Review of Income and Wealth
Series 55, Number 2, June 2009

HOW DO SPOUSES SHARE THEIR FULL INCOME? IDENTIFICATION OF THE SHARING RULE USING SELF-REPORTED INCOME

by Ekaterina Kalugina

University of Nantes and CEE (Centre on Employment Studies)

Natalia Radtchenko

CREST

and

Catherine Sofer*

University of Paris 1–Panthéon–Sorbonne, CNRS, and Paris School of Economics

The paper applies the collective model to the analysis of intra-household inequality using one of the subjective-qualitative questions available in the RLMS (Russia Longitudinal Monitoring Survey) data, and provides a test for its assumptions. Interpreting the individual answers as reported budget scales we assume a correspondence between the budget level that household members report and their true income sharing. We first show that this assumption is supported by the data, and then use couples who report the same level of budget to identify the full sharing rule for the whole sample.

Introduction

One central issue in applications of the economics of the household to policy analysis is that of within-household welfare comparisons and, in particular, of intra-family inequality. The current article examines this issue in the framework of a collective model of household behavior.

We provide an application of the collective model to the analysis of intra-household inequality, using the answers to the subjective Economic Ladder question from the RLMS (Russia Longitudinal Monitoring Survey): "*Please imagine a 9-step ladder where on the bottom, the first step, stand the poorest people, and on the highest step, the ninth, stand the rich. On which step are you today?*" We interpret the answers to this question as a self-reported budget scale. We choose the term "budget" here to differentiate it from what we will call the household "full income" within the collective model framework.

The collective model based on the sharing rule (Chiappori, 1988, 1992, 1997; Apps and Rees, 1997) is usually used to determine empirically the intra-household allocation of resources formally represented by the sharing rule. Most empirical applications are limited to identifying the sharing rule up to a constant. We face this constraint because private consumption cannot be observed. We propose to use the self-reported budget scale just mentioned as an additional source of identification allowing the full sharing rule retrieval.

*Correspondence to: Catherine Sofer, CES, Maison des Sciences Economiques, 106-112, bd de l'Hôpital, 75647 Paris cedex 13, France (Catherine.Sofer@univ-paris1.fr).

We interpret intra-household equality as the equal[1] distribution of self-reported full income between the members (two principal adults) of the household. Following recent models by Apps and Rees (1997), Chiappori (1997), Rapoport *et al.* (2006, 2009), and Bourguignon and Chiuri (2005), not only the labor and non-labor incomes but also the output of household production are included in the household resources to be shared. We consider that such an approach reflects the true consumption of leisure by both of the principal members of the household in a way better than that found in more standard collective models.

Using the framework of the collective model including household production, we make a number of assumptions linking self-reported budget to the theoretical results of the model. More precisely, we assume that the answers to a question in the data about self-reported budget reflect the true division of income within the family. This assumption is tested and we show that it is not refuted by the data. Then, from the results obtained for the sub-sample of couples reporting the same level of budget, we calculate the constant of the sharing rule for the whole sample: we thus propose a new method for deriving not only the derivatives, but also the sharing rule itself (see Browning *et al.*, 2006).

In recent years a large number of empirical papers have analyzed individual well-being and poverty using subjective data (Ferrer-i-Carbonell and Frijters, 2004). In this paper we assume that the main reason why two members of the same family report different budgets is that they do actually end up with unequal incomes as a result of household income-sharing. Empirically, and as predicted by non-unitary models (bargaining as well as collective models), in the RLMS survey data many husbands and wives report different values of budget.

After briefly presenting the collective model with household production, and setting out the predicted relationship between the sharing rule from the collective model and self-reported budget data, we show that the values of the latter reported by husbands and wives are significantly different. The data come from the Russian Longitudinal Monitoring Survey (RLMS, Rounds V–VIII, 1994–98). We test a number of alternative explanations of these discrepancies and conclude that the data support our hypothesis that differences in these subjective responses reflect real differences in income sharing. Specifically, we estimate an endogenous ordered probit model in order to explain the differences in husbands' and wives' answers. This estimation is based on the collective model with household production; as such we have to take into account the endogenous profit from household production. Thus we estimate the model using full information maximum likelihood (FIML) and find, as expected, that the more "bargaining power" a woman has (as measured by her wage relative to her husband's, for example), the more likely she is to self-report a level of budget higher than that reported by her husband. These results provide an original test of the collective model.

In a second stage, we estimate the total labor supplies of household members (market work plus household work) using the seemingly unrelated regressions estimator. We first use the sub-sample of households who report equal budget-sharing to derive the labor supply parameters. The parameters of the sharing rule

[1]Allowing for approximated equality between partners and taking into account potential measurement errors.

are then identified in a second stage using the whole sample. We are thus able to calculate the marginal effects of wages and non-labor income on the sharing rule: these show, in particular, that one's income share is more sensitive to one's own wage than to the partner's wage.

The paper is organized as follows. Section 1 outlines the collective model of household labor supply with household production, based upon Rapoport *et al.* (2006, 2009). In addition, we propose an original way of defining intra-household equality using the concept of the full income. Section 2 presents the data. We then apply our model to intra-household inequality and provide a test of its main assumptions. In Section 3, we present the method used to fully identify the sharing rule. Section 4 presents the results.

1. The Model

In this section we derive conditions for the equal sharing of full income, starting from the collective model including household production (Apps and Rees, 1997; Rapoport *et al.*, 2006, 2009). The model is based on examining the labor market behavior of spouses. In addition, we propose an original way of defining intra-household equality while using the concept of the full income adapted by the collective model.

1.1. *The Collective Model with Household Production*

Consider two individuals ($i = f, m$). We assume that there are only two decision-makers, although we allow the presence of children and relatives (elderly).[2] Each has a utility function depending on leisure (assignable and observed), L_i, the consumption of a Hicksian composite good (unobserved), C_i, with a normalized price of 1.

Besides the composite good, C_i, purchased in the market, the household produces a vector of domestic goods, $\mathbf{Y}$. Let the production function of the k-th domestic good[3] be

$$Y^k = d^k\left(t_f^k, t_m^k; \mathbf{z}\right), \quad k = 1, \ldots K,$$

where t_i^k, $(I = f, m)$ is member i's household work devoted to the production of domestic good k, and $\mathbf{z}$ is a vector representing household heterogeneity. We assume that all goods are privately consumed. Individual utility can be written as: $U_i = U_i(L_i, C_i, \mathbf{Y}_i; \mathbf{z})$, where $\mathbf{Y}_i$ is the vector of member i's consumption of domestic goods.

[2]We acknowledge that elderly parents and grown-up children may influence the decision-making process (see, for example, Fortin *et al.*, 2008). We omit this possibility in order to keep the model tractable. Indeed, most analyses of the collective model with multiple decision-makers focus on consumption data rather than labor market behavior which is crucial for our method of sharing rule identification.

[3]We assume that there is no joint production in the household production sector.

Let $t_i = \sum_k t_i^k$ $(i = f, m)$ be the total time that a household member i devotes to the production of domestic goods, h_f, and h_m market labor supplies, T the total time available, y the household's non-labor income, and w_f and w_m the wage rate of woman (f) and man (m) respectively.

1.1.1. The Household Maximization Problem

In the collective model with household production, the Pareto-efficient solution results from program (P1):

$$\text{(P1)} \quad \underset{L_f, C_f, Y_f, L_m, C_m, Y_m}{Max} \left(\mu_f(.) U_f\left(L_f, C_f, \mathbf{Y}_f, \ldots; \mathbf{z}\right) + \mu_m(.) U_m(L_m, C_m, \mathbf{Y_m}, \ldots; \mathbf{z})\right)$$

subject to:

$$C_f + C_m + \mathbf{p}\mathbf{Y}_f + \mathbf{p}\mathbf{Y}_m + L_f w_f + L_m w_m \leq T w_f + T w_m + y + \Pi\left(w_f, w_m, \mathbf{p}\right)$$

$$Y^k = d^k\left(t_f^k, t_m^k; \mathbf{z}\right), \quad k = 1, \ldots K,$$

$$\mathbf{Y} = \mathbf{Y}_f + \mathbf{Y}_m$$

$$L_i + t_i \leq T \quad (i = f, m)$$

where $\mu_i = \mu_i(w_f, w_m, y, \mathbf{s}, \mathbf{z})$ are continuously differentiable weighting factors contained in [0, 1] such that $\mu_f + \mu_m = 1$ with $\mathbf{s}$ being a vector of distribution factors;[4] $\Pi(w_f, w_m, \mathbf{p})$ is the profit from household production. $\mathbf{p}$ is a price vector of household goods, generally endogenous and varying from household to household.

1.1.2. Decentralization and the Sharing Rule

As in Apps and Rees (1997) and Chiappori (1997), the second theorem of welfare economics implies that the equilibrium corresponding to program (P1) can be decentralized and the solution can be obtained in two stages.

First, the household determines the optimal allocation of time of each member in household production, using the criterion of the maximization of profit or net value of household production. This imputed profit is added to the other income flows and the output of household production allocated to household members. In the second stage, consumption is decentralized by the appropriate choice of shares Φ_i $(i = f, m)$ of total full income. Program (P1) can thus be reformulated as (P2.1) and (P2.2):

$$\text{(P2.1)} \qquad \underset{t_f, t_m}{Max}\, \Pi = \mathbf{p}\mathbf{Y} - w_f t_f - w_m t_m$$

subject to:

[4]Distribution factors are variables which influence the bargaining power of household members, but neither prices nor preferences (see Chiappori *et al.*, 2002).

$$Y^k = d^k\left(t_f^k, t_m^k; \mathbf{z}\right), \quad k = 1, \ldots K,$$

(P2.2) $$\underset{C_i, L_i, Y_i}{Max} U_i(L_i, C_i, \mathbf{Y}_i, \ldots; \mathbf{z}), \quad i = f, m$$

subject to individual budget, time constraints and to a household goods constraint:

$$C_i + \mathbf{p}\mathbf{Y}_i + L_i w_i \leq \Phi_i$$

$$L_i + h_i + t_i = T,$$

$$\boldsymbol{Y} = \boldsymbol{Y}_f + \boldsymbol{Y}_m$$

where the sharing rule $\Phi_i(w_f, w_m, y; \mathbf{p}, \mathbf{s}, \mathbf{z})$ represents the amount of full income (in absolute value) allocated to member i, with:

$$\Phi = \Phi_f + \Phi_m = \left(w_f + w_m\right)T + y + \Pi$$

1.1.3. The Demands for Leisure

Solving program (P3) below, which is a reformulation of (P2), yields the Marshallian demands (1.1) and (1.2) for leisure. We have:

(P3.1) $$\underset{t_f, t_m}{Max}\, \Pi = \mathbf{p}\mathbf{Y} - w_f t_f - w_m t_m$$

$$Y^k = d^k\left(t_f^k, t_m^k; \mathbf{z}\right), \quad k = 1, \ldots K,$$

$$\mathbf{Y} = \mathbf{Y}_f + \mathbf{Y}_m$$

(P3.2) $$\underset{C_i, L_i, Y_i}{Max} U_i(L_i, C_i, \mathbf{Y}_i, \ldots; \mathbf{z}), \quad i = f, m$$

subject to:

$$C_i + \mathbf{p}\mathbf{Y}_i + w_i(T - h_i) \leq \Phi_i$$

where h_i is member's i working time on the market, $i = m, f$

$$\Phi_m + \Phi_f = \Phi$$

$$L_i + h_i + t_i = T,$$

The Marshallian demands for leisure are

(1.1) $$L_f = L^f\left(w_f, \mathbf{p}, \Phi_f\left(w_f, w_m, y; \mathbf{p}, \mathbf{s}, \mathbf{z}\right); \mathbf{z}\right)$$

$$L_m = L^m\left(w_m, \mathbf{p}, \Phi - \Phi_f\left(w_f, w_m, y; \mathbf{p}, \mathbf{s}, \mathbf{z}\right); \mathbf{z}\right) \tag{1.2}$$

1.2. *Intra-Household Income Comparisons*

Intra-household equality can be defined in a number of different ways. Assuming inter-personal utility comparisons, for example, we can consider the equality of utility between the two household members. In this paper we interpret intra-household equality as an equal distribution of the total household income defined by the collective model as the sum of monetary and non-monetary incomes (leisure being valued as the opportunity cost of work).[5]

We use the data which contain the answer to a subjective question about income (or budget, as we prefer to call it when referring to the data) to differentiate it from what we called the household "full income." Respondents place their budget on a 9-step ladder. Making the usual assumption of no systematic bias in these replies, we directly relate their subjective answer to the income they actually receive within the family. The assumption made here is that the respondent's answers to this question provide information about the income share allocated to them within the household that is available for private consumption. We will discuss this assumption in depth in the next section. Assume for the time being that intra-household equality is defined as equality in the sharing of full income, which in turn is indicated by both husband and wife giving the same answer to the budget question.[6] More precisely, we assume that:

$\Phi_f > \Phi_m$, if the wife reports a higher value of budget than her husband
$\Phi_f < \Phi_m$, if the wife reports a lower value of budget than her husband
$\Phi_f = \Phi_m$, if both husband and wife report the same level of budget.

The definitions of Φ_f and Φ_m yield the following system describing intra-household inequality:

$$\begin{cases} \Phi_f < \dfrac{1}{2}\left[\left(w_m + w_f\right)T + y + \Pi\right], & \text{if } \Phi_f < \Phi_m \\ \Phi_f = \dfrac{1}{2}\left[\left(w_m + w_f\right)T + y + \Pi\right], & \text{if } \Phi_f = \Phi_m \\ \Phi_f > \dfrac{1}{2}\left[\left(w_m + w_f\right)T + y + \Pi\right], & \text{if } \Phi_f > \Phi_m \end{cases} \tag{1.3}$$

2. Do Subjective Answers Reflect True Income-Sharing?

In this section, we first describe the data, and then concentrate on the answers to the self-reported budget question and the assumptions we make. In the last paragraph, we carry out some estimates to test these assumptions.

[5]To our knowledge, it is an original way of defining intra-household equality, but it has an easy interpretation.

[6]The assumption is less restrictive empirically as the hypothesized equality between partners' full income holds only approximately; see Section 2.

2.1. *The Data*

The data used in the econometric analysis come from the Russia Longitudinal Monitoring Survey (RLMS). This database is jointly collected by the University of North Carolina (Chapel Hill), the Institute of Sociology, Russian Academy of Sciences (ISRosRAN) and the Russian Institute of Nutrition.

The survey has two phases: during the first phase of the project (1992–94), the RLMS collected four rounds (I–IV) of data on 5,900 households on average; since 1994 the RLMS has collected 12 further rounds (V–XVI) of data in the second phase of the project. Since the RLMS switched partners in Russia for the second phase, the second phase data were drawn anew from the population. The second phase sample size is approximately 4,000 households. The samples in the two phases do not concern the same individuals.

Two questionnaires are given to survey respondents: a household questionnaire and an individual questionnaire. The first asks about household structure, expenditure, income, housing conditions, land use, and so on. The second covers employment, labor income, education, satisfaction with economic conditions, etc. The individual questionnaire for rounds I–VIII (1992–98) included a section on "Use of Time," containing questions on the amount of time devoted to household occupations in the seven days preceding the interview. These occupations are: working on the individual land plot, dacha, or garden plot, excluding farm plots or personal subsidiary farms; looking for and purchasing food items; preparing food and washing dishes; cleaning the apartment; doing laundry, ironing; looking after the children; caring for any (other) children—one's own or others'—aged 12 or under, who do not live with the interviewee and caring for whom is not part of the interviewee's job; looking after one's father who is aged over 50 (for example, going to the store, helping with cleaning, or washing clothes); looking after one's mother who is aged over 50; and helping relatives or acquaintances who are aged over 50.

We use data from rounds V–VIII (1994–98) of phase II as we will need the time use questionnaire to include household production in the empirical analysis. The sample used for the econometric analysis consists of couples where both partners are employed and the two salaries are observed. This yields an unbalanced panel of 1,480 households (household heads) with 2,419 observations, as some households are observed several times. After excluding households with missing values on key variables, we are left with 2,144 observations. Table 1

TABLE 1

Frequencies of Number of Waves Observed per Household

Number of Waves Observed	Frequency (%)
1	55.6
2	27.6
3	12.4
4	4.4
Total	100

Source: Russia Longitudinal Monitoring Survey, rounds V–VIII (1994–98).

TABLE 2
SAMPLE MEANS OF VARIABLES

Variable	Women			Men		
	Round VIII Means	Round VII Means	Round VI Means	Round VIII Means	Round VII Means	Round VI Means
Market time per week (h_i), hrs	38.78 (15.38)	38.41 (14.68)	39.5 (12.23)	44.72 (17.25)	44.75 (16.84)	45.22 (12.99)
Domestic time per week (hh_i), hrs	46.87 (29.8)	45 (30.7)	42.9 (30.4)	14.72 (16.47)	15.71 (19.36)	13.74 (17.52)
Total working time per week (H_i), hrs	85.66 (31.92)	83.23 (31.49)	82.36 (31.53)	59.39 (22.69)	60.43 (24.93)	58.95 (22.48)
Hourly wage (w_i), roubles	3.87 (10.9)	6.12 (14.5)	7 (17)	7.8 (45)	10.46 (36)	12.7 (55.5)
Household total monthly monetary income (Y), roubles	2,196 (14,484)	2,696 (5,878)	2,887 (6,145)	2,196 (14,484)	2,696 (5,878)	2,887 (6,145)

Notes: Standard deviations in parentheses.
Source: Russia Longitudinal Monitoring Survey, rounds VI–VIII (1995–98).

reports the percentage of households observed for 1, 2, 3 or 4 waves. More than half of households are observed only in one wave, and only 16.8 percent of households are observed strictly more than twice. Due to the small size of the panel (Table 1), we pool the data and do not control for any invariant household effects in what follows. These effects can produce biases, but given the characteristics of the data, they are expected to be insignificant. By contrast, we control for the period of observation in order to take into account common aggregate time-specific shocks due to the instability of the Russian economy during transition, in particular instability in the Russian labor market.

Table 2 shows the sample means of the variables used in the econometric analysis.

The difference in total working time between men and women is particularly striking: though women work slightly fewer hours in the market (as is the case in many countries), the total amount of household work performed by women is substantial, as is the difference between men's and women's total work hours.

2.2. *Self-Reported Budget and its Interpretation*

To measure individual budget, we use the following Subjective Economic Ladder question from the RLMS: "*Please imagine a 9-step ladder where on the bottom, the first step, stand the poorest people, and on the highest step, the ninth, stand the rich. On which step are you today?*" We analyze the intra-family correlation in the answers to this question. Here we make an assumption that household members give the same answer to this question if they receive the same share (one half) of full household income, including monetary (market and domestic) as well as non-monetary income.

For the descriptive statistics, we include all the couples in which both answered the above question and provided wage information. To analyze self-rated budget, we collapse the highest ranks (6, 7, 8, and 9) of the ladder into one

TABLE 3

INCOME LEVELS (SELF REPORTED BUDGETS)

Economic Ladder Question (1, the poorest; 6, the richest)	Round 5 (1994) Number (%)	Round 6 (1995) Number (%)	Round 7 (1996) Number (%)	Round 8 (1998) Number (%)
1	109 (6.0)	145 (9.1)	72 (6.3)	102 (8.1)
2	238 (13.1)	184 (11.6)	147 (12.8)	198 (15.8)
3	471 (25.9)	350 (22.0)	266 (23.1)	333 (26.5)
4	462 (25.4)	403 (25.4)	291 (25.3)	309 (24.6)
5	404 (22.3)	386 (24.3)	280 (24.3)	243 (19.4)
6	131 (7.2)	121 (7.6)	94 (8.2)	70 (5.6)
Total	1,815 (100)	1,589 (100)	1,150 (100)	1,255 (100)

Source: Russia Longitudinal Monitoring Survey, rounds V–VIII (1994–98).

TABLE 4

WITHIN HOUSEHOLD DISCREPANCIES IN SELF-REPORTED BUDGET

Wife's Score Minus Husband's Score	Round 5 (1994) Number (%)	Round 6 (1995) Number (%)	Round 7 1996) Number (%)	Round 8 (1998) Number (%)
–2	87 (10.8)	61 (9.4)	53 (11.3)	60 (11.8)
–1	139 (17.3)	126 (19.4)	101 (21.6)	112 (22.1)
0	339 (42.2)	283 (43.5)	188 (40.3)	192 (37.9)
1	142 (17.7)	127 (19.5)	80 (17.1)	95 (18.7)
2	97 (12.1)	53 (8.1)	45 (9.6)	48 (9.5)
Total	804 (100)	650 (100)	467 (100)	507 (100)

Notes: 0, there is no difference between husband's and wife's responses; –1, the wife is situated one step lower than her spouse; –2, the wife is situated 2 or more steps lower than her spouse; 1, the wife is situated one step higher than her spouse; 2, the wife is situated 2 or more steps higher than her spouse.

Source: Russia Longitudinal Monitoring Survey, rounds V–VIII (1994–98).

category as few respondents considered themselves as amongst the richest. Table 3 summarizes the distribution of self-rated economic welfare, or here, budget. The vast majority of individuals situate themselves on the bottom of the ladder or, speaking differently, they consider themselves poor: if we take the poorest two steps to be the subjectively poor, we observe that the subjective poverty rate rose from 19.12 percent in 1994 to 23.91 percent in 1998. Most of the individuals report themselves to be on steps 3, 4 and 5 of the 9-step ladder.

In this paper we are interested in income differences within a given household. Table 4 presents the differences in the Economic Ladder replies of husbands and wives. We consider married household heads, and compare their answer to that of their spouse. In more than half of the households, men and women provide different answers to the subjective question, as shown in Table 4. Almost 18 percent of men consider themselves a step poorer than their wives and 10 percent differ by more than two steps. On average, women report lower budgets than men in the same households: in 1998, in over 34 percent of households, the wife reports a lower budget, versus only 28 percent of households in which husbands report being poorer. Our interpretation of the difference is that, as income sharing is the result of a bargaining process, income is not necessarily equally shared between husband and wife. This assumption is widely discussed and tested below.

We use these budget differences to construct an index of intra-household inequality for the empirical analysis.

2.3. *Are Subjective Answers Reliable?*

We first provide some evidence to support the assumption that subjective data contain useful information. Ravallion and Lokshin (2001, 2002), for example, argue that although "the welfare inferences drawn from answers to subjective survey questions are clouded by concerns about measurement errors and how latent psychological factors influence observed respondent characteristics," subjective measures of income and poverty can be used as complements to standard socio-economic poverty measures. The use of subjective data, launched by the Leyden school in the 1970s for subjective poverty measurement, has developed rapidly since the late 1990s (Senik, 2005). Many nationally-representative household surveys, such as the British Household Panel Survey (BHPS), the German Socio-Economic Panel (GSOEP) or the data used in this paper (the RLMS) contain subjective questions related to general well-being, satisfaction with income, job, health and so on, or individuals' attitudes towards variables such as inequality or unemployment. These questions are generally used as proxies for welfare or well-being. In this study, individuals define their own level of welfare and provide information that would not be otherwise available, at least in large-scale surveys.

The main justification for the use of subjective data comes from the limitation of the axiom of revealed preferences (Senik, 2005). The traditional approaches to individual behavior can be complemented by the use of data on individual perceptions in the cases when use of the former is restricted by the presence of externalities, social interactions, and so on. For example, subjective information is often used to reveal the non-pecuniary costs of unemployment (Clark and Oswald, 1994; Winkelmann and Winkelmann, 1998) and individuals' attitudes towards inequality can help to design redistributive policies (Ng, 1996; Ravallion and Lokshin, 2000). In general, these analyses provide consistent results that are not against common sense. However, two key assumptions are necessary for the analysis of subjective data: first is that individuals are able to evaluate their own situation, and second that responses can be compared across individuals (Ferrer-i-Carbonell, 2002). The reliability and validity of individual answers has been studied extensively in the recent literature (Diener, 1984; Veenhoven, 1993; Diener *et al.*, 1999), and Easterlin (2001) has pointed out that "the general conclusion of such assessments is that subjective indicators, . . . though not perfect, do reflect respondents' substantive feelings of well-being." Keeping these reflections in mind, we appeal to subjective data in a relatively new sphere: the analysis of intra-household inequality.[7]

A number of critics have worried about the comparison of income (budget) scales: people live in different social environments, so their answers about budget may merely reflect their position *relative* to their own social environment rather than to a common scale. The argument is not totally convincing in our context, as

[7]As far as we know, the only other application of subjective information to intra-household distribution of welfare is Bonke and Browning (2003), in which they use a measure of self-perceived economic well-being.

TABLE 5

SIMULTANEOUS ESTIMATION OF TWO PARTNERS' REPLIES (3SLS)

	Woman's Reply Coefficient	Man's Reply Coefficient
Woman's monthly labor income	11.496***	3.637**
	(1.656)	(1.588)
Man's monthly labor income	5.040***	7.762***
	(0.978)	(0.938)
Age difference: $Age_f - Age_m$	0.000	0.020***
	(0.007)	(0.007)
Household non-labor income	0.001**	0.001***
	(0.0005)	(0.0004)
Number of children 0–6 years old	0.061	0.074
	(0.062)	(0.059)
Number of children 7–18 years old	–0.030	–0.042
	(0.038)	(0.036)
Number of elderly persons in the household	0.159***	0.036
	(0.059)	(0.057)
Ln of living space (sq. meters)	–0.009	0.032
	(0.083)	(0.079)
Family is working on an individual plot	–0.078	–0.069
	(0.069)	(0.067)
Number of man's years of education	0.025**	0.027**
	(0.012)	(0.012)
Woman has higher degree of education than man	0.031	–0.136**
	(0.068)	(0.065)
Moscow–St. Petersburg	–0.255***	–0.240***
	(0.094)	(0.090)
Round 5	0.073	–0.076
	(0.086)	(0.082)
Round 6	0.085	0.033
	(0.089)	(0.086)
Round 8	–0.018	–0.061
	(0.095)	(0.091)
Constant	2.897***	3.059***
	(0.320)	(0.307)
Number of observations	2,163	2,163
R^2	0.0703	0.0709
χ^2	163.67	164.99
Prob. $>\chi^2$	0.0000	0.0000

Notes: Standard errors in parentheses; *significant at 10% level, **significant at 5% level, ***significant at 1% level.

Source: Russia Longitudinal Monitoring Survey, rounds V–VIII (1994–98).

we can assume that two individuals living together and sharing, at least partially, their budget, have the same scale for self-positioning on the budget ladder. We show in Table 5 that both spouses have in mind, while answering the question, an income that includes household transfers. Thus, for none of them would the often quoted reference group of work colleagues, for example, be relevant. Instead, here, the relevant reference group would rather be other households they know (which could, of course, include colleagues of both sides). As husbands and wives share a similar social environment, they should thus share the same reference points regarding their budget relative to that of other individuals in households that they know. Such reasoning is also supported by the finding of Plug and Van Praag

(1998), who report that both adult partners appear to answer almost identically to subjective questions of the Leyden type.

Another issue is that we may define equal sharing too narrowly. We are aware that interpreting small differences in the answers to subjective questions as revealing true inequality in income sharing may imply too high a level of confidence in interpersonal comparisons of subjective answers. We thus allow for some heterogeneity between partners by interpreting a difference of one in replies as indicating no difference in income (one being optimistic, the other one pessimistic, for example, or one being in an especially good mood on the day of the interview).

We construct an index which takes the value of 0 if the within-household response difference equals –2 or less (the wife considers herself to be poorer than her husband); 1 if the difference between wife's and husband's replies is no greater than 1 in absolute value (the two partners report more or less the same budget); and 2 if the wife reports higher economic welfare than her husband (a difference on the scale of at least 2).[8]

A final objection concerns the question asked in the data: "On which step are you today?" Although this question is posed on an individual basis within the individual questionnaire, it does not explicitly refer to household income-sharing. To test whether people, when responding to this question, could have their own earnings in mind, rather than their share of household full income, we carry out a simultaneous estimation of the two members' replies, regressing them on each member's labor income along with some individual and household characteristics. If one's reply referred to his/her own purely individual labor income, the partner's labor income would not be significant. The test results are obtained by the Seemingly Unrelated Regressions Estimator and shown in Table 5.

Table 5 shows that household members clearly refer to a kind of household income, i.e. including household transfers, rather than to their own earnings, only when answering the budget question. For both partners, the replies are strongly influenced not only by one's own income, but also by one's partner labor income. Moreover, for each one, the impact of one's own income is greater than that of one's partner evaluated income. Thus, one's own labor income has a higher value in his or her individual part of revenue than one's partner income. This is consistent with our interpretation in terms of a sharing rule. If a higher labor income increases my bargaining power, then, if my wage increases, I shall answer a higher value to the budget question, for two reasons: first, because of a positive income effect, which exerts the same positive influence upon my spouse's income; and second, because of a "negotiation effect," which increases my income share, but, conversely, decreases my spouse's.

2.4. *An Original Test of the Collective Model*

In this section we propose an original test of the collective model which is different from the most commonly used Chiappori-type tests (e.g. Chiappori *et al.*, 2002).

[8]We also ran the estimations with equal sharing corresponding to strict equality in the answers. The results were very similar.

Having assumed that the data provide reliable information on the individual shares of full income, Φ_f and Φ_m, we can directly test the usual assumptions made regarding the sharing rule.

The empirical model describing intra-household inequality (equation 1.3 above) can be formulated as an endogenous ordered probit derived from the sharing rule. As the allocation of time is endogenous in this model, introducing household production requires that the profit from household production, Π, be endogenized. This is carried out here by adding two simultaneous equations of labor supply in domestic production, for husbands and wives. Note that, as the sharing rule itself is generally assumed to be a function of monetary characteristics (wages and non-labor income), but does not directly depend on non-monetary variables, such as household productivity, the theoretical model implies that the only channel between the variables of the ordered probit and the two latter equations is via the profit from domestic production.

The model is estimated by the full information maximum likelihood (FIML) method.

2.4.1. The Econometric Model

Let I be an index function taking values 0, 1 or 2 depending on whether the difference observed between female and male levels of full income is negative, zero or positive.

$$I = \begin{cases} 0, & if \quad \Phi_f < \Phi_m \\ 1, & if \quad \Phi_f = \Phi_m \\ 2, & if \quad \Phi_f > \Phi_m \end{cases} \tag{2.1}$$

Let Φ_f^* be a criterion function associated with an unobservable sharing rule:

$$\Phi_f^* = \boldsymbol{\gamma}'\mathbf{Z} + \varepsilon,$$

where $\mathbf{Z}$ is a vector of household-specific characteristics and distribution factors which are assumed to influence the sharing rule.

The index function can then be written as:

$$I = \begin{cases} 0, & if \quad \Phi_f^* \le k_1 \\ 1, & if \quad k_1 < \Phi_f^* \le k_2 \\ 2, & if \quad \Phi_f^* > k_2 \end{cases} \tag{2.2}$$

where k_1 and k_2 are unknown parameters to be estimated.

Recall that the sharing rule depends on the profit from domestic production Π, which is endogenous as household production depends on the time devoted to household work and wage rates. As such, system (2.2) needs to be completed by equations describing household work. The resulting system (2.3) is the econometric representation of the theoretical model (1.3):

$$I = \begin{cases} 0, & \text{if} \quad \Phi_f^* \le \kappa_1, \\ 1, & \text{if} \quad \kappa_1 < \Phi_f^* \le \kappa_2, \\ 2, & \text{if} \quad \Phi_f^* > \kappa_2, \\ t_f = \boldsymbol{\alpha}_f \boldsymbol{X}_f + u_1 \\ t_m = \boldsymbol{\alpha}_m \boldsymbol{X}_m + u_2 \end{cases} \tag{2.3}$$

where $\boldsymbol{\alpha}_i$ are the parameter vectors and $\mathbf{X}_i$ are the vectors of individual i specific characteristics and household-specific productivity factors. The error terms ε, u_1 and u_2 are assumed to have a trivariate standard normal distribution with zero mean and covariance matrix Σ:

$$\Sigma = \begin{pmatrix} 1 & \sigma_{\varepsilon u_1} & \sigma_{\varepsilon u_2} \\ \sigma_{\varepsilon u_1} & \sigma_1^2 & \sigma_{u_1 u_2} \\ \sigma_{\varepsilon u_2} & \sigma_{u_1 u_2} & \sigma_2^2 \end{pmatrix}$$

with $\sigma_{\varepsilon u_j} = \operatorname{cov}(\varepsilon, u_j)$, $j = 1, 2$, $\sigma_{u_1 u_2} = \operatorname{cov}(u_1, u_2)$, $\sigma_1^2 = Var(u_1)$ and $\sigma_2^2 = Var(u_2)$.

As mentioned above, the theoretical model implies that the only correlation possible between the error terms of the ordered probit equation and each of the homework equations stems from household production profit. Moreover, including household work in the model provides an implicit test of a potential effect of non-market characteristics on the sharing rule when relaxing the usual assumption made that the sharing rule is a function of monetary characteristics only (wages, non-labor income, etc):[9] in fact, it could also depend on some non-market characteristics, such as household productivity, for example.

2.4.2. Maximum Likelihood Estimation

The model is estimated by full information maximum likelihood (FIML). This estimation method implements the FIML procedure to estimate simultaneously the ordered and continuous parts of the model in order to provide consistent standard errors.

The likelihood function for the system of equations (2.3) is:

$$\begin{aligned} L = & \prod_{i:I=0} [F((\kappa_1 - \boldsymbol{\gamma}'\mathbf{Z}_i)|u_{1i}, u_{2i}) \times f(u_{1i}, u_{2i})] \\ & \times \prod_{i:I=1} [(F((\kappa_2 - \boldsymbol{\gamma}'\mathbf{Z}_i)|u_1, u_2) - F((\kappa_1 - \boldsymbol{\gamma}'\mathbf{Z}_i)|u_{1i}, u_{2i})) \times f(u_{1i}, u_{2i})] \\ & \times \prod_{i:I=2} [1 - F((\kappa_2 - \boldsymbol{\gamma}'\mathbf{Z}_i)|u_{1i}, u_{2i}) \times f(u_{1i}, u_{2i})] \end{aligned}$$

[9]A usual hypothesis made in the literature (cf. Apps and Rees, 1997; Chiappori, 1997; Rapoport *et al.*, 2009).

where i denotes the i-th observation, and $F(.|u_{1i},u_{2i})$ is the conditional cumulative distribution function of ε on u_{1i},u_{2i}; $f(u_{1i},u_{2i})$ is the bivariate standard normal distribution function.

The variable $\varepsilon|u_1,u_2$ follows a normal distribution. Denoting

$$\tilde{\Sigma} = \begin{pmatrix} \sigma_1^2 & \sigma_{u_1u_2} \\ \sigma_{u_1u_2} & \sigma_2^2 \end{pmatrix}$$

we can calculate its mean μ and variance σ^2 as follows (Greene, 2000):

$$\mu = \left(\sigma_{\varepsilon u_1}, \sigma_{\varepsilon u_2}\right)\tilde{\Sigma}^{-1}(u_1, u_2)' = \left[(\rho_1 u_1/\sigma_1 + \rho_2 u_2/\sigma_2) - \rho(\rho_1 u_2/\sigma_2 + \rho_2 u_1/\sigma_1)\right]/\left(1-\rho^2\right)$$

$$\sigma^2 = 1 - \left(\sigma_{\varepsilon u_1}, \sigma_{\varepsilon u_2}\right)\tilde{\Sigma}^{-1}\left(\sigma_{\varepsilon u_1}, \sigma_{\varepsilon u_2}\right)' = 1 - \left[\rho_1^2 + \rho_2^2 - 2\rho\rho_1\rho_2\right]/\left(1-\rho^2\right),$$

where ρ_1, ρ_2, and ρ are the coefficients of correlation between ε and u_1, ε and u_2, u_1 and u_2 respectively.

The log of the likelihood function can be defined in terms of the cumulative standard normal distribution as below:

$$\ln L = \sum_{i:I=0} \ln F_0\left(z_i^1\right) \times f(u_{1i}, u_{2i}) + \sum_{i:I=1} \ln\left(F_0\left(z_i^2\right) - F_0\left(z_i^1\right)\right) \times f(u_{1i}, u_{2i}) + \sum_{i:I=2} \ln\left(1 - F_0\left(z_i^2\right)\right) \times f(u_{1i}, u_{2i})$$

with F_0 standing for the cumulative standard normal distribution function and $z_i^j = (k_j - \boldsymbol{\gamma}\mathbf{Z}_i - \mu)/\sigma$, $(j = 1, 2)$.

2.4.3. The Results

The dependent variables are the natural logarithms of male and female monthly domestic labor supply in hours, and our index of intra-household inequality introduced in Section 2. All of the independent variables are assumed to be exogenous. We include the wage rates of both husband and wife, individual demographic characteristics (age, age-squared and education), household characteristics (number of children, number of elderly persons, assets and possession of durables) and type and region of settlement. The estimates are reported in Table 6.[10] The corresponding marginal effects can be seen in Table A1 (Appendix A).

Relatively few variables are significantly correlated with domestic labor supply. The partner's wage rate is an important determinant of women's domestic working time: higher male wages are associated with greater domestic labor supply by the wife, while higher female wages have no significant effect on males'

[10]Estimations are carried out taking into account that the observations are independent across households, but not necessarily within them. Specifying "cluster" option when using Stata, we get the robust estimated standard errors and variance–covariance matrix of the estimators.

TABLE 6

FULL INFORMATION MAXIMUM LIKELIHOOD ESTIMATION OF WOMAN'S and MAN'S DOMESTIC LABOR SUPPLY AND THE INDEX OF INTRA-HOUSEHOLD INEQUALITY[a] (ENDOGENOUS ORDERED PROBIT MODEL)

	Woman's Domestic Labor Supply	Man's Domestic Labor Supply	Index[a]
Ln of man's wage rate	0.044**	0.014	0.1***
	(0.015)	(0.026)	(0.035)
Ln of woman's wage rate	–0.006	0.015	
	(0.017)	(0.027)	
Wage difference[b]			0.17**
			(0.037)
Man's age		–0.014	
		(0.021)	
Man's age squared		0.014	
		(0.025)	
Woman's age	0.025*		
	(0.016)		
Woman's age squared	–0.026		
	(0.020)		
Age difference[c]			–0.013*
			(0.007)
Woman has technical or higher education	–0.032		
	(0.031)		
Man has technical or higher education		0.054	
		(0.049)	
Male education (years)			–0.01
			(0.012)
Woman has higher degree of education than man			0.06
			(0.068)
Household non-labor income			–0.0002
			(0.0003)
Number of children 0–6 years old	0.44***	0.455***	0.017
	(0.037)	(0.049)	(0.062)
Number of children 7–18 years old	0.19***	0.171***	0.06*
	(0.021)	(0.034)	(0.037)
Number of elderly persons in the household	0.021	0.121**	0.08
	(0.035)	(0.049)	(0.060)
Ln of living space (sq. meters)	–0.020	–0.063	–0.04
	(0.043)	(0.069)	(0.079)
Automobile owned	0.024	–0.053	
	(0.037)	(0.060)	
Washing machine owned	–0.030	0.003	
	(0.048)	(0.073)	
Family is working on an individual plot	0.016	0.015	–0.02
	(0.059)	(0.093)	(0.071)
Rural	0.146**	0.22***	
	(0.039)	(0.062)	
North Caucasian	–0.030	0.03	
	(0.041)	(0.063)	
Volga-Vaytski and Volga Basin	–0.034	0.010	
	(0.045)	(0.072)	
Moscow–St. Petersburg	–0.09*	–0.16**	–0.02
	(0.031)	(0.053)	(0.094)
Northern and North Western	–0.072	0.135	
	(0.053)	(0.087)	
The Urals	–0.184**	–0.06	
	(0.057)	(0.089)	
Western Siberia	–0.108*	0.01	
	(0.048)	(0.086)	

TABLE 6 (*continued*)

	Woman's Domestic Labor Supply	Man's Domestic Labor Supply	Index[a]
Eastern Siberia and Far Eastern	–0.15***	0.034	
	(0.061)	(0.109)	
Round 5	0.075*	0.162**	0.09
	(0.049)	(0.075)	(0.083)
Round 6	0.006	0.019	0.044
	(0.059)	(0.095)	(0.085)
Round 8	–0.06	–0.062	0.025
	(0.062)	(0.102)	(0.092)
Constant	4.21***	3.82***	
	(0.315)	(0.440)	
Ancillary parameters			
k_1			–1.2***
			(0.311)
k_2			1.34***
			(0.311)
ρ_1 (correlation between woman's domestic labor supply and the sharing rule)			–0.06*
			(0.028)
ρ_2 (correlation between man's domestic labor supply and the sharing rule)			–0.03
			(0.029)
ρ (correlation between man's and woman's supply)			0.27***
			(0.022)
σ_1			0.615***
			(0.021)
σ_2			0.985***
			(0.019)
Number of observations		1,916	
Log likelihood		–6,462.59	

Notes: Standard errors in parentheses; *significant at the 10% level, **significant at the 5% level, ***significant at the 1% level.

[a]The dependent variable is the index of intra household inequality: 0, the wife reports being poorer than her husband; 1, there is no difference; 2, the wife reports being richer than her husband.

[b]Wage difference: the difference between ln of woman's real wage rate and ln of man's real wage rate.

[c]Age difference: the difference between woman's age and man's age.

The reference categories are: Urban versus Rural, Central and Central Black-Earth for region, Round 7 for wave.

Source: Russia Longitudinal Monitoring Survey, rounds V–VIII (1994–98).

domestic work. Other significant variables in both equations are the number of young children (0–6 years old) and older children (7–18 years old) in the household: as expected, more children increase both spouses' domestic work, especially when the children are younger. Non labor-market variables are not significant here. Living space, durables possession or owning an individual plot do not influence the hours of domestic work of either husband or wife. Household work does vary by region and type of settlement. Both partners work less in Moscow and St. Petersburg, and in the Urals and Eastern and Western Siberia women's domestic labor supply is lower than in the other regions. As might be expected, both men and women living in rural areas work more at home than do those living in urban areas.

We have included some variables in the ordered probit equation, such as non-labor income,[11] which, as we may expect, are correlated with the spouses' bargaining power. As noted above, this index takes a value of 0 if the within-household difference in replies is less than or equal to –2 (the wife feels poorer than her husband); 1 if this difference is no greater than 1 in absolute value (the two partners thus giving more or less the same answer to the budget question); and 2 if the wife reports a higher level of budget than her husband (with the difference on the scale being at least 2). The wage difference in these equations is expressed as the natural logarithm of the difference between female and male wages.

The results in Table 6 are in line with those predicted by the theory: the wage difference is highly significant with the "correct" sign.

We thus find, as expected, that the higher a woman's wage compared to her husband's, the greater is the probability that her response to the budget question is higher, on the Ladder, than her husband's. This conclusion is confirmed by the marginal effects analysis in Table A1 in Appendix A. The marginal effects are almost the same in absolute value for the first and third categories of the dependent variable, so the result is symmetric. The wage ratio is therefore a powerful determinant of the outcome of intra-household bargaining. Another variable which influences the distribution of full income among household members is the age difference, here the wife's age minus her husband's age. The estimated coefficient on this variable is negative and significant: the older the woman is relative to her husband, the lower the probability of the woman's higher response. The effect of the age difference can be interpreted as showing the greater bargaining power of women who are relatively younger compared to their husbands. On the other hand, we find no significant effect of the difference in partners' education levels on the distribution of income within the household.

These results are in accordance with the predictions of the collective model and strongly support the assumption made throughout the paper that the answers given to the budget question do correspond to individual income shares, which themselves are the result of a bargaining process. In the case of the unitary model of household behavior, the total individual income of each partner would be the same and the discrepancies in self reported levels would be random and thus not related to the wages or to age differences as is found here.

Note that the correlations between domestic labor supplies and the sharing rule are low and insignificant (ρ_1 and ρ_2 in Table 6). This result provides some support for our further assumption that the surplus from domestic production (profit Π in the theoretical model) is negligible compared to other sources of household income.[12] In the empirical analysis of what follows, we thus assume that household production is evaluated at its costs, i.e. using the level of wages.

To check the robustness of our results we run the estimation of the index equation only, dropping the equations for household work. The estimation results

[11]For each household, the data give information upon the different sources of income. Household non-labor income is obtained as the sum of all the different types of non-labor income.

[12]In order to avoid the result that the model has only corner solutions, and because our results hold with a larger class of functions, we do not assume constant returns to scales. Note that we do not assume either that the profit is *exactly* zero. What we have to assume here is that the profit is *negligible* compared to other sources of income, which does not imply constant returns to scales.

are presented in Appendix A, Table A2. Not surprisingly, given the low correlations found, the estimation of simple ordered probit model for the intra-household inequality index gives very similar results (Table A2).[13]

The results of our estimation show that the wage and age differentials are important determinants of intra-household inequality. These results support the choice of the collective model to analyze the intra-household allocation of income.

We now turn to the second main objective of the paper, namely the identification of the sharing rule.

3. Identifying the Sharing Rule: A New Method

According to a basic result of the collective model (Chiappori, 1988, 1997), the sharing rule identification is ascertained up to a constant by examining the labor market behavior of both spouses. Here, additional information on the budget levels of the household members provides us with a supplementary constraint allowing complete identification of the sharing rule.

The derivatives of the sharing rule can be computed using the estimated parameters of the simultaneous estimation of total labor supply (market plus domestic work):

$$H_f = \boldsymbol{\beta}_f \mathbf{Q} + v_1 \tag{3.1}$$
$$H_m = \boldsymbol{\beta}_m \mathbf{Q} + v_2$$

with $H_i = h_i + t_i$, $i = f, m$

where $\boldsymbol{\beta}_i$ are the parameter vectors, and $\mathbf{Q} = (w_f, w_m, y_f, y_m, \mathbf{s}, \mathbf{z})$ is a vector whose components are the individuals' specific characteristics and household-specific distribution factors; v_1 and v_2 are the error terms.

The next step is to identify the constant of the sharing rule, as well as its derivatives. To do this, assume that Π is observable (which is not the case), $\Phi_f(w_f, w_m, y_f, y_m, \mathbf{s}, \mathbf{z})$ can be recovered from the sample of households who share full income (approximately) equally. For this sample, we have:

$$\Phi_f = \Phi_m = \frac{1}{2}\left[\left(w_m + w_f\right)T + y + \Pi\right]. \tag{3.2}$$

Unfortunately, Π can never be observed. We thus assume, in addition, that, empirically, the surplus from domestic production is negligible compared to other sources of household income. This is equivalent to assuming that household production is evaluated at its market costs, i.e. wages.

The empirical justification for this assumption is the low values found for the correlations between domestic labor supply and the sharing rule equations (ρ_1 and ρ_2 in equations (2.3) above). The correlation between men's hours of domestic

[13]In addition we have looked for the presence of unobserved individual heterogeneity in the answers. We have approximated the differences in the two partners' responses by a continuous variable and regressed it using an OLS with fixed effects. The results have shown that unobserved heterogeneity, which is sometimes thought to be important in subjective data, is in fact negligible here. Indeed, the "between" R^2 indicates a low contribution of invariant effects. Given this result along with a poor quality of the panel dimension of our dataset, we use a pooling of the data throughout the paper.

work and the index of intra-household inequality is negative, low in absolute value and insignificant (–0.03). For women, the correlation is also small, negative (–0.06), and significant at the 10 percent level. With regard to households where both members participate in the labor market, Π is the only channel in the theoretical model through which domestic work and the sharing rule could be correlated; these findings support the assumption that we make above. According to the model presented in Section 1, the source of these correlations would be household production profit. The significant correlations would mean that the sharing rule is affected by time allocation to the domestic work via its profit. Our results, by contrast, mean that the unobserved characteristics affecting the household (productivity, unobserved inputs . . .) do not influence the sharing rule much as compared with market work characteristics.

Here, we propose a direct identification method, based on the additional condition provided by our index of intra-household equality introduced in Section 2. The method consists of a two-stage estimation.

3.1. *Econometric Model*

In theory, the estimation of the total labor supplies of the two household members on the sub-sample of the couples for whom full income shares are fully "observed" should allow us to identify the individual shares of full income for the rest of the sample. In order to take into account the budget constraint $\Phi_f + \Phi_m = \Phi$, we estimate rather the ratio of full income shares. The total labor supplies of the two household members are:

$$\begin{cases} H_f = \alpha_f + \beta_f \ln \Phi_f + \boldsymbol{\gamma}_f \mathbf{X}_f + e_f \\ H_m = \alpha_m + \beta_m \ln \Phi_m + \boldsymbol{\gamma}_m \mathbf{X}_m + e_m \end{cases} \tag{3.3}$$

where $(\alpha_f, \alpha_m, \beta_f, \beta_m)$, $\boldsymbol{\gamma}_f, \boldsymbol{\gamma}_m$ are the parameter vectors; $\mathbf{X}_f$ and $\mathbf{X}_m$ are respectively the vectors of female and male individual characteristics; e_f, e_m are the error terms which are assumed to have a joint distribution.

Using the sub-sample S_1 of households who are assumed to share full income equally, i.e. here the sub-sample of couples for whom the index value calculated above is 1 (the same answer, plus or minus one, to the subjective ladder question), we obtain:

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

Or, assuming Π to be very small,

$$\Phi_f = \Phi_m = \frac{1}{2}\left[\left(w_m + w_f\right)T + y\right]. \tag{3.4}$$

The system (3.3) can then be estimated using this sub-sample.

In this first stage the vectors of parameters $(\alpha_f, \alpha_m, \beta_f, \beta_m)$, $\boldsymbol{\gamma}_f, \boldsymbol{\gamma}_m$ can be identified.

Note that the probability mass corresponding to the index value of 1 is continuously spread over the interval $[\Phi_f^* - k_1; k_2 - \Phi_f^*]$ with

$\Phi_f^* = 1/2\lfloor (w_m + w_f)T + y \rfloor$ rather than being concentrated at the point Φ_f^*. Thus for those individuals belonging to the sub-sample S_1 the hypothesized equality between partners' full incomes holds only approximately: we have made this choice (see Section 2 above) in order to make our formal definition of equality at the same time less restrictive and more realistic. According to our interpretation, the measures of Φ_f and Φ_m as $1/2[(w_m + w_f)T + y]$ are subject to error, implying that the estimators are biased towards zero (Greene, 2000). This bias can be corrected by using the results obtained from the ordered probit model.[14]

Another source of bias is sample selection when we use the sub-sample of couples for whom the index value is 1. We correct for this selection bias by using the results from the ordered probit model. The method and demonstration are contained in Appendix B1.

A vector of parameters $\boldsymbol{\delta}$ is identified in the second stage by estimating (3.5) and using the whole sample of households.

$$ln\,\hat{R} = \boldsymbol{\delta}\mathbf{X} + u \tag{3.5}$$

where $\mathbf{X} = (w_f, w_m, y_f, y_m, \mathbf{s}, \mathbf{z})$; $ln\,\hat{R}$ is the predicted logarithm of the ratio between the man's and the woman's shares:

$$ln\hat{R} = \left(H_f - \alpha_f - \boldsymbol{\gamma}_f \mathbf{X}_f\right)/\beta_f - (H_m - \alpha_m - \boldsymbol{\gamma}_m \mathbf{X}_m)/\beta_m \tag{3.6}$$

and the error term $u = \lambda + e_f/\beta_f - e_m/\beta_m$.

Finally the shares Φ_f and Φ_m are calculated using the predicted sharing ratio $\hat{R} = \dfrac{\Phi_f}{\Phi_m}$ and their sum equalized to (observed) full income: $\Phi = \Phi_f + \Phi_m = (w_f + w_m)T + y$.

The method of estimation is SURE in the first stage and weighted OLS in the second stage (the method is detailed in Appendix B2).

3.2. *Sharing Rule: Marginal Effects*

The shares Φ_f and Φ_m can be defined using the sharing ratio $R = \dfrac{\Phi_f}{\Phi_m}$ and their sum equalized to (observed) full income: $\Phi = \Phi_f + \Phi_m = (w_f + w_m)T + y$. These two constraints on the shares allow to get the following expressions for Φ_f and Φ_m:

$$\Phi_f = \frac{\Phi R}{1+R} \quad \Phi_m = \frac{\Phi}{1+R}. \tag{3.7}$$

Then the marginal effects of wages on the individual shares can be obtained using the sharing rule elasticities:

[14]The correction procedure is shown in Kalugina *et al.* (2007).

$$\frac{\partial \Phi_f}{\partial w_i} = \frac{R(1+R)\partial\Phi/\partial w_i + \Phi\partial R/\partial w_i}{(1+R)^2} = \frac{R(1+R)T + \Phi\partial R/\partial w_i}{(1+R)^2}$$

$$\frac{\partial \Phi_m}{\partial w_i} = \frac{(1+R)\partial\Phi/\partial w_i - \Phi\partial R/\partial w_i}{(1+R)^2} = \frac{(1+R)T - \Phi\partial R/\partial w_i}{(1+R)^2}$$

3.3. *Estimation Results*

3.3.1. Labor Supply Estimations

The explanatory variables used in the total labor supply estimations (market plus household work) are the natural logarithm of the individual's full income calculated using (3.4), individual age and age squared, household characteristics (number of children, presence of elderly persons, possession of durables such as a car, a washing machine), type of settlement and if the household is living in Moscow–St. Petersburg. The estimates are reported in Table C1 (Appendix C).

The main results are as follows. The total labor supply of both household members is positively correlated with their individual full incomes and is negatively correlated with their wage rates. This implies a negative relationship between (true) leisure and wages, which, in turn, can be interpreted as incomes being so low that leisure is a very expensive good: the substitution effect dominates the income effect.

3.3.2. Estimation of the Sharing Rule

The dependent variable in the sharing rule equation is the predicted ratio between the female and male shares of full income, $\hat{R}$. The vector of explanatory variables includes the natural logarithms of the wage rates and their squares, and the same individual and household characteristics as in Section 2 except assets and possession of durables.

The results of the sharing rule estimation are presented in Table 7. Due to the non-linearity of the estimated equation in terms of wages, the elasticity of the dependent variable with respect to wages is defined by both a constant term and a term which depends on the corresponding wage.[15] The resulting elasticities are given in Table 8. The ratio mean being close to 1, the marginal effects of the other variables on the sharing ratio can be observed directly in Table 7.

The sharing rule elasticities with respect to the wages are strong and statistically significant. The effect of women's wages on the sharing ratio is positive, so that the effect of women's wages on the woman's share is positive and stronger than its effect on the men's share. Symmetrically, the effect of men's wages on the sharing ratio is negative, so that the effect of male wage on the man's share is

[15] $\frac{\partial \ln R}{\partial \ln w_i} = b_1 + b_2 \ln w_i$, $i = f, m$; where b_1 and b_2 are the regression coefficients on the linear and squared terms respectively.

TABLE 7

WEIGHTED OLS ESTIMATION OF THE SHARING RULE

Ln of sharing ratio $\hat{R} = \frac{\Phi_f}{\Phi_m}$	
Ln of woman's wage rate	1.59***
	(0.022)
Ln of man's wage rate	–0.94***
	(0.069)
Ln of woman's wage rate squared	–0.01
	(0.006)
Ln of man's wage rate squared	0.004
	(0.015)
Non-labor income/100	–0.003***
	(0.0006)
Man's age	–0.002
	(0.002)
Age difference[a]	–0.17***
	(0.003)
Years of man's education	–0.19***
	(0.004)
Woman has higher degree of education than man	0.44***
	(0.028)
Number of children 0–6 years old	–0.09***
	(0.016)
Number of children 7–18 years old	0.53***
	(0.017)
Number of elderly persons in the household	0.54***
	(0.021)
Rural	–0.02
	(0.047)
Moscow–St. Petersburg	–0.27***
	(0.058)
Round 5	0.85***
	(0.046)
Round 6	0.37***
	(0.027)
Round 8	–0.08**
	(0.030)
Constant	–0.12
	(0.119)
Number of observations	2,174

Notes: Standard errors in parentheses.

[a]Age difference: the difference between the woman's age and the man's age.

Source: Russia Longitudinal Monitoring Survey, rounds V–VIII (1994–98).

positive and stronger than its effect on the woman's share. The effect of women's wages is stronger than that of men's wages. The results are consistent with the presence of intra-household bargaining.

Table 7 shows that the effect of non-labor income is found to be significant and negative, exerting thus a negative effect on the woman's share and a positive effect on the man's share. However, as the variable is not individualized, non-labor income cannot be considered as a distribution factor in the household decision process.

TABLE 8
ELASTICITIES OF THE SHARING RULE WITH RESPECT TO THE WAGE RATES

	Elasticities
$\partial lnR/\partial lnw_f$	1.544***
	(0.022)
$\partial lnR/\partial lnw_m$	–0.919***
	(0.023)

Notes: Standard errors in parentheses; ***significant at the 1% level.

Source: Russia Longitudinal Monitoring Survey, rounds V–VIII (1994–98).

The effects of the other variables confirm the results of the model test presented in Section 2. Indeed, once again, the age difference effect is negative and significant, showing the greater bargaining power of women who are relatively younger compared to their husbands. In addition, the sharing ratio decreases with the man's education and is strongly higher if the woman's level of education is higher than her husband's. Hence, differences in education have a large impact on full-income sharing in the household.

The number of children 7–18 years old exerts a positive effect on the sharing ratio, while that of young children (under 7 years old) is negative. The negative effect can be explained partly by the fact that the woman's working time increases more than the man's in the presence of young children (Appendix C, Table C1). The opposite effects of the presence of younger and older children could indicate that younger children diminish women's bargaining power by decreasing their value on the marriage market, while it is not the case for older children.

The number of elderly people has a positive impact on the sharing ratio, and hence exerts a positive effect on the woman's share. Given its negative impact on the woman's total working hours (Appendix C, Table C1), the positive effect on the sharing rule can be explained by elderly people participating in domestic work.[16]

3.3.3. Identification Results

The identification results can be summarized by Figure 1, depicting calculated relative full budget shares as a function of relative wages, and Table 9, showing the means and medians of the budget shares calculated using (3.7).

Plotting calculated relative full budget shares as a function of relative wages for the whole sample (Figure 1) confirms that the wage difference within the

[16]As for older children , the positive impact found could only reflect the fact that the woman's share also includes the dependant's share: her own *true* share could in fact have decreased. But there is no way of disentangling the two interpretations. In its actual development, the collective model of labor supply is not very appropriate for household public good nature such as children or other dependants. The works trying to relax such a constraint imply too strong theoretical and empirical restrictions: a solution of Chiappori and Ekeland (2005) requires restrictions on marginal utilities and existence of a good consumed by only one household member; Michaud and Vermeulen (2006) propose a model identification allowing for externalities while assuming the same preferences for individuals living in couples and alone.

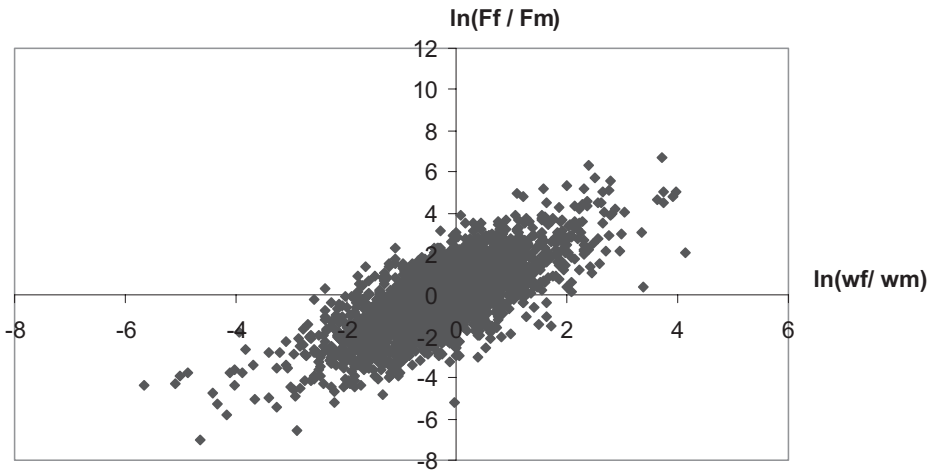

Figure 1. Relative Full Budget Shares ($\ln(\Phi_F / \Phi_M)$ as a Function of Relative Wages ($LN(W_F/ W_M)$)
Source: Russia Longitudinal Monitoring Survey, rounds V–VIII (1994–98).

TABLE 9
MEANS AND MEDIANS OF THE CALCULATED BUDGET SHARES

	Woman's Budget Share, Φ_f	Man's Budget Share, Φ_m	Full Budget, $\Phi_f + \Phi_m$
Mean	14,059 (47%)	15,709 (53%)	29,768
Median	7,367 (47%)	8,195 (53%)	15,562

Source: Russia Longitudinal Monitoring Survey (rounds V–VIII).

household is a strong determinant of the intra-household sharing of resources. Indeed, one's relative budget share is clearly increasing with increase of one's relative wage.[17]

The average ratio of wife/husband wage rates given by our sample is of about 75 percent with female wage rate of about 9 roubles and male wage rate of 12 roubles. As may be expected, on average, the woman's share is inferior to that of man: looking at Table 9, it can be seen that women's share of household total income is 47 percent.

The marginal effects of wages on the sharing rule calculated at wages means and median value of the sharing ratio $R = 0.9$ are given in Table 10.

A numerical example based on the average wage rates and average household characteristics shows less equal sharing (Table 11). Consider an average Russian household, represented by a 39-year-old woman earning 9 roubles per hour, whose husband is 41 years old, earning 12 roubles per hour. Assume that they have a

[17]Relative shares and wages are presented in logarithms in order to linearize the function of interest.

TABLE 10

Marginal Effects of Wage Rates on the Sharing Rule

	Marginal Effects
$\partial R/\partial w_f$	0.100***
	(0.001)
$\partial R/\partial w_m$	–0.050***
	(0.001)
$\partial \Phi_f/\partial w_f$	925***
	(5.52)
$\partial \Phi_f/\partial w_m$	48***
	(5.26)
$\partial \Phi_m/\partial w_f$	–253***
	(6.1)
$\partial \Phi_m/\partial w_m$	623***
	(5.26)

Notes: Standard errors in parentheses.
Source: Russia Longitudinal Monitoring Survey (rounds V–VIII).

TABLE 11

Predicted Impact of Various Changes in the Covariates on the Probability of Equal Full Income Sharing and on the Shares of the Two Partners

		P0 (%)	P1 (%)	P2 (%)	Φ_f	Φ_m	R (Φ_f/Φ_m)	$\Delta\Phi_f$	$\Delta\Phi_m$
1	Values at the variables mean	11	79	10	6,256	10,427	0.6		
		(5.84)	(0.95)	(5.81)	(132)	(132)	(0.019)		
2	$\Delta w_f = 1$ rouble				7,146	10,210	0.7	890	–217
					(135)	(135)	(0.022)	(20)	(20)
3	$\Delta w_m = 1$ rouble				6,200	11,156	0.5	–56	729
					(159)	(159)	(0.021)	(58)	(58)
4	$\Delta\ w_f = w_f - w_m$	10	79	11	8,857	9,844	0.9	2,601	–583
		(5.87)	(0.96)	(5.84)	(146)	(146)	(0.03)	(51)	(51)
5	A second younger child	10	82	9	5,834	10,850	0.54	–423	423
		(6.03)	(0.95)	(5.99)	(134)	(134)	(0.019)	(63)	(63)
6	A second older child	10	79	11	8,319	8,365	0.99	2,062	–2,062
		(5.92)	(0.96)	(5.89)	(158)	(158)	(0.034)	(75)	(75)
7	An elderly person	10	79	11	8,361	8,324	1	2,104	–2,104
		(6.07)	(0.96)	(6.03)	(141)	(141)	(0.034)	(89)	(89)
8	Woman's higher degree	9	80	11	7,943	8,741	0.91	1686	–1,686
		(5.63)	(0.96)	(5.61)	(148)	(148)	(0.032)	(114)	(114)

Notes: Standard errors in parentheses.
P0: Probability of the index taking a value of 0 (wife reports being poorer).
P1: Probability of the index taking a value of 1 (equality).
P2: Probability of the index taking a value of 2 (wife reports being richer).
$\Delta\Phi_f$: Change in woman's share.
$\Delta\Phi_m$: Change in man's share.
Δw_f: Woman's wage rate change with respect to the control value.
Δw_m: Man's wage rate change with respect to the control value.
Source: Russia Longitudinal Monitoring Survey, rounds V–VIII (1994–98).

7-year-old child (or older), that both received 12 years of education, that the family lives in a city in the Urals, and that the wave chosen for this exercise is of round 7. The variables used in these calculations for the shares and transfers refer to monthly incomes.

The model yields an estimated probability of 79 percent that husband and wife report equality in the sharing of income as measured by our index, *I*, with the full incomes of the household members amounting to 6,256 roubles for the woman and 10,427 for the man (Table 11, line 1).

Now assume that the woman's wages are the same as her husband's (Table 11, line 4). The probability that the wife receives a lower share decreases to 10 percent as compared to 11 percent in the initial situation and predicted income sharing approaches equality, with a ratio between shares of 0.9 (as compared to 0.6).

A one rouble increase in the woman's wage rate leads to a slightly less unequal sharing of household full income, with 7,146 roubles allocated to the wife and 10,210 allocated to the husband. A one rouble increase in the man's wage rate has a symmetric effect with slightly more equal sharing of the extra income (Table 11, lines 2 and 3 respectively).

Assume now that the family has another child, aged between 7 and 18; then the probability of the wife receiving a larger share increases to 11 percent and full income would be reallocated with about 2,100 roubles passing from husband to wife (Table 11, line 6). The same reallocation is predicted if there is an elderly person (Table 11, line 7). Therefore, the presence of older children and elderly persons increases the woman's bargaining power. By contrast, a younger child decreases her part by 423.

The wife's education being higher than her husband's (for example, higher education versus technical studies) has a strong effect on the sharing of full income, with the woman now receiving 48 percent of the total income (Table 11, line 8) compared to 38 percent at the variables mean.

Concluding Remarks

In this paper we have proposed an application of the collective model to the analysis of intra-household inequality using self-reported budget scales. We use a collective model taking into account household production. The results contradict the unitary model and support the assumptions of the collective model, as well as those of any bargaining model of the household. The wage difference within the household is indeed found to be a strong determinant of the intra-household sharing of resources.

We then set out a new method of identification of the sharing rule. Using the results obtained from couples who report the same level of budget, and interpreting this as equal income-sharing, we are able to identify the sharing rule for the whole sample. The results are consistent with those predicted by the model: as expected, wages and education level exert a strong influence on the sharing rule, with an increase in one's wage increasing one's own share and decreasing the partner's share. Perhaps more unexpected is the positive effect of children older than 7 and of elderly persons on the wife's share. This seems to indicate that variables other than those related to market wages or non-labor income can influence intra-household bargaining. Exploring this result further should be the aim of future research, from both an empirical as well as a theoretical point of view.

Appendix A

Index of Intra-Household Inequality

TABLE A1

Marginal Effects (FIML estimation of model (2.3)) [a]

	Marginal Effects for the Ordered Probit		
	dP(0)/dX3	dP(1)/dX3	dP(2)/dX3
Ln of man's wage rate	0.016***	–0.001	–0.015***
	(0.005)	(0.001)	(0.005)
Ln of woman's wage rate	–0.031***	0.002	0.029***
	(0.006)	(0.002)	(0.006)
Age difference[b]	0.002*	–0.0002	–0.002*
	(0.001)	(0.0001)	(0.001)
Male education (years)	0.002	–0.0001	–0.002
	(0.002)	(0.0002)	(0.002)
Woman has higher degree of education than man	–0.012	0.001	0.011
	(0.012)	(0.0009)	(0.012)
Household non-labor income/100	0.00004	–0.000003	–0.00004
	(0.00006)	(0.000005)	(0.00005)
Number of children 0–6 years old	–0.003	–0.0002	0.003
	(0.011)	(0.0007)	(0.01)
Number of children 7–18 years old	–0.011*	0.0007	0.010*
	(0.007)	(0.0009)	(0.006)
Number of elderly persons in the household	–0.014	0.0009	0.013
	(0.011)	(0.001)	(0.01)
Ln of living space (sq. meters)	0.006	–0.0004	–0.006
	(0.015)	(0.001)	(0.014)
Family is working on an individual plot	0.004	–0.0002	–0.004
	(0.013)	(0.0006)	(0.012)
Moscow–St. Petersburg	0.003	–0.0002	–0.003
	(0.017)	(0.0017)	(0.016)
Round 5	–0.02	0.001	0.02
	(0.015)	(0.001)	(0.015)
Round 6	–0.01	0.0003	0.01
	(0.015)	(0.0006)	(0.015)
Round 8	–0.005	0.0002	0.004
	(0.016)	(0.0006)	(0.016)
Number of observations	1,916		

Notes: Standard errors in parentheses; *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.

[a]The dependent variable is the index of intra household inequality: 0, the wife reports being poorer than her husband; 1, there is no difference; 2, the wife reports being richer than her husband.

[b]Age difference: the difference between the woman's age and the man's age.

Source: Russia Longitudinal Monitoring Survey, rounds V–VIII (1994–98).

TABLE A2

INDEX OF INTRA-HOUSEHOLD INEQUALITY (ORDERED PROBIT ESTIMATION)[a]

	Index[a]
Ln of man's wage rate	0.168***
	(0.035)
Wage difference[b]	0.079**
	(0.037)
Age difference[c]	–0.013*
	(0.007)
Male education (years)	–0.011
	(0.012)
Woman has higher degree of education than man	0.067
	(0.068)
Household non-labor income	–0.0002
	(0.0003)
Number of children 0–6 years old	0.017
	(0.062)
Number of children 7–18 years old	0.061*
	(0.037)
Number of elderly persons in the household	0.076
	(0.060)
Ln of living space (sq. meters)	–0.036
	(0.079)
Moscow–St. Petersburg	–0.020
	(0.071)
Round 5	–0.019
	(0.094)
Round 6	0.089
	(0.083)
Round 8	0.044
	(0.085)
Ancillary parameters	0.025
	(0.092)
k_1	0.168***
	(0.035)
k_2	0.079**
	(0.037)
Number of observations	1,916
Log likelihood	–1,245.59

Notes: Standard errors in parentheses; *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.

[a]The dependent variable is the index of intra household inequality: 0, the wife reports being poorer than her husband; 1, there is no difference; 2, the wife reports being richer than her husband.

[b]Wage difference: the difference between ln of woman's real wage rate and ln of man's real wage rate.

[c]Age difference: the difference between woman's age and man's age.

The reference categories are: Urban versus Rural, round 7 for wave.

Source: Russian Longitudinal Monitoring Survey, rounds V–VIII (1994–98).

APPENDIX B

B1 Correction of the Selection Bias

The correction term Ratio1 of the selection bias in the labor supply equations is constructed as follows:

$$E(e_i|I=1)=E(E(e_i|\varepsilon)|I=1)=M_1\left(\sigma_{e_i\varepsilon}\right)E(\varepsilon|I=1),$$

where $M_2(\sigma_{e_i\varepsilon})$ is a coefficient depending on the covariance between ε and e_i to be estimated, $i = 1, 2$.

$$\text{Ratio } 1 = E(\varepsilon|I=1) = E\left(\varepsilon\left|z^1 < \varepsilon < z^2\right.\right) = \frac{f(z^1) - f(z^2)}{F(z^2) - F(z^1)},$$

where $f(.)$, $F(.)$ are the standard normal density and cumulative density functions respectively.

B2 Weighted OLS

The method of estimation in the first step is 3SLS.

The second step requires linear equation estimation (3.5). The dependent variable is the predicted logarithm of the sharing ratio. The method of weighted least squares is applied at this stage.

The econometric model presented in Section 3.1 is motivated by the non-availability of the individual shares. The problem is solved by using additional information on the sharing rule presented by the equality index: the key assumption made here is that in the case of equality of the answers as measured by the equality index, the individual shares are assumed to be half of the household full income.

Thus, in the first stage we use the information on the allocated income shares using the sub-sample of households who gave the same answer. The remaining sub-sample does not allow measuring the shares, but it provides some information about the sharing: indeed, as it is shown in Section 2, the whole sample provides the distribution of the equality index. This information is used in the second stage by comparing this distribution with the predicted values of the sharing ratio obtained with the parameters of equation (3.7). It allows construction of the 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. The resulting generalized least squares estimator is asymptotically the best among the least squares estimators (Gourieroux and Monfort, 1995). Thus, confronting the sharing ratios predicted in the first stage of the identification study with ordered probit results from the previous section allow control of the quality of predictions and obtaining more efficient estimators of the sharing rule.

The weights w are defined as

$$w = \frac{1}{Var(u|\mathbf{Z})} = \frac{1}{E\left(\ln \hat{R} - k\boldsymbol{\gamma}\mathbf{Z}\left|\mathbf{Z}\right.\right)^2}$$

with $\boldsymbol{\gamma}\mathbf{Z}$ being the predicted latent variable corresponding to the equality index estimation (2.2). It can easily be shown[18] that:

[18]The deviation is detailed in Kalugina *et al.* (2007).

$$k = \frac{E\left(\ln \hat{R} \middle| \mathbf{Z}\right)}{E\left(g^* \middle| \mathbf{Z}\right)} = \frac{\ln \bar{\hat{R}}}{\boldsymbol{\gamma}\bar{\mathbf{Z}}}.$$

Appendix C

TABLE C1

Seemingly Unrelated Regressions: Estimation of Woman's and Man's Total Labor Supply

	Woman's Total Labor Supply	Man's Total Labor Supply
Ln of individual full income ($\Phi_f = \Phi_m$)	10.2*	9.75*
	(5.70)	(5.45)
Ln of woman's wage rate	–23.7***	
	(6.99)	
Ln of man's wage rate		–27***
		(4.12)
Woman's age	3.4	
	(2.27)	
Woman's age squared	–3.75	
	(2.87)	
Man's age		3.15*
		(1.73)
Man's age squared		–4.7**
		(2.08)
Number of children 0–6 years old	66.7***	26.12***
	(5.50)	(4.19)
Number of children 7–18 years old	27.9***	7.66***
	(3.72)	(2.74)
Number of elderly persons in the household	–2.28	1.15
	(5.42)	(3.84)
Automobile owned	9.47*	19***
	(5.23)	(4.02)
Washing machine owned	–5.15	5.81
	(8.85)	(6.79)
Rural	14.7*	–4.65
	(8.67)	(5.72)
Moscow–St. Petersburg	7.6	15.5***
	(7.73)	(5.92)
Round 5	16.3**	4.76
	(7.44)	(5.54)
Round 6	–2.96	1.67
	(7.42)	(5.64)
Round 8	–12.54	–12.42
	(8.02)	(6.12)
Ratio1	86.32*	–25.8
	(47.7)	(24.9)
Constant	166.8***	134**
	(58.9)	(53.8)
Number of observations	1,729	1,729

Notes: Standard errors in parentheses; *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.

The reference categories are: Urban versus Rural, region other than Moscow and St. Petersburg, Round 7 for round of observation.

Source: Russia Longitudinal Monitoring Survey, rounds V–VIII (1994–98).

References

Apps, Patricia F. and Ray Rees, "Collective Labor Supply and Household Production," *Journal of Political Economy*, 105(1), 178–90, 1997.

Bonke, Jens and Martin Browning, "The Distribution of Well-Being and Income Within the Household," University of Copenhagen, Department of Economics, CAM Working Paper No. 2003-01, January 2003.

Bourguignon, François J. and Maria C. Chiuri, "Labor Market Time and Home Production: A New Test for Collective Models of Intra-Household Allocation," CSEF Working Paper 131, March 2005.

Browning, Martin, Pierre-André Chiappori, and Arthur Lewbel, "Estimating Consumption Economies of Scale, Adult Equivalence Scales, and Household Bargaining Power," Boston College Working Papers in Economics, No. 588, August 2006.

Chiappori, Pierre-André, "Rational Household Labor Supply," *Econometrica*, 56, 63–89, 1988.

———, "Collective Labor Supply and Welfare," *Journal of Political Economy*, 100(3), 437–67, 1992.

———, "Introducing Household Production in Collective Models of Labor Supply," *Journal of Political Economy*, 105(1), 191–209, 1997.

Chiappori, Pierre-André and Ivar Ekeland, "The Micro Economics of Group Behaviour: Identification," Mimeo, Columbia University, May 2005.

Chiappori, Pierre-André, Bernard Fortin, and Guy Lacroix, "Marriage Market, Divorce Legislation and Household Labor Supply," *Journal of Political Economy*, 110(1), 37–72, 2002.

Clark, Andrew and Andrew J. Oswald, "Unhappiness and Unemployment," *Economic Journal*, 104(424), 648–59, 1994.

Diener, Ed, "Subjective Well-Being," *Psychological Bulletin*, 93(3), 542–75, 1984.

Diener, Ed, Eunkook M. Suh, E. Richard, and Heidi L. Smith, "Subjective Well-Being: Three Decades of Progress," *Psychological Bulletin*, 125(2), 276–302, 1999.

Easterlin, Richard A., "Income and Happiness: Towards a Unified Theory," *Economic Journal*, 111(473), 465–84, 2001.

Ferrer-i-Carbonell, Ada, "Subjective Questions to Measure Welfare and Well-Being," Tinbergen Institute Discussion Paper 2002-020/3, January 2002.

Ferrer-i-Carbonell, Ada and Paul Frijters, "How Important is Methodology for the Estimates of the Determinants of Happiness?" *Economic Journal*, 114(497), 641–59, 2004.

Fortin, Bernard, Anyck Dauphin, Abdel-Rahmen El Lhaga, and Guy Lacroix, "Assessing the Number of Household Decision-Makers," Mimeo, Laval University, April 2008.

Greene, William H., *Econometric Analysis*, 4th edition, Prentice-Hall, Englewood Cliffs, 2000.

Gourieroux, Christian and Alain Monfort, *Statistics and Econometric Models*, Volume II, Cambridge University Press, 1995.

Kalugina, Ekaterina, Natalia Radtchenko, and Catherine Sofer, "How Do Spouses Share their Full Income? Identification of the Sharing Rule Using Self-Reported Income," CREST Working Paper 2007-07, 2007.

Michaud, Piere-Carl and Frederic Vermeulen, "A Collective Labor Supply Model: Identification and Estimation in the Presence of Externalities by Means of Panel Data," Rand Working Paper WR-406, July 2006.

Ng, Yew-Kwang, "Happiness Surveys: Some Comparability Issues and an Exploratory Survey Based on Just Perceivable Increments," *Social Indicators Research*, 38(1), 1–27, 1996.

Plug, Erik J. S. and Bernard M. S. Van Praag, "Similarity in Response Behavior Between Household Members: An Application to Income Evaluation," *Journal of Economic Psychology*, 19(4), 497–513, 1998.

Rapoport, Benoît, Catherine Sofer, and Anne Solaz, "La production domestique dans les modèles collectives," *Actualité Economique*, 82(1–2), 247–70, 2006.

———, "Household Production in a Collective Model: Some New Results," *Journal of Population Economics*, 2009, forthcoming.

Ravallion, Martin and Michael Lokshin, "Who Wants To Redistribute? The Tunnel Effect in 1990s Russia," *Journal of Public Economics*, 76(1), 87–104, 2000.

———, "Identifying Welfare Effects from Subjective Questions," *Economica*, 68(271), 335–57, 2001.

———, "Self-Rated Economic Welfare in Russia," *European Economic Review*, 46(8), 1453–73, 2002.

Senik, Claudia, "What Can we Learn from Subjective Data? The Case of Income and Well-Being," *Journal of Economic Surveys*, 19(1), 43–63, 2005.

Veenhoven, Ruut, *Happiness in Nations, Subjective Appreciation of Life in 56 Nations 1946–1992*, Erasmus University Rotterdam, 1993.

Winkelmann, Liliana and Rainer Winkelmann, "Why are the Unemployed So Unhappy? Evidence from Panel Data," *Economica*, 65(257), 1–15, 1998.