortgage, insurance, reforms, maintenance costs, etc.". In the durable category we include all purchases on home equipment and on vehicles or means of transport.

Table 3 around here

Now, the averages for these variables for employees, self-employed, unemployed and retired can be assessed in comparison with the total sample. Thus, the higher total average income corresponds to the self-employed (54,837 €) and the lowest to the unemployed group, being the employees and retired groups in between these two extreme categories.[25] As regards nondurable expenditure, we can observe that the figure is similar for the groups of employees and retired, despite the lower income of this last group, which provides informal evidence in favour of the permanent income hypothesis. Also, as expected, durable expenditure maintains to a greater extent, the proportionality with the volume of total income across groups of individuals. As regards hours worked, we observe that self-employed display a higher average weekly worked hours than employees (46.07 vs. 39.45), what is coherent with total income. Finally, the differences in the demographic variables across all these groups are as expected.

Focusing on the employees' group, within this category those with fixed-term contracts show, as expected, higher values in all the economic aggregates. Further, there is a significant reduction in expenditure and total income for the sample of temporary workers (being a temporary employee implies a fall of 30% in total income and expenditure). Additionally, temporary workers display lower weekly worked hours on average than workers with fixed-term contracts. Concerning the demographic variables, we would like to highlight that temporary employees are younger than fixed-term contract workers.

[25] The hypothesis of heterogeneity in the value of the elasticity of intertemporal substitution in consumption is often related to the relationship between this elasticity and the level of consumption (Attanasio and Browning 1995), and, then, with the level of income and with the level of wealth (Atkeson and Ogaki 1996).

For our research, the measure for aggregate consumption we use corresponds to the nondurable expenditures. We calculate a Stone price index for this measure using the corresponding CPI for each of the expenditures that compose this aggregate.[26] We will also use a nominal interest rate for the Spanish bank deposits. This variable is available in the statistical information of the Bank of Spain (see Cutanda et al. 2020, or Cutanda and Sanchis-Llopis 2021 and 2023, for details). Despite the nominal interest rate is common for all the individuals, the real interest rate obtained is not, as we use the individual price index to calculate the real interest rate.

Our measure for leisure is obtained subtracting the number of hours worked during a week (by the main income earner of the household) from the weekly total hours available. As it is usual in the literature, we obtain the hourly wage by dividing the main income earner labour income by the hours worked.[27]

4. Results.

In this section we report the results for the estimation of the EISC and the EISL, using the corresponding intertemporal conditions for these two parameters. We report the estimates of these intertemporal elasticities using different samples of individuals, according to their labour status. Finally, we will estimate the EISC and the EISL using a system of the 3 conditions (the two intertemporal conditions and the intratemporal condition). In this last exercise, we will consider the restrictions across equations that

[26] CPIs are taken from the Spanish National Statistical Office (INE).
[27] Given that the EFF provides the required information, we calculate this measure for employees and self-employed.

emerge from the optimization problem, given that the same parameters of the utility function appear in different equations.

The particular characteristics of the population analysed by the SHF imply that we should be cautious when comparing our results with the results previously obtained in the related literature. Thus, the differences observed for the Spanish case can be attributed to the particular features of the SHF. Notwithstanding, knowing and verifying these differences might be highly valuable as the accepted estimates for the intertemporal elasticity parameters for the Spanish economy might be changed or, at least, qualified.

In Table 4, we present the results for estimating the elasticity of intertemporal substitution of consumption for the total sample and for the different groups of individuals we have considered, according to their labour economic activity – employees, unemployed, retired and self-employed. We would like to point out that our estimates for this parameter, for the employees' sample, are always statistically significant and are close to the upper limit of the values usually obtained in the related empirical literature using similar samples, including some works for the Spanish economy (see Cutanda et al. 2020, or Cutanda and Sanchis-Llopis 2021 and 2023). The estimated elasticities we achieve are always above 0.7.[28] We get an estimate of 0.9 for the whole sample.[29] Concerning the different labour status groups, we get that the EISC for the sample of self-employed is the highest (0.976), followed by the elasticity of the sample of employees (0.931). Both for the retired and unemployed samples, we get significantly lower

[28] Crump et al. (2022) obtain an estimate for the U.S. elasticity about 0.7 (in a specification not controlling for excess of sensitivity). Differently to us, they use subjective expectations in the estimation of the Euler equation, rather than realized expenditures. Additionally, the results found by Dogra et al. (2016) using the PSID dataset imply an elasticity between 0.7 and 0.9, controlling for liquidity constraints.

[29] This estimate is similar to the values used in calibrated models designed to match growth and fluctuations, that use values about 1. However, the median value for these estimates is far from 1 (see Havránek, 2015). Further, Guvenen (2006) indicates that this contradiction is resolved by introducing heterogeneity in the models, an argument that gives support to our research.

estimates for the EISC, especially low in the case of the unemployed group (0.725), which is more than 20% below the estimated elasticity for the employees' sample.

Table 4 around here

In all the specifications for the Euler equations presented in Table 4 we have included controls for demographic variables: the age of the head of the household and its square, the number of adults in the household and the number of members. We get in all specifications that these demographic variables are not statistically significant. Further, at the bottom of Table 4, we report the results of the Hansen's test of over-identifying restrictions, for which we get appropriate results (in all cases we cannot reject the null hypothesis, and thus the instrument sets used in each specification are valid).

From these results, we can conclude that the labour status of the head of the household plays a relevant role in the estimation of the elasticity of intertemporal substitution for consumption. We consider this should not be unexpected given that this parameter measures how consumption changes in reaction to variations of the real interest rates, and, so, to cyclical changes. Further, it is remarkable the high degree of intertemporal substitution displayed by the sample of unemployed individuals, a group usually discarded in the empirical research for the EISC, due to their presumed high exposure to credit rationing. [30] However, this result has to be taken with caution given that the mean wealth observed in the SHF for the sample of unemployed, is higher than that corresponding to the sample of unemployed in the economy. We also consider noticeable the high degree of intertemporal substitution for consumption for the retired

[30] See Ganong and Noel (2019) for evidence on the relationship between spending and unemployment.

group implied by our results, given the available wide empirical evidence on the so-called consumption retirement puzzle (see Banks et al. 1998).[31]

In Table 5, we present the results for the estimation of the Euler equation for leisure, both for the whole sample of employees (column 1) and the self-employed one (column 2). Further, for the sample of employees, we also report the results splitting the sample for individuals in fixed and temporary contracts (columns 3 and 4). In column (1) we obtain that the estimate of the elasticity of intertemporal substitution of leisure for the sample of employees is positive. For these individuals, we obtain an estimate for the EISL of 0.170, that is below previous estimates obtained for the Spanish economy using pseudo-panel data (about 0.25), see Cutanda and Sanchis-Llopis (2021 and 2023). With respect to the demographic controls, our results show no statistical significance for any of these variables, as occurred with the estimation of the Euler equation for consumption,[32] although the significance levels of the Hansen's test improve with respect to Table 4. So, we can conclude that while the estimates using the SHF data (as compared to data from other Spanish surveys) seem to reflect more intertemporal substitution for consumption, we get the reverse result for the intertemporal substitution of leisure.

Table 5 around here

Next, we split the sample of employees in two sub-samples (temporary and fixed contract employees), to test whether the duration of the labour contract (a relevant characteristic of the contract) affects the estimates we obtain for the EISL. This is a

[31] The available empirical evidence does not support the existence of the retirees' consumption puzzle for the Spanish case. See Labeaga and Osuna (2007) and Luengo-Prado and Sevilla (2012). Recently, Labeaga and Sanchez-Robles (2021) find a negative association between consumption growth and retirement with data for the 1977-1996 period.

[32] This is similar to the results obtained for the same equations in Cutanda and Sanchis-Llopis (2021 and 2023), using a different survey in a previous sample period.

particularly interesting issue for the Spanish economy, given the higher rate of temporary contracts in Spain. As the size of the sample of households whose head has a temporary contract is small, we widen the sample by adding those households whose spouse has a temporary contract.[33] These results are presented in columns (3) and (4), for the fixed-term and temporary contracts, respectively. The estimated elasticity for individuals with fixed-term contrasts falls to 0.160, indicating that more stability in the workplace is associated to a lower estimated intertemporal elasticity for leisure. Contrarily, the estimate for the sample of temporary workers is much higher, 0.214, and closer to previous results for the Spanish economy (see Cutanda and Sanchis-Llopis 2021 and 2023). This result should be taken with caution given that the sample for this kind of workers amounts to only 160 observations, which suggests that this group of workers is considerably underrepresented in the SHF, especially in a country like Spain where the rate of temporary jobs ranges between 25 and 30% in the sampling period considered. Additionally, and for the sake of comparability, we report the estimates using the self-employed sample in column (2). For this group, we have imputed a value for the hourly wage with the same criterion used for obtaining the wage for workers, i.e., dividing their labour income by their declared hours worked. It is important to remark that the elasticity of intertemporal substitution for leisure obtained for the self-employed is not statistically significant, indicating that this group essentially does not substitute leisure intertemporally, or it does at a lesser extent than employees.

The fact that for temporary contract employees, we estimate a larger elasticity for intertemporal substitution of leisure as compared to fixed-term contract employees is striking. The different economic consumption behaviour of temporary employees, and

[33] This explains why the size of the employees' sample does not coincide with the sum of the sizes of the temporary and fixed contract sub-samples.

also of self-employed, has been traditionally explained by the greater uncertainty these groups face in comparison to the fixed-term contract employees. Nevertheless, these results provide evidence of a different intertemporal behaviour in consumption and leisure for these groups. About the intertemporal substitution of leisure, this could be explained by the fact that the self-employed might have a different perception of the (labour) uncertainty they face, or to the fact that they are able, to some extent, to control and influence their labour situation (what does not occur to temporary employees).

As shown above, the type of labour contract held by individuals plays a relevant role in the different estimates we find for the intertemporal substitution of leisure. Thus, now we consider whether individuals with different contracts also show different intertemporal behaviours for consumption. To this end, in Table 6 we present the estimated elasticity of intertemporal substitution for consumption for fixed-term and temporary contracts employees.[34] The estimated intertemporal elasticity of consumption for the fixed-term contract workers increases significantly and reaches a value above one, 1.09. The elasticity we obtain for the temporary contract employees is 0.871. In these cases, the results of the Hansen's test of overidentifying restrictions are quite acceptable.

Table 6 around here

Finally, we estimate the complete system of equations composed by the two intertemporal equations (for consumption and leisure) and the intratemporal condition. The objective of estimating the system is that it will allow the detection of possible interrelations between leisure and consumption decisions which are difficult to test by using the equations separately. Further, this empirical strategy may, effectively, detect an

[34] The sample size for employees is bigger in Table 7 as compared to the sample in Table 5 because we lose less observations due to instrumentation. In this case the maximum lag for the instruments used is 2.

empirical failure of the model if the estimation results of the system are different from the estimation results of the intertemporal equations. This could indicate that the intratemporal separability assumption is not suitable. So, in Table 7 we present the results of estimating the complete system of intertemporal equations. These results are comparable to those obtained in Tables 4 and 5 for our canonical sample (see column (1) in these two tables). In this sense, although the estimates in Table 7 are below the values reported in the previous tables, they are quite similar. Thus, in Table 7 we obtain an intertemporal elasticity for consumption of 0.849, when in Table 4 it was 0.931, and an intertemporal elasticity for leisure of 0.131, when it was 0.170 in Table 5. Thus, the estimation of the system of equations confirms our previous conclusion that using SHF data provides a larger intertemporal elasticity for consumption and lower for leisure, as compared to previous estimates with other Spanish surveys, and we detect no problem with the separability assumption.

Table 7 around here

5. Discussion and implications.

This paper analyses the intertemporal behaviour of different groups of individuals as regards their labour supply status. The empirical research on this subject imposes very restrictive conditions to build the estimation samples. These requirements try to satisfy the theoretical assumptions, and in practice produce very reduced empirical samples, which makes the results obtained scarcely reliable. This is especially important when the groups excluded are large, as can be the group of unemployed individuals in downturns. This research aims to check the severity and relevance of this problem in the case of the

Spanish economy using a survey of individual information (the SHF), not used yet to analyse intertemporal behaviour.

The empirical research on the intertemporal behaviour of consumption (and leisure) with individual information usually excludes from the analysis individuals unemployed, self-employed or retired. In this study, we estimate the intertemporal elasticity of substitution of consumption and leisure for these groups and compare the results with those obtained for the sample of employees. We deepen into the analysis by splitting the sample of employees into the sub-samples of fixed term and temporary contracts, that constitute two types of contracts with different duration and degree of uncertainty. To our knowledge, this point has not been addressed in the empirical literature.

As regards the results we obtain, we start with the group of employees, that is the group usually considered in empirical literature. The estimates we obtain are comparable to those previously obtained in Cutanda et al. (2020) and Cutanda and Sanchis-Llopis (2021 and 2023) for Spain, using pseudo-panel data for a different period. These results are quite interesting, given that the SHF oversamples the wealthier individuals in the economy. With the SHF the intertemporal elasticity for consumption is estimated around 0.9 (as compared to an average of 0.7 in the mentioned works), and the intertemporal elasticity for leisure is estimated around 0.17 (as compared to 0.25). These estimates are of the same order of magnitude than those provided by Cutanda et al. (2020) and Cutanda and Sanchis-Llopis (2021 and 2023), and the differences can be attributed to the sample design of the SHF.

As regards the results for the different labour supply statuses, we find that employees have a higher intertemporal substitution for consumption. Further, both the

group of retired and, especially, the group of unemployed, display lower values for the intertemporal elasticity of consumption (0.87 and 0.72, respectively). This conclusion is reinforced by the fact that the sample of self-employed, who have the highest average working hours, attain the highest elasticity (0.97). These results provide evidence that individual's labour market status matters in the analysis of intertemporal consumption and confirm previous empirical results (see Quintana-Domeque and Wohlfart 2016).

In relation to the duration of the contracts, we obtain that for the sample of fixed-term contract employees the elasticity of intertemporal substitution of leisure is lower than that estimated for the sample of employees with temporary contracts. However, we obtain the opposite for the elasticity of intertemporal substitution of consumption. So, our results uncover that the higher the stability of the employment situation the lower (higher) the elasticity of intertemporal substitution for leisure (consumption). Notwithstanding, we obtain that the sample of self-employed, who face a higher rate of uncertainty, does not show any intertemporal substitution of leisure. This might occur as this group of workers have a different consideration of uncertainty, as compared to temporary workers, related to a perceived higher degree of control over their labour situation.

Finally, our results confirm, that there is room for policies aimed at changing intertemporal individual behaviour, through modifying the intertemporal prices of consumption or leisure using taxes. Further, it is important to bear in mind that such policies should be implemented at the microeconomic level to maximize their effects.

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Table 1. Individuals by labour situation.

Year	**Employees**	**Self-emp.**	**Unemployed**	**Retired**	**Inactive**
2011	310	125	69	550	373
2014	161	84	36	311	216
2017	110	51	22	205	73
Total	581	260	127	1066	662

Note: Inactive individuals include individuals permanently disabled, students, individuals doing housework and other individuals in inactivity.

Table 2. Employees by type of contract: fixed *versus* temporal contracts.

Year	**Fixed-term contracts**	**Temporary contracts**
2011	282	41
2014	149	18
2017	98	15
Total	529	74

Notes: In temporary contracts we consider either that the head of the household is in a temporary contract or his wife.

Table 3. Economic and demographic characteristics.

	Total	Employees	Self-emp.	Unemp.	Retired	Fixed-term contract	Temp. contracts
Non-durable consump.	14175	14708	19312	10380	14523	15341	12005
Durable consump.	2506	3231	4483	1908	1879	3397	2689
Total income	37156	43351	54837	24592	36031	46304	31121
Age head	53.96	41.73	46.89	40.52	67.19	42.48	37.52
N. of members	2.55	3.00	3.12	2.88	2.08	3.01	3.05
N. of adults	2.28	2.47	2.67	2.43	2.07	2.48	2.46
Hours	-	39.45	46.07	-	-	40.04	38.23

Notes:

1. Durable consumption is the aggregate of all expenditures declared by the household for these goods (house equipment, means of transport, jewels, art-works, antiquities).
2. We do not include any expenditure in real state or the rent of any house.
3. Total income is a variable constructed by the SHF.

Table 4. Elasticity of intertemporal substitution for consumption across different groups.

$$ln(C_{it}) = k_o + k_1 ln(L_{it}) + k_2 ln\left(\frac{W_{it}}{P_{it}}\right)$$

	Total	Employees	Unemployed	Retired	Self-employed
EISC	0.900***	0.931***	0.725*	0.876***	0.976***
	(0.045)	(0.222)	(0.448)	(0.056)	(0.098)
Age head	0.105	-0.117	0.111	-0.073	0.021
	(0.123)	(0.508)	(0.130)	(0.227)	(0.417)
Age head sq.	-0.001	0.001	-0.001	0.001	-0.001
	(0.001)	(0.005)	(0.001)	(0.002)	(0.003)
N. of members	0.421	0.356	-0.008	0.820*	0.401
	(0.244)	(0.696)	(0.387)	(0.775)	(0.526)
N. of adults	-0.949	1.532	-0.056	-0.559	-0.241
	(0.825)	(4.592	(0.482)	(0.780)	(0.397)
Constant	-0.179***	-0.183	-0.301***	-0.125***	-0.176***
	(0.042)	(0.134	(0.055)	(0.032)	(0.062)
Number obs.	1736	520	120	909	187
Test for overidentifying restrictions					
Hansen's J	0.017	1.303	0.324	0.086	0.765
Chi2(1) p-value	0.896	0.253	0.569	0.769	0.381

Notes:

1. The instruments for all the specifications are the second and third difference of the real interest rate, the second and third lag of the number of members of the household, the second difference of the age of the head of the household and its square and a constant.
2. *, *** and *** mean statistically significant at the 1, 5 an 10%, respectively.

Table 5. Elasticity of intertemporal substitution for leisure across different groups.

$$ln(C_{it}) = k_o + k_1 ln(L_{it}) + k_2 ln\left(\frac{W_{it}}{P_{it}}\right)$$

	Employees	**Self-Employed**	**Fixed-term contract**	**Temporary contract (head or wife)**
EISL	0.170***	0.013	0.160***	0.214***
	(0.029)	(0.047)	(0.030)	(0.056)
Age head	0.012	-0.089	0.012	0.019
	(0.009)	(0.397)	(0.009)	0.017
Age head sq.	-0.001	0.001	-0.001	-0.001
	(0.001)	(0.004)	(0.001)	(0.001)
N. of members	0.013	0.112	0.021	-0.032
	(0.015)	(0.072)	(0.015)	(0.043)
N. of adults	-0.005	-0.146	-0.009	-0.007
	(0.012)	(0.074)	(0.012)	(0.034)
Constant	-0.007	0.031	-0.005	-0.006
	(0.005)	(0.017)	(0.004)	(0.017)
Number obs.	1216	331	1141	160
Test overidentifying restrictions Hansen's J				
Chi2(1)	0.001	0.289	0.050	0.039
p-value	0.966	0.590	0.821	0.842

Notes:

1. The instruments for this specification are the second lag of the interest rate, the second difference of the number of members of the household, the first difference of the age of the household and its square, the second difference of the number of adults of the household and of the log of the income of the head of the household and a constant.
2. *, *** and *** mean statistically significant at the 1, 5 an 10%, respectively.

Table 6. Elasticity of Intertemporal Substitution for consumption across different types of contracts.

$$ln(C_{it}) = k_o + k_1 ln(L_{it}) + k_2 ln\left(\frac{W_{it}}{P_{it}}\right)$$

	Employees	Fixed-term contract	Temporary contract
EISC	1.092***	1.180***	0.871**
	(0.213)	(0.247)	(0.308)
Age head	0.080	0.083	-0.081
	(0.034)	(0.040)	(0.053)
Age head sq.	-0.001	-0.001	0.001
	(0.001)	(0.001)	(0.001)
N. of members	0.074*	0.086	0.163*
	(0.048)	(0.054)	(0.088)
N. of adults	0.023	0.018	-0.025
	(0.044)	(0.048)	(0.100)
Constant	-0.098***	-0.096***	-0.082***
	(0.017)	(0.018)	(0.034)
Number obs.	1216	1141	160
Test overidentifying restrictions			
Hansen's J Chi2(1)	0.072	0.067	1.331
p-value	0.787	0.795	0.248

Notes:

1. The instruments for this specification are the second lag of the interest rate, the second difference of the number of members of the household, the first difference of the age of the household and its square, the second difference of the number of adults of the household and of the log of the income of the head of the household and a constant.
2. *, *** and *** mean statistically significant at the 1, 5 an 10%, respectively.

Table 7: System of equations.

$$\Delta ln(C_{it+1}) = k_{ioC} + k_{1C} ln\left(\frac{P_{Cit}R_t}{P_{Cit+1}}\right) + k_{2C}\Delta\theta_{it+1} + \varepsilon_{iCt+1}$$

$$\Delta ln(L_{it+1}) = k_{ioL} + k_{1L} ln\left(\frac{P_{Lit}R_t}{P_{Lit+1}}\right) + k_{2L}\Delta\theta_{it+1} + \varepsilon_{iLt+1}$$

$$ln(C_{it}) = k_o + k_1 ln(L_{it}) + k_2 ln\left(\frac{W_{it}}{P_{it}}\right)$$

EISC	0.849***
	(0.072)
Age head	-0.184
	(0.157)
Age head sq.	0.002
	(0.002)
N. of members	-0.007
	(0.022)
N. of adults	-0.386
	(0.364)
Constant 1 (k_{ioC})	-0.095
	(0.039)
EISL	0.131**
	(0.047)
Constant 2 (k_{ioL})	151.348
	(128.853)
Leisure	-33.687
	(30.056)
Constant 3 (k_o)	-0.011
	(0.010)
N. observations	357
Test overidentifying restrictions	
Hansen's J Chi2(1)	6.504
p-value	0.590

Notes:

1. The instruments are: 1st equation: the second and third difference of the real interest rate, the second and third lag of the number of members of the household, the second difference of the age of the head of the household and its square, and a constant. 2nd equation: second lag of the real interest rate, the second difference of the number of members of the household, the age of the head of the household and its square, the second difference of the number of adults of the household, the second and third difference of the log of the income of the household and a constant. 3rd equation: the second and third differences of the log of the real nondurable consumption and a constant.
2. *, *** and *** mean statistically significant at the 1, 5 an 10%, respectively.