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ABSTRACT

Consumption and Habits: Evidence from Panel Data*

The purpose of this Paper is to test for the presence of habit formation in consumption decisions using household panel data. We use the test proposed by Meghir and Weber (1996) and estimate the within-period marginal rate of substitution between commodities, which is robust to the presence of liquidity constraints. To that end, we use a Spanish panel dataset in which households are observed up to eight consecutive quarters. This temporal dimension is crucial, since it allows us to take into account time invariant unobserved heterogeneity across households ('fixed effects') and, therefore, to investigate if the relationship between current and past consumption reflects habits or heterogeneity. Our results confirm the importance of accounting for fixed effects when analysing intertemporal consumption decisions allowing for time non-separabilities. Once fixed effects are controlled for and a proper set of instruments is used, the results yield supporting evidence of habit formation in the demand system of food at home, transport and services.

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1 Introduction

The purpose of this paper is to test for the presence of habit formation in consumption decisions using household panel data. We use the test proposed by Meghir and Weber (1996) and estimate the within-period marginal rate of substitution (MRS) between commodities, which is robust to the presence of liquidity constraints. To that end, we use a Spanish panel data set in which households are observed up to eight consecutive quarters. This temporal dimension is crucial, since it allows us to take into account time invariant unobserved heterogeneity across households ("fixed effects") and, therefore, to investigate if the relationship between current and past consumption reflects habits or heterogeneity.

Over the last decade several influential papers have revealed discrepancies between the predictions of models that assume intertemporally separable preferences and the empirical evidence. Estimates of these models have generated puzzles that range from the equity premium (i.e. the consumption growth rate appears to be too smooth to justify the mean equity premium) to the excess sensitivity and the excess smoothness of consumption to permanent income shocks (see Deaton, 1991).

A growing body of literature has emphasized the importance of allowing for habit formation, as a way of modelling time dependence in preferences, to improve the predictions of time-separable models. For instance, some authors have pursued this path and showed that habit persistence may partially solve the equity premium puzzle, since it smooths consumption growth over and above the smoothing implied by the life cycle-permanent income hypothesis with time-separable preferences (see Abel, 1990, and Constantinides, 1990). In addition, if preferences exhibit habit formation, consumption reacts slowly to permanent income shocks, and this can in principle explain the excess sensitivity of nondurable consumption observed in the aggregate data. The notion of habit persistence has been also used to address other important issues in macroeconomics and finances, such as the hump-shaped response of consumption to monetary and other shocks (Fuhrer, 2000), the relationship between savings and growth (Carroll, Overland and Weil, 2000), or the stock market volatility puzzle (Campbell and Cochrane, 1999).

Despite of the growing interest in studying consumption behavior when preferences are assumed to be time non-separable, most of the empirical work has been done using aggregate data. Apart from the well-known aggregation problems derived from the use of this type of data (see Attanasio and Weber, 1993, Attanasio, 1999, or Blundell and Stocker, 1999), simple life-cycle considerations open an interesting research agenda for testing time non separabilities in preferences at a microeconomic level.

The lack of empirical microeconomic evidence presumably arises from data availability constraints: the microeconomic data sets used in most of the consumption literature so far contained either very limited information on consumption or none at all. Some recent exceptions are the papers by Meghir and Weber (1996) and Dynan (2000), which do not find evidence of habit formation in preferences at the household level, and Naik and Moore (1996) which find support for the habit formation model. Nevertheless, that evidence presents several drawbacks. Naik and Moore (1996) and Dynan (2000) use yearly information from the Panel Study of Income Dynamics (PSID), which only offers information on food consumption. Therefore, it is necessary to assume separability in preferences between food and other nondurables and, as emphasized by Attanasio and Weber (1995), all available studies of demand systems strongly reject such a hypothesis. Moreover, Dynan (2000) does not account explicitly for time invariant unobserved heterogeneity across households and, although Naik and Moore (1996) do, they perform a fixed effect estimation of a dynamic model but without accounting for the potential endogeneity of some of the explanatory variables. Meghir and Weber (1996), using quarterly data from the Consumer Expenditure Survey (CEX), find that, when other non-durable commodities are controlled for, there is no evidence of habit persistence in the demand system of food at home, transport and services. Nevertheless, although the CEX does follow households over time, it is only for four consecutive quarters, and this is not enough to control properly for time invariant unobserved heterogeneity across households. This could be crucial since, if correlated fixed effects do affect the preferences specification, improper treatment of unmeasured variables could give rise to a spurious relationship between future and past consumption due solely to uncontrolled heterogeneity. Therefore, previous evidence would be based on inconsistent estimates of the structural parameters of the model.

In this paper we overcome these potential problems and address the importance of accounting for time invariant unobserved heterogeneity across households when testing for the presence of habit formation in preferences. For that purpose, we use data from the Spanish Continuous Family Expenditure Survey (Encuesta Continua de Presupuestos Familiares, ECPF).[1] The key to identify the structural parameters in the presence of fixed effects is that we can use information up to eight consecutive quarters for some households in the survey. Therefore, fixed effects can be ruled out by a proper transformation of the empirical specification and an adequate set of instruments can be used in the estimation, since enough lagged values of the variables are available. Given that our data set contains information on several consumption commodities, we model three nondurable goods: food at home, transport, and services. Conditioning on labor market variables and other non-durable goods, we estimate the intertemporal Euler conditions and the within period MRS between goods, which are robust to the presence of liquidity constraints.

Our results confirm the importance of accounting for fixed effects when analyzing consumption decisions allowing for time non-separabilities. When we do not account for unobserved heterogeneity, we find that preferences are intertemporally separable and the results are the same whether using the MRS or Euler equations. However, our results are markedly different once we control for fixed effects and use an adequate set of instruments. In this case, we find evidence of habit formation according to the MRS for food and transport, while for services the parameter is not significant at standard levels. Using the Euler equations we also obtain evidence of habits for food, while no evidence of dynamics is found for transport and services. This result could be interpreted as evidence of binding liquidity constraints.

The paper is organized as follows: Section 2 presents the theoretical model. Section 3 describes the empirical specification and discuss identification issues and the estimation strategy. In Section 4 we describe the data set used. Section 5 contains the estimation results. Finally, Section 6 presents some concluding remarks.

2 The model

Following Meghir and Weber (1996), we present a model in which borrowing restrictions are present. It is well known that liquidity constraints invalidate the standard

[1] This survey has recently attracted international attention (see Browning and Collado, 2001).

Euler equations by introducing dependence on variables in the information set of the consumer. Therefore, in a model based on a single good or a composite of non-durable goods one can never be sure that such dependence in the data comes from liquidity constraints or intertemporal non-separabilities. Nevertheless, this identification problem can be solved by looking at several commodities. It is possible to exploit the fact that MRS between commodities depends on past quantities of consumption if preferences are nonseparable over time, without contamination from the effects due to the presence of liquidity constraints.

We limit the study to three non-durable goods: food at home, transport and services.[2] We assume that the household maximizes the present discounted value of a lifetime utility

$$\max_{\{C_t\}} E_t \sum_{k=t}^{T} \beta^{k-t} U_k(C_k, C_{k-1}, X_k), \tag{1}$$

where E_t represents the expectation conditional on information at time t, $C_t = (c_{1t}, .., c_{nt})$ is a vector of goods, β is the discount factor, and X captures other family variables including labor supply decisions and other goods which can be nonseparable from the goods we model. The households are subject to the standard dynamic budget constraint:

$$W_{t+1} = (W_t + Y_t - p_t' C_t)(1 + r_t), \tag{2}$$

where W_t represents the beginning of period assets, r_t is the nominal interest rate between periods t and $t+1$, p_t is a vector of prices, and Y_t is household disposable income. Finally, as in Zeldes (1989), we define the following function describing liquidity constraints

$$W_{t+1} \geq f(\xi_{it}), \tag{3}$$

where ξ_{it} is a vector of household's characteristics other than consumption decisions.

The optimal allocation of consumption goods can be described by the following first order conditions of the maximization of (1) subject to (2) and (3)

$$\frac{\partial U_t}{\partial c_{jt}} + \beta E_t \frac{\partial U_{t+1}}{\partial c_{jt}} - \beta p_{jt} E_t \left[(1 + r_t)(\lambda_{t+1} + \phi_t) \right] = 0, \tag{4}$$

$$\lambda_t = E_t \left[\beta (1 + r_t)(\lambda_{t+1} + \phi_t) \right], \tag{5}$$

[2] The reason is that these goods cannot generally be used as a means of alleviating liquidity constraints and are generally consumed by all households and hence we minimize the presence of zeros. It also allows for a closer comparison with Meghir and Weber (1996).

where λ_t and ϕ_t represent the multipliers of the budget and the liquidity constraint, respectively. Therefore, the presence of time non-separabilities implies that future utility affects both the MRS between goods as well as the Euler equations. Notice that in the absence of liquidity constraints, $\phi_t = 0$, and we obtain the standard first order conditions. However, the presence of liquidity constraints makes the estimation of the model difficult given that the multipliers are unobservable (see, for instance, Attanasio, 1999, and references therein).

Notice that the presence of liquidity constraints affects all the goods in the same way, that is through the marginal utility of wealth (λ_t). This can be seen by combining expressions (4) and (5) to obtain

$$\frac{\partial U_t}{\partial c_{jt}} + \beta E_t \frac{\partial U_{t+1}}{\partial c_{jt}} = p_{jt}\lambda_t. \tag{6}$$

From (6) it follows that the MRS between two goods in the same period does not depend of the marginal utility of wealth and of the existence of liquidity constraints. Formally, using the optimal allocation of consumption for another good (o) we have:

$$\frac{\partial U_t}{\partial c_{jt}} + \beta E_t \frac{\partial U_{t+1}}{\partial c_{jt}} = \frac{p_{jt}}{p_{ot}} \left[\frac{\partial U_t}{\partial c_{ot}} + \beta E_t \frac{\partial U_{t+1}}{\partial c_{ot}} \right]. \tag{7}$$

Therefore, modelling two or more than two goods and since the MRS between any two goods depends on all the quantities but only on the relative prices of the two goods, it is possible to identify one MRS from another. In fact, the key to identify one MRS from another crucially depends on the variation of relative prices. Moreover, the time dependence observed in the MRS can be understood in terms of the existence of habits or durability in consumption decisions, depending on the sign of the cross-partial derivatives $\frac{\partial U_{t+1}}{\partial c_{jt}}$. Habit persistence implies that $\frac{\partial U_{t+1}}{\partial c_{jt}}$ is negative and durability implies a positive coefficient. The intuition in the habit formation case is that households are more displeased with fluctuations in consumption than in a framework without habits and, therefore, for a given level of current consumption, larger habits lower utility. Durability has essentially the opposite effect (see Ferson and Constantinides, 1991).

Under the absence of liquidity constraints, $\phi_t = 0$, it is still possible to analyze intertemporal substitution effects using the martingale property of λ_t implied by (5) to derive the Euler equation for each good:

$$\frac{\partial U_t}{\partial c_{jt}} + \beta E_t \frac{\partial U_{t+1}}{\partial c_{jt}} = E_t \left\{ \left[\frac{\partial U_{t+1}}{\partial c_{jt+1}} + \beta E_t \frac{\partial U_{t+2}}{\partial c_{jt+1}} \right] \beta (1 + r_t) \frac{p_{jt}}{p_{jt+1}} \right\}. \tag{8}$$

Thus, while the MRS is robust to the presence of liquidity constraints, this is not true for the Euler equation. Therefore, the analysis of the MRS is informative about the existence of intertemporal non-separabilities without reference to the Euler equation and the comparison between both representations of the first order conditions can be used to distinguish between liquidity constraints and intertemporal dependence in preferences.

Notwithstanding, identification of dynamics can be influenced by the presence of preference shocks. Thus, the empirical specification of preferences requires to properly account for these effects.

3 Empirical Specification

In order to keep our analysis as close as possible to Meghir and Weber (1996), we assume that preferences for the three goods are described by a flexible direct translog utility function modified to allow for time non-separabilities and preference shocks:

$$\begin{aligned} U_t &= \sum_{j=1}^{3} \left[\varrho_{jt} c_{jt} + a_j \ln c_{jt} \right] + 0.5 \sum_{j=1}^{3} \sum_{k=1}^{3} b_{jk} \ln c_{jt} \ln c_{kt} \\ & \quad + \sum_{j=1}^{3} \gamma_j \ln c_{jt} \ln c_{jt-1}, \end{aligned} \tag{9}$$

where a_j, b_{jk}, and γ_j are coefficients to be estimated and ϱ_{it} are random parameters reflecting preference shocks. This preference specification is very flexible and allows testing several interesting hypothesis. Intertemporal separability implies that $\gamma_j = 0$, $\forall j$. Homothetic separability implies $b_{jj} = 0$ for all goods, and $b_{jk} = 0$ for any two goods (j, k) implies additive separability.[3]

Given these preferences, the marginal utility of any good g is given by the following expression

$$MU_{gt} = \left\{ \varrho_{gt} + \frac{a_g}{c_{gt}} + \sum_k b_{gk} \frac{\ln c_{kt}}{c_{gt}} + \gamma_g \frac{\ln c_{gt-1}}{c_{gt}} + \gamma_g \beta E_t \frac{\ln c_{gt+1}}{c_{gt}} \right\}. \tag{10}$$

In order to estimate the MRS and the Euler equations we use the same normalization restrictions on the coefficients. Therefore, the equations to be estimated take the

[3] Other preferences specification commonly used in empirical studies is the isoelastic one. Nevertheless, as pointed out by Attanasio and Weber (1995), isoelastic utility is particularly inappropriate for food, which is a necessity.

form:

$$\frac{1}{p_{jt}} MU_{jt} = \frac{1}{p_{ot}} MU_{ot}, \tag{11}$$

for the MRS between two goods j and o consumed at period t, and

$$\frac{1}{p_{jt}} MU_{jt} = E_t \left[\beta \frac{(1+r_t)}{p_{ot+1}} MU_{ot+1} \right], \tag{12}$$

for the Euler equation which relates the good jth at period t to the good oth at period $t+1$, where j represents food and transport, and the numeraire o are services.

Notice that an advantage of the trans-log specification is that both conditions are linear in known transformed variables, which makes estimation easier. Another approach frequently used in the literature (see for example Dynan, 2000) consists of using the log-linear approximation of the first order conditions. But this introduces a conditional variance term in the consumption growth equation and, therefore, is subject to the criticisms raised by Carroll (1992) and Attanasio (1999). In our case, linearity is achieved without imposing constant conditional variance and log-normality in the joint distribution of consumption changes and interest rates (see Hansen and Singleton, 1982). This approach, contrary to the log-transformation, is robust to the presence of the precautionary saving motive.

Finally, preferences are modeled so as to take into account demographic and labor supply variables. Hence, we consider that coefficients a_j depend on households's characteristics (z_t) as follows:

$$a_j (z_t) = a_{j0} + \sum_k a_{jk} z_{kt}. \tag{13}$$

In our empirical specification we have included among the variables z the age and education of the head of the household, family composition variables and seasonal dummies. Of particular interest is the labor supply behavior, which is expected to affect the utility derived from consumption. This happens when decisions on consumption and leisure are taken simultaneously, making them to be non-separable. Both research on labor supply and the recent literature on non-durable consumption have controlled for these factors as determinants of the life-cycle shape of consumption (see, for instance, Attanasio and Browning, 1995). Therefore, dummies for the labor force participation of wife and husband have been also included. Although these variables should be considered endogenous, modeling labor supply is beyond the scope of this paper. Therefore, our analysis is limited to the estimation of conditional preferences, and labor supply variables are instrumented with their lagged values.[4] Moreover, the goods we model could be non-separable from other nondurable goods, which have been also included within the variables z. Finally, a dummy for wife's labor market status has been interacted with these goods and the quantities of food, transport and services. To estimate the models, the coefficients in the MRS and Euler equations have been normalized by setting the services coefficient a_{o0} equal to 1.[5]

3.1 Stochastic Terms: The role of Unobserved Heterogeneity

3.1.1 Within Period Consumption Allocation: The MRS

In the empirical analysis of the model we have to take into account the presence of two sources of stochastic variability. Firstly, the expectational errors, $u^t_{j,t+1}$, which by assumption of rational expectations are orthogonal to variables dated at time t.[6] Secondly, the existence of preference shocks, ϱ_{jt}.

Thus, the error term of the MRS takes the following form (the subscript denoting households has been dropped):

$$\varepsilon^{MRS}_{jt} = \left[\frac{\varrho_{ot} + \gamma_o u^t_{o(t+1)}}{p_{ot}}\right] - \left[\frac{\varrho_{jt} + \gamma_j u^t_{j(t+1)}}{p_{jt}}\right]. \qquad (14)$$

Under absence of autocorrelation, (14) is orthogonal to information known in period t and to choice variables dated at $t-1$ or earlier. Therefore, we can take choices dated $t-1$ as instruments (quantities at $t-1$, income at $t-1$, and lagged labor market status), and also demographic composition at period t since it is taken as predetermined. Notice that, because of random preference shocks, choices made in period t are not valid instruments. We will refer to the estimation of these equations as estimates in "levels" since, as will be clearer below, we do not allow for the presence of a time invariant unobserved heterogeneity component affecting the preference specification.

Nevertheless, the existence of fixed effects affecting the preference shocks, leads to inconsistent estimates of the equation in levels. The reason is that choice variables in

[4] Rigidities in the Spanish labour market makes the lagged participation dummies good instruments for contemporaneous ones.

[5] Although a different normalization restriction can be used, our aim to use this one is to keep our analysis as close as possible to Meghir and Weber (1996).

[6] Notice that these errors can be correlated across households, so we cannot rule out the effects of aggregate shocks. However, since we use data for a long time period (1985-1995), we assume that aggregate shocks possibly correlated across households are averaged out.

any period are not valid instruments. Specifically, let's assume that preference shocks for household h can be written as follows:

$$\varrho_{jth} = \eta_h + \vartheta_{jth}, \tag{15}$$

$$\varrho_{oth} = \eta_h + \vartheta_{oth}, \tag{16}$$

where there are time invariant components (η_h) affecting household's consumption choice. Under the previous assumptions the error term can be rewritten as follows

$$\varepsilon_{jth}^{MRS} = \eta_h \left[\frac{1}{p_{ot}} - \frac{1}{p_{jt}}\right] + \left[\frac{\vartheta_{oth} + \gamma_o u^t_{o(t+1)h}}{p_{ot}}\right] - \left[\frac{\vartheta_{jth} + \gamma_j u^t_{j(t+1)h}}{p_{jt}}\right]. \tag{17}$$

Notice that, since choice variables in any period are correlated with the fixed effects, they are not valid instruments.

It is evident from the previous expression that first differencing the equation does not eliminate the fixed effects. Thus, in order to drop out the η_h, we define the variable $\kappa_{jt}^{MRS} = \left[\frac{1}{p_{ot}} - \frac{1}{p_{jt}}\right]$. Then, if one multiplies the MRS at time t by κ_{jt-1}^{MRS} and that at time $t-1$ by κ_{jt}^{MRS}, the difference between the two expressions yields the following one for the error term that does not depend on the fixed effects:

$$\begin{aligned} \triangle\, \varepsilon_{jth}^{MRS} &= \left[\frac{\vartheta_{oth} + \gamma_o u^t_{o(t+1)h}}{p_{ot}}\right] \kappa_{jt-1}^{MRS} - \left[\frac{\vartheta_{o(t-1)h} + \gamma_o u^{t-1}_{oth}}{p_{ot-1}}\right] \kappa_{jt}^{MRS} \\ &\quad - \left[\frac{\vartheta_{jth} + \gamma_j u^t_{j(t+1)h}}{p_{jt}}\right] \kappa_{jt-1}^{MRS} + \left[\frac{\vartheta_{j(t-1)h} + \gamma_j u^{t-1}_{jth}}{p_{j(t-1)}}\right] \kappa_{jt}^{MRS}. \end{aligned} \tag{18}$$

We will refer to the estimation of this model as the estimates in "differences". In this case, the error of the differenced equation is orthogonal to the choice variables dated $t-2$ and earlier, and we can use them as valid instruments.

3.1.2 Intertemporal Consumption Allocation: The Euler Equation

The error term of the Euler equation takes the following form:

$$\varepsilon_{jt}^{E} = \left[\beta \frac{\varrho_{o(t+1)}(1+r_t)}{p_{o(t+1)}} - \frac{\varrho_{jt}}{p_{jt}}\right] + u^t_{o(t+1)} + u^t_{o(t+2)} - u^t_{j(t+1)}. \tag{19}$$

As usual, the error term has a MA(1) structure. As in the case of the MRS, in absence of fixed effects the error term is orthogonal to information known in period t and to choice variables dated at $t-1$ and earlier. Nevertheless, under the specifications for preference shocks (15) and (16), the error term for household h can be expressed as follows:

$$\varepsilon_{jth}^{E}=\eta_{h}\left[\beta\frac{(1+r_{t})}{p_{ot+1}}-\frac{1}{p_{jt}}\right]+\left[\beta\frac{\vartheta_{o(t+1)h}(1+r_{t})}{p_{ot+1}}-\frac{\vartheta_{jth}}{p_{jt}}\right]+u_{o(t+1)h}^{t}+u_{o(t+2)h}^{t}-u_{j(t+1)h}^{t}. \tag{20}$$

Again, choice variables do depend on the error term and, therefore, can not be used as valid instruments.

In order to account for the presence of fixed effects we proceed along the lines suggested for the MRS. In particular, we define the variable $\kappa_{jt}^{E}=\left[\beta\frac{(1+r_{t})}{p_{ot+1}}-\frac{1}{p_{jt}}\right]$. Then if one multiplies the Euler equation at time t by $\kappa_{jt-1}^{E}$and that at time $t-1$ by κ_{jt}^{E}, the difference between the two expressions does not depend on the fixed effects. Therefore, choice variables dated at $t-2$ and earlier can be used as instruments in order to obtain consistent estimates of the structural parameters. Notice that since services related variables are dated at $t+1$, more instruments are available for the Euler equations than for the MRS, for which services variables are dated at t. Nevertheless, the same set of instruments have been used in both cases.[7]

3.2 Estimation

The two models we estimate consist of two equations each: food versus services and transport versus services. For the MRS all equations are dated at t, while for the Euler equations services are dated at $t+1$. Estimation is performed using the generalized method of moments (GMM, see Hansen, 1982). Let's define an error term ε_{jth} for the jth equation and household h in period t, such that

$$E_{t}(\varepsilon_{jth}\mid l_{th})=0, \tag{21}$$

where $E_{t}(.)$ denotes the conditional expectation given information at time t and l_{th} is an instrument uncorrelated with ε_{jth}. Therefore we have the following set of orthogonality conditions:

$$E_{t}(\varepsilon_{jth}l_{th})=0. \tag{22}$$

[7]Notice that, in order to estimate both the MRS and the intertemporal Euler conditions using the same normalization restrictions on the coefficients, we estimate Euler equations in which services are dated at $t+1$ and food and transport are dated at t. Nevertheless, other Euler equations could have been chosen (for example, food dated at $t+1$ and transport and services dated at t).

These orthogonality conditions define the estimator. The GMM estimates are based on minimizing the quadratic form $\sum_j \varepsilon_j^{'} A \varepsilon_j$, where $A = L(L'L)^{-1}L$, being L the matrix of instruments. Hansen (1982) and Arellano and Bond (1991) discussed the weighting matrix A and provided conditions under which the parameter estimates are consistent and asymptotically normal and the minimized value of the quadratic form is asymptotically chi-square under the null hypothesis.

For the MRS representation of the first order conditions the error term of the equation in levels has the following form (dropping the h subscript denoting households):

$$\begin{aligned}\varepsilon_{jt} &= \frac{1}{e_{ot}} - \frac{a_{j0}}{e_{jt}} - \sum_k a_{jk}\left(\frac{z_{kt}}{e_{jt}}\right) - \sum_s b_{sj}\left(\frac{\ln x_{st}}{e_{jt}}\right) + \sum_k a_{ok}\left(\frac{z_{kt}}{e_{ot}}\right) + \sum_s b_{so}\left(\frac{\ln x_{st}}{e_{ot}}\right) \\ &\quad -\gamma_{j1}\frac{\ln x_{jt-1}}{e_{jt}} - \gamma_{j2}\frac{\ln x_{jt+1}}{e_{jt}} + \gamma_{o1}\frac{\ln x_{ot-1}}{e_{ot}} + \gamma_{o2}\frac{\ln x_{ot+1}}{e_{ot}}, \qquad (23)\end{aligned}$$

for j equal to food and transport. In (23) e_{jt} is the nominal expenditure on good j, x_{jt} is the quantity for good j, and z_{kt} represents household composition variables and the rest of the variables included in the specification. The parameters of good "o" (services) appear in both equations and we have imposed the normalization restriction that $a_{o0} = 1$.

To estimate this system, we first minimize the quadratic form for $j =$ food/services, transport/services to obtain parameter estimates with no cross-equation restrictions. We then apply minimum distance to the unrestricted coefficients to impose the cross-equation restrictions given by the theoretical model and to recover the structural parameters. First of all, we impose the equality of the parameters of the services equation across the two MRS and the two Euler equations. Secondly, symmetry is imposed (i.e. the effect of food on transport and services is imposed to be equal to the effect of transport and services on food, and the effect of transport on services is imposed to be equal to the effect of services on transport). Finally, we impose equality of the parameters for the lag and lead of quantities in each equation, which is also a restriction given by our theoretical model (see equations (4) and (5)).

Similarly, for the Euler equation we have

$$\begin{aligned}\varepsilon_{jt} &= \frac{R_t}{e_{ot+1}} - \frac{a_{j0}}{e_{jt}} - \sum_k a_{jk}\left(\frac{z_{kt}}{e_{jt}}\right) - \sum_s b_{sj}\left(\frac{\ln x_{st}}{e_{jt}}\right) + \\ &\quad \sum_k a_{ok}\left(\frac{z_{kt+1}R_t}{e_{ot+1}}\right) + \sum_s b_{so}\left(\frac{\ln x_{st+1}R_t}{e_{ot+1}}\right)\end{aligned}$$

$$-\gamma_{j1}\frac{\ln x_{jt-1}}{e_{jt}}-\gamma_{j2}\frac{\ln x_{jt+1}}{e_{jt}}+\gamma_{o1}\frac{\ln x_{ot}R_t}{e_{ot+1}}+\gamma_{o2}\frac{\ln x_{ot+2}R_t}{e_{ot+1}}, \tag{24}$$

where j = food and transport and $R_t=\beta(1+r_t)$. Conditional on the discount factor, β, the estimation problem is linear. We do not estimate the discount factor, but we tried several different values. In particular, the results we present are obtained for $\beta=0.99$.[8] The equation contains the same conditioning characteristics as the MRS.

Regarding the equations in differences, we have the same type of expressions, but with the variables transformed as explained in the previous section.

4 The data

To implement the model presented in the previous section, we use eleven years (1985-95) of a Spanish data set, the Continuous Family Expenditure Survey (ECPF). The ECPF is a rotating panel based on a survey conducted by the Spanish National Statistics Office (Instituto Nacional de Estadística, INE). The ECPF reports interviews for about 3,200 households every quarter randomly rotating at 12.5 per cent each quarter. As a result, we can follow a household for a maximum of eight consecutive quarters.

This survey has important advantages over other data sets which have consumption information. The available data sets for the US (the CEX and the PSID) and the UK (Family Expenditure Survey, FES) report information on consumption, income, demographic characteristics and other variables. Nevertheless, in the FES each household is interviewed only once (see Attanasio and Weber, 1993, and Attanasio and Browning, 1995) and the PSID only reports information on food consumption and, therefore, it makes no possible to control for the presence of other goods which may well be nonseparable from food.[9] By contrast, in the CEX each household is interviewed five quarters, although only four are available (see Attanasio, 1993a and 1993b, for additional details). The ECPF shares with the CEX some structural characteristics, and differs crucially in others. The fact that it is a longer panel represents the main advantage over the CEX. It allows us to properly transform the model to rule out fixed effects and to use an adequate set of instruments to obtain consistent estimates of the parameters.

[8] Nevertheless, the results are robust to small changes of the discount factor β (i.e. 0.995 or 0.997). Estimates conditional on an assumed value for β are less efficient than the joint estimation of all the parameters in the model including β, but also less reliable for the accuracy of estimates of the rest of the structural parameters.

[9] Attanasio and Weber (1995) show how this can lead to misleading results.

In Table 1 we present the structure of the data in terms of the number of interviews completed by the households. Firstly, we should note that there is some evidence of attrition in the sample. Secondly, during this period, a relatively large number of households complete eight consecutive interviews. Since our results could be affected by attrition bias, we use the unbalanced panel in the estimation process.

Our sample includes married couples,[10] with or without dependent children whose head is aged 25-60 and whose expenditure on the goods we model is positive.[11] To minimize the number of zeros we have aggregated to some extent expenditures on services. We have also dropped households with extremely low monetary income (<300 euros). In order to estimate the MRS and Euler equations in levels, we need household information for at least three and four consecutive quarters respectively. To estimate the MRS in differences, four observations per household are required, while for the Euler equations we need household information for five consecutive quarters. Therefore, we have excluded those households observed for less quarters than the needed in each case. After filtering the sample we are left with 3,764 and 3,160 households for the estimation of the MRS and Euler equations in levels, respectively. The number of households for the estimation in differences is 1,945 and 1,499, respectively.

The goods we explicitly model are food consumed at home, transport and services. Food at home does not include alcohol expenditures. Transport includes public and private transport expenditures, including fuel and maintenance. Services include education, medical and other nondurable expenditures. We also include, and treat as given, a group of nondurable goods composed by clothing and footwear, and nondurable housing expenditures. We refer to these group of goods as "collateral goods". Participation dummies, variables for number of children, age and education of the husband and seasonal dummies have been also included. Table A1 in the Appendix reports the mean and the standard deviation of the variables used in the analysis.

Since the intertemporal variability of the relative prices is crucial to have identification, Figure 1 shows the evolution of food and transport prices relative to services for the period considered. As can be seen, both relative prices vary over time and move

[10] The reason is that we are interested in capturing the effect of male and female labour market status on consumption.

[11] Given the nature of these goods, it is likely that zeros represent coding errors and not corner solutions or infrequency of purchases.

differently. The correlation between them is 0.64, so it seems possible to identify one MRS from another.

Finally, in order to check the time dependence of consumption, we look at the correlation patterns exhibited by the three goods we model in the ECPF over the period 1985-95. We estimate a simple reduced form autoregressive model by OLS for the log of food, transport and services. Table 2 shows the regressions which include seasonal dummies. This yields evidence of correlation of consumption over four consecutive quarters. In what follows we try to match this autoregressive behavior within our structural model.

5 Results

In this section we report the estimates from the different models described in previous sections. We only present the structural estimates, that is, the estimates once all within and cross equations restrictions are imposed. Two sets of estimates are presented. The first one contains the estimates of the MRS and Euler equations in levels. The second set of results examines the presence of dynamics in the MRS and Euler equations after controlling for time invariant unobserved heterogeneity. Sargan test for instruments validity are also reported, since if correlated heterogeneity is important, the test should detect this problem in the estimation in levels. Finally, the implicit within period income and price elasticities have been also computed, as well as the intertemporal elasticity of substitution and a measure of the degree of habit formation implied by our estimates.

5.1 Estimation in Levels

Table A2 in the Appendix reports the results from the estimation of the MRS for food, transport and services, together with the relevant test for overidenifying restrictions. The set of instruments used includes: dummies for education, number of children, age and age squared of the husband, seasonal dummies, prices of all goods and interest rate, dated at t. Prices and interest rate have also been included dated at $t-1$,[12] together with labor market status of the spouses, quantities of all goods, income and

[12] Meghir and Weber (1996) also include among the set of instruments prices dated at t and $t-1$, since they are considered exogenous.

some interactions of income with demographics. Most of the above are also included divided by expenditures on food, transport and services dated at $t-1$ to match as much as possible the specifications we estimate.

The first interesting result is that the Sargan test for the validity of instruments (before imposing cross equation restrictions) is high both for the food/services and transport/services MRS. The test statistic for food/services MRS gives a value of 170.12, while for transport/services it is 161.82. The 5 percent critical value from the chi-squared for 76 degrees of freedom is 97.35. This result is consistent with the presence of correlated fixed effects, which leads to rejection of the null hypothesis of the validity of the instruments. The Euler equations (see Table A3 in the Appendix) reproduce previous result.

Notwithstanding these results indicate some potential problems, we can analyze the dynamic structure derived from the models with this preference specification. In Table 3 we present the relevant parameters of the MRS and Euler equations. We first focus on testing intertemporal separability, that is, $\gamma_j = 0$, $\forall j$. The relevant parameters are those on the log of lagged and leaded consumption, $\ln c_{t-1}$ and $\ln c_{t+1}$, where c is food, transport or services, depending on the equation we are considering. There is evidence that preferences are intertemporally separable: the parameters are not significant individually, so the habit formation hypotheses would be rejected. This result still holds when we consider the Euler equation: we cannot reject the null hypothesis of intertemporal separability in preferences. The fact that the Euler equation results are compatible with the ones derived from the MRS might be viewed as supporting evidence of no liquidity constraints. At this point, it is important to note that our results do not differ from those in Meghir and Weber (1996). Using a similar estimation strategy and a similar set of instruments, they find that preferences are separable and that the dynamic structure of preferences implied by the Euler equation is the same as the one implied by the MRS.

Using the MRS equations we can also test whether additive separability is a valid assumption for the group of goods we model. That is, the hypothesis that the coefficients $b_{jk} = 0$. The t-statistics for the relevant hypothesis show that the effect of transport and services on food is significant, while the effect of services on transport is not. Moreover, the hypothesis that these goods are in turn separable from the collateral goods can not be rejected according to the t-statistics. Finally, from our results the hypothesis of homothetic separability ($b_{jj} = 0$) can not be rejected. Nevertheless, as noted in the theoretical section, these results can be potentially biased due to spurious dependence, since individual heterogeneity has not been properly accounted for. This issue will be considered in the next section.

5.2 Estimation in Differences: The role of Unobserved Heterogeneity

In this subsection we concentrate on the estimation of models including time invariant unobserved heterogeneity in the preference specification. Our main aim is to see if the effects obtained previously could be in part attributed to correlated fixed effects which introduce a bias in the estimated coefficients. The estimated models are presented in the Appendix, Tables A4 and A5. The set of instruments include quantities, nominal expenditures, income and prices in period $t-2$. Notice that, since prices appear in the error term, are not valid instruments. Therefore, in this case, prices dated at period t and $t-1$ should not be included among the set of instruments, and only prices dated at period $t-2$ and earlier are valid instruments.

As shown in Tables A4 and A5, the model is not rejected by the Sargan test: in the MRS the test statistic for food/services is 92.17 (which has a p-value of 9.99%), which at 76 degrees of freedom the 5 percent critical value from the chi-squared is 97.35. For transport/services, the Sargan test in the MRS is 92.06, which has a p-value of 10.13%. These results suggest the potential importance that the control for the unobserved heterogeneity has: once it is taken into account, the model is adequately transformed and the instruments are properly selected, there is no clear evidence of misspecification. The same type of results are obtained according to the Euler equations.

Regarding the hypothesis of intertemporal separability, Table 4 presents the relevant parameters. The estimated parameters from the MRS are individually significant for food and transport, confirming the existence of habit formation in these cases,[13] while the data show evidence of intertemporal separability for services. Wald test for the joint significance of the dynamics in the MRS equation (see Table 5) takes value of

[13] Notice that, although durability is theoretically possible, we are modelling non-durable goods, so this possibility should not appear.

11.05, which should be compared to a χ^2 with 3 degrees of freedom. The 5% per cent critical value is 7.81. This result implies that there is evidence that preferences are nonseparable over time for food and transport, once we have allowed preferences to be nonseparable across goods and labor market variables.

It is interesting to point out that the dynamic effects obtained from the Euler equations (see Table 4) also offer evidence of habit formation in food, while there is no evidence that preferences are nonseparable over time for transport and services. The fact that the dynamic structure from the Euler equation is compatible with the one from the MRS for food consumption does not indicate the presence of liquidity constraints for this good. Nevertheless, in the case of transport the result is consistent with the (alternative) hypothesis that the Euler equations are contaminated by liquidity constraints even after controlling for fixed effects. These results indicate that modelling just one category of goods or an aggregate good could have important consequences on the results. Besides the lack of control for fixed effects, this could be one of the reasons for the results in Dynan (2000).

As regards the separability across goods, there is no evidence of homothetic separability. Moreover, we find evidence of within period nonseparability between food, transport, services and other expenditures (collateral goods), both in the context of the MRS and the Euler equations.[14] In Table 5 we present the relevant Wald test for these hypotheses. It is clear that all separability assumptions are rejected.

Regarding the effect of labor market variables, we obtain a significant effect in the MRS and Euler representations. In Table 5 we present Wald test for the joint significance of the coefficients of the MRS equations that relate to labor market status. The test has 16 degrees of freedom and strongly reject the null. From this result it is evident that labor market variables are highly significant. Quantitatively the effect of female labor market status is also quite large.

Finally, using the results of the estimated models in levels and differences, we have calculated the within period total expenditure and price elasticities. The elasticities obtained from the model in levels are presented in order to emphasize the inappropriateness of the figures obtained. Table 6 shows that, according to the estimates in

[14] When the collateral goods are removed from the conditioning set, there is no evidence of habits in food. This result shows the importance of accounting for goods that are non-separable from the goods we model.

levels, food is a luxury at mean values and elastic to price changes. Expenditures on services are inelastic to prices and independent of income at mean values. Table 7 shows the same type of calculations, but using the estimated coefficients for the MRS in differences. As it can be seen, the elasticities obtained have the expected signs and size: price and income elasticities for food consumption are clearly smaller than 1 in absolute value at every point of the distribution, while these elasticities are close to 1 for transport and greater than 1 for services.[15]

5.3 Intertemporal Elasticity of Substitution and Habit Formation

In this subsection we calculate the intertemporal elasticity of substitution implicit in our preferences, as well as a measure of the degree of habit formation. We try to map our estimates of the structural parameters with these two measures emphasized in the literature on consumption dynamics.

5.3.1 Intertemporal Elasticity of Substitution

In a time non-separable framework, the intertemporal elasticity of substitution (IES) is well defined as the inverse of the expression $-c\frac{U_{cc}}{U_c}$, where U_c and U_{cc} are, respectively, the first and second partial derivatives of the utility function with respect to consumption, c. In a time-separable model the product of the IES and the coefficient of relative risk aversion (RRA) equals 1. Nevertheless, as shown by Constantinides (1990) and Boldrin, Christiano and Fisher (1997), habit formation breaks the link between the IES and the level of risk aversion, being its product below 1. Hence, we are able to obtain an upper bound for the RRA parameter:

$$RRA < \frac{1}{IES} = \omega_{RRA}.$$

Using our preferences specification given in equation (9), the IES can be computed for each good we model, and has the following expression:

$$IES_j = \frac{\lambda_{jt} + \varrho_{jt} c_{jt}}{\lambda_{jt} - \ b_{jj}}, \tag{25}$$

where $\lambda_{jt} = a_j + 0.5 \sum_{k \neq j} b_{jk} \ln c_{kt} + b_{jj} \ln c_{jt} + \gamma_j \ln c_{jt-1}$.

[15] This evidence is in line with other results obtained from the estimation of within-period demand systems using this data set (see, for example, Labeaga and Lopez, 1997).

In Table 8 we report the implicit estimates of the IES and the upper bound for the RRA parameter for food, transport and services, according to the estimated preference parameters from the MRS in differences and evaluated at different points of the distribution. As can be seen, the upper bound for the RRA is around 1 for food and transport, which is a value commonly used to calibrate general equilibrium models. This value is quite robust across the distribution of both goods. Nevertheless, the estimated value for services is considerably below 1, ranging between 0,24 and 0,64. These results show that there are important sources of heterogeneity in the measure of IES, while services tend to generate a degree of IES in line with recent empirical time series evidence this is not the case for food and transport.

5.3.2 Strength of Habits

Since intertemporal non-separabilities in preferences creates a link between current and past consumption, the degree of habit formation in behavior can be obtained by computing the fraction of past consumption that explains current consumption.

From the first order condition of the household's optimization problem, one can find the value of $\ln x_{jt}$ as a function of $\ln x_{jt-1}$, being $\frac{\gamma_j}{b_{jj}}$ the parameter that links current and past consumption for each of the goods we model. From the previous MRS estimates in differences, we obtain that this parameter is equal to 0.76 for food, 0.21 for transport and 0.006 for services.

The estimates for food are more or less in the range needed to explain some empirical regularities such as the "excess smoothness" of aggregate consumption (Deaton (1987) shows that α must equal 0.78), or the equity premium puzzle (Constantinides (1990) shows that α must be 0.80). The estimates for transport and services are far of this range. Nevertheless, one should be cautious when making these comparisons, since it is not clear that the habit formation found in the goods we model would generalize to broader measures of consumption.

6 Conclusions

In this paper we have shown the importance of accounting for time invariant unobserved heterogeneity across households when analyzing the existence of intertemporal non-separabilities in consumption decisions. Using data from the Spanish Continuous

Family Expenditure Survey, our principal findings can be summarized as follows:

(a) When time invariant unobserved heterogeneity across households is not taken into account, we find evidence that preferences are intertemporally separable. This result is obtained both from the MRS and Euler equations. Moreover, the large Sargan tests of overidentifying restrictions shows evidence of misspecification.

(b) Once fixed effects are controlled for, the results yield evidence of habit formation for food consumption and transport. In this case, the Sargan test does not detect significant correlation between the instruments and the error terms. The results obtained using the intertemporal Euler condition for transport do differ from the ones obtained using the MRS.

(c) Preferences are found to be nonseparable even when conditioning on labor market status of both spouses and other nondurable goods.

These results show the importance of distinguishing between which has been called in the literature "true" and "spurious" state dependence (see Heckman, 1991). Improper treatment of unmeasured variables could give rise to a relationship between future and past consumption due solely to uncontrolled heterogeneity. However, it might well be the case that individuals have different "propensities" for having different consumption behavior, independently of the level of consumption in previous periods. These propensities are what we have identified as time invariant unobserved heterogeneity in nondurable consumption, which should be controlled for in order to obtain a causal habit effect.

Table 1. Completed consecutive interviews

Number of Interviews	Percentage of households
1	15.46
2	10.86
3	9.13
4	10.42
5	10.29
6	8.65
7	8.28
8	26.90
Total	100.00

Table 2. Autoregressive models

	Food	Transport	Services
Food_{t-1}	0.2122 (0.018)	0.0621 (0.035)	0.0392 (0.028)
Food_{t-2}	0.1490 (0.019)	0.0120 (0.037)	0.0072 (0.029)
Food_{t-3}	0.1635 (0.021)	-0.0295 (0.039)	0.0324 (0.031)
Food_{t-4}	0.2382 (0.019)	-0.0399 (0.037)	-0.0242 (0.029)
Transport_{t-1}	0.0078 (0.009)	0.2213 (0.018)	0.0214 (0.014)
Transport_{t-2}	-0.0025 (0.009)	0.1622 (0.018)	-0.0180 (0.014)
Transport_{t-3}	-0.0132 (0.010)	0.1299 (0.019)	0.0223 (0.015)
Transport_{t-4}	-0.0066 (0.010)	0.1922 (0.019)	0.0082 (0.015)
Services_{t-1}	0.0016 (0.013)	0.0671 (0.025)	0.2720 (0.019)
Services_{t-2}	0.0128 (0.013)	0.0570 (0.025)	0.1691 (0.020)
Services_{t-3}	0.0064 (0.013)	0.0070 (0.024)	0.1760 (0.019)
Services_{t-4}	0.0183 (0.013)	-0.0421 (0.024)	0.2162 (0.019)
Number of observations		2606	

Note: Seasonal dummies included.

Table 3. Dynamic structure. Estimates in levels

	MRS	Euler
Food: ln c_{t-1} =ln c_{t+1}	-0.0088	-0.0228
	(0.0129)	(0.0171)
Transport: ln c_{t-1} =ln c_{t+1}	0.0005	0.0032
	(0.0025)	(0.0037)
Services: ln c_{t-1} =ln c_{t+1}	0.0006	0.0033
	(0.0043)	(0.0086)

Table 4. Dynamic structure. Estimates in differences

	MRS	Euler
Food: ln c_{t-1} =ln c_{t+1}	-0.0102	-0.0230
	(0.0040)	(0.0045)
Transport: ln c_{t-1} =ln c_{t+1}	-0.0039	-0.0020
	(0.0017)	(0.0025)
Services: ln c_{t-1} =ln c_{t+1}	-0.0004	0.0012
	(0.0009)	(0.0009)

Table 5. Diagnostics. MRS (Differences)

Test for Intertemporal Separability (3 d.o.f)	11.05 ($p - value$: 1.1%)
Test for Additive Separability (6 d.o.f)	96.84 ($p - value$: 0%)
Separability from Collateral Goods (3 d.o.f)	32.04 (($p - value$: 0%))
Significance of Labor Market Variables (16 d.o.f)	1277.55 ($p - value$: 0%)

Table 6. Within Period Elasticities (MRS, Levels)

	Price Elasticity			Income Elasticity		
	Food	Transport	Services	Food	Transport	Services
Mean	-1.15	-1.06	-0.33	1.14	1.06	0.22
Q25	-1.32	-1.05	-0.91	0.89	1.02	0.002
Q50	-1.18	-1.03	-0.25	1.18	1.03	0.09
Q75	-0.89	-1.02	-0.01	1.32	1.05	0.74

Table 7. Within Period Elasticities (MRS, Differences)

	Price Elasticity			Income Elasticity		
	Food	Transport	Services	Food	Transport	Services
Mean	-0.69	-0.97	-1.10	0.68	0.97	1.54
Q25	-0.90	-0.99	-1.09	0.63	0.97	1.14
Q50	-0.75	-0.98	-1.06	0.75	0.98	1.22
Q75	-0.63	-0.97	-1.04	0.90	0.99	1.39

Table 8. IES and ω_{RRA}

	IES			ω_{RRA}		
	Food	Transport	Services	Food	Transport	Services
Mean	1.01	1.03	2.32	0.99	0.97	0.43
Q25	1.01	1.04	4.17	0.99	0.96	0.24
Q50	0.99	1.01	2.32	1.01	0.99	0.43
Q75	0.99	1.00	1.56	1.01	1.00	0.64

Note: Qi is the ith percentile.

Appendix

Data Source:

Rotating panel from the Spanish Continuous Family Expenditure Survey ("Encuesta Contínua de Presupuestos Familiares") from 1985:I to 1995:IV, provided by the National Statistical Office (Instituto Nacional de Estadística, INE). The consumption information in this data set is very detailed. In each of the eight interviews, the person of reference is asked to report expenditures for the three preceding months on 279 different categories.

Variables:

Education: There exists information on the degree of education received by the head of the household. It is grouped in the following categories: Illiterate and no schooling, Primary education, Secondary education, and University education.

Number of children: Variable for number of children younger than 14.

Husband's labor market situation: Dummy equals 1 if the husband is employed and 0 otherwise.

Wife's labor market situation: Dummy equals 1 if the wife is employed and 0 otherwise.

Family Income: Total monetary income.

Interest Rates: Nominal interest rates are a weighted average of the different amount borrowed by households from banks and saving banks (see Cuenca, 1994 for details).

Table A1. Descriptive statistics

Variables	Mean	Std. Deviation
Husband's Age	36.19	7.45
Wife's Age	33.69	7.69
Family Composition		
Couples No Children	0.10	0.29
Number of Children < 14	1.90	1.04
Education		
Illiterate and No Schooling	0.06	0.23
Primary Education	0.40	0.49
Secondary Education	0.40	0.47
University Education	0.14	0.35
Labor Market Status		
Husband Employed	0.95	0.22
Wife Employed	0.32	0.47
Number of observations	14003	

Table A2. Marginal Rate of Substitution Function

	Estimates in Levels		
	Food	Transport	Services
Food	-0.0527		
	(0.0387)		
Transport	-0.0390	0.0066	
	(0.0184)	(0.0073)	
Services	-0.1068	0.0038	0.0054
	(0.0182)	(0.0076)	(0.0121)
Food*Wife Works	0.1713		
	(0.0484)		
Transport*Wife Works	0.0656	0.0104	
	(0.0423)	(0.0157)	
Services*Wife Works	0.2595	-0.0268	0.0454
	(0.0927)	(0.0219)	(0.0576)
Collaterals	-0.0284	-0.0187	-0.0375
	(0.0865)	(0.0231)	(0.0198)
Collaterals*Wife Works	-0.0803	0.0420	0.1230
	(0.2336)	(0.0475)	(0.0912)
Age	0.0012	0.0001	0.0007
	(0.0027)	(0.0005)	(0.0009)
Age^2	-0.003	-0.0001	-0.0001
	(0.0002)	(0.0001)	(0.0001)
Illiterate and No School.	-0.1583	-0.0201	-0.0454
	(0.0897)	(0.0156)	(0.0234)
Secondary Educ.	-0.0373	-0.0115	-0.0375
	(0.0480)	(0.0098)	(0.0210)
University Educ.	-0.0290	-0.0032	-0.0167
	(0.0558)	(0.0164)	(0.0397)
Children<14	-0.0266	-0.0048	-0.0111
	(0.0144)	(0.0039)	(0.0066)
Wife Works	-2.5847	-0.5870	-2.7127
	(1.5586)	(0.3973)	(0.7807)
Husband Works	0.0092	0.0105	0.0157
	(0.1325)	(0.0321)	(0.0424)
$\ln c_{t-1} = \ln c_{t+1}$	-0.0088	0.0005	0.0006
	(0.0129)	(0.0025)	(0.0043)
Constant	3.0564	3.8895	1.0
	(9.2118)	(0.7522)	(-)
Efficient Sargan test (76 d.o.f)	170.12 (0%)	161.82 (0%)	
Number of observations	14003	14003	14003

Note: Quarterly dummies included. Standard errors (robust to heteroskedasticty) in parentheses. Sargan test followed by degrees of freedom in parentheses, followed by p-value.

Table A3. Intertemporal Euler Equations

	Estimates in Levels		
	Food	Transport	Services
Food	0.0037		
	(0.0321)		
Transport	-0.0548	-0.0015	
	(0.0505)	(0.0078)	
Services	-0.0984	-0.0094	0.0139
	(0.0718)	(0.0121)	(0.0127)
Food*Wife Works	0.0695		
	(0.0534)		
Transport*Wife Works	0.1235	-0.0026	
	(0.1354)	(0.0135)	
Services*Wife Works	0.1777	-0.0065	-0.0132
	(0.1963)	(0.0231)	(0.0431)
Collaterals	-0.0387	-0.0093	-0.0453
	(0.0689)	(0.0215)	(0.0129)
Collaterals*Wife Works	0.2393	0.1157	0.2857
	(0.2368)	(0.0552)	(0.0996)
Age	-0.0033	-0.0004	-0.0005
	(0.0025)	(0.0007)	(0.0009)
Age^2	-0.0006	-0.0001	-0.0001
	(0.0002)	(0.0001)	(0.0001)
Illiterate and No School.	-0.0522	0.0014	-0.0263
	(0.0913)	(0.0196)	(0.0218)
Secondary Educ.	0.0120	-0.0048	-0.0134
	(0.0401)	(0.0101)	(0.0217)
University Educ.	-0.0997	-0.0269	-0.0849
	(0.0575)	(0.0176)	(0.0418)
Children<14	-0.0106	-0.0017	-0.0033
	(0.0166)	(0.0051)	(0.0080)
Wife Works	-4.2561	-1.3786	-3.2528
	(1.4578)	(0.3698)	(0.6616)
Husband Works	-0.1320	-0.0515	-0.0879
	(0.1386)	(0.0373)	(0.0442)
$\ln c_{t-1} = \ln c_{t+1}$	-0.0228	0.0032	0.0033
	(0.0171)	(0.0037)	(0.0086)
Constant	-10.7699	-4.6802	1.0
	(5.8944)	(1.6633)	(-)
Efficient Sargan test (76 d.o.f)	190.72 (0%)	196.14 (0%)	
Number of observations	10239	10239	10239

Table A4. Marginal Rate of Substitution Function

	Estimates in Differences		
	Food	Transport	Services
Food	0.0134		
	(0.0109)		
Transport	-0.0513	0.0188	
	(0.0059)	(0.0052)	
Services	-0.0054	-0.0057	0.0064
	(0.0051)	(0.0020)	(0.0024)
Food*Wife Works	0.0138		
	(0.0120)		
Transport*Wife Works	0.0438	-0.0267	
	(0.0081)	(0.0067)	
Services*Wife Works	0.0505	0.0076	0.0065
	(0.0192)	(0.0035)	(0.0131)
Collaterals	-0.0517	-0.0981	-0.0071
	(0.0113)	(0.0082)	(0.0035)
Collaterals*Wife Works	0.0598	0.1016	0.0053
	(0.0257)	(0.0115)	(0.0144)
Age	-0.0049	-0.0005	0.0002
	(0.0018)	(0.0006)	(0.0003)
Age^2	-0.0008	-0.0004	-0.0006
	(0.0002)	(0.0007)	(0.0002)
Illiterate and No School.	0.0695	-0.0432	0.0057
	(0.0444)	(0.0186)	(0.0059)
Secondary Educ.	-0.0154	0.0223	0.0112
	(0.0249)	(0.0082)	(0.0056)
University educ.	-0.1769	-0.0255	-0.0205
	(0.0299)	(0.0395)	(0.0109)
Children<14	-0.0114	-0.0031	0.0015
	(0.0094)	(0.0044)	(0.0027)
Wife Works	-1.1415	-0.9919	-0.4663
	(0.2253)	(0.1107)	(0.1733)
Husband Works	-0.0290	-0.0472	-0.0155
	(0.0218)	(0.0207)	(0.0057)
$\ln c_{t-1} = \ln c_{t+1}$	-0.0102	-0.0039	-0.0004
	(0.0040)	(0.0017)	(0.0009)
Constant	0.7240	3.9299	1.0
	(0.3006)	(0.2534)	(-)
Efficient Sargan test (76 d.o.f)	92.17 (9.9%)	92.06 (10.1%)	
Number of observations	4551	4551	4551

Table A5. Intertemporal Euler Equations

	Estimates in Differences		
	Food	Transport	Services
Food	-0.0094		
	(0.0082)		
Transport	-0.0409	0.0148	
	(0.0052)	(0.0055)	
Services	-0.0164	-0.0044	0.0055
	(0.0041)	(0.0015)	(0.0031)
Food*Wife Works	0.0191		
	(0.0128)		
Transport*Wife Works	0.0306	-0.0127	
	(0.0128)	(0.0080)	
Services*Wife Works	0.0063	0.0062	-0.0005
	(0.0172)	(0.0044)	(0.0113)
Collaterals	-0.0125	-0.0721	-0.0010
	(0.0101)	(0.0084)	(0.0045)
Collaterals*Wife Works	0.0489	0.0753	0.0085
	(0.0291)	(0.0133)	(0.0160)
Age	-0.0064	0.0003	0.0004
	(0.0015)	(0.0007)	(0.0003)
Age^2	-0.0009	-0.0004	-0.0003
	(0.0002)	(0.0001)	(0.0003)
Illiterate and No School.	0.0275	0.0030	-0.0051
	(0.0555)	(0.0454)	(0.0057)
Secondary Educ.	-0.0438	0.0292	-0.0183
	(0.0185)	(0.0165)	(0.0066)
University educ.	-0.1631	0.0508	-0.0116
	(0.0290)	(0.0549)	(0.0302)
Children<14	0.0085	-0.0096	0.0042
	(0.0132)	(0.0071)	(0.0022)
Wife Works	-0.6501	-0.7340	-0.1396
	(0.2635)	(0.1386)	(0.1831)
Husband Works	-0.0497	-0.0140	-0.0052
	(0.0177)	(0.0165)	(0.0069)
$\ln c_{t-1} = \ln c_{t+1}$	-0.0230	-0.0020	0.0012
	(0.0045)	(0.0025)	(0.0009)
Constant	0.7948	2.2126	1.0
	(0.1095)	(0.2700)	(-)
Efficient Sargan test (76 d.o.f)	95.89 (6.3%)	63.79 (83%)	
Number of observations	2606	2606	2606

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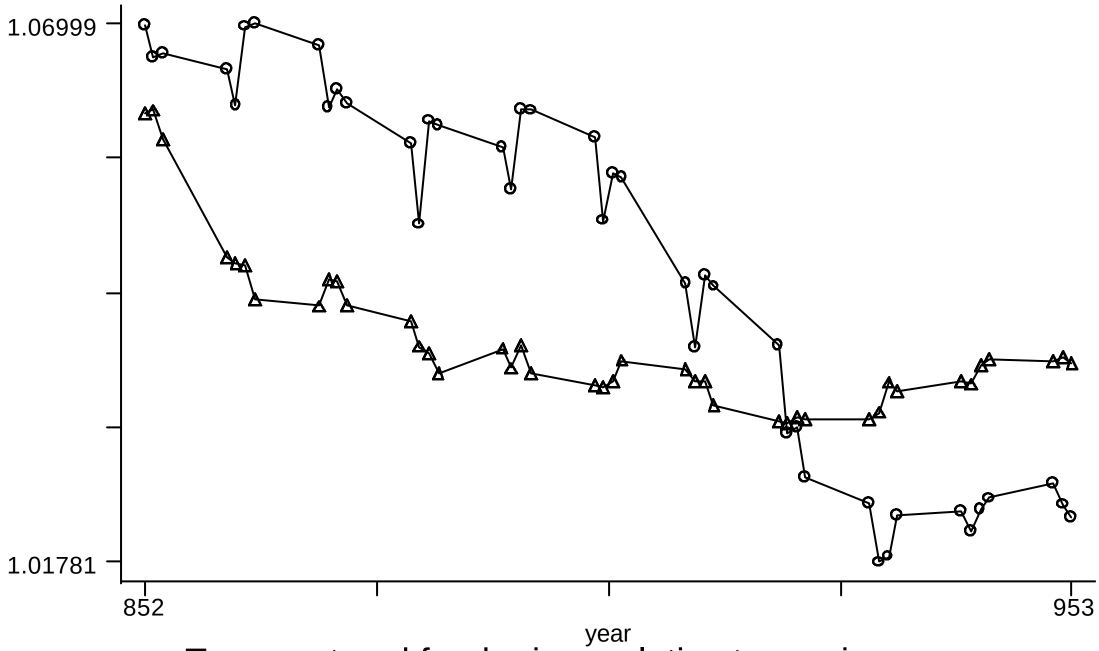

Transport and food prices relative to services