

The Spanish Sharing Rule ^{*}

by

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Abstract

In this paper we estimate the intrahousehold distribution of household's private expenditures between men and women (the sharing rule) in two types of Spanish households: those in which the woman works and those in which the woman does not work. The results for working women are parallel to those obtained for other countries which indicate a proportionally higher transfer from the woman to the man than from the man to the woman, such that the proportion of the woman's share decreases both with the woman's wage and with the man's wage. However, in households where the woman does not work, we observe a slight increase in the proportion of the woman's share when the man's wage increases.

1. Introduction

When we try to sort out what goes on inside Spanish households, we face several theoretical and data problems. At the theoretical level, the traditional unitary model considers the household as a single agent that maximizes an objective function under a budget constraint in which all incomes are pooled together. As such, the unitary model cannot be employed to recover individual preferences or the intrahousehold distribution of resources. In contrast, Chiappori's (1988) collective model recognizes that the household is composed of at least two agents, the couple, who may well have different preferences. Under the assumption that households agree upon Pareto-efficient allocations, the collective model has testable implications for household behavior. Furthermore, in this framework, it is possible to recover individual preferences, as well as the sensitivity of the intrahousehold distribution of resources (the so-called sharing rule) to changes in each individual's wage and other variables.

Regarding the collection of data on Spanish couples, only commodity demands and each partner's labor participation decisions are observed, but not so their labor supplies. Therefore, the standard labor supply collective model is not applicable. In its place, we adapt the Browning *et al.* (1994) commodity demand collective model to study households in which the man works full-time and the woman is allowed to work or not at all.

The identification of the sharing rule relies on the observability of some individual behavior within the household. Collective models can be classified into two groups, depending on the sort of individual behavior that is supposed to be observable: labor supply collective models and commodity demand collective models. In the first group, labor supply collective models, the sharing rule defines the woman's share of non-labor income as a function of man's and woman's wages and non-labor income itself. There are different approaches to identify the effect of such variables on the sharing rule. First, the standard collective model (Chiappori, 1988, Fortin y Lacroix, 1997) refers to the case in which, together with a single composite commodity, the labor supplies of the two agents are ob-

served ¹. Second, this model has been extended to the case in which only one labor supply is observed. Blundell *et al.* (1998) develops an identification strategy for the sharing rule in the case where the woman's labor supply is observed and the man either works full-time or does not participate at all. Identification relies on the concept of participation frontier, which is defined as the set of wages and non-labor income such that the man is indifferent about participating or not. Pareto efficiency then implies that the woman is indifferent as well. Donni (2001) presents an identification method for the case in which both spouses work, but the man is restricted to working only full-time. In such a case, if the woman's labor supply, and at least one commodity demand, are jointly observed, the sharing rule can be recovered. Donni also considers the possibility of the wife's non-participation, and shows that the sharing rule can be identified in this case from the participation frontier and the observation of one commodity demand.

In the second group of models, with an absence of labor supply data, the commodity demand collective models, (Browning *et al.* 1994, and Rapallini 2002), base their identification method on the observability of an assignable good or two exclusive goods, such as clothing. As such, two individual demands are observed, one for men's clothing and another for women's ². In such models, the sharing rule, defined as the woman's share of household's private expenditures, is affected by household's private expenditures and observable variables (distribution factors) that influence the decision-making process but do not influence preferences. Public goods are excluded from these models, but the results can be interpreted if they are conditioned to a predetermined level of public goods. In order to avoid any bias derived from the fact that consumption and leisure are jointly

¹ This setting has been extended in Chiappori *et al.* (2002) to allow for the existence of public goods

² Without the assumption of the observability of individual demands, Bourguignon *et al.* (1995) identify the sharing rule using the second derivatives of any triplet of commodity demands. This makes the model less suitable for empirical application.

determined, these papers restrict themselves to a sample of married couples in full-time employment.

The goal of this paper is to identify, estimate and compare the sharing rule in two samples of households, i.e., one in which the man works full-time and the woman works full-time or part-time, and another in which the woman does not work but her husband does, full-time. The identification of the sharing rule is based on the typical assumptions made in collective demand models, the observability of two individual commodity demands: men's and women's clothing, and the existence of certain distribution factors. In particular, the two individual labor incomes are treated as distribution factors. As our sample includes both types of households, those in which the woman participates in the labor market and households in which she does not, in the joint decision on leisure and consumption we allow for endogeneity of the female's labor participation decision. In contrast to Blundell *et al.* (1998) and Donni (2001), as long as we observe clothing demands in households in which the woman participates and in those in which she does not participate, the identification of the sharing rule does not require modelling the participation frontier.

In accordance with Browning *et al.* (1994), a nonlinear flexible functional form is assumed for the sharing rule. However, to test the collective model restrictions, a linear approximation is used. The endogeneity of the female's labor participation decision is modelled in a switching regression model with endogenous switching (Maddala, 1983). We consider the problems that arises in measuring consumption (i.e., bulk purchases for food and drink and infrequent purchases for other goods), as well as the endogeneity of household's private expenditures.

The main results of this paper refer to the effects of household's private expenditures and of labor incomes on the sharing rule, defined as the woman's proportion of household's private expenditures. First, for households in which the wife works, the effect of household's private expenditures is negative, that is to say, the wife receives proportionally less of any increase in household's private expenditures. In this sense, we can say that the woman's

share is a necessity. In contrast, in households in which the woman does not work, her share is a luxury. Second, the effects of individual labor incomes have different signs in households in which the woman works and in those in which she does not. For working couples, both labor incomes have negative effect on the sharing rule. However, the woman's proportion of household's private expenditures increases slightly when either the man's labor income or the woman's potential labor income increase in households in which the woman does not work.

Different studies have found different signs for the estimated sharing rule parameters depending on the model and on the country of analysis, all of them for households in which women work. In contrast to our result for Spanish working couples, the Canadian and Italian results in Browning *et al.* (1994) and Rapallini (2002), respectively, indicate that the woman's share is a luxury. Similarly to our results, a negative effect of the woman's labor income on her share of household's resources has been found in the following studies: Fortin and Lacroix (1997), working with data on Canadian couples over 36 years old, Donni (2002), with French data, Chiappori *et al.* (2002) with U.S. data, and Rapallini (2002) with Italian data. However, Blundell *et al.* (1998) for the U.K. and Browning *et al.* (1994) find a positive effect of the wife's wage on her share of household's private expenditures, and a negative effect of the man's wage.

The next section presents a standard collective model with the assumptions that allow us to recover the sharing rule. Section 3 presents the parametric model and the identification problem applied to this model. Section 4 presents the econometric model and the estimation results. Finally, section 5 concludes.

2. The Theoretical Framework

In modelling intrahousehold allocations in the collective model, we consider certain assumptions that allow us to recover the intrahousehold distribution of private consumption (the sharing rule). These assumptions are: (i) Pareto-efficiency decision with two agents,

(ii) the observability of household's private expenditures, (iii) egoistic preferences over leisure and private goods, and (iv) the observability of the individual's consumption of either an assignable good or two exclusive goods, one for each agent.

In this framework, household allocations are determined by the solution to the problem:

$$\begin{aligned} \max_{q^1, q^2, C^1, C^2} U^1(q^1, C^1, 0) + \mu(X, z)U^2(q^2, C^2, L^2) & \quad (2.1) \\ \text{subject to : } q^1 + q^2 + C &= X \\ L^2 &\in \{0, 1\} \end{aligned}$$

Where we consider preferences on leisure and consumption where the woman's leisure choice is binary. We consider agent 1 to be the man and agent 2 the woman. There are two private exclusive goods q^1 and q^2 , and one private composite good, C , with all the prices set to one. Household's private expenditures are X and one the time endowment. $L^2 \in \{0, 1\}$ is the woman's leisure time. The scalar function μ determines the woman's power relative to the man's. This function depends on X and on a set of variables that affect the decision process but not the preferences, the so-called distribution factors. We denote by z the vector of distribution factors.

The Second Welfare Theorem implies that the problem can be decentralized. This means that allocations are decided on within the household through a two-stage allocation procedure. At the top stage, household's private expenditures are allocated to either partner for expenditure on non-public goods. At the bottom stage, the woman makes her own participation decision and each partner spends their individual total expenditure on non-public goods. The sharing rule is the individual total expenditure required by both partners that affords an efficient allocation.

For each vector (X, z) , the woman chooses to participate or not. Then, there exist two sets, i.e., the participation set, P , and the non-participation set, N , such that the bottom stage of the problem defines two sharing rules, one in the participation set and another one in the nonparticipation set.

Proposition 1. *Existence of two sharing rules.* Under assumptions i, ii and iii, there exist ρ_1, ρ_2 with $\rho_k \in [0, 1]$, such that (q^i, C^i) solves

$$\max_{q^1, C^1} U^1(q^1, C^1, 0) \quad \text{subject to: } q^1 + C^1 = X(1 - \rho_1) \quad \text{if } (X, z) \in P, \quad (2.2)$$

$$\max_{q^2, C^2} U^2(q^2, C^2, 0) \quad \text{subject to: } q^2 + C^2 = X\rho_1 \quad \text{if } (X, z) \in P, \quad (2.3)$$

when the woman works, and

$$\max_{q^1, C^1} U^1(q^1, C^1, 0) \quad \text{subject to: } q^1 + C^1 = X(1 - \rho_2) \quad \text{if } (X, z) \in N, \quad (2.4)$$

$$\max_{q^2, C^2} U^2(q^2, C^2, 1) \quad \text{subject to: } q^2 + C^2 = X\rho_2 \quad \text{if } (X, z) \in N, \quad (2.5)$$

when the woman does not work.

Then, the sharing rule ρ_1 is the proportion of woman's private expenditures when she works, and ρ_2 is that proportion when the woman does not work. Note that the man maximizes the same function in the participation and the non-participation sets. Consequently, the structural parameters of the man's demand functions are the same in both sets. In this problem without public goods, the existence of the sharing rules is a sufficient condition for efficiency.

Browning *et al.* (1994) show that under the previous assumptions and in the presence of distribution factors, the structural model, i.e., the individual demands, the sharing rule, and the decision process, can be identified. We assume that we observe at least one distribution factor. The next proposition shows that the sharing rule functions $\rho_k(X, z)$ for $k = 1, 2$ are identified.

Proposition 2 *Identification of the sharing rules.* (Browning *et al.*, 1994) Under assumptions i, ii, iii and iv, and

$$\frac{\partial q^1 / \partial z_i}{\partial q^1 / \partial X} \neq \frac{\partial q^2 / \partial z_i}{\partial q^2 / \partial X} \quad \text{for at least one } i$$

each member shares $\rho_k X$ and $(1 - \rho_k)X$, for $k = 1, 2$, are identified up to a (unique) additive constant.

3. Parametric identification

We base the parametric identification of the sharing rule on the model of Browning *et al.* (1994), although we also consider households in which the woman does not work, as well as a different functional form for the Engel curves. The vector of distribution factors that we consider here consist of the two agents' labor incomes. They may affect how the partners share expenditures, but they should not affect individual demands once we condition on the total expenditures by either partner.

If we consider that the exclusive goods' demands are the solutions to the problems (2.2), (2.3), (2.4) and (2.5), such demands have the following form:

$$q^1 = \alpha^1(X(1 - \rho_k(X, z))) \quad \text{for } k=1,2, \quad (3.1)$$

$$q^2 = \beta_k^2(X\rho_k(X, z)) \quad \text{for } k=1,2. \quad (3.2)$$

Let be z the vector (y_1, y_2) of individual labor incomes and consider the following flexible functional form for the sharing rule (Browning *et al.*, 1994):

$$\rho_k(X, y_1, y_2) = \frac{\exp(\Psi_k(X, y_1, y_2))}{1 + \exp(\Psi_k(X, y_1, y_2))}, \quad (3.3)$$

and let

$$\Psi_k(X, y_1, y_2) = 2(\alpha_k + \theta_k \ln X + \gamma_{1k} \ln y_1 + \gamma_{2k} \ln y_2). \quad (3.4)$$

By choosing this functional form we bound ρ_k between zero and one, with $\rho = 0.5$ for $\Psi = 0$. The constant α_k center the shares, the lower it is, the lower is the woman's share. The parameter θ_k reflects whether the woman's share is a luxury or a necessity. To see this, note that the elasticity of the woman's share with respect to household's private expenditures is higher than one only if the elasticity of the proportion of the woman's share is positive. This elasticity has the following form:

$$\frac{\partial \ln \rho_k}{\partial \ln X} = 2\theta_k(1 - \rho_k). \quad (3.5)$$

Starting from the equal-sharing point, $\rho_k = 0.5$, if $\theta_k > 0$, the woman's share is a luxury and the man's share a necessity. If θ_k is negative, the woman's share is a necessity.

Changes in individual labor incomes affect the sharing rule in accordance to the following equation:

$$\frac{\partial \ln \rho_k}{\partial \ln y_i} = 2(1 - \rho_k) \left(\theta_k \frac{\partial \ln X}{\partial \ln y_i} + \gamma_{ik} \right). \quad (3.6)$$

Taking into account that when the woman does not work, her potential labor income does not affect household's private expenditures, for this distribution factor ($y_2 \in N$), the above equation, (3.6), depends exclusively on the parameter γ_{22} .

We consider men's (q^1) and women's (q^2) clothing as the two exclusive goods, whose Engel curves have the following Working-Leser form:

$$q^1/X = w^1 = a^1 + b^1 \ln x_k^1 = a^1 + b^1 \left(\frac{X}{1 + \exp(\Psi_k(X, y_1, y_2))} \right), \quad (3.7)$$

$$q^2/X = w^2 = a_k^2 + b_k^2 \ln x_k^2 = a_k^2 + b_k^2 \left(\frac{X \exp(\Psi_k(X, y_1, y_2))}{1 + \exp(\Psi_k(X, y_1, y_2))} \right). \quad (3.8)$$

If we estimate these non-linear Engel curves by non-linear ordinary least squares, all the parameters are identified because of the non-linearity. However, as Proposition 2 shows, non-linearity is not a necessary condition for identification. We identify the parameters of the Engel curves in a linearized model. The linearization consist of a Taylor expansion around $\psi = 0$, and the adoption of the following approximation: $\ln(1 + \epsilon) = \epsilon$ for ϵ near zero. Therefore, the linearized expression for the sharing rule is:

$$\rho(\Psi_k) = \rho(0) + \Psi_k \rho'(0) = \frac{1}{2} \left(1 + \frac{\Psi_k}{2} \right); \quad (3.9)$$

$$\ln \rho(\Psi_k) = \ln \frac{1}{2} + \ln \left(1 + \frac{\Psi_k}{2} \right) = \ln \frac{1}{2} + \frac{\Psi_k}{2}. \quad (3.10)$$

Using the same approximations, the proportion of the man's share can be expressed as:

$$\ln(1 - \rho(\Psi_k)) = \ln \frac{1}{2} + \ln \left(1 - \frac{\Psi_k}{2} \right) = \ln \frac{1}{2} - \frac{\Psi_k}{2}. \quad (3.11)$$

Taking into account the linearized sharing rule, we have the following linear in variables expression for the structural Engel curves:

$$\begin{aligned} w_k^1 &= a^1 + b^1 \ln X + b^1 \left(\ln \frac{1}{2} - \alpha_k - \theta_k \ln X - \gamma_{1k} \ln y_1 - \gamma_{2k} \ln y_2 \right) = \\ &= \left(a^1 + b^1 \left(\ln \frac{1}{2} - \alpha_k \right) \right) + \left(b^1 (1 - \theta_k) \right) \ln X + \left(-b^1 \gamma_{1k} \right) \ln y_1 + \left(-b^1 \gamma_{2k} \right) \ln y_2, \end{aligned} \quad (3.12)$$

$$\begin{aligned} w_k^2 &= a_k^2 + b_k^2 \left(\ln \frac{1}{2} + \alpha_k + \theta_k \ln X + \gamma_{1k} \ln y_1 + \gamma_{2k} \ln y_2 \right) = \\ &= \left(a_k^2 + b_k^2 \left(\ln \frac{1}{2} + \alpha_k \right) \right) + \left(b_k^2 (1 + \theta_k) \right) \ln X + \left(b_k^2 \gamma_{1k} \right) \ln y_1 + \left(b_k^2 \gamma_{2k} \right) \ln y_2. \end{aligned} \quad (3.13)$$

The reduced form for these Engel curves is the following linear in variables and parameters form:

$$w_k^1 = A_{1k} + B_{1k} \ln X + C_{1k} \ln y_1 + D_{1k} \ln y_2, \quad (3.14)$$

$$w_k^2 = A_{2k} + B_{2k} \ln X + C_{2k} \ln y_1 + D_{2k} \ln y_2. \quad (3.15)$$

Consequently, the identification problem is expressed in the following eight identification equations:

$$A_{1k} = a^1 + b^1 \left(\ln \frac{1}{2} - \alpha_k \right) \quad (3.16)$$

$$B_{1k} = b^1 (1 - \theta_k) \quad (3.17)$$

$$C_{1k} = -b^1 \gamma_{1k} \quad (3.18)$$

$$D_{1k} = -b^1 \gamma_{2k} \quad (3.19)$$

$$A_{2k} = a_k^2 + b_k^2 \left(\ln \frac{1}{2} + \alpha_k \right) \quad (3.20)$$

$$B_{2k} = b_k^2 (1 + \theta_k) \quad (3.21)$$

$$C_{2k} = b_k^2 \gamma_{1k} \quad (3.22)$$

$$D_{2k} = b_k^2 \gamma_{2k} \quad (3.23)$$

We observe that equations (3.18), (3.19), (3.22) and (3.23) impose the Distribution Factor Proportionality condition (Browning and Chiappori, 1998):

$$\frac{C_{1k}}{D_{1k}} = \frac{C_{2k}}{D_{2k}} = \frac{\gamma_{1k}}{\gamma_{2k}}. \quad (3.24)$$

Note also that the parameters of the man's Engel curves do not depend on the woman's participation decision. However, in the identification problem we allow for differences between the man's propensities to consumption in the participation and in the non-participation sets, i.e., we identify b_1^1 and b_2^1 . We also contrast if $b_1^1 = b_2^1$.

The identification system has eight unknowns for every k , the eight structural parameters. As the Jacobian is singular, some of the parameters are not uniquely identified. From the identification system, we can identify the sharing rule parameters θ_k , γ_{1k} , and γ_{2k} . The constant parameter α_k is not identified, so, we can then identify the sharing rules up to an additive constant. We can also identify the marginal propensities to consumption b_k^1 and b_k^2 but not the constants a_k^i .

We estimate the reduced form of the Engel curves system by instrumental variables. We use the minimum distance estimator for estimating the five parameters $(\theta_k, \gamma_{1k}, \gamma_{2k}, b_k^1, b_k^2)$ for each k from the eight-equation identification system. In this estimation, we take the values that result from the system as initial parameters. We fix the sharing rule constant term, α_k , such that the mean household has equal sharing, i.e., $\Psi_k(\bar{X}, \bar{y}_1, \bar{y}_2) = 0$. We assume zero the Engel curve's constants, a_k^i .

4. Estimation

Our model is of a two-Engel-curve system, i.e., men's and women's clothing, and a woman's participation decision model. In order to consider the endogeneity of the woman's participation decision, these models are jointly estimated using a switching regression model with endogenous switching with two different regimes: the woman's participation regime and the non-participation regime. We assume that the collective model holds for household formed

by couples. We test the model restrictions, i.e., the Distribution Factor Proportionality and the equality of the man's propensity to consume under both regimes.

4.1. Data

We use the data on household expenditures from the Spanish "Encuesta de Presupuestos Familiares de 1990-91". The sample selected consist of couples, both with and without children, in which the man works full-time. Among these households, there are 1,864 in which the woman works, and 3,755 in which she does not work at all.

In order to estimate the Engel curves of women's and men's clothing, we use data on such expenditures, as well as on household's private expenditures, on individual labor incomes and on household characteristics. We consider the following expenditures to be private expenditures: food, transport, clothing, personal care, home entertainment, outside home entertainment, alcohol and tobacco, and a group of miscellaneous other expenditures. Then, we exclude children's expenditures as well as those for energy, cleaning and housing, considering them to be public goods.

The data taken from the expenditure survey pose several problems in the measuring of consumption, i.e., the measurement of annual consumption from the survey's reference period. Food expenditures present the measurement problem of bulk purchases that is corrected according to Peña and Ruiz-Castillo (1992). Clothing, as well as the majority of group expenditures, presents the infrequency of purchase problem. In order to correct the bias caused by this problem, we use the method proposed by Meghir and Robin (1992). Zamora (2002) presents details of this correction.

Table 1 details descriptive statistics of the variables used in the analysis. The variable private consumption per capita has been corrected by infrequency of purchase.

4.2. Econometric model

In the estimation of the Engel curves (3.14) and (3.15) we consider two regimes: regime one, in which the woman works, and regime two, in which she does not. The joint decision

Table 1. Descriptive Statistics

	Woman Works (1)		Woman does not work (2)		Mean Diff.
	# 1864		# 3755		$\mu_2 = \mu_1$
	Mean (desv.)	% zeros	Mean (desv.)	% zeros	t-Student
GOODS (W_i)					
(i=1) Man Clothes	.0459 (.0653)	37.45	.0446(.0649)	36.78	-0.71
(i=2) Woman Clothes	.0542 (.0745)	29.14	.0439 (.0661)	33.24	-5.24
EXPLANATORY VARIABLES					
Private Expenditure per capita	546.649 (336.052)		412.103 (267.787)		-16.25
Private consumption per capita	514.255 (325.309)		387.097 (258.549)		-15.89
Man's labor income	1.581.188 (832.795)		1.514.648 (1.031.027)		-2.42
Woman's labor income	999.642 (643.102)		13.254 (.337)*		-18.08
No members	3.49 (1.03)		3.665(1.083)		5.69
n1/n	.086 (.140)		.085 (.138)		-.1399
n2/n	.1265 (.158)		.124 (.155)		-.503
n3/n	.133 (.174)		.153 (.182)		4.0
n4/n	.026 (.079)		.035 (.091)		3.70
na1/n	.032 (.139)		.024 (.110)		-2.37
na2/n	.596 (.214)		.570 (.215)		-4.25
Man's age	36.23 (7.309)		39.34 (9.571)		12.35
Primary studies man	.224 (.417)		.235(.424)		.91
High school man	.271 (.445)		.190 (.392)		-7.01
University man	.244 (.429)		.096 (.295)		-15.03
Primary studies woman	.231 (.422)		.272(.445)		3.26
High school woman	.255 (.436)		.149 (.356)		-9.76
University woman	.258 (.438)		.047 (.211)		-24.44
Urban	.612 (.487)		.538 (.499)		-5.25
Executive	.218 (.413)		.084 (.277)		-14.43
Laborer	.520 (.499)		.598 (.490)		5.56
Businessman	.140 (.347)		.162 (.369)		2.21
Own home	.707 (.455)		.727 (.446)		1.59
Car	.911 (.284)		.837 (.369)		-7.65
No. durable goods	10.84 (3.33)		9.56 (2.98)		-14.54

* logarithm of woman's labor income from the wage equation estimation

n1=children 0-3 years , n2=4-8, n3=9-14, n4=15-16, na1=adults 18-24 years , na2 > 24

on leisure and consumption leads to the endogeneity of the woman's participation decision in the estimation of the Engel curves. Therefore, the model falls in the general class of switching regression model with endogenous switching and it is described by the following equations:

$$P = I(\eta'_p W_p + \epsilon_p) \quad \text{with} \quad \epsilon_p \sim N(0, 1), \quad (4.1)$$

$$w_1^i = A_{i1} + B_{i1} \ln X + C_{i1} \ln y_1 + D_{i1} \ln y_2 + \Lambda_{i1} Z + v_{i1} \quad \text{for } i = 1, 2 \quad \text{if } P = 1, \quad (4.2)$$

$$w_2^i = A_{i2} + B_{i2} \ln X + C_{i2} \ln y_1 + D_{i2} \ln y_2 + \Lambda_{i2} Z + v_{i2} \quad \text{for } i = 1, 2 \quad \text{if } P = 0. \quad (4.3)$$

Where equation (4.1) is the probit model of the woman's participation process, with $P = 1$ if the woman participates and $P = 0$ if she does not participate, and Z is a vector of household characteristics. The correlation between the participation process and the Engel curves gives the following self-selection bias in the Engel curves (Maddala, 1983):

$$E(v_{i1} | P = 1) = -E(v_{i1} \epsilon_p) \frac{\phi(\eta'_p W_p)}{\Phi(\eta'_p W_p)} \quad (4.4)$$

$$E(v_{i2} | P = 0) = E(v_{i2} \epsilon_p) \frac{\phi(\eta'_p W_p)}{1 - \Phi(\eta'_p W_p)} \quad (4.5)$$

where ϕ and Φ are the density and distribution functions of the standardized Normal respectively.

Given that the woman's labor income is an explanatory variable even in the case in which the woman does not work, we estimate her potential labor income, in this case, according to a wage equation. (See Table 1 in the Appendix for the wage-equation's specification and results).

We allow for endogeneity of household's private expenditures. In the estimation by instrumental variables, we use total household income, its square, and the purchase probabilities of alcohol and tobacco, child expenditures, and the miscellaneous group other expenditures as instruments. We use the two-stage estimation method. In the first stage, we estimate the woman's potential labor income for women who do not work and the

self-selection bias variables in both regimes, and we also correct the infrequency of purchase problem. In the second stage, we estimate the Engel curve systems, (4.2) and (4.3), correcting for the self-selection that arises from the woman’s participation decision.

4.3. Results

We present the results of the reduced form Engel curves, (4.2) and (4.3), in Table 2. The estimation of the participation decision model is presented in Table 1 of the Appendix.

Table 2. Urestricted Model

	Woman Works (#1864)		Woman Does not Work (#3755)	
	Param.	t-Stud.	Param.	t-Stud.
Man’s Clothing				
A_1k	-.2927	(-4.93)	-.3653	(-3.77)
B_1k	.0244	(10.4)	.0337	(19.6)
C_1k	-.0042	(-2.30)	-.0016	(-1.03)
D_1k	-.0004	(-0.32)	.0035	(0.40)
Self-sel. bias	.0281	(2.23)	.0078	(0.51)
Woman’s Clothing				
A_2k	-.4902	(-6.22)	-.0238	(-0.23)
B_2k	.0359	(11.6)	.0247	(13.6)
C_2k	-.0046	(1.88)	.0036	(2.14)
D_2k	-.0024	(-1.35)	-.0226	(-2.45)
Self-sel. bias	-.0009	(-0.05)	-.0174	(-1.08)

The results of the estimation of this reduced form indicate that the Distribution Factor Proportionality restrictions (3.24) are not rejected. The Chi-square statistics are 0.14 and 0.06 when the woman works and when she does not work, respectively. In this model, there is a positive self-selection bias on men’s clothing when the woman works. According to the model, this effect has to be transmitted by the sharing rule that is the only variable affected by the woman’s participation, which, in turn, influence the men’s clothing demand.

Table 3 presents the structural parameters, i.e., the sharing rule parameters and the individual marginal propensities to consumption, estimated by the minimum distance method, as explained in the above section. Finally, Table 3 also presents the elasticities of the sharing rule with respect to household’s private expenditures and individual labor in-

comes, calculated in accordance with equations (3.5) and (3.6). We have seen that if men's clothing is the result of the problems (2.2) and (2.4), the man's marginal propensities to consumption are equal in both regimes. From the estimation of the structural model, we can test this restriction. The result is that the man's propensities to consumption are statistically different depending on the woman's participation. This result provides evidence against the egoistic preferences assumption, i.e., the woman's leisure can affect the man's welfare. We can transform the decentralized problems (2.2) and (2.4) to take this interdependence into account. The method consist of conditioning the man's preferences on the woman's leisure. As such, the existence and the identification of the sharing rules hold, but we allow for different man's propensities to consumption depending on the woman's participation.

Table 3. The Sharing Rule

	Woman Works (#1.864)		Woman Does not Work (#3.755)	
	Param.	t-Stud.	Param.	t-Stud.
θ_k	-.62797	(-10.5)	.49445	(5.62)
$\gamma_1 k$	-.02231	(-1.11)	-.39771	(-5.69)
$\gamma_2 k$.07262	(2.80)	.03566	(1.38)
Sharing Rule Elasticities				
$\frac{\partial \ln \rho_k}{\partial \ln X}$	-0.62797		0.49445	
$\frac{\partial \ln \rho_k}{\partial \ln y_1}$	-0.4537		0.0236	
$\frac{\partial \ln \rho_k}{\partial \ln y_2}$	-0.200		0.0357	
Marginal Propensities to Consumption				
	Woman Works (#1.864)		Woman Does not Work (#3.755)	
	Param.	t-Stud.	Param.	t-Stud.
b_k^{1*}	.00854	(7.49)	.06226	(5.63)
b_k^2	.08869	(5.46)	.01038	(11.1)

* Rejection of the hypothesis $b_1^1 = b_2^1$

From the man's marginal propensities to consumption we calculate the elasticities

of men's and women's clothing with respect the partners' shares. Such elasticities are, respectively:

$$\frac{\partial \ln q^1}{\partial \ln x^1} = (1 - \rho) + \frac{b^1}{w^1} \quad \text{and} \quad \frac{\partial \ln q^2}{\partial \ln x^2} = \rho + \frac{b^2}{w^2}.$$

Then, at the equal sharing point and in the mean of the sample, women's clothing is a luxury with an elasticity of 1.89 when the woman works, and a necessity, with an elasticity of 0.69, when she does not work. Men's clothing has an elasticity with respect to his share of 2.14 when the woman works, and of 0.74 when the woman does not work. These individual elasticities are quite different from those derived from the reduced form Engel curves with respect to household's private expenditures according to which clothing is always a luxury.

According to the effects of household's private expenditures, the estimated parameter θ_k indicates that the woman's share increases more than proportionally when household's private expenditures increase and the woman does not work. In this sense, the woman's share is a luxury with an elasticity of 1.49 in the equal sharing point. However, when the woman works, she receives proportionally less when expenditure goes up (the elasticity is 0.37). This latter result contrasts with those of Browning *et al.* (1994) and Rapallini (2002) where the share of the working woman is a luxury. Conversely, however, the man's share is a luxury, with an elasticity of 1.63, when the woman works, and a necessity, with an elasticity of 0.50, when the woman does not work.

The individual labor incomes also affect the sharing rule. The effect is transmitted to the sharing rule directly and by means of its effect on household's private expenditures. The total effect can be calculated according to the equation (3.6). In order to be able to calculate this expression, we must know the elasticity of household's private expenditures with respect to labor incomes. In order to calculate such elasticity, we consider the following expressions:

$$X + K = y_1 + y_2 + y,$$

$$K = aX,$$

where K is the expenditure on public goods, y is the non-labor income plus savings, and a is a positive constant. Then, the elasticities are:

$$\frac{\partial \ln X}{\partial \ln y_1} = \frac{y_1}{X + K} \quad \text{and} \quad \frac{\partial \ln X}{\partial \ln y_2} = \frac{y_2}{X + K}.$$

We calculate these ratios from our data in both types of households. The ratios of the man's labor income to household expenditures when the woman works and when the woman does not work are 0.687 and 0.852 respectively. The ratio of the woman's labor income to household expenditures is 0.434 when she works. The woman's potential labor income does not have any effect on household expenditures when she does not work.

The two labor-income effects that are statistically significant at 95 percent are the woman's labor income effect when she works and the man's labor income effect when the woman does not work. When the woman works, we observe that a one percent increase in her labor income decreases her proportion in household's private expenditures by 0.20 percent (measured from the equal sharing point and in the sample's mean). Although the woman's share, $x^2 = X\rho_1$, increases a 0.236 percent, given that her husband's share increases more (0.642 percent), her proportion in household's private expenditures decreases. The effect of the man's labor income is not precisely estimated when the woman works, but its value indicates a decrease in the proportion of the woman's share when the man's labor income increases. In this sense, we can say that the woman behaves in a more altruistic way than the man. On the other hand, when the woman does not work, the significant effect of the man's labor income indicates that, when his labor income increases by one percent, the proportion of the woman's share increases by 0.02 percent. This is the result of a proportionally equivalent increase in the woman's share and in the man's share when his labor income increases. When the woman's potential labor income increases, her proportion of the expenditures also increases slightly.

5. Conclusions

In the absence of data on the intrahousehold distribution of consumption, the collective model has proven to be the way of recovering it. In particular, we recover the distribution of household's private expenditures between the man and the woman in two types of households, those in which the woman works and those in which the woman does not work, considering that the man works full-time in both types of households. Under the current development of the collective model we can identify the intrahousehold distribution up to an additive constant, i.e., we can recover the effects of a set of variables on the sharing rule. In our case this set is formed by household's private expenditures plus individual labor incomes.

The identification method we follow in this work relies on the observability of two individual commodity demands: women's clothing and men's clothing. The method starts with the specification of a flexible non-linear form for the sharing rule. In this case, identification is trivial because it is achieved entirely by nonlinearity. However, we develop a linearized model in which we show that the constant term of the sharing rule is not identified, and the Distribution Factor Proportionality restrictions can be tested, such as the theoretical model predicts. The econometric model jointly estimates the woman's participation decision model and the clothing Engel curves thereby correcting the infrequency and the endogeneity problems.

The estimation results provides us with an opportunity to compare the intrahousehold allocation in both types of households, i.e., those in which the woman works and those in which she does not. Our results when the woman works are quite in line with those found in French, U.S., Canadian and Italian households: we observe that, when her labor income increases, the transfer from the woman to the man is proportionally higher than the transfer from the man to the woman. In this sense, we can say that working women behave in a more altruistic way than their husbands. The estimates for households in which the woman does not work show a proportionally higher transfer from the man to

the woman, such that the proportion of the woman's share increases slightly when the man's labor income increases.

6. Appendix

Table 1. Participation Model and Wage Equation

Woman's Participation model			Wage Equation		
Variable	Param.	t-Stud.	Variable	Param.	t-Stud.
Constant	-.9851	(-2.26)	Constant	11.063	(26.89)
Woman's age	.1050	(3.63)	Woman's age	.0995	(5.6)
Woman's age ²	-.0014	(-3.83)	Woman's age ²	-.0011	(-4.96)
Man's age	-.0567	(-1.91)	Primary	.1827	(.71)
Man's age ²	.0005	(1.32)	Secondary	.8512	(3.27)
Primary woman	-.1622	(-.54)	University	.6293	(2.42)
Secondary woman	-.1220	(-.38)	Age*Primary	.0053	(.70)
University woman	-.0754	(-.18)	Age*Secondary	-.0068	(-.91)
Primary man	.8792	(2.87)	Age*University	.0118	(1.63)
Secondary man	.5733	(1.86)	Heckman's Lambda	-.0110	(-.84)
University man	1.008	(2.61)	—————		
Age*Primary woman	.0107	(1.22)	R^2	.279	
Age*Secondary woman	.0216	(2.27)	$F(k, n - k - 1)$	72	
Age*University woman	.0411	(3.51)	ρ	-.1516	
Age*Primary man	-.0258	(-2.87)	σ^2	.5302	
Age*Secondary man	-.0153	(-1.71)			
Age*University man	-.0267	(-2.43)			
n1	-.3487	(-8.58)			
n2	-.1525	(-5.0)			
n3	-.0806	(-2.86)			
n4	-.0615	(-1.15)			
—————					
$\chi^2(20)$	932.7				
-2 log Likelihood	6227				
Pseudo R^2	.15				

References

Arévalo, R., M.T. Cardelús and J. Ruiz-Castillo (1998), “La Encuesta de Presupuestos Familiares de 1990-91”, Universidad Carlos III de Madrid

Arévalo, R., M.T. Cardelús. and J. Ruiz-Castillo (1995), “La Encuesta de Presupuestos Familiares de 1990-91”. Apéndice 1. La Codificación de los Bienes”, Documento de Trabajo 95-08, Serie de Economía 06, Universidad Carlos III de Madrid

Blundell, R., P.A. Chiappori, T. Magnac and C. Meghir (1998), “Collective Labor Supply: Heterogeneity and Nonparticipation”, Mimeo, University College of London

Bourguignon, F., M. Browning, P.A. Chiappori (1995), “The Collective Approach to Household Behavior”, WP 95-04. DELTA

Browning, M., F. Bourguignon, P.A. Chiappori and V. Lechene (1994), “Income and Outcomes: A Structural Model of Intrahousehold Allocation”, *Journal of Political Economy*, Vol 102, N. 6, pp. 1067-1096

Browning, M. and P.A. Chiappori (1998), “Efficient Intra-Household Allocations: A General Characterization and Empirical Test”, *Econometrica*, Vol 66, N. 6, pp. 1241-1278

Chiappori, P.A., (1988), “Rational Household Labor Supply”, *Econometrica*, Vol. 56, N.1, pp. 63-90

Chiappori, P.A., R. Blundell and C. Meghir (2002), “Collective Labor Supply With Children”, WP 02/08, The Institute for Fiscal Studies, London

Chiappori, P.A., B. Fortin and G. Lacroix (2002), “Marriage Market, Divorce Legislation, and Household Labor Supply”, *Journal of Political Economy*, vol. 110, n. 1, pp. 37-72

Davidson, R. and J. Mackinnon (1993), *Estimation and Inference in Econometrics*, Oxford University Press, New York.

Donni, O. (2001), “Collective Female Labor Supply: Theory and Application”, Working Paper n. 141, CREFÉ et Université du Québec à Montréal

Fortin, B. and G. Lacroix (1997), “A Test of the Unitary and Collective Models of Household Labour Supply” *The Economic Journal*, 107, pp. 933-955

Maddala, G. S. (1983), *Limited Dependent and Qualitative Variables in Econometrics*, New York: Cambridge University Press

Meghir, C. and J.M. Robin (1992), “Frequency of Purchase and the Estimation of Demand Systems”, *Journal of Econometrics*, Vol 53, pp. 53-85

Peña, D. and J. Ruiz-Castillo (1998), “Estimating Food and Drinks Household Expenditures in the Presence of Bulk Purchases”, *Journal of Business and Economic Statistics*, Vol 16, N. 3, pp.292-303

Rapallini, C. (2002), “Intra-household allocation of consumption: testing the collective rationality and the sharing rule with Italian Data”, Mimeo

Zamora, B. (2002), “Female Labor Participation and Allocation of Household Expenditure. Evidence on Spanish Data”, Mimeo