Life satisfaction and household production in a collective model: Evidence from Italy

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Abstract

The model takes into account the household production and self reported information is interpreted in relation with the sharing rule governing the bargaining process in the family. Considering that the theoretical framework implies a wide concept of full income, which includes the allocation of time between the spouses, we used the self reported information on whole satisfaction in life. We demonstrate that self reported data on satisfaction are useful in recovering the individual share of the household full income and the relevance of the wages in this bargaining process. We find also that non strictly economic individual variables and some household characteristics are important in explaining the Italian sharing rule.

JEL Classification: D1, J22, C3.
Keywords: Collective model, Within-household income comparisons, Subjective data, Italy.

Introduction

Intra-household allocation of resources can be defined in different ways and it is crucial for setting correctly welfare policies; for instance, the comparison between different policies against children poverty, or for supporting fertility and female labor supply, is possible if the intra-household allocation of resources is known, both in terms of time use and flows of income. Traditionally, economic theory has considered the family as the basic decision unit and the tools of consumer theory were applied to the household; accordingly household's choices, both on consumption and on labor supply, were analyzed as those of one person by applying the single rational agent hypothesis. Despite the general practice, this approach has weakness as not only in terms of its theoretical foundations[1], but also in terms of empirical support[2]. A viable alternative to the unitary framework must recognize in a nontrivial fashion the involvement of two or more agents, with distinct preferences, in shaping family preferences. In the collective approach, firstly suggested by Bourguignon (1984) and Chiappori (1988b, 1992)[3], household's choices are grounded in individual preferences of each member, more frequently the adults; therefore family's choices are regarded as the result of a decision process. The main assumption of this approach is that household decisions are always efficient in the Pareto sense: nothing is said a priori about the nature of the decision process and the so called sharing rule, i.e. the rule governing intrahousehold allocation, has to be estimated from the data rather than postulated ex ante[4]. The present literature on collective models identify the derivatives of the sharing rule and empirically recover it, up to a constant[5]. In a very recent paper, Kalugina et al. (2009)

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[1] The unitary model is not coherent with individualism, one of the most important assumption of the neo-classical micro-economic analysis, which requires each individual to be characterized by her/his own preferences.

[2] One of the consequences of the unitary model is the pooling of all household resources and cross substitution effects on labor, or -more generally- symmetry of the Slusky matrix. A large number of empirical studies find that the fraction of earned income received by the husband and wife significantly affects the family behavior (see among others Bourguignon et al. (1993)).

[3] A complete survey of this approach is in Chiappori and Donni (2006)

[4] In comparison with bargaining models, the collective approach is more general in the sense that cooperative bargaining Nash solutions, at least under symmetric information, are always Pareto efficient. The collective approach seems to be more reasonable concerning the assumption on the nature of the decision process which may be assumed to be both cooperative and non cooperative. In particular, how Browning et al. (1994) motivate their assumption of Pareto optimality is quite strong. They argue that the marital environment possesses characteristics, such as a long term relationship, relatively good information and a stable bargaining environment, which would promote efficient outcomes not only in a cooperative game but also in a repeated non-cooperative game.

[5] In the original model proposed by Chiappori (1988a,b) and Chiappori et al. (2002) two individuals are assumed (each of them privately consumes leisure and a Hicksian composite good) and the main conclusion is that the two individual preferences, and the decision process, can generically be recovered (up to an additive constant) from the two labor supply functions. This result has been extended to household production by Chiappori (1997); Bourguignon and Chiuri (2005) and in Blundell et al. (2007) to discrete participation decisions. The model has been empirically applied by (among others) Fortin and

go beyond by using self reported data. More precisely, they assume a link between the distribution of the total resources of the household and the self reported household income level declared by the two adult members. Their conjecture is that there is a connection between the personal perception of total resources of the family and the share individually managed by each member.

This paper provides an application of a collective model with data on Italian households by using self reported information on whole satisfaction in life. The model is a collective model with household production and subjective questions are interpreted in relation with the sharing rule governing the bargaining process in the household. In particular, the answer to the question: '*By bearing in mind your last 12 months, are you in the whole satisfied or not satisfied of your present life?*' is interpreted to recover the sharing process of the household full income. We use subjective data on whole satisfaction because the theoretical model with household production implies a wide concept of full income, which includes the allocation of time between the spouses both in the market and domestic work and for leisure. Ladder questions on subjective data are reported on the 2003 ISTAT Time Use Survey (TUS), which is a survey lacking in information concerning individual wages and on non labor incomes. To test the use of self reported data, the collective rationality, as well as the sharing rule, incomes data are essential and provided in this paper by matching the TUS with the 2003 Bank of Italy Survey on Households Income and Wealth (SHIW). With those data we demonstrate not only that self reported data on satisfaction are useful in recovering the individual share of the household full income and the relevance of wages in the bargaining process, but also that non strictly economic individual variables, such as the spouses' level of education and the age, and some household characteristics, as for example the age of the children and the presence of other members in the family, are of course important in explaining the Italian sharing rule.

The paper is organized as follows: Section 1 presents the theoretical framework and the econometric specification. Section 2 describes the two data sets employed to estimate the model with Italian data and the matching procedure required. Section 3 discusses the use of subjective data in collective models. Section 4 presents the results of the estimation of the intra household index, the female and male domestic labor supply and of the sharing rule. Section 6 concludes.

Lacroix (1997); Chiappori et al. (2002), and very recently by Rapoport et al. (2009). In all these works the estimation of the sharing rule is limited to the first derivatives (for instance in Rapoport et al. (2009) and Bourguignon and Chiuri (2005)), or the sharing rule has been recovered by assuming that if the female and the male wages are equal, the sharing rule should be one half of the full income.

1 The model

In the collective model adopted here household resources are labor income, non labor income and the output of the household production. Following the usual notation, let consider the two adult members of the household $i = f, m$, each of them with her/his individual utility function. Individual utility function depends on L_i -the leisure (assignable and observed)-, on consumption C_i of a Hicksian composite good with a normalized price equal to 1 (unobservable) and on a vector Y_i of member i's consumption of a domestic goods. Briefly, the individual utility function is the following: $U_i = U_i(L_i, C_i, Y_i, z)$, where z is an N- vector of household characteristics. Let the production function of the kth domestic good be:

$$Y^k = g^k\left(t_f^k, t_m^k, z\right) \quad k = 1, ...K$$

where $t_i^k, i = m, f$ is the member i's household work devoted to the production of the domestic good k. Let T be the total time available and $t_i = \sum t_i^k \; i = m, f$ the total time that household members devote to the production of the domestic goods. Let s be an R-vector of distribution factors, y the household's non labor income and w_f and w_m the female and male wage rates, respectively. The Pareto efficient solution of a collective model with household production is the result of a following maximization program (1)

$$\underset{L,fC_f,Y_f,L_m,C_m,Y_m}{Max} \left(\mu_f\left(.\right) + U_f\left(L_f, C_f, Y_f, ..., z\right) + \mu_m\left(.\right) U_m\left(L_m, C_m, Y_m, ..., z\right)\right)$$

$$(1)$$

$$s.t. \; C_f + C_m + pY_{f+}pY_m + L_f w_f + L_m w_m \leq T w_f + T w_m + y + \Pi\left(w_f, w_m, p\right)$$

where $\mu_i = \mu_i(w_f, w_m, y, s, z)$ are in $[0, 1]$ continuously differentiable weighting factors such that $\mu_f + \mu_m = 1$; $\Pi(w_f, w_m, p)$ is the profit function of the household production; domestic goods are marketable and p is a vector of domestic goods prices, exogenous and equal for all households.

Maximization program (1) can be reformulated in programs (2) and (3) as follow:

$$Max_{t_f,t_m} \Pi = pY - w_f t_f - w_m t_m \tag{2}$$

$$Max_{C_i,L_i,Y_i} U_i = (L_i, C_i, Y_i, ..., z) \; i = f, m \tag{3}$$

$$s.t.$$

$$C_i + pY_i + L_i w_i \leq \phi_i$$

$$L_i + h_i + t_i = T$$

Where there are two constraints, on budget and on time, and $\phi_i(w_f, w_m, p, y; s, z)$ is the part of the full income allocated to the member i, such that: $\phi = \phi_f + \phi_m = (w_f + w_m) T + y + \Pi$.

In other words, here full income ϕ is a sum of monetary and non monetary incomes: the total time available –at the price of individual wage- plus the non labor income plus the profit of the household production function. Programs (2) and (3) can be reformulated as follow to recover the Marshallian demands for leisure:

$$Max_{t_f,t_m} \Pi = pY - w_f t_f - w_m t_m$$

$$Max_{C_i,L_i,Y_i} U_i (L_i, C_i, Y_i, ..., z), \; i = f, m$$

$$s.t.$$

$$C_f + pY_f + w_f (T - h_f) \leq \phi_f$$

$$C_m + pY_m + w_m (T - h_m) \leq \phi_m$$

where h_i is member's i working time on the market,

$$\phi_m + \phi_f = \phi$$

$$L_i + h_i + t_i = T$$

$$L_f = L^f (w_f, \phi_f (w_f, w_m, y, s, z); z)$$

$$L_m = L^m (w_m, \phi - \phi_f (w_m, w_f, y, s, z); z)$$

where L_f and L_m are the Marshallian demands for leisure.

As illustrated in deep in Section 3, the assumption made in this paper in that the subjective answer on satisfaction of each member of the couple is related with the share of full income each of them receives. That it means that if both, husband and wife, give the same

reply to this question we assume that the bargaining process in the household is such that $\phi_f = \phi_m$, while if she declares a better (worse) satisfaction in comparison with her husband evaluation, we assume that $\phi_f > \phi_m$ ($\phi_f < \phi_m$).

Considering the definition of full income, these conjecture imply that:

$$
\begin{aligned}
\phi_f &< \frac{1}{2}\left[(w_f + w_m) T + y + \Pi\right] \; if \; \phi_f < \phi_m \\
\phi_f &= \frac{1}{2}\left[(w_f + w_m) T + y + \Pi\right] \; if \; \phi_f = \phi_m \\
\phi_f &> \frac{1}{2}\left[(w_f + w_m) T + y + \Pi\right] \; if \; \phi_f > \phi_m
\end{aligned}
$$

To test this model and recovering the sharing rule, we proceed in three main steps:

(1) first of all, we test the assumption that the subjective answers are related with household full income, with a simultaneous estimation of them with respect to individual and family explanatory variables;

(2) secondly, we estimate a three equations model, i.e. the two domestic labor supplies and the index of inequality in the family, hereafter described. The estimation is a FIML and this step is necessary to test the collective rationality and the inequality index created from self reported data;

(3) finally, the parameters of the sharing rule for the sub sample of couple who declare the same level of satisfaction are estimated. For this sub sample, in fact, the sharing rule is identified and so the sub sample parameters can be used to estimated the whole sample sharing rule.

The econometric model is built considering that in program (2) the allocation of time is endogenous, as the profit of the household production function. While time devoted to domestic work, time for leisure and time in labor market are observables, the profit of the production function and the sharing rules are not known and should be recovered from the data. The profit of the production function is the only variable that is endogenous and which is common to the three equations of the system: actually the two domestic labor supplies depend on ϕ, which depend on Π. Following closely Kalugina et al. (2009), let define an index function I, which is increasing depending on the female share of full income, i.e. it is equal to zero if $\phi_f < \phi_m$, I=1 if $\phi_f = \phi_m$ and assumes value 2 if $\phi_f > \phi_m$. The unobservable sharing rule is a function of individual and family characteristics, as follows:

$$
\phi_f^* = \gamma' Z + \varepsilon
$$

The index function can be written as:

$$I = \begin{cases} 0, \ if \ \phi_f^* \leq k_1 \\ 1, \ if \ k_1 < \phi_f^* \leq k_2 \\ 2, \ if \ \phi_f^* > k \end{cases}$$

and the following is the system to estimate:

$$\begin{cases} 0, \ if \ \phi_f^* \leq k_1 \\ 1, \ if \ k_1 < \phi_f^* \leq k_2 \\ 2, \ if \ \phi_f^* > k_2 \\ t_f = \alpha_f X_f + u_1 \\ t_m = \alpha_m X_m + u_2 \end{cases}$$

Wilkelmann (2005) shows that to identify the intra-family correlation in well-being in a couple by using self reported data, an ordered probit model is required. Since in this system there is an ordered component, the index, and a linear one, i.e. the two domestic labor supply equations, we use a full information maximum likelihood estimation[6]. As far as the sharing rule is concerned, programs (2) and (3) allows to recover not only the two household members Marshallian demand for leisure, but also the two total labor supplies (of market and non market labor), that are estimated with the following specification:

$$H_f = \alpha_f + \beta_f \ln \phi_f + \gamma_f X_f + e_f \tag{4}$$

$$H_m = \alpha_m + \beta_m \ln \phi_m + \gamma_m X_m + e_m \tag{5}$$

where $(\alpha_f, \alpha_m, \beta_f, \beta_m, \gamma_f, \gamma_f)$, are the parameters' vectors of individual characteristics and e_f and e_m the errors terms. Programs (2) and (3) allow us to recover the derivatives of the sharing rule[7], but not the sharing rule itself. As known, to evaluate empirically the sharing rule an additional assumption is necessary and, in line with Kalugina et al. (2009), here is that in the sub-sample of couples who declare the same level of whole satisfaction in life, the partners share the same amount of the total full income in the following way:

$$\phi_f = \phi_m = \frac{1}{2} \left[(w_f + w_m) \right] T + y + \Pi$$

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[6]We drop from the sample households with I=1 as the results of extreme values of satisfaction (1 and 4). This is to avoid equal responses at the boundaries, that may not indicate actual convergence of responses since in these points people could not choose higher or lower values.

[7]Chiappori (1997) and Chiappori et al. (2002)

Assuming that Π is very small, ϕ_f and ϕ_m are known and the two total labor supplies equations (4) and (5) can be estimated. We correct for sample selection in the estimation of the two labour supplies in the sub-sample of couples for whom the index value is 1. The method of estimation in this case is 3SLS and sample selection bias is corrected using the inverse of the Mill's ratio resulting from the ordered probit. Finally, the parameters of two labour supply equations can be used to estimated the sharing rule with the following specification:

$$\ln \hat{R} = \delta X + u$$

where $X = (w_f, w_m, y_f, y_m, s, z)$ and $ln\hat{R}$ is the predicted natural logarithm of the ratio between the man's and woman's shares. The method applied in this final stage is weighted least squares. Following again Kalugina et al. (2009), we construct weights to ponder stronger observations whose predicted sharing ratios are more in coherence with the equality index evolution and weaker than those with less coherent predictions. The weight assigned to an observation is defined as the inverse of the variance of this observation.

2 The data

The data we dispose of come from two different surveys. The main survey is the Italian Time Use Survey (TUS) collected by the Italian National Statistics Institute (ISTAT) during 2002 and 2003. The TUS is a nationally representative survey covered 21,075 households and 55,773 individuals. For the scope of the analysis we select a sub-sample of 4,673 dual-earner couples. The survey contains information on individual time use, level of education, working status, professional position and subjective well being. As far as time use is concerned, information is collected from three sources: the first one is a general questionnaire; the second is a questionnaire on the weekly use of time, while the third source is a diary of a whole day. In the weekly questionnaire, time use is recorded hourly during seven days, normally those of the previous week of the interview. In the diary questionnaire information is reported every ten minutes, along a day chosen by the respondent. Thus from TUS we are able to recover individual variables on working status, domestic and market labor supply and education. We use also a set of household variables giving information on family's composition, residential location and the relationship between the individual characteristics of the two spouses.

Unfortunately the TUS does not allow one to identify individual wages or income from other sources. Hence we have to recover income's variables from the Survey on Income and

Wealth (SHIW) collected by the Bank of Italy in the same year, by applying a statistical matching method. The 2002 SHIW covered 8,011 households and 22,148 individuals from which we select again 1,453 dual earner couples for whom the two salaries are observed. The survey contains information on working hours and income by each member of the household and on the wealth of the household. The SHIW is a two-years survey, and so more recent data are disposable. On the contrary for TUS, the 2002 is the most recent available.

Table 1: Statistics of the imputed variables from SHIW (2002) sample to TUS (2002) sample

	(1) Mean	(2) Standard Deviation
Female hourly wage in the SHIW sample	9.409	11.261
Female hourly wage in the TUS sample after matching	9.569	9.912
Female hourly wage in the SHIW sample	12.062	15.496
Female hourly wage in the TUS sample after matching	11.530	15.212
Annual non labour income in the SHIW sample	1188.781	3943.325
Annual non labour income in the TUS sample after matching	1056.336	3230.34

The two surveys are complementary in that they both contain detailed demographic characteristics, education, skills. The statistical matching would be feasible since the data sets share a common set of conditioning variables and are drawn from the same population[8]. The first condition is satisfied after re-coding variables on education and professional position to make definitions comparable across the two surveys. The two samples are homogeneous due to the selection in both surveys of sub-samples with the same similar characteristics Additional possible source of bias in using complementary sources is the difference in the surveys sampling design. Battistin et al. (2003) proposed a procedure based on propensity score estimation in order to correct for sampling difference, they applied this procedure to Italian ISTAT's and Bank of Italy's data sets and their results show that correcting for sampling may not be required. According to their results we can reasonably assume that bias coming from sampling is negligible in our data.

We have to recover two variables (wage rates and non labor income in 2002 SHIW) into 2002 TUS where they are unobserved. Since we deal with a multivariate imputation we follow the approach of Multiple Chained Equations (MICE) proposed by Van Buuren et al. (1999) and implemented in Stata by Royston (2004). The required assumption to implement this procedure is that missing data are at random (Van Buuren et al., 1999), which is feasible when the missing values distribution depends only on the statistical source and not on

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[8]Previous studies based on the use of complementary sources point out the requirement of these two fundamental conditions in order to implement a robust matching (Arellano and Meghir, 1992; Battistin et al., 2003)

selection bias[9].

We specify two conditional distributions for the variables to be imputed using the following set of variables: age, number of children, education, gender, region, family composition, professional position and a subjective evaluation on economic situation of the family. This methodology imputes the variables using a switching regression procedure as described in Van Buuren et al. (1999, p. 690)[10].

Statistics on observed and imputed variables are shown in Table 1: means and standard deviations from the two samples are not statistically significant after imputation. Matching results are even more appropriate for wage rates which recover fundamental information for the scope of the analysis. The imputed variables respect the observed distribution also across Italian regions[11]

3   Self reported data

The main justification of using subjective data in economics points to the limitation of the axiomatic theory of revealed preferences (Senik, 2005). More precisely, the use of subjective data was launched by the Leyden School in the seventies and has developed during all the nineties in fields such as the measurement of poverty and the perception of inequality (see Thurow (1971) and Ravallion and Lokshin (2001)) , in which the interpersonal comparisons of utility is essential[12]. Generally speaking, the axiomatic theory of revealed preferences is useless when market failures, non market interaction and coordination failures has to be taken into account. But inequality, poverty and redistributive issues are not the only fields in which satisfaction can be usefully employed: for example the measurement of unemployment costs has been largely analyzed in this perspective (Clark and Oswald, 1994; Winkelmann and Winkelmann, 1998).

In this paper we use subjective data to better understand the interaction between the two adult members of the household, bearing in mind that both market and non market factors characterize this interaction. From a methodological point of view, interpreting subjective satisfaction data implies (i) relating discrete verbal satisfaction judgments to a

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[9]The imputation of the values on TUS sample is done using the distributions observed for the interesting variables in the SHIW sample. Thus the probability of missingness does not depend on unobserved information but only on the data source. As consequence we can reasonably assume that our missing are "at random".

[10]We use the Stata module *ice* (Royston, 2005) with the "match" option which replaces the linear regression imputation with a matching procedure. Matching is recommended instead of linear regressions for continuous variables when the normality assumption is untenable, as in this case. Hence this method is robust to departures from normality in the imputed variables distribution.

[11]Further data on the variables distribution are available upon request.

[12]Van Praag and Frijters (1999)

Table 2: Description of main variables

	(1) Mean	(2) Standard Deviation
Index of economic equality	0.991	(0.528)
Male reply to the satisfaction's question	2.912	(0.542)
Female reply to the satisfaction's question	2.903	(0.546)
Monthly household's non labour income	378.164	(700.439)
Monthly wage of male partner	1,506.243	(4,176.652)
Monthly wage of the female partner	840.485	(2,237.963)
Female's hourly wage (euros)	10.495	(20.749)
Male's hourly wage (euros)	12.270	(21.977)
Total labour supply (market and domestic) of female partner	234.602	(105.209)
Total labour supply (market and domestic) of male partner	182.422	(119.681)
Female monthly domestic work hours	149.658	(86.021)
Male monthly domestic work hours	55.168	(61.612)
Level of education of female partner	4.583	(1.458)
Male partner's level of education	4.745	(1.492)
Male partner age	43.829	(9.011)
Female partner age	40.692	(8.620)
Number of children under 3 years old	0.148	(0.379)
Number of children under 6 years old	0.205	(0.448)
Number of children over 6 years old	0.591	(0.769)
People living in the household not belonging to the family	0.016	(0.127)
Household size	3.386	(0.926)
Family has a domestic worker	0.051	(0.219)
Family has a babysitter	0.025	(0.156)
Dummy for The Islands	0.065	(0.247)
Dummy for South	0.191	(0.393)
Dummy for Centre	0.190	(0.392)
Dummy for North East	0.226	(0.419)
Observations	4673	

latent, unobserved, continuous utility variable, and (ii) associating utility levels to observable characteristics. Considering each stage of this process, strong assumptions must be accepted: (a) the link between observable variables (income for instance) and latent utility is the same for all individuals, i.e. the parameters of the individual satisfaction function are identical for all agents; (b) the association between a verbal satisfaction label and a latent utility level is the same for everybody[13]. The Leyden school explicitly adopts both assumptions on the ground that *"facing a given satisfaction scale, individuals, in order to make their answers as significant as possible, divide the maximum imaginable amount of utility in as many equal shares as proposed intervals"* , and *"individuals of a same culture associate the same utility quantiles to the same satisfaction labels "*[14].

In this work verbal satisfaction judgment are taken from the TUS, which includes a large set of subjective questions on health condition, job satisfaction and disposable leisure,

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[13]Senik (2005)
[14]Van Praag (1991)

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on household economic level and on spouses' sharing either in domestic work andin caring duties. As anticipated in Section 1, here the sharing rule is recovered starting from the spouse's answer to a question, formulated as follows: *"By bearing in mind the last 12 months, are you in the whole satisfied or unsatisfied of your present life?* and with this possible answers : *"Fully satisfied"*, *"Rather satisfied"*, *"Less than satisfied"* and *"Not satisfied at all"* and *"No answer"*.

To recover the sharing rule by using this information, the assumptions required are not only those related with satisfaction data, but also those needed to understand the couple interaction. As regards the first point, in line with the Leyden school, we assume that the link between observable variables (full income) and latent utility is the same for the partners, in other words the parameters of the individual satisfaction function are identical for the two agents and the association between the verbal satisfaction label and a latent utility level is the same.

As far as the couple interaction, the conjectures done in this paper are two: first, that the discrete verbal satisfaction judgment given by each spouse is a good approximation of the utility that each one obtains from her/his share of full income. As precised in section 1, the maximization program of the household can be considered as a two steps program in which in the first stage the household production function is maximized and in the second stage individual utility is considered. In this theoretical framework full income is defined as the sum of different factors: labor and non labor incomes and the profit of the household production function. In particular, this measure of full income come from different combinations of time spends by each member in labor market, domestic work and leisure. Considering this large definition of full income, the individual judgment of whole satisfaction in life seems to be more suitable for approximate the combination of all those issues, rather than the individual self judgment specifically on one of these (i.e. job satisfaction, amount and quality of leisure or the household economic welfare).

The second assumption is done to recover the sharing rule; as known from section 1, we assume that if partners give the same answer to the whole satisfaction in life, this means that in the allocation of the household full income both succeed in drawing the same amount. As clearly illustrated by Kalugina et al. (2006) the equal satisfaction scales is here interpreted as the equal utility distribution. Let $V_f(w_f, \phi_f)$ and $V_m(w_m, \phi_m)$be the indirect utility function and g the utility ratio:

$$\frac{V_f(w_f, \phi_f)}{V_m(w_m, \phi_m)} = g(w_f, w_m, \phi_f, \phi_m)$$

if $V_f(w_f, \phi_f)$=$V_m(w_m, \phi_m)$, then $g = 1$. In such a way the sharing rule for the sub-sample

of spouses who give the same answer to the satisfaction question is fully identified.

4   The results

Table 3 shows the simultaneous estimation of the two partners answers to the satisfaction question. The main important result is that the difference between the female and the male hourly wage has a high significance for the male. This means that partner wage is relevant in the individual judgment of whole satisfaction, even if the negative sign of the coefficient seems to suggest that for Italian men is relevant to have a higher wage with respect to the female partner.

Table 3: Simultaneous estimation of two partners replies on general satifaction (3SLS)

	(1) Male's satisfaction	(2) Female's satisfaction
Natural log of hourly wage of female partner	0.020	0.004
	(0.014)	(0.014)
Difference between female and male natural log of hourly wage	-0.028***	-0.013
	(0.011)	(0.011)
Natural log of hh non labour income	-0.009*	-0.014***
	(0.005)	(0.005)
Female monthly hours of domestic work (log)	-0.003	0.001
	(0.003)	(0.003)
Male monthly hours of domestic work (log)	0.001	0.000
	(0.002)	(0.002)
Difference of age between the female and the male partner	0.001	0.003
	(0.002)	(0.002)
Dummy for female higher educated than male	-0.019	0.001
	(0.020)	(0.020)
Household has both a domestic help and baby-sitter	0.079	-0.086
	(0.101)	(0.102)
Number of children under 3 years old	0.055***	0.096***
	(0.021)	(0.021)
Number of children under 6 years old	0.035**	-0.006
	(0.018)	(0.018)
Number of children over 6 years old	-0.026**	-0.013
	(0.011)	(0.011)
Constant	2.922***	2.955***
	(0.041)	(0.042)
Observations	4673	4673
R-squared	0.007	0.008

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

A possible explanation of this result is that the Italian couple interaction is more affected by cultural factors than by pure economic variables. In particular, this estimation shows

that the male partner satisfaction in highly influenced by the female partner wage, but not if this increases the whole household economic resources; the female partner wage seems to be more important if it assigns a higher position to the male partner, at least in the job market. Consider that it is possible to appreciate this point only if data on whole satisfaction in life are analyzed, while the same simultaneous estimation on the self judgment on household economic situation shows that both partners answers are positively correlated with the partner's wage[15]. As far as family characteristics is concerned, the presence of children under three years old is positively correlated with the whole satisfaction of both partners, while children under six years old are positively correlated with male satisfaction and negatively with the female satisfaction, even if in a non-significant measure. The presence of children over six years old appears to be negatively correlated also with the male satisfaction. A possible explanation of these results, confirmed in the next steps of this work, could be the difficulty in having suitable caring solutions for Italian female workers[16] and the pressure on economic resources perceived by the male partner when the age of the children increases. Finally, Table 3 shows a negative and significant coefficient for household non-labor income, both for the male and the female spouse. The relevance of non-economic factors in the Italian couple interaction is confirmed by the estimation of the system of the index I with the two domestic labor supplies.

As expected, Table 4 shows that the female domestic labor supply is negatively related with her own wage, positively with her age and negatively with the age of the children. Reasonably, the female domestic labor decreases if there is a domestic worker in the household and increases for women living in the South of Italy. Accordingly, the male domestic labor supply in the South of Italy is lower than in the North. Concerning the age of children, the maximum of male effort appears to be concentrated with children less than 6 years old, while the caring of children under 3 years old seems to be mainly in charge of the female partner. Moreover, if the male wage is not relevant in explaining male domestic labor supply, this is negatively related with the female wage. Finally, the male level of education explains positively his engagement in domestic tasks. The weight of non monetary variables for individual satisfaction of people living in couple is further straightened by the index estimation: in explaining answers on better female satisfaction with respect to their male partners, only the hours of female leisure and the female level of education has a significance. In the final step of this work we identify the sharing rule by using for the whole sample the coefficients of the seemingly unrelated estimation of the woman's and man's total labor supply (domestic plus market labor) done for the sub sample of couple who declare the same level of satisfaction.

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[15]Further data on self judgment on household economic welfare and the related estimation are available upon request.

[16]see Del Boca (2002) and Del Boca and Vuri (2007)

Table 4: Full information maximum likelihood estimation of woman's and man's domestic labor supply and the index of intra-household inequality (endogenous ordered probit model)

	(1) Woman's domestic labor supply	(2) Man's domestic labour supply	(3) Index
Natural logaritm of hourly female partner wage	-0.110* (0.059)	-0.181* (0.107)	-0.029 (0.032)
Natural logaritm of hourly male wage	-0.071 (0.060)	0.114 (0.114)	
Female partner age	0.071* (0.039)		
Squared female partner age	-0.001 (0.000)		
Dummy variable for female high education level	-0.008 (0.092)		
Number of children under 3 years old	0.744*** (0.128)	1.590*** (0.234)	0.051 (0.047)
Number of children under 6 years old	0.378*** (0.104)	0.915*** (0.190)	-0.053 (0.039)
Number of children over 6 years old	0.272*** (0.063)	0.429*** (0.115)	
People living in the household not belonging to the family	0.060 (0.350)	0.583 (0.642)	-0.005 (0.139)
Family has a babysitter	-0.199 (0.291)	-0.882* (0.533)	0.063 (0.115)
Family has a domestic worker	-0.490** (0.205)	-0.504 (0.377)	0.010 (0.080)
Dummy for The Islands	0.062 (0.189)	-0.800** (0.347)	
Dummy for South	0.355*** (0.128)	-1.574*** (0.236)	
Dummy for Centre	0.228* (0.127)	-0.378 (0.233)	
Dummy for North East	-0.077 (0.120)	-0.496** (0.221)	
Male partner age		0.111 (0.069)	
Squared male partner age		-0.002** (0.001)	
Dummy variable for male high education level		1.009*** (0.168)	
Difference between female and male natural log if hourly wage			0.030 (0.024)
Difference of age between the female and the male partner			-0.002 (0.005)
Monthly hours of leisure work (log) of male partner			0.006 (0.006)
Monthly hours of leisure (log) of female partner			0.025* (0.014)
Natural logaritm hh non labour income			-0.004 (0.012)
Dummy for female higher educated than male			0.080* (0.044)
Constant	2.520*** (0.823)	-1.156 (1.548)	
Rho1			0.029 (0.020)
Rho2			-0.027 (0.019)
Rho3			0.301*** (0.015)
k1			-1.101*** (0.093)
k2			1.068*** (0.093)
Sigma			1.098*** (0.010)
Observations	4673	4673	4673

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Notes: The dependent variable for the equation three is the index of intra household inequality taking "0" if wife's satisfaction is smaller,
"1" if there is no difference and "2" if the wife reports higher satisfaction

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Table 5: Seemigly unrelated regressions: woman's and man's total labour supply estimation

	(1) Woman's total labour supply	(2) Man's total labour supply
Natural logarithm of individual income share	0.233***	0.996***
	(0.009)	(0.012)
Natural logarithm of hourly female partner wage	-0.020*	
	(0.011)	
Female partner age	-0.001	
	(0.007)	
Squared female partner age	0.000	
	(0.000)	
Dummy variable for female high education level	-0.149***	
	(0.017)	
Number of children under 3 years old	0.150***	0.030
	(0.023)	(0.026)
Number of children under 6 years old	0.095***	0.048**
	(0.019)	(0.021)
Number of children over 6 years old	0.063***	0.038***
	(0.012)	(0.013)
People living in the household not belonging to the family	0.153**	0.119
	(0.067)	(0.075)
Family has a babysitter	-0.001	0.026
	(0.053)	(0.060)
Family has a domestic worker	-0.121***	-0.033
	(0.039)	(0.043)
Dummy for The Islands	0.161***	0.238***
	(0.035)	(0.039)
Dummy for South	0.204***	0.216***
	(0.027)	(0.030)
Dummy for Centre	0.119***	0.149***
	(0.023)	(0.026)
Dummy for North East	-0.001	0.060**
	(0.022)	(0.025)
Ratio1	-32.015	-35.813
	(51.569)	(57.942)
Natural logarithm of hourly male wage		-0.715***
		(0.015)
Male partner age		-0.019**
		(0.008)
Squared male partner age		0.000*
		(0.000)
Dummy variable for male high education level		-0.127***
		(0.019)
Constant	19.495	17.836
	(25.366)	(28.502)
Observations	3076	3076
R-squared	0.233	0.705

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
The reference category for the geographical dummies is North West

Table 5 shows the estimation for the sub-sample and Table 6 displays the estimation of the sharing rule for the whole sample. Even if dual-earner couples are selected, the seemingly unrelated regression, from one side, seems to be driven by the variables explaining the domestic labor supply: as far as the female total monthly hours of work, this is negatively related with her own age, while very young children require a special effort in terms of hours worked. On the other side, in the case of the male estimation, the negative and high significant coefficient of the wage can be justified not only with the domestic labor supply (which is in average less than one third of the male total work), but also with the prevalence of an income effect for people less paid.

To conclude, the weighted OLS estimation of the sharing rule points out that the variables positively related with a bigger female share of full income are, of course, her hourly wage, but also the level of education of her partner, the presence of a domestic worker and/or a baby sitter and to live in the North of Italy. Non labor income of the household is not significant, while the presence of children is negatively related with her bargaining power. The explanation of this empirical evidence is not straightforward: from one side, taking into account that the sharing rule is recovered from a different self judgment of the spouses on their life, a possible reason is that the satisfaction of having children for women is not sufficiently counterbalanced by the female time spent at home for caring tasks when children are very young. From the other side, where there are children less than three years old, the time spent at home seems to increase relatively more for men, as their bargaining power. Probably, other factors influence the female judgment on the satisfaction in life and - in this theoretical framework- her bargaining power when there are very young children in the family. Those elements are not evident from this work, but the issue could be the aim of future research.

5   Concluding remarks

In this paper we recover empirically the sharing rule of a collective model with household production with data on Italian households. Adopting a methodology proposed Kalugina et al. (2009), the sharing rule is identified from self reported data. Here we use self reported data on satisfaction on whole life, instead of the self judgment on the household economic level. This choice is justified both by the wide concept of full income derived from the collective model with household production adopted here and with the idea to test if the allocation of time in the couple is driven not only by the market wage, but also by other elements. In fact, we show that, if the female market wage still important in explaining the woman bargaining power in the family, her share of full income increases with the male level of education and decreases if the household lives in the South of Italy. If the previous

Table 6: Weighted OLS estimation of the Sharing Rule

	Ln of sharing ratio
Natural logaritm of hourly female partner wage	1.255***
	(0.162)
Natural logaritm of hourly male wage	0.692***
	(0.109)
Natural logaritm hh non labour income	-0.072
	(0.045)
Female partner age	-0.043***
	(0.009)
Difference of age between the female and the male partner	0.001
	(0.020)
Level of education of female partner	-0.007
	(0.051)
Male partner's level of education	-0.103**
	(0.046)
Number of children under 3 years old	-6.013***
	(0.501)
Number of children under 6 years old	-2.921***
	(0.176)
Number of children over 6 years old	-3.200***
	(0.190)
People living in the household not belonging to the family	-0.003
	(0.508)
Family has a domestic worker	4.652***
	(0.539)
Family has a babysitter	1.010***
	(0.228)
Dummy for The Islands	-0.065
	(0.449)
Dummy for South	-3.082***
	(0.276)
Dummy for Centre	-2.490***
	(0.243)
Dummy for North East	0.915***
	(0.166)
Constant	-47.281***
	(0.712)
Observations	4206

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
The reference category for the geographical dummies is North West

non economic variables are expected, more difficult is to explain the role of children in the sharing rule. In particular, it seams that the female share of full income declines strongly if there are very young children in the family.

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