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Research article

Labour supply status and intertemporal behaviour: evidence from Spanish panel data

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Abstract: In this paper, we estimated the intertemporal substitution for consumption and leisure in Spain. We used the standard intertemporal optimization consumption model with an intra-temporally separable utility function, using different population groups: employees, self-employed, unemployed, or retired people. Further, we analyse if the elasticity of intra-temporal substitution for leisure is affected by the individual labour status (temporary workers vs. fixed-term contract workers). For this purpose, we used 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 intertemporal substitution elasticities for both consumption and leisure are different depending on individuals' labour status and the labour contract's characteristics, such as the duration of the contract (temporary vs. 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 empirical research as it places important restrictions on the samples under analysis to ensure that individuals meet the highly demanding theoretical behavioral assumptions. This implies a lack of generality in the estimates of the structural behavioral parameters obtained.

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, empirical results obtained using this approach would be particularly sensitive to cyclical shocks.[1]

The elasticities of intertemporal substitution for consumption and leisure, two key parameters to study individual intertemporal behaviour, have been comprehensively investigated. However, some aspects of intertemporal behaviour have not yet been sufficiently analysed (Thimme, 2017; Keane, 2011). In particular, there is a lack of comprehension about how these elasticities change with age, specific individual labour status, or some important features of the labour contract. These gaps exist despite scarce relevant empirical works that study changes in economic behaviour related to individuals becoming unemployed (Dynarski and Sheffrin, 1987; 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).[2]

The intertemporal elasticity of leisure substitution has gained a lot of attention lately due to the problems associated with population aging and the viability of the social security system in nations with pay-as-you-go schemes.[3] The effect of taxes on the current labour supply has traditionally attracted interest in the literature (see Keane, 2011). However, the empirical analysis of the effect of taxes on intertemporal labour supply is scarce, which is likely due to the limitations of the available statistical sources.[4]

[1] 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.

[2] Furthermore, studies on the significance of age in decisions about savings and consumption have increased as a result of the current aging process in developed countries. In this regard, Wesley Carpenter et al. (2021) examined the interplay of retirement and aging 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.

[3] This is due to the potential effects on labour participation of the tax increase required for the system's sustainability. See, for the Spanish case, Cutanda and Sanchis-Llopis (2023b).

[4] Information with temporal continuity on labour income taxes and working hours would be necessary for this empirical analysis. As far as we know, no Spanish statistics source currently offers this kind of information with the level of detail required.

In previous studies, the estimation of the Euler equation for consumption usually included 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 intra-temporally separable utility function, using population samples that differ in their labour supply status.[5] Our working hypothesis is that the 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 their consumption and leisure decisions separately. 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 are differences in intertemporal consumption behaviour across specific subgroups of workers, such as temporary vs. 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.[6] 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. We anticipate that the estimated intertemporal elasticities, obtained using a panel of workers drawn from the SHF, will be in line with those obtained using other Spanish individual data surveys. Further, the results obtained 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 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.

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

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

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; in Section 5, we conclude.

2. The models

The empirical analysis of intertemporal consumption (or leisure) has been traditionally undertaken independently of the intertemporal behaviour of the other, assuming that intratemporal preferences are separable. Further, many empirical studies tried 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 to estimate the same canonical model for the considered groups, to compare and verify the differences in terms of estimated intertemporal elasticities. To the best of our knowledge, previous works have not used this approach, as most studies focused on the intertemporal behaviour of these specific broad groups, either workers or retirees and, very occasionally, unemployed individuals.[7]

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 non-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.[8] Additionally, there is plenty of formal and informal evidence of heterogeneous behaviour in consumption.[9]

In this paper, we follow MaCurdy (1981, 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:

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

[8] 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-Jørgensen (2002) found differences in estimates of the elasticity between asset holders and non-asset holders, and this increased with the size of the asset held.

[9] See, for example, Dynan et al. (2004) and Kueng (2018). Quintana-Domeque and Wohlfart (2016) also found 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 the 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).[10] E_t is the mathematical expectation 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, $R_t = 1 + r_t$, with r_t being the nominal interest rate;[11] $W_{i,t}$ 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 Bellman's optimality principle, solving the previous optimization problem is equivalent to maximizing 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 substitutes consumption and leisure intertemporally; and one intratemporal equation that relates consumption and leisure in the same period (see Mankiw et al., 1985).

Optimizing 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:

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

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

These 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

[10] The analysis of intertemporal non-separabilities has proven to be very complex, even under the assumption that consumption and leisure may be intratemporally separable. Generally, it would imply the use of a utility function that would depend on a stock that provides a flow of services that would cause time dependence (due to habits or durables, in the case of consumption, and human capital in the case of labour supply). Regarding the consumption case, see Attanasio (1999).

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

equations would be quite similar (and similar to the intratemporal condition), which would imply an identification problem. Mankiw et al. (1985) overcame this identification problem by estimating a system of equations integrated by all the first-order conditions (two intertemporal conditions and one intratemporal) using U.S. time series. However, their results were quite disappointing.[12] 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.[13]

In our work, we also consider that the utility function is separable between consumption and leisure. The aim of our research is to verify if the individual's labor supply status affects their intertemporal substitution between consumption and leisure, even if they consider both economic decisions separately. 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 expectation hypothesis. So, a rejection of the model does not allow the reason behind it to be identified (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.[14]

The approach we use circumvents these problems as we directly test for the intertemporal condition across individuals with different labour market statuses. 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 intertemporal consumption and leisure decisions. Thus, our null hypothesis can be

[12] They conclude that "aggregate data are not readily characterized as ex post realizations from a stochastic dynamic optimization" (p. 226) because the estimations of the utility function's parameters they obtained were unplausible (implying non-optimizing individual behaviour).

[13] 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. This adds to the analytical difficulties of this approach. As a result, there are very few works on this topic. For the analysis of intratemporal non-separability, only Ziliak and Kniester's (2005) work, which examines a translog utility function, is mentioned by Keane (2011). Further, there are also studies analysing the effect of unemployment on consumption as part of this research program, although they do not usually focus on intratemporal separability. See, for instance, Ganong and Noel (2019).

[14] 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.

interpreted as follows: changes in individuals' employment statuses do not affect the intertemporal elasticity of substitution of their consumption or labour supply.

We would like to note that the model we use is a bachelor's type model, which is the most common and conventional method for analysing households' intertemporal consumption and leisure behaviour. Compared to more recent alternatives, such as the family labour supply model, we believe that this model constitutes the best option for analysing the impact of labour status variations on intertemporal behaviour for various reasons. Although the family labour supply model enhances the conventional analysis of intertemporal labour supply by enabling the analysis of the interlinks between the labour supply of various household members, we believe that it poses challenging difficulties for the analysis of the impact of labour status on intertemporal behaviour. The primary difficulty is that some of our samples are too small to apply an extra selection criterion of being a family with two wage earners, which would result in sample sizes that are not feasible for the empirical study.[15]

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_i) using an exponential term, as follows:

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

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:

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

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

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), $k_{1L} = 1/\alpha$ and $k_{1L} = 1/\emptyset$ are the intertemporal elasticities of consumption and leisure, respectively. These two expressions measure the response of their respective growth rates

[15] Furthermore, there would be some analytical limitations if we applied this model in our study. First, this literature uses a different (and sometimes distinct) methodology than the standard one for analysing the first-order intertemporal condition of leisure (see Bredemeier et al., 2019 and Blundell et al., 2016). Second, some of the assumptions made in this literature might be problematic for analysing the effect of differences in labour status, for example, the assumption that the parameters of the utility function governing consumption (i.e., the relative risk aversion) are the same for all labour statuses.

to the real interest rate, which theoretically should not change concerning differences in the individual's labour market status.

In the presence of borrowing constraints, expressions (7) and (8) would not hold,[16] as these expressions would depend on the unobservable Lagrange multiplier associated with the constraint when individuals are liquidity-constrained (see Zeldes, 1989, Domeij and Flodén, 2006). For individuals with liquidity constraints, the estimation of expressions (7) and (8) may result in intertemporal elasticities that are biased. However, we believe that accounting for borrowing constraints does not contribute to the understanding of our findings for various reasons. The first is related to the fact that our data overrepresent wealthier individuals, who are less affected by financial constraints than the rest of the population. The second is that, for every year in the survey, only about 6% of the participants meet Zeldes (1989) criterion to identify liquidity-constrained individuals (net wealth below two months of labour income), except for 2017, when the criterion is met by 9% of the sample. Third, until 2011, the SHF requested information on each household's credit situation. With this information, we observe that less than 100 households reported not receiving a credit, and fewer than 50 reported receiving a credit that was less than the requested amount for the period 2002–2008. Finally, recent empirical research indicates that labour situation differences, individual characteristics, or variations in consumption behaviour linked to specific preferences (see Gelman, 2021) may even be more significant factors than borrowing constraints or any other factor associated with the cycle market conditions in explaining the empirical failure of the canonical model of intertemporal choice, from which Equations (7) and (8) are derived.

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 the intratemporal condition to the first-order conditions:

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

The estimation of this system of equations would allow us to verify 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, interlinked.[17,18] The joint estimation cannot be considered a test of separability, although the decisions that result from both consumption and leisure condition one another. 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 out this exercise with U.S. time series, but the results they

[16] We thank two anonymous reviewers for pointing us this point.

[17] 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 why its inclusion in the system does not provide satisfactory results, given that it relates the levels of consumption and leisure in the same period, which does not seem appropriate to explain intertemporal behaviour.

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

obtained were not satisfactory (as explained in footnote 12). Cutanda and Sanchis-Llopis (2021, 2023a) 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.

It is relevant 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). Furthermore, all time-invariant demographic variables will vanish as the vector of demographic variables (θ_{it}) enters 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, which 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 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 economic activity status. This is an important aspect traditionally ignored by empirical research; most studies focus on verifying whether the evidence supports the empirical implications of the intertemporal optimization 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 on detecting differences in the elasticities of intertemporal substitution of consumption and leisure.[19]

Further, previous empirical research has also failed to address whether relevant differences in the characteristics of the employment relationship affect the employees' intertemporal behaviour. This issue has been gaining more interest as temporary contracts have been increasing in some economies. This debate has been especially intense in countries such as Spain where 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

[19] 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 Olafsson 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).

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 income uncertainty associated with temporal contracts as compared to fixed-term contracts. This is related to the fact that provided temporary employment is far less expensive than permanent employment, businesses respond to cyclical changes by adjusting temporary employment more than fixed-term workers. Lugilde (2018) has found, using the total sample of the SHF, that an increase in 1% income uncertainty reduces Spanish expenditure in approximately 5%–7%.[20]

Another group traditionally excluded from the empirical analysis of intertemporal consumption and leisure is the group of self-employed individuals. This could be explained on one hand by their presumed different intertemporal economic behavior compared to employees[21] and, on the other hand, by their reduced number in population samples, making the size of this subsample quite reduced and with a lot of attrition, which might complicate the econometric requirements. Some studies have focused on this group, such as Parker et al. (2005), who found that wage uncertainty is a key determinant of self-employed labor supply. Self-employment is probably one of the groups more affected by uncertainty, which makes this group highly appropriate for studying intertemporal economic behaviour. In relation to this, Christelis 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' gross wage per hour to obtain an expression for the hourly earnings of the self-employed, i.e., by dividing their gross monthly income by the hours worked, given that this information is available in the SHF, exactly in the same manner than for the employees' group.[22] 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. The standard procedure for dealing with the problem of measurement error, as well as a plausible problem of endogeneity associated with the (potential) relationship between some explanatory variables and the model error term, is to use an instrumental variables estimator. In this work, we estimate our models using a generalized method of moments (GMM) and instrumental variables.

We have conducted a series of robustness tests to confirm the validity of the instruments and the quality of our findings,[23] even though empirical literature on the intertemporal elasticity of leisure is generally less concerned with the measurement error in wages and the division bias it produces than the

[20] 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.

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

[22] This is the usual procedure to measure wages in microeconomic surveys, which usually contain information in income and hours worked, but not in wages.

[23] We thank two anonymous referees for pointing us the convenience of performing these robustness tests.

literature on the elasticity of labour supply.[24] First, we have confirmed that there is a very small difference, about 20% of the estimated values, between our GMM estimates and the FE estimates.[25] Second, following Borja's (1980) proposal, we have verified the validity of the instruments and the robustness of the calculated intertemporal elasticities of leisure. In particular, we have checked that our results do not change when we expand our baseline specification with different sets of explanatory variables.[26]

For the data, in this work, we use a panel dataset 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 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.[27,28]

The SHF is a rotating unbalanced panel interviewing approximately 6000 individuals in each wave.[29] There are 34,829 observations in total. However, we drop individuals with missing values in relevant information. After removing those individuals with zero total non-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 end up with a working sample of 10,804 observations, corresponding to 2685 individuals who collaborate a minimum of four times during the sample period. [30] We consider this sample as sufficient to empirically analyse individual intertemporal behaviour.[31] In Table 1, we

[24] It is relevant to note that the elasticity of intertemporal substitution, rather than the wage level, links the change in leisure with the real interest rate obtained with wage inflation. Therefore, their impact on wage inflation may be lessened or even eliminated if the measurement error in wages does not change from one period to the next.

[25] According to Elminejad et al. (2023), the difference between these estimates provides a measure for the division bias, provided the validity of the instruments set. The difference we find is similar to that obtained by Borja (1980).

[26] These results are available from the authors upon request.

[27] 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) examined the SHF dataset and compared it with other sources of information, concluding that the SHF would be appropriate to study individuals' behavior.

[28] 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 results for the five imputations.

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

[30] 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 a gross total income larger than 150,000 €. We analyse in the empirical work this issue in detail.

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

present the number of individuals considered for our estimations for each of the samples analysed. We do not use observations prior to 2011 due to the need to take differences and lagged instruments. Individuals in a specific sample maintain their labour status, as we do not allow changes in that status. This criterion implies that certain samples are small, especially those of unemployed and temporary workers. We are convinced that the high Spanish rates for these two categories still allow them to be used for empirical reasons. Visual inspection of Table 1 indicates that the number of individuals with more than three interviews in the survey falls very significantly since 2011.

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.

In Table 2, we present the number of individuals with fixed-term contracts and with temporary contracts. As 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 still consider it valid to check if there are differences between these individuals and fixed-term contract employees.

Table 2. Employees by type of contract: fixed vs. 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 that either the head of the household or their partner is in a temporary contract.

Given these particularities, it seems relevant to analyze the information about certain economic and demographic variables in the SHF for our working samples. We present this information in Table 3. We would like to point out that among the expenditure variables we consider, we do not include any expenditure in real estate 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

non-durable and durable expenditure are 14,175 and 2,506 €, respectively.[32] 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.

Table 3. Economic and demographic characteristics.

	Total	Employees	Self-emp.	Unemp.	Retired	Fixed-term contract	Temp. contracts
Non-durable consump.	14,175	14,708	19,312	10,380	14,523	15,341	12,005
Durable consump.	2,506	3,231	4,483	1,908	1,879	3,397	2,689
Total income	37,156	43,351	54,837	24,592	36,031	46,304	31,121
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, artworks, antiquities).
2. We do not include any expenditure in real estate or the rent of any house.
3. Total income is a variable constructed by the SHF.

Now, the averages for these variables for employees, self-employed, unemployed, and retired individuals 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.[33] As regards non-durable 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 favor 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 of weekly worked hours than employees (46.07 vs. 39.45), coherent with total income. Finally, the differences in the demographic variables across all these groups are as expected.

Focusing on the employees' group, 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, on average, lower weekly

[32] The non-durable expenditure 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 vehicles or means of transport.

[33] 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).

worked hours than those with fixed-term contracts. Concerning demographic variables, we would like to highlight that temporary employees are younger than fixed-term contract workers.

For our research, the measure for aggregate consumption we use corresponds to the non-durable expenditures. We calculate a Stone price index for this measure using the corresponding CPI for each of the expenditures that compose this aggregate.[34] We also use a nominal interest rate for 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 2023a for details). Despite the nominal interest rate being common for all 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 by subtracting the number of hours worked during a week (by the main income earner of the household) from the weekly total hours available. As usual in the literature, we obtain the hourly wage by dividing the main income earner labor income by the hours worked.[35]

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 labor status. Finally, we estimate the EISC and the EISL using a system of the three conditions (the two intertemporal conditions and the intratemporal condition). In this last exercise, we will consider the restrictions across equations that emerge from the optimization problem, given that the same parameters of the utility function appear in different equations.

The particular characteristics of the population analyzed by the SHF imply that we should be cautious when comparing our results with those previously obtained in 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 labor 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 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, 2023a).[36] The estimated elasticities we

[34] CPIs are taken from the Spanish National Statistical Office (INE).

[35] Given that the EFF provides the required information, we calculate this measure for employees and self-employed.

[36] See Thimme (2017) for a survey on the estimates of the elasticity of intertemporal substitution for consumption.

achieve are always above 0.74.[37,38] We get an estimate of 0.783 for the whole sample.[39] Concerning the different labor status groups, we get that the EISC for the self-employed sample is the highest (0.841), followed by the elasticity of the employees sample (0.834). Both for the retired and unemployed samples, we get significantly lower estimates for the EISC, especially low in the case of the retired group (0.794).[40]

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

	Total	Employees	Unemployed	Retired	Self-employed
EISC	0.783***	0.834***	0.744***	0.794***	0.841***
	(0.030)	(0.042)	(0.091)	(0.036)	(0.051)
Age head	0.020***	−0.017**	−0.003	0.031**	0.026*
	(0.006)	(0.008)	(0.016)	(0.013)	(0.019)
Age head sq.	−0.001***	−0.001**	−0.001	−0.001**	−0.001**
	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
N. of members	0.057***	0.087***	0.110**	0.001	0.005
	(0.018)	(0.026)	(0.046)	(0.036)	(0.049)
N. of adults	0.079***	0.056**	0.001	0.149***	0.103**
	(0.018)	(0.240)	(0.049)	(0.038)	(0.048)
Constant	−0.098***	−0.078***	−0.173***	−0.099***	−0.114***
	(0.008)	(0.013)	(0.030)	(0.011)	(0.026)
Number obs.	5029	1580	347	2519	583
Test for overidentifying restrictions					
Hansen's J Chi2(1)	0.001	0.055	0.115	0.014	0.306
p-value	0.973	0.814	0.734	0.905	0.580

[37] Carrasco et al. (2005) obtained values slightly above 1, although they were derived from estimates previously obtained with a model with habits (and not estimated directly). Furthermore, rather than using total non-durable expenditure, their estimates were obtained using specific non-durable goods and services.

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

[39] This estimate is similar to the values used in calibrated models designed to match growth and fluctuations that use values of approximately 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 supports our research.

[40] We have tested whether the estimates of the intertemporal elasticity of consumption for the sample of employees (column 2 in Table 4) are statistically different from the estimated elasticities obtained with the other three samples (columns 3, 4, and 5 in Table 4). The results of the tests indicate that the estimated elasticities are statistically different (we reject the null of equality of the intertemporal elasticity of consumption across the samples), which provides evidence of heterogeneity across groups. We are grateful to an anonymous referee for suggesting to test for the difference across samples.

Notes:

1. The instruments for the interest rate in columns (1) and (2) are the first lag of the real interest rate and the second lag of the number of members of the household; in columns (3) and (5), the instrument set is the second lag of the real interest rate and of its first difference; in column (4), the instrument set is the second difference of the real interest rate and the second lag of the number of members of the household.
2. *, ***, and *** mean statistically significant at 1%, 5%, and 10%, respectively.
3. $\Delta ln(C_{it+1}) = k_{ioC} + k_{1C} ln\left(\frac{P_{it}R_t}{P_{it+1}}\right) + k_{2C}\Delta\theta_{it+1} + \varepsilon_{iCt+1}$

In all 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, in general, statistically significant, except for the unemployed and self-employed samples, which might be explained by the lower number of observations of these groups. Leaving aside this group, we get that the age of the head of the household is statistically significant; the number of members of the household is statistically significant in all samples, except for the retirees and the self-employed; and the number of adults in the household is always statistically significant, except for the sample of unemployed. Further, at the bottom of Table 4, we report the results of Hansen's test of overidentifying 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 labor status of the head of the household plays a relevant role in the estimation of the elasticity of intertemporal substitution for consumption. We consider that 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, the high degree of intertemporal substitution displayed by the sample of unemployed individuals is remarkable, a group usually discarded in the empirical research for the EISC, due to their presumed high exposure to credit rationing.[41] 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 the high degree of intertemporal substitution for consumption for the retired group as being noticeable, as implied by our results, given the available wide empirical evidence on the so-called consumption retirement puzzle (see Banks et al., 1998).[42]

The high estimated values of the consumption intertemporal elasticities of substitution of consumption reported in Table 4 provide some scope for considering a consumption target for monetary policy. According to the values reported, a 1% drop in the log of the real interest rate log results in a higher level of real non-durable expenditure and a drop in its growth rate close to 0.8% (about 0.85% for self-employed and employees). Unsurprisingly, people whose consumption patterns are typically viewed as more Keynesian (the unemployed and retired) show weaker responses to

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

[42] 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) found a negative association between consumption growth and retirement with data for the 1977–1996 period.

changes in real interest rates. It seems likely that these individuals would benefit more from specific income subsidies in order to increase their consumption.

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

	Employees	Self-employed	Fixed-term contract	Temporary contract (head or partner)
EISL	0.170***	0.013	0.160***	0.214***
	(0.029)	(0.047)	(0.030)	(0.039)
Age head	0.012	−0.089	0.012	0.019
	(0.009)	(0.397)	(0.009)	0.012
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)	(0.030)
N. of adults	−0.005	−0.146	−0.009	−0.007
	(0.012)	(0.074)	(0.012)	(0.024)
Constant	−0.007	0.031	−0.005	−0.006
	(0.005)	(0.017)	(0.004)	(0.012)
Number obs.	1229	331	1141	320
Test overidentifying restrictions				
Hansen's J Chi2(1)	0.001	0.289	0.050	0.079
p-value	0.966	0.590	0.821	0.778

Notes:

1. The instruments for this specification are the second lag of the interest rate, the second differences of the number of members of the household, the number of adults in the household, the log of the income of the head of the household, and a constant.
2. *, ***, and *** mean statistically significant at 1%, 5%, and 10%, respectively.
3. $\Delta ln(L_{it+1}) = k_{ioL} + k_{1L} ln\left(\frac{W_{it}R_t}{W_{it+1}}\right) + k_{2L}\Delta\theta_{it+1} + \varepsilon_{iLt+1}$

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, which is below previous estimates obtained for the Spanish economy using pseudo-panel data (about 0.25); see Cutanda and Sanchis-Llopis (2021 and 2023a).[43] With respect to the demographic controls, our results show no statistical significance for any of these

[43] See Keane (2011) for a general review of the estimates of the elasticity of intertemporal substitution of leisure. Keane (2011) offered to the interested reader a complete analysis of the different types of labor elasticities estimated in the literature and the different methodologies to do it.

variables, as occurred with the estimation of the Euler equation for consumption,[44] although the significance levels of 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.[45] In contrast to the findings shown in Table 4, the much lower estimated value of the intertemporal elasticity of substitution of leisure eliminates the possibility that monetary policy will have an impact on leisure, and then on labor supply, over the cycle. Indeed, these findings enable us to conclude that there is very little intertemporal substitution in leisure in Spain particularly for self-employed individuals.

Next, we split the sample of employees into two subsamples (temporary and fixed-contract employees) to test whether the duration of the labor contract (a relevant characteristic of the contract) affects the estimates we obtain for the EISL. This is a 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 in which the spouse has a temporary contract. 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 with a lower estimated intertemporal elasticity for leisure. Contrarily, the estimate for the sample of temporary workers is much higher at 0.214, and closer to previous results for the Spanish economy (see Cutanda and Sanchis-Llopis 2021 and 2023a). This result should be taken with caution given that the sample for this kind of worker amounts to only 160 observations, which suggests that this group is considerably underrepresented in the SHF, especially in a country like Spain where the rate of temporary jobs ranged 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 labor 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 it to 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 behavior of temporary employees, and 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 different intertemporal behavior in consumption and leisure for these groups. The intertemporal substitution of leisure could be

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

[45] We have tested whether the EISC and EISL estimated, reported in Tables 4 and 5, respectively, are statistically different across the various samples (except for the EISL obtained using the self-employed, as this parameter is not statistically significant). The results we obtained for the tests indicate that all the calculated EISC and EISL are statistically different across the different labor groups. These results are available from the authors upon request.

explained by the fact that the self-employed might have a different perception of the (labor) uncertainty they face or by the fact that they are able, to some extent, to control and influence their labor situation (which does not occur with temporary employees).

As shown above, the type of labor 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 behaviors for consumption. To this end, in Table 6, we present the estimated elasticity of intertemporal substitution for consumption for fixed-term and temporary contract employees. 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 Hansen's test of overidentifying restrictions are quite acceptable. The results in Table 6 support our earlier hypotheses regarding the potential for monetary policy to influence consumer behavior over the economic cycle because the estimated elasticities for employees, particularly those with fixed-term contracts, are greater than one.

Table 6. Elasticity of intertemporal substitution for consumption across different types of contracts.

	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	1142	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 in the number of members of the household, the first difference in the age of the household and its square, the second difference in the number of adults of the household and in the log of the income of the head of the household and a constant.
2. *, ***, and *** mean statistically significant at 1%, 5%, and 10%, respectively.
3. $\Delta ln(C_{it+1}) = k_{ioC} + k_{1C} ln\left(\frac{P_{it}R_t}{P_{it+1}}\right) + k_{2C}\Delta\theta_{it+1} + \varepsilon_{iCt+1}$

Finally, we estimate the complete system of equations composed of 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 using the equations separately. Further, this empirical strategy may, effectively, detect an 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 0.808, when in Table 4 it was 0.783, and an intertemporal elasticity for leisure of 0.124, 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. System of equations.

EISC	0.808^{***}
	(0.076)
Age head	0.010
	(0.189)
Age head sq.	0.003
	(0.002)
N. of members	0.002
	(0.025)
N. of adults	−0.523
	(0.379)
Constant 1 (k_{ioC})	−0.080
	(0.040)
EISL	0.124^{**}
	(0.049)
Constant 2 (k_{ioL})	−0.006
	(0.011)
Leisure	4.682
	(7.109)
Constant 3 (k_o)	−13.225
	(30.447)
N. observations	357
Test overidentifying restrictions	
Hansen's J Chi2(1)	2.246
p-value	0.896

Notes:

1. The instruments 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 in the age of the head of the household and its square, and a constant, for the consumption intertemporal equation; the second lag of the real interest rate, the second difference in the number of members of the household, the second difference in the number of adults of the household, the second and third difference in the log of the income of the household and a constant for the leisure intertemporal equation; and the second lag and difference in the real interest rate and a constant for the intratemporal equation.
2. *, ***, and *** mean statistically significant at 1%, 5%, and 10%, respectively.

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

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

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

5. Conclusions

This paper analyzes the intertemporal behavior of different groups of individuals regarding their labor 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 the group of unemployed individuals in a downturn. 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 yet used to analyze intertemporal behavior.

The empirical research on the intertemporal behavior of consumption (and leisure) with individual information usually excludes unemployed, self-employed, or retired individuals from the analysis. 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 employees sample. We deepen the analysis by splitting the sample of employees into fixed-term and temporary contract samples, which constitute two types of contracts with different durations and degrees of uncertainty. To our knowledge, this point has not been addressed in the empirical literature.

Regarding our results, we start with the group of employees, the group usually considered in the empirical literature. The estimates we obtain are comparable to those previously obtained in Cutanda et al. (2020) and Cutanda and Sanchis-Llopis (2021 and 2023a) for Spain, using pseudo-panel data for a different period. These results are quite interesting, given that the SHF over-samples the wealthier individuals in the economy. With the SHF, the intertemporal elasticity for consumption is estimated to be around 0.8 (as compared to an average of 0.7 in the mentioned works), and the intertemporal elasticity for leisure is estimated to be around 0.17 (as compared to 0.25). These estimates are of the same order of magnitude as those provided by Cutanda et al. (2020) and Cutanda and Sanchis-Llopis (2021 and 2023a), and the differences can be attributed to the sample design of the SHF.

Regarding the different labor supply statuses, we find that employees have a higher intertemporal substitution for consumption. Further, both the retired sample and the unemployed display relatively

lower values for the intertemporal elasticity of consumption (0.79 and 0.74, respectively), although higher than expected. This conclusion is reinforced by the fact that the sample of self-employed, who have the highest average working hours, attain the highest elasticity (0.84). These results provide evidence that an individual's labor market status matters in the analysis of intertemporal consumption and confirm previous empirical results (see Quintana-Domeque and Wohlfart, 2016).

Concerning the duration of the contracts, for the fixed-term contract employees, the elasticity of intertemporal substitution of leisure is lower than that estimated for the 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 has a different consideration of uncertainty, as compared to temporary workers, related to a perceived higher degree of control over their labor situation.

Finally, our results for both intertemporal elasticities corroborate recent findings in consumer research that give more importance to factors such as preferences and other factors in explaining the failure of canonical consumption's intertemporal optimization model, and less importance to borrowing constraints or uncertainty (more related to the cycle and economic situation).[46] Further, our findings confirm the possibility of implementing policies aimed at changing the individuals' intertemporal behavior through modifying the intertemporal prices of consumption (given the high intertemporal elasticities for the groups analyzed) or, to a lesser extent, leisure through taxes. In connection with this matter, it is crucial to remember that to optimize the impact of these policies, they should be implemented at the microeconomic level.

Use of AI tools declaration

The authors declare they have not used Artificial Intelligence (AI) tools in the creation of this article.

Author contributions

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by both authors. Both authors wrote different parts of the first draft, and also read and approved the final manuscript.

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[46] In line with our results, Aguiar et al. (2023) found a high intertemporal elasticity of substitution of consumption for poor hand-to-mouth individuals. See also Kaplan et al. (2014) and Gelman (2021).

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Data

All the data used in this study are publicly available in the following page webs of Spanish public entities: https://www.bde.es/bde/es/areas/estadis/estadisticas-por/encuestas-hogar/relacionados/Encuesta_Financi/, for the Spanish Household Finances Survey (SHF) and the interest rate used. https://www.ine.es/, for the prices' indexes used.

Conflict of interest

All authors declare no conflicts of interest in this paper. Particularly, the authors have no relevant financial or non-financial interests to disclosure.

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