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Envy and Habits: Panel Data Estimates of Interdependent Preferences

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Abstract

We estimate the importance of preference interdependence from consumption choices. Our strategy follows the literature that tests the constraints imposed by optimality in the evolution of individual consumption. We derive an Euler equation from a preference specification that allows for non-separabilities across households and across time. The introduction of habits and envy places additional restrictions on the evolution of the optimal consumption path. We use a unique data set that follows a sample of 3,200 households for up to eight consecutive quarters to test these restrictions. Our estimates suggest that, if one defines utility over consumption services, a large fraction of these services is relative, with one fourth of the weight placed in the consumption of the reference group and more than one third of the weight placed on the agent's past consumption.

Keywords: Consumption Externalities, Habit Formation, Panel Data.
JEL Classification: C23, D12, D91

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1 Introduction

The assumption that preferences are separable across time and across households is standard in the economic literature, but it is not particularly appealing. Indeed, social scientists have long stressed the relevance of habit and status-seeking as being important characteristics of human behavior. In our discipline origins of this proposition can be traced as far back as Smith (1759) and Veblen (1912), although it was not until the works of Duesenberry (1949), Pollak (1976) and Ryder and Heal (1973) that an effort was made to provide these ideas with some micro-theoretic foundations. The subsequent literature has associated two types of reference consumption levels to these non-separabilities. The first is an internal criterion based on the individual?s own past consumption levels. This case is often referred to as characterizing ?habit formation". The second is based on an external criterion, expressed in terms of the consumption of some outside reference group, typically the average consumption of the neigborhood, the community or the overall economy. This is often referred to as "envy" as in Varian (1974), "catching up with the Joneses" as in Abel (1990), "keeping up with the Joneses" as in Gali (1994), "status" as in Corneo and Jeanne (2001), "jealousy" as in Dupor and Liu (2003) or "rivalry" as in Bruni and Porta (2005) or "consumption externalities" as in Liu and Turnovsky (2005).

A large body of empirical work investigates the importance of habit formation for consumption behavior[1]. The point of departure in any of these studies is an Euler equation derived under a preference specification that allows for temporal interdependencies. Then, a linearized version of this equation is estimated using time series data on consumption and asset returns. Using UK data, Osborn (1988) introduces a consumption specification that allows for seasonal variation and habit persistence and finds that the habit coefficients are jointly significant. Ferson and Constantinides (1991) find evidence of habit persistence dominating durability at monthly, quarterly and annual frequencies. Fuhrer and Klein (2006) and Fuhrer

[1]The introduction of habits in the standard consumption model induces agents to adjust slowly to permanent income shocks and this helps rationalizing the reported excess smoothness puzzle. See, for instance, Campbell and Deaton (1989). Furthermore, habit formation has been used to reproduce the hump-shaped response of aggregate spending to monetary shocks (Fuhrer (2000)), the link between saving and growth (Carroll et al. (2000)) and to improve the empirical fit of business cycle models (Boldrin et al. (2001)).

(2000) relying on a utility function that assigns relative weights to both current consumption and an internal benchmark find that 80% of the weight should be attached to the latter. Dynan (2000) uses panel data, specifically food consumption from the Panel Study of Income Dynamics, and finds no evidence of habit formation at the annual frequency. As Carrasco et al. (2005) point out this result could be a consequence of unobserved heterogeneity across households, and show that, after controlling for fixed effects, food consumption and services exhibit habit formation. Finally, following the revealed preference tradition, Crawford (2010) characterizes a set of identifying restrictions for the habit formation model. His results suggest that the introduction of habit formation in the standard discounted utility model improves its explanatory power considerably, virtually to the point where 100% of the micro-data are perfectly rationalizable if one allows intertemporal complementarities for many goods.

At the theoretical level, envy has been introduced to rationalize several departures from the predictions of the standard paradigm that assumes preferences are separable across households. Abel (1990) and Gali (1994) rely on interpersonal comparisons to account for the excess return on equity. Carroll et al. (2000) explore the implications of relative consumption for the process of capital accumulation. Alonso-Carrera et al. (2007) study the impact of interpersonal comparisons in an economy displaying dynastic altruism. Akerlof and Yellen (1990) present a model of worker behavior where individual effort does not only depend on the workers' own wage but also on the wage received by their coworkers. Liu and Turnovsky (2005) explore the impact of envy on labor supply choices. Wendner and Goulder (2008) find that the marginal excess burden from taxation is lower in the presence of status concerns. Ljungqvist and Uhlig (2000) find that the optimal tax policy in an economy populated by envious households displays countercyclical Keynesian features. Ng and Wang (1993) and Howarth (2006) explore the implications of envy for environmental degradation and the use of natural resources. Despite this growing theoretical literature there are very few attempts to provide econometric estimates of the importance of envy. The asset pricing literature from Abel (1990) to Campbell and Cochrane (1999) provides some indirect evidence on the relevance of an externally generated reference stock as a mean to rationalize the equity premium puzzle.

Additional support for the importance of interpersonal comparisons is provided by the recent literature on happiness. Clark and Oswald (1996), Luttmer (2005) and Dynan and Ravina (2007) are just a few examples that stress the importance of positional concerns as a crucial determinant of (self-reported) well-being. Oswald (1997) concludes that evidence from psychology and experimental economics support the claim that satisfaction depends upon the agent's relative position, again emphasizing the role of positional externalities. Nonetheless, to our knowledge, Ravina (2008) and Maurer and Meier (2008) are the only two studies that try to infer the degree of envy using data on individual consumption choices.

Our goal is to assess the importance of both types of non-separabilities from observed consumption choices. Where envy and habits matter, the level of satisfaction derived from a given bundle of consumption depends, not only on the consumption bundle itself, but also on how it compares to the bundle of consumption of some reference group or to the agent?s own past bundle of consumption. In this context, optimality imposes additional restrictions on the evolution of consumption through time and across households. We exploit these restrictions to estimate the relative importance of these two types of interactions; interdependence across time, habit formation, and interdependence across households, envy[2]. Our results provide strong support for preference specifications that allow for both types of non-separability. Specifically, if one expresses utility derived from consumption services as a weighted average of the absolute (current) level of consumption, the level of consumption relative to that of the reference group, and the current level of consumption relative to the past level of consumption, our estimates suggest that households derive one third of their satisfaction from comparisons between their current and past consumption and one forth from comparisons between their consumption and that of their neighbours, with barely one half being determined by their current consumption choices.

Our dataset, the Spanish Continuous Family Expenditure Survey (Encuesta Continua de Presupuestos Familiares, ECPF), recently used by Browning and Collado (2001); Collado and Browning (2007), Carrasco et al. (2005) and Crawford

[2]In contrast to the existing literature, with the sole exception of Ravina (2008), we consider simultaneously the effects of both types of non-separability.

(2010) has two important advantages over other datasets. First, its long time dimension with each household being followed up to eight consecutive quarters. Second, the wealth of data on household geographical and socio-demographic characteristics it includes. The long time dimension allows identifying the structural parameters in the presence of fixed effects, while the presence of geographic data allows for a sensible characterization of reference groups, that, similar to Frank (1985) and Ravina (2008), we define as those households that live in the same area (census tract) as the household of interest.

Finally, a crucial problem in the identification of models of social interactions is related to the reflection problem (Manski 1993), recently stressed by Maurer and Meier (2008) in a context similar to ours. A priori it is difficult to distinguish whether similar behavior within a group arises from the interaction among group members, endogenous effect, or simply results from common exogenous characteristics of the group, exogenous effect, or from individuals within the group sharing similar unobservable characteristics or facing similar shocks, correlated effect. Since the construction of our reference group is based on a purely geographical criterion established by the Spanish Statistical Office (INE) and, as we will argue, these groups are not particularly homogeneous in terms of observable characteristics of their members, one may think that the exogenous effects do not drive our estimate for envy. Despite of this, we conduct several robustness checks. First, we include the neighbours' socio-economic characteristics as an additional regressor. Second, we control for shocks at the census tract level including measures of the local unemployment rate and the average interest rate faced by the reference group. Third, we include in our preferred specification an alternative measure of envy based on a reference group constructed using observable socio-demographic characteristics following Maurer and Meier (2008). Our baseline estimates remain robust throughout these exercises.

Our work is closely related to Maurer and Meier (2008) and particularly to Ravina (2008). The first authors propose a social multiplier approach to disentangle consumption externalities from correlated effects. Using US data and a definition of reference group that is based on socio-demographic, as opposed to geographic, characteristics, they report two main findings. First, much of the co-movement of individual consumption within groups reflects correlated effects. Second, once they control for these effects, they still find substantial evidence of consumption externalities. On the other hand, Ravina (2008) uses a sample of US credit-card holders to conduct an exercise similar to ours. Nonetheless, several issues arise with her credit card data. First, her measure of consumption is incomplete since it only includes purchases made with a single credit card. Second, it may include purchases of durable consumption that will require an explicit modeling of consumption services. Third, the use of this data requires assumptions on the separability of consumption expenditures according to the method of payment, i.e. those paid with credit card should be separable from those paid by other mean. A priori, these assumptions are difficult to justify. In contrast, our dataset overcomes these shortcomings by including a very comprehensive measure of consumption and a wide range of socio-demographic and geographic characteristics that allow the construction of sensible reference groups.

The paper is organized as follows. Section 2 sets out the theoretical model and derives our empirical specification. Section 3 discusses the data. Section 4 presents the empirical strategy, while the main results are presented in Section 5. The conclusions are summarized in Section 6, while the Appendices provide some technical details.

2 Theoretical Background: A simple model with envy and habits

Consider an endowment economy populated by a continuum of infinitely-lived households distributed along the unit interval. At time t the $i-th$ household chooses current consumption expenditures, C_{it} , to maximize,

$$E_t\left[\sum_{s=0}^{\infty}\beta_i^s u\left(\tilde{C}_{it+s};\psi_{it+s}\right)\right] \tag{1}$$

where β_i is her subjective discount factor, $\tilde{C}_{it}$ are consumption services, and ψ_{it+s} is a vector of variables that move marginal utility, "taste-shifters". In order to capture the importance of intertemporal and interpersonal comparisons we model consumption services as [3],

$$\tilde{C}_{it} = C_{it} - \gamma \bar{C}_{it} - \theta C_{it-1} \tag{2}$$

These services depend not only on the household's current consumption expenditures but also on the current consumption expenditures of her reference group and on her own past consumption expenditures. Specifically γ measures the weight that the agent places on the consumption of her reference group and therefore is our measure of envy, while θ measures the importance of habits.

The individual budget constraint takes the standard form,

$$A_{it+1} = R_{it+1} \left(A_{it} + Y_{it} - C_{it} \right) \tag{3}$$

where Y_{it} is current non-interest income, A_{it+1} is next period wealth, and R_{it+1} is the gross return on assets.

The first order condition for this optimization program, where $u_{it}^{\tilde{C}}$ is the marginal utility of consumption services for the $i-th$ household at time t , is given by,

$$E_t \left[u_{it}^{\tilde{C}} - \beta_i \theta u_{it+1}^{\tilde{C}} \right] = E_t \left[R_{it+1} \beta_i \left(u_{it+1}^{\tilde{C}} - \beta \theta u_{it+2}^{\tilde{C}} \right) \right] \tag{4}$$

Under a constant return on wealth Deaton (1992) shows that (4) can be expressed as a second-order difference equation with the following familiar solution[4],

[3]This additive specification of envy and habits has been widely used in different contexts (see for instance Ljungqvist and Uhlig (2000)). The literature has proposed an alternative modeling strategy that assumes interdependencies enter in a multiplicative way (Abel 1990; Carroll et al. 2000). Appendix I shows that our estimation equation remains unchanged under this alternative multiplicative approach.

[4]Hayashi (1985) proves that (5) holds approximately under static expectations on the evolution of a time-varying return on wealth. See Appendix II for a detailed derivation of (5).

$$u^{\tilde{C}}_{it-1} = \beta_i E_{t-1}\left[R_{it} u^{\tilde{C}}_{it}\right] \quad (5)$$

Now, let's assume our instantaneous utility function takes the standard iso-elastic specification,

$$u\left(\tilde{C}_{it};\psi_{it}\right) = e^{\psi_{it}}\frac{\left(\tilde{C}_{it}\right)^{1-\sigma}}{1-\sigma} \quad (6)$$

where σ, the coefficient of relative risk aversion, governs the rate of change in marginal utility. Replacing (6) in (5) we reach,

$$\beta_i E_{t-1}\left[R_{it} e^{\psi'_{it}-\psi'_{it-1}}\left(\frac{\tilde{C}_{it}}{\tilde{C}_{it-1}}\right)^{-\sigma}\right] = 1 \quad (7)$$

We follow most of the literature by considering a log-linear approximation that, under rational expectations, gives rise to our basic estimation equation[5].

$$\Delta c_{it} = \mu_i + \frac{1}{\sigma} r_{it} + \gamma\Delta\bar{c}_{it} + \theta\Delta c_{it-1} + \Delta\psi_{it} + \varepsilon_{it} \text{ where } \quad E_{t-1}\left(\varepsilon_{it}\right) = 0 \quad (8)$$

where lower case variables stand for the log of the upper case variable, Δ is the difference operator, μ_i is a combination of the rate of time preference and higher order terms resulting from the linear approximation[6], and ε_{it} is an expectational error uncorrelated with any information available at time $t-1$. The interpretation of (8) is straight forward. After controlling for the effect of taste-shifters, the growth rate of consumption increases with the degree of patience captured by the intercept, with anticipated changes on the return on saving as a consequence of

[5]An alternative approach, see for instance Carroll (2001) and Gourinchas and Parker (2002), uses simulation techniques to estimate a structural model of intertemporal choices. As Attanasio and Low (2004) point out this approach has its own limitations. Given this, and for ease of comparability with most of the existing consumption literature, we will use a linear approximation of (7).

[6]We are implicitly assuming that these higher order terms are constant and therefore captured by the intercept. Alternatively we could assume that the innovations to the higher moments are uncorrelated with the other regressors. In this case the deviations from the mean of these higher order moments will be captured by the error term.

intertemporal substitution, with the growth rate of consumption of the reference group as a consequence of envy, and with the past growth rate of the agent's consumption as a consequence of habit formation. It is worth noticing that if envy and habit do not matter, $\gamma = \theta = 0$, (8) reduces to the permanent income hypothesis under time separable preferences and time-varying interest rate as stated by Hall and Mishkin (1982) and Campbell and Mankiw (1991). Alternatively if we set $\gamma = 0$ our specification reduces to the one used by Dynan (2000).

The estimation of (8) faces several challenges. First, consumption data is poorly measured. Second, time averaging may induce first-order serial correlation in consumption growth that may resemble habit formation. Third, some regressors may be endogenous. And fourth, individual choices may be affected by aggregate shocks. Nonetheless, we leave the discussion of these issues for the section on empirical strategy, and now we turn to describe our data.

3 The data

The estimation of (8) requires data on household consumption where the same sample of households is followed for several consecutive periods. To implement the model we use twelve years (1985-1996) of the Spanish Household Budget Continuous Survey (Encuesta Continua de Presupuestos Familiares, ECPF). The ECPF is a rotating panel based on a survey conducted by the Spanish National Statistics Office (Instituto Nacional de Estadistica, INE). The ECPF interviews a sample of 3,200 households every quarter, randomly rotating 12.5% of them each quarter. As a result, we can follow a household for a maximum of eight consecutive quarters.

This survey has several advantages compared to other datasets commonly used in the consumption literature such as the Panel Study on Income Dynamics (PSID) and the Consumer Expenditure Survey (CEX) for the US or the Family Expenditure Survey (FES) for the UK. The PSID only reports information on food consumption, not allowing to control for other goods which may well be non-separable from food. The FES interviews each household only once and therefore it lacks the time-series dimension required for the estimation of (8). The CEX, although it reports various consumption categories, only follows each household for four quarters. In contrast, the ECPF reports a complete measure of consumption expenditures, follows each household for a long period of time (twice as many quarters as the CEX), and more importantly includes very detailed geographical information on the area of residence for each family. This longer panel structure allows to control for fixed effects and to construct an adequate set of instruments, while the geographical information is crucial for the construction of the reference groups[7] .

The original dataset includes 30,133 households (148,482 observations). Since, as we will argue, we need lagged variables as instruments for our estimation, we select households reporting full information for at least four consecutive quarters[8]. In line with most of the consumption literature, we restrict our sample to married couples with or without children, and drop households whose head is either very young (younger than 18) or old (older than 65). This process leaves us with 15,094 households (95,643 observations). Once we transform the variables for estimation, i.e. we take all the lags and differences, our working sample contains 35,957 observations on 12,064 households[9] Table 1 summarizes this data cleaning process.

We construct our dependent variable, total consumption expenditures on nondurable goods and services, as the sum of food, alcohol, tobacco, services, and expenditures on other nondurable goods, such as heating fuel, public and private transport, personal care and semi-durable goods like clothing and footwear. This measure of consumption accounts for roughly 80% of total consumption expenditures and its time path is similar to consumption expenditures obtained from national accounts. In order to express nominal expenditures in real terms we construct a household specific price index. This index is an average of the nominal price of each category of goods used in the construction of the CPI weighted by each household's share of expenditure in each category. Our measure for the nominal interest rate comes from

[7]For a complete description of the ECPF see Browning and Collado (2001), Carrasco et al. (2005) or Crawford (2010)

[8]We could select those households with eight consecutive quarters in order to simplify the estimation. However, due to some evidence of attrition in the sample, we use the unbalanced panel in the estimation process.

[9]The drop from 15,094 households to 12,064 households is a consequence of missing data on some of the exogenous variables.

the 12-month non-transferable deposit rate reported by the Bank of Spain. We use household specific inflation rates to calculate the real rate of return on wealth.

The specification of the reference groups is a crucial task for our empirical analysis. As Manski (1993) points out "inference is not possible unless the researcher has prior information specifying the composition of reference groups". In an ideal environment, the researcher would use observed behaviour and infer the most relevant determinants of reference groups. Since the data requirements for this endogenous determination of reference groups are prohibitively demanding, the literature has opted for two alternative approaches. A first approach follows the lead of the sociological literature on peer effects (Festinger 1954; Kapteyn 1997). These authors suggest that people primarily compare themselves to members of their own social group, who are individuals with similar age, gender or education. This is the approach followed by Maurer and Meier (2008) that construct reference groups based on attributes of the head of the household; age, race, gender, family status, educational attainment, occupational status and size of the nearest city. Under this approach it is reasonable to ask whether the observed common behaviour is the result of social interactions or simply results from common characteristics. A second approach stresses the importance of the visibility of consumption expenditures as an important determinant of envious choices Charles et al. (2009) and Heffetz (2011). As Frank (1985) points out evolutionary psychology calls attention to the fact that the relevant reproductive battles were typically decided by competitive balance in highly local environments. This literature suggests that geographical proximity should be an important determinant of reference groups[10] . Following Dynan and Ravina (2007) we construct our reference groups using this second approach, although we conduct robustness checks including an alternative reference group constructed following the first approach.

We, therefore, identify reference groups with census tracts. These tracts are spatial, small, and permanent statistical subdivisions of the Spanish territory. Census tract boundaries are delineated with the intention of being maintained over a long

[10]This criterion for the determination of the reference group is by no means exclusive. There might be other relevant approaches to construct reference groups or other relevant reference groups.

period of time so that statistical comparisons can be made from census to census. The 8,000 Spanish municipalities are divided into 35,000 census tracts. These tracts are grouped into provinces and strata that depend on the size of the municipality to which they belong. To collect data for the ECPF, the INE chooses a representative sample of 584 tracts spread over all strata. The number of census tracts chosen for each of the 17 Autonomous Communities (Spanish regions) is proportional to its population with a minimum of 16 tracts for each region.

In our estimation, the reference group of any given household is composed by the other households that live in the same census tract. For each household, we construct the consumption of her reference group, the neighbourhood consumption, as the average (log) consumption of her census tract excluding her own (log) consumption expenditures[11]. It is worth noticing that as opposed to Ravina (2008), who uses cities of residence as reference groups, our approach allows for a more exhaustive dissection of spatial interactions. For instance, a city like Madrid, with more than three million inhabitants, will be broken down into more than 50 reference groups.

Finally, we use several socio-demographic variables, such as age, labour market status, and number of adults and children in our estimation. Tables 2 and 3 describe the construction of all these variables and provide summary statistics including measures of the size of our reference groups.

4 Identification and Empirical Strategy

The estimation of our empirical model, (8), presents several challenges that influence our strategies and choice of techniques. The life-cycle literature on consumption has identified several factors that affect the level of satisfaction derived from a given bundle of consumption, and hence the optimal consumption path. For instance, Attanasio and Browning (1995) highlight several observable demographic characteristics and Carrasco et al. (2005) show the importance of controlling for

[11]We have chosen mean consumption of the reference group but one might think that neighbourhood effects might be transmitted by distributional features other than the mean. For example, it is easy to believe that the magnitude of envy on individual behaviour may depend on the dispersion of behaviour in the reference group; for instance the smaller the dispersion, the stronger the norm.

time-invariant unobserved heterogeneity across households while estimating Euler equations. Following this work, we use the taste-shifters from our theoretical model (ψ_{it}) to capture these household specific factors. These factors include a set of observables: age (age_{it}) and age-squared (age_{it}^2) of the head of the household, number of adults ($nadult_{it}$) and number of children ($nchild_{it}$) in the household. We also allow for unobservable household specific tastes (which we assume to be constant) by introducing fixed family effects (ω_i) and a purely random error (υ_{it}) . As a result,

$$\psi_{it} = \beta_1 age_{it} + \beta_2 age_{it}^2 + \beta_3 nadult_{it} + \beta_4 nchild_{it} + \omega_i + \upsilon_{it} \tag{9}$$

Furthermore, as Attanasio and Low (2004) point out, under rational expectations the average of (8) across time is zero for each household, but in the presence of macroeconomic shocks the cross-sectional mean of these deviations could differ from zero at any point in time. Nonetheless under the assumption that aggregate shocks affect all families in a similar way, we capture the effects of these shocks by introducing annual and quarterly dummies[12] (λ_t) in our estimation equation[13].

Finally, Deaton (1992) questions the standard assumption about separability between leisure and consumption that underlies our theoretical model[14] . Therefore, we try to attenuate its effects by controlling for the change in labour market status (ΔLM_{it}). As a result (8) becomes,

$$\Delta c_{it} = \mu_i + \frac{1}{\sigma} r_{it} + \gamma \Delta \bar{c}_{it} + \theta \Delta c_{it-1} + \beta' \Delta \psi_{it} + \lambda_t + \beta_5 \Delta LM_{it} + \varepsilon'_{it} \quad E_{t-1}\left(\varepsilon'_{it}\right) = 0 \tag{10}$$

[12]We also include quarterly dummies to control seasonal differences in consumption. This set of dummies captures observed seasonal differences (Browning and Collado 2001)

[13]Although it is equivalent to market completeness, our assumption about the effects of aggregate shocks is somewhat less restrictive. Furthermore, using PSID data, Runkle (1991) finds that aggregate shocks are not very important for individual consumption choices. Collado (1998) obtains a similar result using the ECPF. Similarly, Pischke (1995) finds that aggregate fluctuations account for a very small share of individual uncertainty. The former two authors suggest that time dummies properly capture the effects of aggregate shocks, which are not captured by fluctuations in the interest rate.

[14]Kiley (2010), using techniques that are robust in the presence of weak instruments, finds little support for non-separable preferences between consumption and leisure in explaining consumption fluctuations.

To sum up, we have taken care of heterogeneity in observable family characteristics, in unobservable time-invariant tastes, of the effects of aggregate shocks and seasonal differences in consumption and labour market participation.

Although our estimation equation seems to include most of the factors that the literature highlights as determinants of consumption growth, we still face two problems when trying to estimate (10) even under rational expectations. First, unobservable individual effects may be correlated with the lag in consumption growth. Second, there may be some correlation between our regressors and the error term. For example, the real interest rate and the change in labour market status are unknown at time t, and therefore likely to be correlated with the forecast error. Additionally, like with other consumption data, measurement errors are likely to be prevalent in our habit and envy variables[15]. Table 4 reports a negative autocorrelation in consumption growth that suggests the presence of measurement error and possibly the effects of time averaging of the data (Heaton 1993). We can deal with the first problem by first differencing equation (10), though we generate an error with an order-one moving-average structure, which is correlated with the first differences of lagged consumption growth[16]. The second problem will require the use of instrumental variables.

Equation (10) contains several endogenous regressors; in particular, the real interest rate, the change in labour market status, the growth rate of consumption and, possibly, our measure of envy. Under the restrictions imposed by rational expectations, any variable known at time t will be orthogonal to the error term, and thereby a valid instrument. The high level of persistence of these endogenous

[15]Notice that our envy variable is calculated as the (log) average of the individual levels of consumption within a census tract (excluding the household of interest). Therefore, if measurement error is classical and the tract is large enough, these errors will cancel out through the averaging process. Nevertheless, since the average census tract contains 5 households, caution suggests that we should work under the assumption that measurement errors might still be an issue for our envy variable.

[16]It is also possible that the unobservables ε'_{it} are correlated within group, and thereby correlated with Δc_{it} . Under the assumption that these group specific shocks are time-invariant, we can control for them adding group dummies into equation (10). However, the first-difference of the resulting equation would be identical to that of (10). Furthermore, our robustness checks control for the unemployment rate at the census tract level that is likely to capture the effects of time-varying group specific shocks.

regressors suggests that lagged variables should perform well as instruments. This point has been stressed by Arellano and Bond (1991) and Arellano and Bover (1995) becoming the standard criterion for the selection of instruments in the estimation of consumption Euler equations (see, for instance, Dynan (2000), Carrasco et al. (2005) and Maurer and Meier (2008)). As a result, apart from all exogenous variables, we use the lag of the household specific real interest rate, the lag of labour market status of the head of the household, the lags of the number of adults and number of children, and the second lag of the growth rate of consumption of the reference group as instruments[17] . In addition to the first stage regressions, we report various tests of under-identification, over-identification and weak instruments that confirm the validity of our set of instruments, as we will discuss in the next section[18].

Finally, Manski (1993) discusses confounding difficulties in estimating the (endogenous) effect of peer-group's behaviour on individual choices (in our context, the effect of $\Delta\bar{c}_{it}$ on Δc_{it}). He argues that, in addition to the endogenous effect, individuals in the same group may behave similarly because of common exogenous or socio-economic characteristics of the group (exogenous effects) or because they have similar individual unobservable characteristics or face the same shocks (correlated effects). To deal with the exogenous effect we follow two alternative strategies. First, we include the mean of socio-economic characteristics of the reference group as control variables (number of adults, number of children, age, educational level and real disposable income). Second, we explore the degree of heterogeneity in the (observable) characteristics of the households within and across reference groups using a simple exercise. We randomly draw a household in each reference group in a given period. Then, we pair the head of that household with the head of another household, also randomly selected, from (1) the same reference group, (2) a different reference group controlling for the size of the municipality of residence, and (3) a different reference group regardless of municipality size. We repeat this experiment 100,000 times. Table 5 reports the percentage of such pairing with the

[17]Notice that the autocorrelation induced by time-aggregation and measurement errors requires the use of twice lagged endogenous variables as instruments.

[18]We have experimented including other instruments such as Δc_{it-1} , age_{it-1} and age^2_{it-1} in our regressions. However, they failed the difference-in-Sargan C-test suggesting that they are not a valid set of instruments.

same characteristics between (1) and (2) (and (1) and (3)). Among the pairs of household heads in the same reference groups, roughly one-fourth of them were in the same age group and had the same number of children. About one-third were in the same income bracket and half of them shared levels of education and occupational category. The pairing of household heads in different reference groups yields only slightly lower percentages. For example, 26.6% of the pairing within the same reference groups had the two household heads in the same age group, and the figure was 24.3% for the pairing of heads in different reference groups (regardless of the municipality size). The results, therefore, suggest that although household heads in the same reference groups were more likely to share some common characteristics than those in different reference groups, the difference, if not negligible, does not seem to be significant[19].Finally, to attenuate the impact of common shocks at the census tract level, correlated effects, we include the local unemployment rate and the average interest rate faced by the reference group as additional regressors.

5 Empirical Findings

Our basic results are presented in Table 6. The first column reports OLS estimates. The second column reports OLS estimates obtained in first differences that account for unobserved heterogeneity. In line with Carrasco et al. (2005), the comparison of these results, which are only valid if the regressors are strictly exogenous, suggests the importance of correlated fixed effects. Columns 3 and 4 report GMM and LIML estimates, once we control for the endogeneity of the regressors.

To test the validity of the instruments described in the previous section we conduct tests for under-identification, over-identification and weak instruments. The

[19]In general, in the absence of correlated effects, the endogenous effect will be identified when the exogenous characteristics of the reference group do not affect individual behavior. Appendix III shows, in a simplified linear version of our model, that this is the case for equation (10) as long as $\Delta\bar{c}_{it-1}$ does not enter directly into our estimation equation, i.e. if the frequency of the data induces a contemporaneous relation between the consumption of an individual and her reference group rather than a lagged one. Ravina (2008), using quarterly data, introduces the lag of envy in her basic regression and finds that the estimated coefficient is not statistically different from zero. Additionally, the non-linearity between Δc_{it} and $\Delta\bar{c}_{it}$ in our model further attenuates the impact of the endogenous effect.

model is not rejected either by the Kleibergen-Paap LM statistic or the Hansen J statistic[20] . The statistic for the Kleibergen-Paap LM test has a value of 22.91 (chi-square 2 degrees of freedom) rejecting the null hypothesis of under-identification at any level of significance. The Hansen J statistic of overidentifying restrictions (0.694 for the GMM estimation and 0.677 for the LIML with 1 degree of freedom) confirms the validity of the instruments at standard significance levels and the correct exclusion of certain instruments from the estimated equation. Our set of instruments passes the under-identification and over-identification tests, but GMM regressions still might suffer from the weak instruments problem (Staiger and Stock, 1997). If this is the case, the sampling distribution of GMM statistics is non-normal and standard GMM point estimates, hypothesis tests and confidence intervals are unreliable. Table 7 reports a summary of the results for first-stage regressions. Following Angrist and Pischke (2008) we report first-stage chi-squared and F statistics tests. These results suggest that neither our instruments are weak nor our model is under-identified. Besides, the joint-significant Angrist-Pischke F-statistics of the first stage regression confirm the suitability of our instruments. Finally, as an additional check of the adequacy of the GMM estimates, we have also computed the LIML estimation (that performs better than other methods under weak instruments) without finding significant differences with the GMM estimates. Taking together this evidence suggests that, once one accounts for the potential effects of unobserved heterogeneity, misspecification, if any, does not seem to be severe.

Now we turn to the interpretation of our results. At first glance our estimates have the sign predicted by theory and their magnitudes lie in reasonable ranges. Additionally, the robust standard errors reported in parentheses suggest that most of the coefficients of interest are estimated with reasonable precision. Our estimate for the coefficient on the real interest rate, the intertemporal elasticity of substitution, is around 0.2 with a standard error of 0.052[21] . This value is similar in magnitude to those from previous studies, for instance Attanasio and Weber (1995) report

[20]We have also conducted the C-statistic which proves the goodness of an excluded subset of instruments (the first lag of the difference of number of children and number of adults) reject the null hypothesis that both the smaller set of instruments and the additional are valid.

[21]Notice that, as long as the intertemporal elasticity of substitution is small, the estimates on the envy and habit parameters from the additive specification, (8), have the same magnitudes as the ones derived from the multiplicative specification presented in Appendix I (see equation (A1-3)).

estimates that range from 0.149 to 0.480. Furthermore, our estimate lies between previous values found under interdependent preferences, for instance Maurer and Meier (2008) finds an intertemporal elasticity of substitution of 0.1 and Ravina (2008) reports an estimate close to 0.8. The coefficients on the number of adults and children are both positive and highly significant throughout all of our specifications. As expected, the former point estimate is larger than the latter. Our coefficients on age and age-squared are both significant and consistent with the hump-shaped profile of consumption through the life cycle reported by Attanasio and Browning (1995) among others. The coefficient on the change in labour market status is not statistically different from zero. This suggests that either non-separabilities are not very relevant in our sample or that our labour market variable, which only includes changes in labour market status rather than in hours worked, does not exhibit enough variability to precisely estimate their effects. Similar to previous studies that use our dataset, such as Collado (1998), aggregate shocks do not seem to be very important for individual consumption choices since there are no significant differences among the magnitude of the time dummies.

When we use OLS (columns 1 and 2), ignoring measurement errors and endogeneity, the resulting estimates of envy and habits present biases consistent with the problems discussed in the previous section. On the one hand, our coefficient of habits has the opposite sign than expected as a result of the negative autocorrelation induced by measurement errors or time averaging of consumption data. On the other hand, our coefficient of envy, although positive and significant, is relatively small, and therefore of limited economic interest. Once we instrument our endogenous regressors, using GMM (column 3) and LIML (column 4), our estimates for envy and habits reveal the importance of preference interdependence for individual consumption choices. The coefficient on the change in consumption of the reference group, our measure of envy, is in the order of 0.22 and statistically significant at the 5% level. The coefficient on the change in past individual consumption, our measure of habits, is between 0.32 and 0.35 and significant at the 10% level. In order to interpret the economic meaning of these coefficients, it is helpful to think in terms of the multiplicative specification of consumption services discussed in Appendix I. In this context, consumption services can be expressed as a weighted average of the absolute (current) level of consumption, the level of consumption relative to the reference group and the current level of consumption relative to the past level of consumption where the weights are given by our estimates of envy and habits. Specifically our estimates suggest that, on average, households derive one fourth of their consumption services from comparisons between their consumption and that of their neighbours, one third of their consumption services from comparisons between their current and past consumption, with only the remaining consumption services being determined by their current level of consumption.

Next we explore the robustness of our estimate of envy to the problems discussed by Manski (1993), particularly the presence of exogenous and correlated effects. To control for exogenous effects, the second column of Table 8 includes as additional regressors the means of the number of adults, number of children, age, educational level and income of the reference group. The resulting estimate of envy barely changes suggesting that our baseline result does not seem to be driven by exogenous effects. In order to control for correlated effects, the third column of Table 8 includes a measure of the unemployment rate calculated at the census tract level and the interest rate of the reference group. Once more, the robustness of our envy estimate seems to suggest that local shocks are not responsible for the co-movement in the changes of individual consumption within reference groups reported in our baseline estimation.

Now we compare our estimates of habits and envy with previous results. Meghir and Weber (1996), using the US CEX, and Dynan (2000), using the PSID, do not find evidence of habit formation. In the first study, the short time-dimension of the CEX does not allow to control for time-invariant unobserved heterogeneity. Carrasco et al. (2005), using the ECPF, find that when time invariant unobserved heterogeneity across households is not taken into account preferences seem to be inter-temporally separable. However, once fixed effects are controlled for, their results provide strong evidence of habit formation for food consumption and services, with estimates of 0.7 and 0.14 respectively. Contrary to Naik and Moore (1996), Dynan (2000) does not find evidence of habit formation in her analysis of food consumption. As argued by Ravina (2008) this failure to detect habit formation may arise from the limited set of instruments available to Dynan, particularly the absence of a household-specific interest rate. Ravina (2008) reports an estimate for habit formation in the range of 0.5 and one for envy close to 0.3. These estimates are consistent with the ones reported in our preferred specification. Finally, and despite of the fact that they define their reference groups in terms of socio-demographic characteristics (while ours are based on geographic characteristics), our estimates of envy are consistent with those reported by Maurer and Meier (2008) that range from 0.11 to 0.44. This last study proposes a social multiplier approach to disentangle true consumption externalities from merely correlated effects.

It is also reassuring that our estimates on envy are of similar magnitude as those found recently by the experimental literature. For instance the experiments reported by Alpizar et al. (2005) suggest a mean degree of envy that varies between 0.2 and 0.5 depending on the characteristics of the consumption good.

Finally as we conduct several additional checks using alternative reference groups. We report these results in Table 9. First, along the lines of Maurer and Meier (2008) we construct a reference group using socio-demographic characteristics. In particular, we use sex, education, age, employment status, location of the household and number of children to create 128 reference groups[22]. Column 2 reports the estimated envy coefficient replacing our geographical reference group with the socio-demographic one. The estimated coefficient for this alternative reference group is not significant. In Column 3 we consider both reference groups simultaneously. The socio-demographic one still remains non-significant while the coefficient on the geographical one does not change neither on magnitude no in significance confirming not only our benchmark results but also our characterization of the reference group. Second, since one can argue that the estimated effect of envy on individual consumption might be spurious, we randomly allocate a reference group to each household excluding its own geographical reference group. Column 4 reports the

[22]The educational variable distinguishes primary and below from secondary and above levels; age considers the age of the head of household in the following intervals [18-35], [36-45], [46-55] and [56-65]; employment status discriminate between employment and self-employment; the location variable separates rural from urban households and the number of children distinguish families with one children or less from the rest of families.

average coefficient for envy after running 1000 replications using this random reference group while Column 5 reports the estimates for envy using both the random reference group and our geographical one. These results are reassuring for our basic results. The coefficient on the random reference group is not significant while the coefficient on the geographical one maintains the same size and significance than our benchmark estimation[23].

[23] Additionally we have tested whether the inclusion of income (excess sensitivity of consumption or presence of liquidity constraints) affects the results. Our benchmark estimates are robust to this inclusion

6 Conclusions

In recent years there has been a growing interest in preference specifications that allow for non-separabilities across time and individuals. We have used data on consumption choices to explore the empirical relevance of these specifications. Our estimates of envy and habits are not only statistically significant but also economically important suggesting that a proper understanding of individual consumption choices requires taking into account at least a partial history of individual consumption choices and the choices of others. As Attanasio (1999) points out "it is from consumption that, in all likelihood, utility and welfare are in large part determined" and along these lines our estimates suggest that if we define preferences over consumption services, households derive almost 25% of these services from comparisons between their consumption and that of their neighbours, around 35% from comparisons between their current and past consumption, with the remaining 40% being determined by their current consumption choices.

Our results, derived from explicit consumption choices, complement the large body of empirical evidence that stresses the importance of interpersonal comparisons for self-reported well-being that dates back, at least, to Easterlin (1974). Furthermore, our results have important policy implications. On the one hand, a proper characterization of the determinants of consumption services is crucial for the type of welfare welfare analyses popularized after Lucas (1987). On the other hand, it is well known that the presence of consumption externalities, envy, distorts the marginal rate of substitution between consumption and other sources of utility, such as leisure (Liu and Turnovsky (2005)), human capital formation (Moav and Neeman (2010)), bequests (Alvarez-Cuadrado and Long (2011a)) or effort in the extraction of non-renewable natural resources (Alvarez-Cuadrado and Long (2011b)). As a result envious households tend to over-consume at the expense of those other activities, i.e. working longer hours, accumulating too little human capital, reducing their saving for bequest motives, or exhausting the natural resource. Along these lines, our estimates, together with those of Ravina (2008) and Maurer and Meier (2008), provide a valuable guide for the design of optimal fiscal interventions to internalize the impact of envy, as discussed by Wendner and Goulder (2008).

Finally, in a natural follow up to this project, we plan to explore the extent of interdependencies at a more disaggregated level. Following the work of Heffetz (2011) that finds that income elasticities can be predicted from the degree of positionality of consumer expenditures, we plan to use our rich dataset, which includes detailed information on over 200 expenditure categories, to narrow down the specific sources of envy and habits.

Appendices

Appendix I: A model with multiplicative interdependencies.

Following Abel (1990) and Carroll et al. (2000) consider the problem explored in Section 2 under the assumption that the consumption services for the $i-th$ household in period t are given by the following multiplicative specification of consumption services,

$$\tilde{C}_{it} = \frac{C_{it}}{\bar{C}_{it}^{\gamma} C_{it-1}^{\theta}} = (C_{it})^{1-\gamma-\theta} \left(\frac{C_{it}}{\bar{C}_{it}}\right)^{\gamma} \left(\frac{C_{it}}{C_{it-1}}\right)^{\theta} \quad \text{(A1-1)}$$

Combining (A1-1) with (6) the solution to this program yields an Euler equation that relates current and past consumption of the household and her reference group according to,

$$1 = \beta_i E_{t-1} \left[\left(\frac{C_{it}}{C_{it-1}}\right)^{-\sigma} \left(\frac{\bar{C}_{it}}{\bar{C}_{it-1}}\right)^{-\gamma(1-\sigma)} \left(\frac{C_{it-1}}{C_{it-2}}\right)^{-\theta(1-\sigma)} R_{it} \right] \quad \text{(A1-2)}$$

Considering a log-linear approximation and assuming expectations are formed rationally we reach,

$$\Delta c_{it} = \mu_i + \frac{1}{\sigma} r_{it} + \frac{\gamma(\sigma-1)}{\sigma} \Delta \bar{c}_{it} + \frac{\theta(\sigma-1)}{\sigma} \Delta c_{it} + \Delta \psi_{it} + \varepsilon_{it} \quad E_{t-1}(\varepsilon'_{it}) = 0 \quad \text{(A1-3)}$$

which is the multiplicative counterpart of our basic estimation equation.

Appendix II: Derivation of equation (5)

Under the assumption that the interest rate it constant, we follow Deaton (1992) to express equation (4) as a second order difference equation using the lead operator, F , as follows

$$u_{it}^{\tilde{C}} - \beta_i (\theta + R_i) E_t \left[F u_{it}^{\tilde{C}} \right] + \beta_i^2 \theta R_i E_t \left[F^2 u_{it}^{\tilde{C}} \right] = u_{it}^{\tilde{C}} (1 - \beta_i R_i E_t [F]) (1 - \beta_i \theta E_t [F]) = 0 \quad \text{(A2-1)}$$

We can rule out the unstable solution associated with the second root using the transversality condition, since $\beta_i\theta > 0$. The stable solution that corresponds to the first root is equivalent to (5).

Appendix III: Derivation of model restrictions

Let's assume a general linear version of equation (10) is as follows,

$$\Delta C_{it} = \mu + \frac{1}{\sigma} r_{it} + \gamma \Delta \bar{C}_{it} + \theta \Delta C_{it-1} + \eta_1 \Delta \bar{C}_{it-1} + \eta_2 \bar{r}_{it} + u_{it} \tag{A3-1}$$

where C_{it} is the household consumption (whereas c_{it} in equation (10) is the logarithm of household consumption) and $\Delta\bar{C}_{it}$ is the average consumption of the reference group, $\frac{1}{N_G} \sum\limits_{j \in G} \Delta C_{jt}$, indexed by G (while in equation (10) is $\Delta\bar{c}_{it}$ is the logarithm of the average consumption of the reference group, $\ln\left(\frac{1}{N_G - 1} \sum\limits_{j \in G-i} \Delta C_{jt}\right)$. This leads to

$$\begin{aligned} \Delta \bar{C}_{it} = \mu + \frac{1}{\sigma} \bar{r}_{it} + \gamma \Delta \bar{C}_{it} + \theta \Delta \bar{C}_{it-1} + \eta_1 \Delta \bar{C}_{it-1} + \eta_2 \bar{r}_{it} + \bar{u}_{it} = \\ \frac{\mu}{1-\gamma} + \frac{1/\sigma + \eta_2}{1-\gamma} \bar{r}_{it} + \frac{\theta + \eta_1}{1-\gamma} \Delta \bar{C}_{it-1} + \frac{1}{1-\gamma} \bar{u}_{it} \end{aligned} \tag{A3-2}$$

Plugging the expression of (A3-2) back into equation (A3-1), we have

$$\Delta C_{it} = \frac{\mu}{1-\gamma} + \frac{\eta_1 + \theta\gamma}{1-\gamma} \Delta \bar{C}_{it-1} + \frac{\eta_2 + \gamma/\sigma}{1-\gamma} \bar{r}_{it} + \theta \Delta C_{it-1} + \frac{1}{\sigma} r_{it} + \frac{\gamma}{1-\gamma} \bar{u}_{it} + u_{it} \tag{A3-3}$$

To be able to identify our envy parameter, γ , we need to have either of the following restriction: (i) $\eta_1 = 0$, i.e. $\Delta\bar{C}_{it-1}$ does not enter equation (A3-1); or (ii) $\eta_2 = 0$, i.e. $\bar{r}_{it}$ does not enter equation (A3-1). This second condition additionally requires that the individual interest rate r_{it} enters equation (A3-1). Given that our estimation equation meets both conditions the coefficient on envy is properly identified. Finally, it is worth noticing that when $\gamma = 0$, equations (A3-1) and (A3-3) are the same.

Appendix IV: First-stage regressions

Variables	r_{it}	$\Delta\bar{c}_{it}$	Δc_{it-1}	*Labour Change*
$\Delta nadult$	0.020***	-0.009	0.003	-0.000
	(0.006)	(0.007)	(0.010)	(0.007)
$\Delta nchildren$	0.012	-0.014	0.002	-0.003
	(0.009)	(0.010)	(0.014)	(0.010)
ΔAge	0.004	-0.006	-0.032**	-0.016
	(0.007)	(0.008)	(0.014)	(0.013)
ΔAge^2	-0.039	0.070	0.301*	0.173
	(0.087)	(0.099)	(0.162)	(0.147)
r_{it-1}	-0.575***	0.005	0.122***	0.000
	(0.013)	(0.005)	(0.009)	(0.004)
$\Delta\bar{c}_{it-2}$	0.016***	0.143***	-0.054***	0.008**
	(0.005)	(0.006)	(0.008)	(0.004)
$Lag1.\Delta nchildren$	0.011	-0.006	0.044***	0.000
	(0.009)	(0.011)	(0.015)	(0.010)
$Lag1.\Delta nadult$	0.007	-0.001	0.053***	-0.009
	(0.006)	(0.007)	(0.011)	(0.007)
Lag1.Labour Change	-0.004	0.006	0.009	-0.428***
	(0.005)	(0.006)	(0.009)	(0.012)
Seasonal dummies	Yes	Yes	Yes	Yes

Notes.
1. Robust standard errors in parentheses
2. p<0.01, ** p<0.05, * p<0.1
3. Seasonal and annual dummies are included in all the regressions.

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Tables

Table 1: Sample Selection and data cleaning

Criterion	Number of Households	Number of Observations
Whole sample	30,133	148,482
Less than 4 qrts of participation	(9,977)	(17,760)
<18 years old or >65 y.o	(4,332)	(30,280)
Single	(730)	(4,799)
Final Sample	**15,094**	**95,643**
Differences	12,064	35,957

Table 2: Description of the variables

VARIABLE	DESCRIPTION	SOURCE
	Economics Variables	
Δc_{it}	**Household Non-Durable Consumption Growth Rate** Household's expenditures in goods and services. In particular, it includes the sum of food, alcohol, tobacco and expenditures on other nondurable goods, such as services, heating fuel, public and private transport, personal care and semi-durable goods like clothing and footwear. We construct growth rate by taking the difference in the logarithms of this variable between time t and (t-1).	ECPF
$\Delta \bar{c}_{it}$	**Reference Group Household Non-Durable Consumption Growth Rate** The log differences of average consumption of her census tract excluding her own consumption expenditures.	ECPF
y_{it}	**Real Disposable Income**	ECPF
r_{it}	**Household Real Interest Rate** Computed as: $r_{it} = R_t - \pi_{it}$	Authors' Calculations
R_t	*12 Month Non-Transferable Deposit Interest Rate*	Bank of Spain
π_{it}	*Household Inflation Rate* Computed as: $\pi_{it} = \frac{P^*_{it} - P^*_{it-1}}{P^*_{it-1}}$ Where $P^*_{it} = \sum_j P^j_t w^j_{it}$	Authors' Calculation
P^j_t	*Nominal Price of Commodity j*	Spanish National Statistics Institute
w^j_{it}	*Weight of commodity j* in the i household budget	Authors' Calculations
	Sociodemographic Variables	
nadult	Number of Adults	ECPF
nchildren	Number of Children (Less than 14 years old)	ECPF
dlabourchange	Dummy of Change of the Head of Household Labour status	ECPF
EducationLevel	Educational Level	ECPF
age	Head of Household Years Old	ECPF
hsex	Sex of Head of Household	ECPF
drura	Dummy for Cities with Less than 10,000 citizens	ECPF
dheduc	Dummy for families whose head of household has Graduate Educational Level	ECPF

Table 3: Summary Statistics

Variable	Whole Sample Mean	Whole Sample SD	Sample Selected Mean	Sample Selected SD
Economics Variables				
c_{it} (real non durable consumption)	€2,835	€1,913	€3,146	€1,870
r_{it} (real interest rate)	10.7%	3.6 %	10.7%	3.6%
y_{it} (real income)	€3,277	€2,208	€3,622	€2,214
Sociodemographic Variables				
nadult	2.7	1.2	3.1	1.2
nchildren	1.6	1.4	2	1.3
age	52.8	15.4	46.6	11.2
$hsex(male)$	82%		86%	
drura	28%		27%	
dheduc	8%		8.3%	
Reference Group	**No. of Groups**	**Mean Size**	**Median Size**	
	584	5.43	5	

Table 4: Autocorrelations

	Δc_{it}	Δc_{it-1}	Δc_{it-2}	Δc_{it-3}
Δc_{it}	1			
Δc_{it-1}	-0.4444	1		
Δc_{it-2}	-0.0299	-0.4471	1	
Δc_{it-3}	-0.0384	-0.0281	-0.4421	1

Table 5: Heterogeneity in observables characteristics within and across reference groups

Pairing of heads of households in	Age	No. of children	Income	Education	Occupation
	% of pairing with same characteristics				
Same reference group	26.6	24.9	35.1	55.7	48.6
Different ref. group, same city size	24.7	23.5	29.9	46.0	44.2
Different ref. group regardless of city size	24.3	23.5	29.2	44.0	42.5

Table 6: Basic Estimation

Variables	OLS-POOL	FD-OLS	FD-GMM	FD-LIML
$\Delta\bar{c}_{it}$	0.073***	0.054***	0.224**	0.236**
	(0.005)	(0.005)	(0.103)	(0.106)
Δc_{it-1}	-0.434***	-0.626***	0.316*	0.350*
	(0.005)	(0.005)	(0.162)	(0.166)
r_{it}	0.004**	0.058***	0.197***	0.205***
	(0.002)	(0.005)	(0.052)	(0.054)
$\Delta nadult$	0.066***	0.028***	0.050***	0.050***
	(0.006)	(0.006)	(0.013)	(0.013)
$\Delta nchildren$	0.048***	0.027***	0.039**	0.041**
	(0.008)	(0.008)	(0.017)	(0.017)
ΔAge	0.025**	0.021**	0.046**	0.048**
	(0.010)	(0.010)	(0.020)	(0.020)
ΔAge^2	-0.233**	-0.188	-0.428**	-0.441**
	(0.108)	(0.115)	(0.217)	(0.220)
$LabourChange$	-0.011**	-0.012**	-0.017	-0.01
	(0.005)	(0.006)	(0.027)	(0.028)
$Seasonaldummies$	Yes	Yes	Yes	Yes
Observations	65,378	50,378	35,957	35,957
Number of Households			12,064	12,064
Kleibergen-Paap LM Statistics				
Underidentification test			22.91***	22.91***
Hansen J statistic				
Overidentification test			0.694***	0.677***
C-statistic+			0.694***	0.677***

Notes.
1. Robust standard errors in parentheses
2. p<0.01, ** p<0.05, * p<0.1
3. Instrumented variables:Δc_{it-1}, $\Delta\bar{c}_{it}$, Labour Change and r_{it}
4. Instruments sets:lag r_{it}, lag2 $\Delta\bar{c}_{it}$, lag $\Delta nadult$, lag $\Delta nchildren$ and lag $LabourChange$
5. Excluded variables in the C-statistic: lag of $\Delta nadult$, lag $\Delta nchildren$
6. Seasonal and annual dummies are included in all the regressions.

Table 7: Summary results for Angrist-Pischke first-stage regressions

			(Underid)		**(Weak id)**	
Variable	F(5, 35934))	P-val	AP Chi-sq(2)	P-val	AP F(2, 35934))	P-val
r_{it}	378.06	0.0000	1076.00	0.0000	537.66	0.0000
$\Delta\bar{c}_{it}$	129.50	0.0000	289.06	0.0000	144.44	0.0000
Δc_{it-1}	54.73	0.0000	25.46	0.0000	12.72	0.0000
Labour Change	248.95	0.0000	1230.76	0.0000	614.99	0.0000

Note.
1. Angrist-Pischke multivariate F test of excluded instruments: F(5, 35934)) = 274.43 Prob> F = 0.0000

Table 8: Robustness Checks I

Variables	Baseline	(2)	(3)
$\Delta\bar{c}_{it}$	0.224**	0.213**	0.221**
	(0.103)	(0.098)	(0.098)
Δc_{it-1}	0.316*	0.143*	0.145*
	(0.132)	(0.089)	(0.088)
r_{it}	0.197***	0.211***	0.212***
	(0.052)	(0.054)	(0.055)
$\Delta nadult$	0.050***	0.054***	0.053***
	(0.013)	(0.012)	(0.012)
$\Delta nchildren$	0.039**	0.035**	0.034**
	(0.017)	(0.015)	(0.015)
ΔAge	0.046**	0.040**	0.039**
	(0.020)	(0.018)	(0.018)
ΔAge^2	-0.428**	-0.359*	-0.358*
	(0.217)	(0.197)	(0.198)
Labour Change	-0.017	-0.021	-0.021
	(0.027)	(0.025)	(0.025)
$\Delta\overline{nadult}$		-0.042*	-0.044*
		(0.023)	(0.023)
$\Delta\overline{nchildren}$		0.004	0.005
		(0.015)	(0.015)
$\Delta\overline{Age}$		0.003**	0.003**
		(0.001)	(0.001)
$\Delta\overline{Education\ Level}$		-0.019*	-0.022*
		(0.011)	(0.011)
$\Delta\bar{y}_{it}$		-0.035***	-0.030***
		(0.011)	(0.010)
$\Delta\overline{Unemployment\ Rate}$			-0.021
			(0.030)
$\bar{r}_{it}$			-0.039***
			(0.012)
Seasonal dummies	Yes	Yes	Yes
Observations	35,957	32,483	32,483
Number of Households	12,064	11,053	11,053
Kleibergen-Paap LM Statistics			
Underidentification test	22.91***	25.67***	25.66***
Hansen J statistic			
Overidentification test	0.694***	0.748***	0.639***

Notes.
1. Robust standard errors in parentheses
2. p<0.01, ** p<0.05, * p<0.1
3. Instrumented variables:Δc_{it-1}, $\Delta\bar{c}_{it}$ and Labour Change, r_{it}
4. Instruments sets:lag r_{it}, lag2 $\Delta\bar{c}_{it}$, lag $\Delta nadult$, lag $\Delta nchildren$ and lag $LabourChange$
5. Seasonal and annual dummies are included in all the regressions.

Table 9: Robustness Checks II

Variables	Baseline	(2)	(3)	(4)	(5)
$\Delta\bar{c}_{it}$	0.224**		0.192**		0.203*
	(0.103)		(0.095)		(0.104)
$\Delta\bar{c}_{it_{socio\ demographics}}$		-0.093	0.017		
		(0.172)	(0.017)		
$\Delta\bar{c}_{it_{random}}$				0.069	0.015
				(0.088)	(0.009)
Observations	35,957	35,269	35,495	33,168	34,040
Number of Households	12,064	11,878	11,951	11,384	11,683

Notes.
1. Robust standard errors in parentheses
2. p<0.01, ** p<0.05, * p<0.1
3. Instrumented variables:Δc_{it-1}, $\Delta\bar{c}_{it}$, Labour Change and r_{it}
4. Instruments sets:lag r_{it}, lag2 $\Delta\bar{c}_{it}$, lag $\Delta nadult$, lag $\Delta nchildren$ and lag $LabourChange$
5. Seasonal and annual dummies are included in all the regressions.
6. All estimations include the lag of the consumption of the household, the interest rate and the demographic and labour market control variables.
7. The different sample size in the estimation is due to the construction of the log of consumption for the new reference groups

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