Intra-household Allocation of Time to Household Production Activities-Evidence From Swedish Household Data*

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Abstract

The purpose of this paper is to study the intra-household allocation of time to several household production activities using Swedish cross-sectional household data. The Tobit model is rejected in favor of the Cragg model, suggesting that the intra-household time allocation is best modeled by a two step procedure. Moreover, when household production is defined as the sum of different household activities, the results differ substantially from the case when each household activity is separately estimated. The parameter estimates also indicate that presence of children are more important than economic factors in determining the intra-household allocation of time.

1 Introduction

In this paper, the intra-household allocation of time to several household work activities is analyzed. Most previous time allocation studies (e.g., Gronau (1976), Wales and Woodland (1977), Graham and Greene (1984) and Aronsson, Daunfeldt and Wikström (2001)), have defined household work as an aggregate of different home activities. Results from these studies generally suggest that household characteristics are important in determining the allocation of time within the household. On the other hand, economic factors (e.g., relative wages) seem to have less influence on the intra-household allocation of time to household production. However, the results from these studies are not directly comparable since the definition of household work differs between the studies. Moreover, although this approach explicitly considers household production, nothing can be said about the intra-household allocation of time to different household work activities. In addition, Kooreman and Kapteyn (1987) have shown that wage and

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income effects that are present in a disaggregate analysis may disapear when household production is defined as the sum of different home activities.

The purpose of this paper is to analyze the intra-household allocation of time to different household work activities using repeated Swedish cross-sectional household data. To take the individualistic element of the household members into consideration, the theoretical model underlying the empirical study is based on a cooperative bargaining model (see e.g., Manser and Brown (1980) and McElroy and Horney (1981)). This is in contrast to the study by Kooreman and Kapteyn (1987), where each household member is assumed to maximize a single household utility function. This so called unitary model has lately received both theoretical and empirical criticism (for overviews, see e.g., Alderman et al (1995) and Browning and Chiappori (1997)).

One empirical problem is that the time allocated to various household production activities is frequently reported to be zero. This problem is often handled by a Tobit model where all zeros are considered as the outcome of choice, i.e., they are assumed to arise because the individual household member genuinely does not participate in the observed activity. However, the Tobit model is not suitable if zeros originate from the infrequency of time use interviews. The Tobit model does not either consider that it may be different processes underlying the participation and the household work decision. To take into account that zeros may originate from the method of data collection and/or from a separate process determining the participation decision, a version of the Cragg (1971) model developed by Lin and Schmidt (1984) is estimated. This model has the advantage that it nests the Tobit model, and therefore a likelihood ratio test between the two models can determine which model, the Cragg or the Tobit, best fits the data.

The article is organized as follows: In the next section the theoretical model is presented. Section 3 contains a description of the data used in the empirical study. In Section 4 the empirical model is described and the estimation results are presented. Finally, Section 5 concludes the article.

2 Theory

Consider a household with two decision-makers ($i = m, f$) where m denotes the male and f denotes the female. As a basis for the analysis, a cooperative bargaining model is used where each individual divides total time, H, between: leisure, l_i, market work, h_i, and a set of household production activities t_i^j; $t_i = \sum_{j=1}^{J} t_i^j$.

Assume that individual i is characterized by the following strictly increasing, quasi-concave and twice differentiable utility function

$$u^i(l_i, c_i, \mathbf{x}; \mathbf{z}_i), \qquad i = m, f,$$

where c_i is consumption of a Hicksian commodity good, $\mathbf{x}$ is a vector of public goods

($\mathbf{x} = [x^1, x^2, ..., x^J]$) produced within the household and $\mathbf{z}_i$ is a vector of personal characteristics. The household production function for good j can be written

$$x^j = f^j(t^j_m, t^j_f; \mathbf{a}_m, \mathbf{a}_f), \qquad j = 1, 2, ..., J.$$

where $\mathbf{a}_m$ and $\mathbf{a}_f$ denote characteristics that determine productivity in household production for the male and the female, respectively. It is assumed that the production functions f^j are characterized by constant returns of scale.

The household decision process is assumed to lead to a pareto efficient outcome, and the utility maximization problem for household member i ($i = m, f$) can formally be written

$$\begin{aligned} V &= \max_{l_i, c_i, \mathbf{x}} \ (u^m - \phi^m)(u^f - \phi^f) \qquad i = m, f, \\ s\ t \ \ x^j &= f^j(t^j_m, t^j_f; \mathbf{a}_m, \mathbf{a}_f) \qquad j = 1, 2, ..., J. \\ \sum pc_i + \sum w_i l_i &= H \sum w_i + \pi + y \\ H &= l_i + t_i + h_i \end{aligned} \tag{1}$$

where p is the market price of the Hicksian commodity good, w_i is the market wage for household member i, π represents the profit from the domestic production plan and $y = (y_m + y_f)$ denotes the total household non labor income. This model is based on the assumption that each individual in the household is bargaining over the resource and time allocation from a so-called threat point $\phi^i(w_i, y_i)$. Let us assume that this threat point is given by divorce, i.e., the lowest utility the individual is willing to accept before he/she leaves the household.[1]

In this setting, Apps and Rees (1997) show that the optimal allocation of time within the household, with the imputed prices[2] of the household goods at the household equilibrium r^{j*} and w_i as given, can be found by solving[3]

$$\max_{t^j_m, t^j_f} \ \pi = \sum_{j=1}^{J} \pi^j = \sum_{j=1}^{J} r^{j*} f^j(t^j_m, t^j_f, \mathbf{a}_m, \mathbf{a}_f) - w_m t^j_m - w_f t^j_f. \tag{2}$$

This implies that the time allocation functions for the male and the female can be written

[1] A different interpretation is that the threat point is associated with a non-cooperative solution (see e.g., Kooreman and Kapteyn (1990) and Lundberg and Pollak (1993, 1994)).

[2] The imputed prices of the household goods is the ratio of the Lagrange multipliers linked with the production functions and budget constraints in utility maximization problem (1) (see Apps and Rees (1997)).

[3] The reason that the household equilibrium can be decentralized in this way is that a cooperative game always leads to a (within household) Pareto-efficient allocation. From the second theorem of welfare economics it follows that this outcome, given the choice of initial endowments, always can be supported as a market equilibrium at prices r^{j*} and w_i.

$$
\begin{aligned}
t_m^j &= t_m^j(r^{j*}(w_m, w_f, y_m, y_f; \mathbf{z}_m, \mathbf{z}_f, \mathbf{a}_m, \mathbf{a}_f), w_m, w_f; \mathbf{a}_m, \mathbf{a}_f) \qquad (3) \\
t_f^j &= t_f^j(r^{j*}(w_m, w_f, y_m, y_f; \mathbf{z}_m, \mathbf{z}_f, \mathbf{a}_m, \mathbf{a}_f), w_m, w_f; \mathbf{a}_m, \mathbf{a}_f). \qquad (4)
\end{aligned}
$$

From (3) and (4) it follows that the intra-household time allocation decision can be influenced both by household productivity parameters and individual preference parameters. As shown by Pollak and Wachter (1975), characterestics influencing preferences and household productivity cannot empirically be distinguished from each other.

3 Data

The empirical investigation is based on data from the 1984 and 1993 Swedish Survey of Household and Nonmarket Activities (HUS)[4]. One advantage with HUS, compared with many other household surveys, is that both spouses in multi-person households have been interviewed. The 1984 (1993) HUS-survey consists of 2619 (4137) randomly selected individuals aged 18 to 74. This study uses data for two-adult households, where both spouses are between 20 and 60 years of age. Besides the conventional survey, a selection of respondents were subject to a time-use study. The time-use interviews were performed using the 24-hour recall diary technique (see Juster and Stafford, 1991), and each respondent was interviewed on at most two occasions. The same days of measurement were selected for individuals belonging to the same household. In total, the sample size for the first and the second time use interviews in 1984 (1993) was 2552 (3249), respectively, 2468 (3218) individuals. Of these participated 1680 (2346) in both interviews, and 862 respondents participated both in the 1984 and the 1993 time-use study. The data used in this study is restricted to households were each member has participated in the main survey and at least in one time-use interview.

Following the definitions used in the HUS-survey, each individual is supposed to divide time between the following eight different household activities:

- Preparing meals for immediate consumption (setting the table and serving included) and for future use.
- Dishwashing and putting away.
- Cleaning up at home and outside the house.
- Washing and associated activities (e.g., drying and ironing).
- Household management activities.

[4]For a more detailed description of HUS, see Klevmarkan and Olovsson (1993) and Flood, Klevmarken and Olovsson (1997).

- Active childcare.
- Purchases of everyday goods, clothing, consumer durables and property.
- Maintenance and repairs. This activity includes gardening, maintenance and repairs at home, vacation home and vehicle.

One problem with time-use data is that daily variation in time allocation will influence the estimates. For individuals that have been interviewed once on a weekend and once during the working week, time used for each household activity is therefore computed as a weighted average with the weights 5/7 for weekdays and 2/7 for weekend days. Moreover, only information on primary activities is used.

Information on hours worked at the market is collected from the conventional survey, and the empirical study is restricted to two-earner households. Moreover, households were at least one member has been given doubtful or inconsistent tax-return values, or have been sick for more than three weeks during the year, are excluded. Households where individual wages are reported missing are also excluded. Non-labor income is defined as the sum of interest incomes, interest subsidies, dividends and capital gains less capital losses, interest on debts and administrative expenses. To get a measure of non-labor income that is consistent with this definition, farmers and owners of more than one property (aside from vacation home) are excluded from the 1984 data. The 1984 and the 1993 sample then contain 347 and 360 households, respectively. Descriptive statistics for the two samples are presented in Table 1.

Table 1 About here

Table 1 shows that men, on average, work more hours at the market per year and earn higher hourly wages than women. However, this does not mean that the female enjoys more leisure compared to her male partner. According to Table 1, women instead work more hours in household production. The disaggregate statistics also show that the female, on average, spends more time than her spouse in most of the different household production activities. The only exception, which is present both in the 1984 and 1993 data, is maintenance and repairs. Women have, on average, a higher share of non labor income than men in the 1984 data and lower in the 1993 data. As a consequence of the 1991 Swedish tax reform[5], marginal tax rates were also considerably lower in 1993.

4 Results

4.1 Models for time allocation

One problem that has to be considered in the empirical model is that the time-use data exhibits censoring at zero. This problem is often handled by a Tobit model where all

[5]For a more detailed description of the 1991 Swedish tax reform, see Agell, Englund and Södersten (1998).

zeros are considered as the outcome of an optimal choice, i.e., zeros arise if and only if the individual household member decides not to participate in the household activity. Formally, this means that the Tobit censoring rule can be written

$$\begin{aligned} t_i^j &= t_i^{j*} \quad if \quad t_i^{j*} > 0 \\ &= 0 \quad otherwise \end{aligned}$$

where t_i^j is the dependent variable measuring household member i:s ($i = m, f$) observed time allocated to household production activity j ($j = 1, ..., 8$), and t_i^{j*} is its corresponding latent value given by

$$t_i^{j*} = \boldsymbol{\beta}_i^{j\prime}\mathbf{x} + e_i^j \tag{5}$$

where $\mathbf{x}$ is a row vector of k explanatory variables, $\boldsymbol{\beta}_i^{j\prime}$ is the corresponding column vector of k parameters and $e_i^j \sim N(0, \sigma_i^{j2})$. The resulting log-likelihood is

$$\log L(\boldsymbol{\beta}_i^{j\prime}, \sigma_i^j) = \sum_{t_i^j=0} \log(1 - \phi(\boldsymbol{\beta}_i^{j\prime}\mathbf{x}/\sigma_i^j)) + \sum_{t_i^j>0} (-\log \sigma_i^j + \log \varphi((t_i^j - \boldsymbol{\beta}_i^{j\prime}\mathbf{x})/\sigma_i^j))$$

where $\phi(\cdot)$ and $\varphi(\cdot)$ correspond to the standard normal cumulative, respectively, density function. In this case, the same stochastic process is assumed to determine the decision to participate in household production and the decision of time spent in household production conditional on participation.

However, in the present framework, all observed zeros may not represent the outcome of a choice. As described in Section 3, the dependent variable is measured by two time-use interviews using the 24-hour recall diary technique. It has long been noted (see e.g., Juster and Stafford (1991) and Klevmarken (1998)) that this method of data collection results in too many individuals reporting zero hours of household production.[6] It is therefore likely that some of the observed zeros arise from the method of data collection. This phenomenon is analogous to the well known problem of under-reporting in consumer expenditure surveys (see e.g., Kay, Keen and Morris (1984), Keen (1986) and Blundell and Meghir (1987)). On the other hand, supplying zero hours to household production may also be a deliberate choice of the individual household member. The observed zeros are then true zeros. However, in contrast to the Tobit specification, it may be different processes behind the participation and the household work decision.

To take into account that the time allocation decision best may be modelled as a two-step procedure, a so-called double hurdle model is estimated. This model was first

[6] This is especially true for activites that are performed with long intervalls (e.g., washing and household management) and where we observe that the dependent variable in relative many cases is zero. However, for other types of activities (e.g., childcare), it is less likely that zeros arise as a consequence of the method of sampling.

developed by Cragg (1971), and suggests that two separate hurdles must be passed before we observe a positive dependent variable. The censoring rule can in this case be written

$$\begin{aligned} t_i^j &= t_i^{j*} \quad if \quad t_i^{j*} > 0 \quad and \quad D_i^j = 1 \\ &= 0 \quad otherwise \end{aligned}$$

where t_i^{j*} is the latent dependent variable given by (5), and D_i^j is a binary variable describing the probability that we observe a positive number, i.e., $D_i^j = 1$ if $t_i^j > 0$. In Cragg's (1971) original model, independence between the two hurdles were assumed. However, in more recent work by e.g., Blundell and Meghir (1987) and Jones (1989) this assumption is relaxed. In this paper, estimation is implemented using a version of the Cragg model suggested by Lin and Schmidt (1984), and previously used by e.g., Blundell and Meghir (1987). The first-hurdle, measuring the probability that we observe a positive number, is first estimated using a ordinary probit model

$$D_i^{j*} = \boldsymbol{\theta}_i^{j\prime}\mathbf{x} + \omega_i^j$$

where $\omega_i^j \sim N(0,1)$.

In the second stage, the information from the first hurdle is used to estimate the distribution of the positive observations. The probability of zero observations is then given by

$$\Pr(t_i^{j*} < 0) + \Pr(t_i^{j*} > 0)\Pr(D_i^j = 0) = 1 - \Pr(t_i^{j*} > 0)\Pr(D_i^j = 1)$$

Thus, the log likelihood function can be written

$$\log L(\boldsymbol{\beta}_i^{j\prime}, \sigma_i^j) = \sum_{t_i^j = 0} \log(1 - \phi(\boldsymbol{\beta}_i^{j\prime}\mathbf{x}/\sigma_i^j)\phi(\boldsymbol{\theta}_i^{j\prime}\mathbf{x})) + \sum_{t_i^j > 0} (-\log\sigma_i^j + \log\varphi((t_i^j - \boldsymbol{\beta}_i^{j\prime}\mathbf{x})/\sigma_i^j) + \log\phi(\boldsymbol{\theta}_i^{j\prime}\mathbf{x}))$$

This model has the advantage that it nests the Tobit model ($\phi(\boldsymbol{\theta}_i^{j\prime}\mathbf{x}_i) = 1$), and a likelihood ratio test can therefore be performed to study if the household work decision is best modelled by a one step or a two step procedure.

4.2 Empirical model

The estimated household work equations are assumed to take the following form

$$\begin{aligned} \ln\ t_m^j &= \alpha_m^j + \beta_m^j w_m + \gamma_m^j w_f + \delta_m^j y_m + \eta_m^j y_f + \widetilde{z}_m^j + \widetilde{z}_f^j + \varepsilon_m^j \quad (6) \\ \ln\ t_f^j &= \alpha_f^j + \beta_f^j w_f + \gamma_f^j w_m + \delta_m^j y_f + \eta_m^j y_m + \widetilde{z}_f^j + \widetilde{z}_m^j + \varepsilon_f^j. \quad (7) \end{aligned}$$

where the dependent variable is measured as annual time allocated to household production activity j. For strictly positive values the dependent variable is, following Blundell and Meghir (1987), specified as log time. The scalars $\widehat{z}_m$ and $\widehat{z}_f$ should now be interpreted to contain characteristics that determine household productivity as well as personal characteristics originating from the utility function. These characteristics are assumed to include age, a dummy variable indicating the presence of children in a specific age bracket (0-6, 7-12 and 13-17 years of age) and a dummy variable reflecting the educational attainment of the individual. The educational dummy takes the value one if the respondent has a university or a university college degree.

To address the problem of endogenously determined marginal wages, estimation is implemented using an instrumental variable method. The instruments chosen for the marginal wage are the pre-tax wage, the pre-tax wage squared, capital income and capital income squared. The results from the instrumental variable estimations are presented in Table A1 and A2 in the appendix. The determinants of the sixteen household activity equations are then separately estimated. An aggregate version, where the dependent variable is the sum of the time allocated to the eight home work activities, is also estimated using the same empirical method.

4.3 Estimation Results

In a first step, the restrictions imposed by the Tobit model is tested against the Cragg model by performing a likelihood ratio test. Comparing the LR-statistics with the critical value $\chi^2(12) = 21$ at the 5% level, the results presented in Table 2 indicate that the restrictions imposed by the Tobit model are heavily rejected. This implies that the observed zeros cannot be considered as the outcome of a single choice, and that an empirical model has to consider that it is different processes determining the discrete switch from zero to postitive values and the continous time allocation decision observed thereafter. Given the strong rejection of the Tobit model, only the estimation results from the Cragg model are henceforth presented.

Table 2 About Here

The results from the first hurdle estimation, indicating the probability that a positive value is observed, yield non-significant results and are therefore not presented in this paper. This is a likely outcome if most of the observed zeros originate from the method of data collection and not from different processes determining the discrete participation decision and the continous time allocation decision. There are, however, some exceptions to this result. For instance, both in the 1984 and 1993 data, presence of children have a significantly positive effect on the probability to observe a positive time allocated to childcare activities. This is not surprising since time allocated to active childcare should be closely linked to the decision to have children.

The results from the second-hurdle estimation are presented in Table A3 in the appendix. In case the different measures of household working time are aggregated into a single measure, there seems to be no significant effect of the variables related to the household's budget constraint. The presence of pre-school children (0-6 years of age) significantly increases household work for men and women. Moreover, the individual educational attainment seems to be an important influence for the intra-household time allocation in the 1993 aggregate data. According to the results, men with a university or a university college degree devote less time for household work compared to those with less education, while men matched with a highly educated spouse spend more time in household production.

However, when the eight household work activities are studied separately, factors related to the household budget restriction seem to have a slightly stronger effect on the intra-household time allocation. In the 1984 data, the results indicate that men with a high marginal wage spend more time, while their spouses spend less time, for household management activities. Moreover, in households where the male has a relatively high marginal wage, both members spend less time for maintenance and repair activities. The results from the 1993 data also indicate that women spend more time on washing activities when they are matched with a spouse characterized by a high marginal wage, and that the corresponding males spend more time for childcare activities. The estimates of the parameters corresponding to the non labor income are not significant in the 1984 data. On the other hand, in the 1993 data, male non labor income signficantly lowers time spent on washing activities and preparation of meals for the male, while it increases his spouse time spent for household management activities.

In contrast to the aggregate results, the presence of pre-school children is insignificantly determined for a majority of the studied cases when the different household work activities are studied separately. In comparison with the 1984 aggregate results, presence of pre-school children only have a significantly positive effect on how many hours the female partner spent for household management activities. Turning to the 1993 data, the presence of children seems to have a stronger effect on the household work decision. For example, presence of pre-school children significantly increases both members time spent for household activities such as dishwashing and preparing meals. One interesting result is that presence of pre-school children does not seem to influence the time allocated to active childcare (except for males in 1984) given that the household have at least one child in this age interval. Hence, this effect is entirely captured by the first hurdle estimation.

The results also indicate that presence of older children (13-17 years of age) reduces both members time spent on childcare activities. This result may capture that older children care for their younger siblings, and that the adult household members can reduce the time allocated to childcare activities. In addition, the presence of younger school children (7-12 years of age) seems to have no significant effect on the time allocation decision. One exception, present both in the 1984 and 1993 data, is that women allocate more time to preparing meals when they have children in this age interval.

The age of the individual has, in contrast to the aggregate results, a statistically significant effect on some of the studied household activities. In the 1984 data, women spend less time on household management activities when they are matched with older men. Moreover, the 1993 results indicate that older women lowers their time spent for washing activities. In an analogous way, when each household activity in the 1984 data is separately studied, the individual educational attainment seems to influence some of the studied activities. In households where women are highly educated, the results indicate that the male partner spend more time preparing meals while women reduce their time allocated to this activity. On the other hand, when each household activity in the 1993 data is separately studied, the male household member is not as sensitive to the individual educational attainment as suggested by the aggregate results. The only statistically significant results are that men matched with a highly educated spouse spend more time preparing meals and that men's own educational attainment lowers time spent for preparing meals and maintenance and repair activities.

To summarize, these results imply that an aggregate analysis may give misleading results on which factors are important in determining the intra-household allocation of time. Comparing the parameter estimates presented in Table A3, presence of children seem in general to be more important than economic factors (marginal wages and non labor incomes) in determining the intra-household time allocation. This result is in accordance with most previous time allocation studies. The results presented in this study also weakly confirm Kooreman and Kapteyn's (1987) result that aggregation of household activities seems to wipe out economic effects that are present in a disaggregate analysis.

5 Conclusion

The aim of this paper has been to analyze the intra-household allocation of time to different household work activities using Swedish cross-sectional household data. The main results can be summarized as follows:

- By performing a LR-test, the Tobit model is rejected in favor of the Cragg model. This implies that in order to model the intra-household allocation of time a two-step procedure appears to be suitable.

- When household production is defined as a sum of different household work activities, the results differ quite substantially from the case when each household activity is separately estimated.

- In general, presence of children seem more important than factors related to the household budget restriction in determining the intra-household allocation of time.

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Table 1: Sample statistics

	1984				1993			
	Men		Women		Men		Women	
Variable	Mean	Std.dev.	Mean	Std.dev.	Mean	Std.dev.	Mean	Std.dev.
Age	41.31	(9.21)	43.85	(9.02)	43.85	(9.12)	41.57	(9.25)
Years of education	11.61	(3.72)	11.15	(3.26)	12.70	(3.59)	12.63	(3.30)
Gross wage rate	54.05	(18.89)	42.82	(24.44)	107.12	(76.60)	88.31	(58.50)
Marginal wage rate	22.18	(7.65)	23.69	(11.69)	58.21	(39.24)	57.14	(39.36)
Marginal tax rate	56.51	(14.11)	43.20	(12.64)	43.90	(10.97)	34.47	(11.83)
Nonlabor income	-692.70	(5492)	534.84	(3445)	3681.22	(20600)	2479.99	(11953)
Market work	2193.89	(330.86)	1624.62	(547.15)	2217.38	(351.12)	1797.41	(455.80)
Household work	800.84	(614.39)	1350.74	(769.56)	797.25	(638.28)	1254.98	(757.79)
Leisure	5741.27	(672.52)	5760.64	(844.23)	5721.37	(732.34)	5683.61	(807.39)
Childcare	99.31	(208.45)	206.50	(347.83)	82.38	(195.19)	180.20	(362.64)
Preparing meals	127.89	(160.40)	382.22	(304.96)	136.16	(174.82)	300.17	(248.93)
Dishwashing	44.72	(72.93)	125.96	(116.11)	46.90	(75.44)	101.89	(125.50)
Cleaning	121.41	(198.40)	300.79	(317.69)	102.97	(275.34)	320.20	(377.52)
Washing	8.87	(57.10)	118.00	(194.00)	16.03	(73.08)	122.58	(221.93)
Household management	26.64	(97.69)	10.47	(76.60)	21.40	(76.12)	22.16	(94.97)
Purchases	89.09	(155.56)	140.37	(200.12)	84.79	(171.96)	129.59	(220.57)
Maintenance and Repairs	277.86	(438.16)	64.83	(174.93)	246.61	(450.30)	78.19	(213.44)
Children/household	1.28	(1.02)			1.02	(1.06)		

Table 2: LR-statistics Cragg vs Tobit

	1984				1993			
	Men		Women		Men		Women	
Activity	LR-stat	p-value	LR-stat	p-value	LR-stat	p-value	LR-stat	p-value
Aggregate	207.23	<0.000	183.80	<0.000	201.17	<0.000	178.74	<0.000
Prep meals	254.91	<0.000	183.30	<0.000	283.28	<0.000	207.61	<0.000
Dishwashing	254.60	<0.000	268.25	<0.000	272.11	<0.000	273.69	<0.000
Cleaning	178.74	<0.000	247.10	<0.000	299.61	<0.000	275.17	<0.000
Washing	41.65	<0.000	299.90	<0.000	79.39	<0.000	291.61	<0.000
Childcare	224.56	<0.000	283.41	<0.000	209.82	<0.000	289.46	<0.000
Purchases	256.85	<0.000	300.31	<0.000	251.05	<0.000	304.25	<0.000
H. management	97.78	<0.000	47.82	<0.000	118.67	<0.000	89.76	<0.000
Main. and Rep.	309.21	<0.000	178.22	<0.000	298.30	<0.000	185.09	<0.000

7 Appendix

Table A1: Instrumental variable estimation 1984 sample

	Male partner		Female partner	
Variable	estimate	t-value	estimate	t-value
Constant	16.95	7.00	8.89	6.87
Gross wage rate	0.05	0.65	0.34	10.11
Gross wage rate^2	0.0008	1.66	0.0002	2.64
Capital income	-0.0001	-3.29	-0.0001	-2.53
Capital income^2	0.0000000001	0.22	0.0000000004	0.13
R^2	0.18		0.79	

Table A2: Instrumental variable estimation 1993 sample

	Male partner		Female partner	
Variable	estimate	t-value	estimate	t-value
Constant	11.21	7.90	7.07	4.11
Gross wage rate	0.44	30.61	0.55	23.46
Gross wage rate^2	0.00006	4.33	0.0002	4.60
Capital income	0.00004	3.09	0.0001	4.39
Capital income^2	-0.0000000002	-2.86	0.0000000003	1.96
R^2	0.94		0.93	

Table A3: Estimation results 1984 and 1993 sample, second hurdle.

	1984				1993			
Equation	Male partner		Female partner		Male partner		Female partner	
Variable	Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value
Prep. meals								
Constant	4.78	6.46	6.44	10.62	3.51	11.02	4.46	15.29
w^m	-0.018	-0.88	-0.019	-1.20	0.0007	0.54	-0.0018	-1.36
w^f	0.010	0.60	0.0052	0.38	-0.0005	-0.33	0.0006	0.49
y^m	$-5.32\cdot 10^{-6}$	-0.47	$-8.34\cdot 10^{-5}$	-0.89	$-4.90\cdot 10^{-6}$	-2.98	$-1.78\cdot 10^{-7}$	-0.11
y^f	$3.58\cdot 10^{-5}$	1.31	$-9.07\cdot 10^{-6}$	-0.63	$9.10\cdot 10^{-6}$	2.25	$9.77\cdot 10^{-7}$	0.28
University^m	-0.28	-1.56	-0.039	-0.26	-0.30	-2.13	-0.17	-1.34
University^f	0.46	2.33	-0.32	-1.90	0.28	2.09	-0.02	-0.16
Age^m	-0.013	-0.74	-0.0071	-0.58	-0.0044	-0.34	0.013	1.06
Age^f	0.011	0.61	-0.0057	-0.43	0.028	2.11	0.0059	0.47
Children (0-6)	0.093	0.54	0.20	1.51	0.58	0.55	0.49	3.83
Children (7-12)	0.099	0.76	0.26	2.49	0.20	1.51	0.25	2.16
Children (13-17)	0.021	0.11	0.048	0.048	-0.071	-0.03	0.29	2.63
Log L	-442.60		-441.39		-476.83		-482.63	
Dishwashing								
Constant	4.91	4.16	5.44	8.70	3.23	7.69	3.62	9.25
w^m	0.0019	0.03	-0.0072	-0.54	-0.0003	-0.19	-0.0006	-0.42
w^f	-0.0047	-1.05	-0.012	-0.62	0.0014	0.84	-0.0007	-0.39
y^m	$8.56\cdot 10^{-7}$	0.08	$-1.24\cdot 10^{-5}$	-1.29	$-5.93\cdot 10^{-7}$	-0.27	$-1.59\cdot 10^{-6}$	-0.85
y^f	$-1.57\cdot 10^{-5}$	-0.58	$-1.28\cdot 10^{-5}$	-0.75	$9.13\cdot 10^{-6}$	1.72	$-9.8\cdot 10^{-8}$	-0.02
University^m	-0.0028	-0.01	0.11	0.64	-0.042	-0.23	0.21	1.36
University^f	0.30	1.50	-0.088	-0.45	-0.018	-0.09	-0.18	-1.32
Age^m	-0.0016	-0.06	-0.021	-1.65	-0.0058	-0.31	0.02	1.23
Age^f	-0.011	-0.42	0.012	0.92	0.022	1.19	-0.0034	-0.19
Children (0-6)	0.072	0.41	0.0068	0.06	0.40	2.31	0.39	2.47
Children (7-12)	0.15	1.05	0.13	1.18	0.18	1.13	0.14	1.02
Children (13-17)	-0.17	-1.02	-0.028	-0.25	0.029	0.20	0.13	1.01
Log L	-293.07		-423.12		-374.75		-465.90	
Cleaning								
Constant	6.53	29.09	7.36	9.39	4.93	10.84	4.83	12.32
w^m	-0.012	-1.05	-0.027	-1.17	-0.0015	-0.88	-0.0005	-0.38
w^f	0.0010	0.31	-0.014	-0.83	-0.0034	-1.26	-0.0025	-1.23
y^m	$1.07\cdot 10^{-5}$	1.52	$1.46\cdot 10^{-6}$	0.12	$7.71\cdot 10^{-7}$	0.30	$7.71\cdot 10^{-7}$	0.42
y^f	$1.23\cdot 10^{-6}$	0.11	$-2.49\cdot 10^{-5}$	-1.16	$1.83\cdot 10^{-6}$	0.45	$-4.9\cdot 10^{-8}$	-0.01
University^m	0.11	0.98	0.15	0.85	-0.059	-0.29	0.33	1.99
University^f	-0.081	-0.65	-0.16	-0.75	0.093	0.49	-0.019	-0.10
Age^m	0.011	1.19	-0.01	-0.78	0.03	1.41	0.022	1.43

Table A3 continued

	1984				1993			
Equation	Male partner		Female partner		Male partner		Female partner	
Variable	Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value
Cleaning(cont)								
Age^f	-0.0055	-0.58	-0.0098	-0.59	-0.032	-1.10	-0.0075	-0.49
Children (0-6)	0.52	5.54	-0.15	-0.88	0.066	0.32	0.12	0.72
Children (7-12)	0.068	0.84	0.12	0.93	-0.11	-0.56	-0.11	-0.74
Children (13-17)	0.26	3.20	-0.18	-1.40	-0.018	-0.11	0.24	1.82
Log L	-390.98		-477.72		-432.51		-508.68	
Washing								
Constant	10.18	3.74	6.29	6.79	4.79	5.32	3.89	6.90
w^m	-0.30	-2.89	0.21	-0.54	0.001	0.58	0.0033	2.06
w^f	-0.122	-3.98	0.0044	0.21	-0.01	-1.96	-0.0025	-0.98
y^m	-0.0009	-4.27	$-1.10 \cdot 10^{-4}$	-1.06	$-1.98 \cdot 10^{-5}$	-2.47	$-1.22 \cdot 10^{-6}$	-0.48
y^f	$2.0 \cdot 10^{-5}$	1.32	$1.66 \cdot 10^{-5}$	0.82	$5.63 \cdot 10^{-6}$	0.41	$1.10 \cdot 10^{-6}$	0.16
University^m	3.27	5.25	0.016	0.08	0.42	1.19	-0.055	-0.26
University^f	1.25	1.94	0.17	0.73	0.37	1.01	0.13	0.65
Age^m	0.16	3.58	-0.021	-1.19	-0.032	-0.62	-0.025	-1.24
Age^f	-0.097	-2.35	-0.0063	-0.32	0.024	0.45	0.048	2.39
Children (0-6)	15.68	3.62	0	0	0.02	0.05	0.15	0.71
Children (7-12)	-19.42	-4.04	0.077	0.57	0.15	0.34	0.069	0.38
Children (13-17)	-0.48	-0.91	-0.072	-0.47	0.31	0.95	0.015	0.09
Log L	-55.29		-356.04		-102.47		-368.62	
Childcare								
Constant	4.95	2.70	5.43	5.07	4.36	5.95	7.26	12.87
w^m	0.014	0.05	-0.0029	-0.15	0.0036	2.18	-0.0013	-0.82
w^f	-0.012	-0.48	-0.01	-0.55	-0.0024	-0.51	$-3.20 \cdot 10^{-5}$	-0.01
y^m	$2.82 \cdot 10^{-6}$	0.04	$-4.03 \cdot 10^{-5}$	-1.35	$-2.45 \cdot 10^{-6}$	-0.81	$2.29 \cdot 10^{-6}$	0.86
y^f	$5.20 \cdot 10^{-5}$	1.31	$-2.20 \cdot 10^{-5}$	-0.80	$1.61 \cdot 10^{-6}$	0.05	$1.68 \cdot 10^{-7}$	0.04
University^m	0.13	0.49	0.11	0.51	-0.091	-0.35	0.11	0.51
University^f	-0.17	-0.52	0.15	0.57	-0.02	-0.08	0.008	0.05
Age^m	0.025	0.91	0.027	0.027	-0.0017	-0.13	-0.01	-.051
Age^f	-0.013	-0.42	-0.014	-0.60	0.0001	0.01	-0.036	-1.80
Children (0-6)	0.31	1.49	0.40	1.95	0.82	3.23	0.23	1.12
Children (7-12)	-0.0034	-0.02	-0.29	-1.77	0.35	1.62	0.22	1.23
Children (13-17)	-0.26	-2.02	-0.75	-3.82	-0.56	-2.14	-0.51	-2.46
Log L	-194.11		-244.46		-175.66		-238.83	
Purchases								
Constant	3.61	3.20	4.00	4.89	5.18	9.67	5.74	11.94
w^m	0.0089	0.31	0.026	1.26	0.0001	0.05	0.0015	0.19
w^f	-0.027	-0.22	0.013	0.77	$1.6 \cdot 10^{-5}$	0.01	-0.0026	-1.14
y^m	$-8.56 \cdot 10^{-6}$	-0.29	$5.99 \cdot 10^{-6}$	$5.99 \cdot 10^{-6}$	$2.80 \cdot 10^{-6}$		$1.61 \cdot 10^{-6}$	0.46

Table A3 continued

	1984				1993			
Equation	Male partner		Female partner		Male partner		Female partner	
Variable	Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value
Purchases(cont)								
y^f	$6.69 \cdot 10^{-5}$	1.62	$5.46 \cdot 10^{-6}$	0.27	$9.50 \cdot 10^{-7}$	0.20	$6.45 \cdot 10^{-6}$	1.09
$University^m$	-0.25	-0.93	-0.31	-1.51	0.078	0.30	-0.28	-1.20
$University^f$	0.35	1.23	-0.21	-0.89	-0.29	-0.40	-0.15	-0.72
Age^m	0.0099	0.33	-0.014	-0.88	-0.015	-0.59	-0.0095	-0.50
Age^f	0.020	0.80	0.014	0.84	0.0084	0.34	0.0002	0.01
Children (0-6)	-0.14	-0.58	0.30	1.76	-0.031	-0.11	0.054	0.28
Children (7-12)	-0.045	-0.25	-0.0070	-0.05	0.081	0.33	0.028	0.15
Children (13-17)	-0.19	-0.99	0.14	0.98	-0.095	-0.44	-0.048	-0.66
Log L	-361.37		-392.44		-325.85		-376.44	
H. management								
Constant	2.59	1.46	9.49	3.89	2.36	3.05	7.20	7.51
w^m	0.088	2.12	-0.25	-2.99	0.0071	1.41	-0.014	-1.58
w^f	0.023	0.52	-0.0088	-0.10	0.0015	0.28	0.0011	0.41
y^m	$1.34 \cdot 10^{-5}$	0.41	-0.0002	-1.75	$-5.36 \cdot 10^{-6}$	-0.86	$8.47 \cdot 10^{-6}$	2.38
y^f	$-6.98 \cdot 10^{-5}$	-1.74	$-1.57 \cdot 10^{-5}$	-0.27	$3.45 \cdot 10^{-6}$	0.37	$-9.22 \cdot 10^{-6}$	-1.21
$University^m$	-1.14	-2.53	-0.64	-1.54	-0.26	-0.85	0.012	0.03
$University^f$	0.11	0.29	0.25	0.53	0.24	0.79	0.21	0.54
Age^m	0.036	0.72	0.085	1.26	0.0097	0.22	-0.08	-2.31
Age^f	-0.021	-0.45	-0.069	-0.85	0.03	0.67	0.052	1.49
Children (0-6)	-0.32	-0.94	0.81	1.56	0.27	0.82	-0.66	-1.77
Children (7-12)	0.12	0.47	-0.71	-1.35	0.28	0.99	0.23	0.65
Children (13-17)	-0.63	-2.31	0.69	1.74	-0.66	-2.64	-0.42	-1.46
Log L	-124.82		-72.65		-158.09		-116.73	
Main. and rep.								
Constant	8.93	8.25	7.97	6.17	5.80	10.26	4.40	7.78
w^m	-0.071	-2.06	-0.12	-2.58	0.0017	0.34	0.0038	1.04
w^f	-0.0079	-0.39	-0.0085	-0.28	0.0023	0.59	-0.0007	-0.42
y^m	$-3.33 \cdot 10^{-5}$	-1.12	$-2.93 \cdot 10^{-5}$	-0.77	$1.80 \cdot 10^{-6}$	0.64	$-5.31 \cdot 10^{-6}$	-1.26
y^f	$-3.27 \cdot 10^{-5}$	-1.17	$1.34 \cdot 10^{-5}$	0.42	$7.11 \cdot 10^{-7}$	0.18	$4.36 \cdot 10^{-6}$	1.16
$University^m$	-0.22	-0.88	0.069	0.18	-0.42	-2.30	0.0005	0.001
$University^f$	0.10	0.36	-0.69	-1.52	0.12	1.52	0.23	1.01
Age^m	-0.0012	-0.61	-0.01	-0.41	-0.0098	-0.48	0.031	1.40
Age^f	-0.025	-1.17	0.015	0.50	0.013	0.64	-0.018	-0.82
Children (0-6)	0.63	2.16	-0.13	-0.45	-0.15	-0.69	0.065	0.25
Children (7-12)	0.30	1.85	-0.058	-0.23	0.019	0.12	-0.11	-0.51
Children (13-17)	0.28	1.77	-0.22	-1.08	-0.037	-0.21	0.35	1.57
Log L	-340.77		-201.97		-323.74		-208.90	

	1984				1993			
Equation	Male partner		Female partner		Male partner		Female partner	
Variable	Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value
Aggregated								
Constant	7.11	13.89	7.61	14.40	6.21	19.96	6.53	29.00
w^m	-0.0018	-0.125	-0.0042	-0.36	0.0016	1.16	0.003	0.25
w^f	-0.012*	-2.36	-0.012	-0.85	-0.0017	-1.11	-0.0011	-1.04
y^m	$9.94 \cdot 10^{-6}$	1.00	$-5.02 \cdot 10^{-6}$	-0.63	$-1.33 \cdot 10^{-6}$	-0.82	$1.34 \cdot 10^{-6}$	0.10
y^f	$-3.44 \cdot 10^{-7}$	-0.02	$-4.74 \cdot 10^{-6}$	-0.38	$4.96 \cdot 10^{-6}$	1.66	$3.20 \cdot 10^{-6}$	1.53
University^m	-0.095	-0.58	-0.15	-1.07	-0.30	-2.02	-0.061	-0.64
University^f	0.24	1.31	-0.055	-0.43	0.36	2.77	0.09	0.98
Age^m	-0.0071	-0.50	-0.004	-0.35	-0.0074	-0.62	-0.0054	-0.55
Age^f	-0.0070	-0.47	-0.0043	-0.37	0.0067	0.57	0.011	1.15
Children (0-6)	0.55	3.80	0.37	3.26	0.46	3.27	0.55	5.52
Children (7-12)	0.25	2.20	0.16	1.87	0.049	0.40	0.074	0.85
Children (13-17)	-0.056	-0.47	-0.001	-0.01	0.17	1.41	0.27	3.20
Log L	-455.75		-367.35		-509.86		-390.98	