Spending time and money within the household.

Martin Browning
CAM,
Institute of Economics,
University of Copenhagen

Mette Gørtz
CAM,
Institute of Economics,
University of Copenhagen

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Abstract

We consider theoretically and empirically the allocation of time and money within the household. The novelty of our empirical work is that we have a survey which provides information on both time use and the allocation of some goods within the household, for the same (married) households. Thus we can consider whether a partner who enjoys more leisure also receives more consumption (which looks like the outcome of 'power' within the household) or receives less (which looks like differing tastes across households).

1 Introduction

The most consistent finding regarding time use across countries and over time is that, *on average*, married men do more market work and less housework than married women. It has also been found that, *on average*, married men and women enjoy much the same leisure.[1] These averages, however, mask very marked heterogeneity in time use within individual households. Thus we find some households in which one partner does a good deal more work (in the market and in the home) than the other partner and enjoys less leisure. There are a number of possible rationale for this. First, there may

[1] The major exception to this is Italy.

be heterogeneity in the tastes for work (relative to the the output from the work) within the household. Second, wages may vary which could induce differences in the leisure taken. Finally, 'power' may be distributed unevenly within the household and the 'low power' individual may be required to work more. Data on time use alone do not suffice to identify the relative importance of the latter factor. To identify this, we need to observe other outcomes within the household. In this paper we present results from a new survey that collects both time use data and information on the intra-household allocation for the same household.

The traditional focus of welfare analysis has been on the distribution of material well being *across* households - the *inter-household* distribution. The household has been viewed as one unit, and it has implicitly been assumed that household members do not have conflicting interests. This description is sometimes referred to as the 'unitary' model. In the past two decades there has been analysis of the situation in which household members have conflicting objectives and a growing interest regarding the distribution of material well-being *within* the household; that is, the *intra-household* distribution of material well-being. One approach to describing intra-household decision processes is to apply different forms of bargaining models with a game-theoretic foundation. A possible short-cut is to assume that the household decision process always end up in a Pareto-efficient situation, cf. Chiappori (1988), Browning et al. (1994). This assumption is intuitively motivated by the observation that the household decision process can be seen as a repeated game where the players have a large amount of information about the other player and act in a cooperative manner The Pareto-efficiency assumption is the foundation for the so-called 'collective' model of intra-household allocation model. In this paper we discuss intra-household allocation of welfare in the light of the two different models of the household - the 'unitary' and the 'collective' model.

The distribution of material welfare within the household depends on two elements: individual time use and the allocation of expenditures. Time use surveys give a good picture of the distribution of time to market work, housework and leisure between partners but do usually not have comparable information on expenditures. This means that we cannot convincingly make the mapping from time use to welfare. Consider, for example, a household comprising a married couple in which the wife seems to work more (in the home and in the market) as compared to other women with similar characteristics, wage of husband and wife and household financial situation. To

make the link to her material welfare relative to other women, we need to know what is happening to the distribution of goods within the household. If we could observe the latter, and we saw that she received more goods than we would predict, then we could attribute the observation to her having a high taste for goods relative to leisure. If, on the other hand, we observe that she also receives less goods then it looks as though she lacks 'power' within the household and that the distribution of material well-being within the household is skewed towards the husband. Clearly then, we need to observe both sets of outcomes (the allocation of time and money) to calculate the intra-household distribution of material well-being and its determinants.

The intra-household allocation of *expenditures* has been in the center of interest in a number of theoretical and empirical studies during the last two decades, (see, for example, Browning *et al* (1994), Lundberg *et al* (1996) and Phipps and Burton (1998)). These studies have been developed along the lines of the collective model of household allocation. Other studies have dealt with intra-household allocation of *time*, cf. Chiappori (1992) and (1997) and Apps and Rees (1996) and (1997). Apps and Rees address the question whether household members exchange time for consumption and stress the importance of having data on the simultaneous allocation of time and consumption within the households.

In this paper we present a simple theoretical model designed to isolate the effects discussed above. We then proceed to the empirical analysis of the new data set mentioned above, which provides information on both time use and the allocation of goods within the household. This is based on a survey of Danish households that was specifically designed for the research reported in this paper. As far as we are aware, this is the first time that data on time use and the allocation of goods within the household have been available in the same survey. This gives us the opportunity to present a much fuller picture of the distribution of material well-being within the household than has been possible in the past.

Our main findings are that a number of the factors that we normally consider as affecting the distribution of 'power' within the household (distribution factors) seem to matter in the empirical treatment of the model. More specifically, for our primary variable of interest, the relative wage of the women compared to her husband's wage, we find that it has a positive effect on the female consumption share. We interpret this as evidence of the collective model as being the most appropriate description of the decision process of the household. A number of other parameters point in the same

x_A	A's total expenditure on private goods
x_H	Expenditure on household good
Q	Household public good
l_A	A's leisure time
h_A	A's housework time
m_A	A's market work
w_A	A's wage
y	Household unearned income

Table 1: Notation

direction. However, the results should be interpreted with caution.

2 Theory

2.1 Allocation within the household

In this section we develop a simple model of the allocation of time and money within the household. We consider a two person household with A being 'she' and B being 'he'. The two members of the household sell labour on a labour market at fixed wages and they buy private goods which are distributed between the two partners. The members of the household also engage in housework which produces a public good that is consumed jointly. Table 1 presents our notation and the following equations give the constraints the household faces.

$$\begin{aligned} x_H + x_A + x_B &= w_A m_A + w_B m_B + y && (1) \\ l_A + h_A + m_A &= T && (2) \\ l_B + h_B + m_B &= T && (3) \\ Q &= F(h_A, h_B, x_H) && (4) \end{aligned}$$

In these constraints we assume that the household public good, Q, is produced with inputs of time and physical inputs for household production (equation (4)). We assume that $F(.)$ is smooth with F_A, F_B and F_x (the partials with respect to the respective levels of housework and money inputs) all positive.

Given the constraints the household faces, we have to model how the two people make decisions over the ten choice variables:

$$(x_H, x_A, x_B, Q, l_A, l_B, h_A, h_B, m_A, m_B)$$

We first assume that each person has private preferences over their own goods:

$$\begin{aligned} u_A &= u^A(x_A, Q, l_A) \\ u_B &= u^B(x_B, Q, l_B) \end{aligned} \tag{5}$$

This formulation explicitly assumes that there are no externalities so that, for example, A's valuation of her leisure is independent of her husband's leisure. Equally we rule out that A has specific preferences over what B consumes (for example, preferring that he did not smoke). These assumptions may be unrealistic but they seem to be minimal assumptions if we are to infer anything about individual welfares from observables. We will return to the discussion on complementarity in leisures below. We are also assuming that the two partners are indifferent between time spent in housework and time spent in market work. If we wished to allow for differential preferences over the two time uses then we would need to include h_A in A's utility function, and similarly for B. We allow that each person cares for the other and that A's and B's social welfare function for the household are given by:

$$\Psi_A = u_A + \lambda_A u_B \tag{6}$$

$$\Psi_B = u_B + \lambda_B u_A \tag{7}$$

where we shall assume that the wieghts λ_A and λ_B are non-negative. Given these preferences there are a number of ways of modelling the interactions between the two partners that lead to 'household behaviour'.[2] Here we simply assume that somehow the two partners agree that they will maximise the weighted sum of their individual social welfare functions to generate a household social welfare function, Ψ, according to:

$$\Psi(x_A, x_B, Q, l_A, l_B) = \tilde{\mu}\Psi_A + (1 - \tilde{\mu})\Psi_B, \tilde{\mu} \in [0, 1] \tag{8}$$

Initially we assume that the Pareto weight for A, $\tilde{\mu}$, is a fixed constant, so that we have a 'unitary' model. More generally, the Pareto weight may depend

[2] The inverted commas here are because households never behave, only the individuals that comprise them.

on so-called *distribution factors,* i.e. observables such as relative wages and extra-household factors such as the sex ratio in the population, but for the moment we rule out that it depends on choice variables such as relative market incomes ($= w_A m_A / w_B m_B$); we return to this in the heterogeneity subsection below. Given the structure above we have a simpler representation for household preferences with:

$$\begin{aligned} \Psi &= \left(\tilde{\mu} + (1-\tilde{\mu})\,\lambda_B\right) u_A + \left(\tilde{\mu}\lambda_A + (1-\tilde{\mu})\right) u_B \\ &= \mu u_A + (1-\mu)\, u_B \end{aligned} \tag{9}$$

The weight μ is a composite of the distribution of power within the household (the parameter $\tilde{\mu}$) and the degree of caring (given by λ_A and λ_B). For convenience, we re-normalise by multiplying by a constant so that the weight on u_B is unity. Thus, the household utility function is:

$$\Psi = \overline{\mu} u_A + u_B \tag{10}$$

where $\overline{\mu} = \mu/(1-\mu)$. With the assumptions made we have that $0 \leq \overline{\mu} \leq \infty$.

Given the constraints (equations (1) and (4)) we have the household utility function:

$$\Psi = \overline{\mu} u^A(x_A, Q, l_A) + u^B(x_B, Q, l_B) =$$

$$= \overline{\mu} u^A(x_A, F\left(T - l_A - m_A, T - l_B - \frac{(x_H + x_A + x_B - y - w_A m_A)}{w_B}, x_H\right), l_A) + \tag{11}$$

$$+ u^B(x_B, F\left(T - l_A - m_A, T - l_B - \frac{(x_H + x_A + x_B - y - w_A m_A)}{w_B}, x_H\right), l_B) \tag{12}$$

which is maximised with respect to $(x_A, l_A, x_B, l_B, m_A, x_H)$. Assuming inte-

rior solutions[3] we have the following first order conditions:

$$\begin{aligned}
\overline{\mu}u_x^A &= (\overline{\mu}u_Q^A + u_Q^B)\frac{F_B}{w_B} && (13)\\
u_x^B &= (\overline{\mu}u_Q^A + u_Q^B)\frac{F_B}{w_B} && (14)\\
F_A &= \frac{\overline{\mu}u_l^A}{\overline{\mu}u_Q^A + u_Q^B} && (15)\\
F_B &= \frac{u_l^B}{\overline{\mu}u_Q^A + u_Q^B} && (16)\\
F_A &= F_B\frac{w_A}{w_B} && (17)\\
F_x &= F_B\frac{1}{w_B} && (18)
\end{aligned}$$

In our data, we do not observe anything about the output of the public good produced, so we cannot hope to use the conditions on the marginal productivities F_A, F_B and F_x. Rearranging the first-order conditions, we end up with four equations:

$$\begin{aligned}
\frac{u_x^B}{u_x^A} &= \overline{\mu} && (19)\\
\frac{u_l^B}{u_l^A} &= \overline{\mu}\frac{w_B}{w_A} && (20)\\
\frac{u_l^B}{u_x^B} &= w_B && (21)\\
\frac{u_l^A}{u_x^A} &= w_A && (22)
\end{aligned}$$

From (21) and (22) we see that each partner acts as an individual for their choice of private consumption and leisure. If preferences over private consumption and leisure are separable from the public good:

$$\begin{aligned}
u^A &= \upsilon^A\left(\phi^A\left(x_A, l_A\right), Q\right)\\
u^B &= \upsilon^B\left(\phi^B\left(x_B, l_B\right), Q\right) && (23)
\end{aligned}$$

[3]In our sample below, all partners are in market work and all report positive levels of leisure.

then this is the familiar result that if there are no externalities we can decentralise any allocation by a redistribution of initial endowments. In this case it is as though A solves:

$$\max_{x_A, l_A} \phi^A (x_A, l_A) \text{ subject to } x_A + w_A l_A = y_A$$

where y_A is A's allocation of income for private expenditure and leisure. The amount y_A is known as the *sharing rule* in the intra-household literature. Note that we have:

$$y_A + y_B = (y - x_H) + (T - h_A) w_A + (T - h_B) w_B$$

so that the individual notional incomes sum to full income for the household, net of the costs of inputs to the public good.

2.2 The additive-log utility function.

In the following treatment of the model for the household equilibrium set out in equations (19) through (22), we focus on the first two of these conditions. These can be used to derive expressions for the female shares of consumption and leisure that we discussed in the introduction to this paper. This expression will generally contain the unbservable Q so that we have to assume some separability in the utility function in our empirical work. To facilitate discussion, suppose we go a long way down that path and assume that the utility functions are additive-log over the three components:

$$\begin{aligned} u^A &= \theta_A \ln (x_A) + \tau_A \ln (l_A) + \ln (Q) \\ u^B &= \theta_B \ln (x_B) + \tau_B \ln (l_B) + \ln (Q) \end{aligned} \tag{24}$$

(where we have normalised the coefficient on the public good to unity). From (19) we have:

$$\overline{\mu} = \frac{u_x^B}{u_x^A} = \frac{\theta_B}{\theta_A} \frac{x_A}{x_B} = \left(\bar{\theta}^{-1} \right) \frac{x_A}{x_B} \tag{25}$$

where $\overline{\theta} = \theta_A / \theta_B$ symbolizes A's preferences for private consumption relative to B's preferences for consumption. Denoting A's relative consumption by ρ_x we have:

$$\rho_x = \frac{x_A}{x_B} = \bar{\theta} \bar{\mu} \tag{26}$$

The distribution of leisure in the household is given by (20). Using the additive-log form above we have that A's relative leisure, ρ_l, is given by:

$$\rho_l = \frac{l_A}{l_B} = \overline{\mu\tau}\frac{w_B}{w_A} \tag{27}$$

where $\bar{\tau} = \tau_A/\tau_B$ is A's relative weighting for leisure.

The comparative statics for the additive-log form are:

- for relative consumption and leisure, only the relative values of the parameters, $\overline{\theta}$, $\overline{\tau}$, and $\overline{\mu}$, and relative wages, $\frac{w_B}{w_A}$, matter;
- if A and B have the same taste for private consumption, $(\theta_A = \theta_B)$, we find that $\rho_x = \overline{\mu}$, so that that A's relative consumption equals A's relative weight in the household utility function.
- if $\overline{\tau} = \tau_A/\tau_B = w_A/w_B$, we find that A's relative leisure equals A's relative weight in the household utility function, $\overline{\mu}$.
- the relative expenditure is independent of the relative wage and the relative leisure is decreasing in A's relative wage:

$$\begin{aligned}
\frac{\partial(x_A/x_B)}{\partial(w_A/w_B)} &= 0 \quad \text{and} \\
\frac{\partial(l_A/l_B)}{\partial(w_A/w_B)} &= -\overline{\mu\tau}\frac{1}{\left(\frac{w_A}{w_B}\right)^2} = -\overline{\mu\tau}\left(\frac{w_B}{w_A}\right)^2 < 0
\end{aligned}$$

- A's relative expenditure and leisure are both increasing in her Pareto weight $\overline{\mu}$:

$$\begin{aligned}
\frac{\partial(x_A/x_B)}{\partial\overline{\mu}} &= \overline{\theta} > 0 \quad \text{and...} \\
\frac{\partial(l_A/l_B)}{\partial\overline{\mu}} &= \overline{\tau}\frac{w_B}{w_A} > 0
\end{aligned}$$

- if A's taste for leisure increases relative to B ($\overline{\tau} = \tau_A/\tau_B$ increases), then she takes relatively more leisure;
- if A's taste for private consumption increases relative to B ($\overline{\theta} = \theta_A/\theta_B$ increases), then she obtains relatively more private expenditure;

We turn now to a consideration of the implications of these results for a cross-section of heterogeneous households. We shall use the relationships above in our empirical work to interpret the coefficients we estimate.

2.3 Heterogeneity

Above, we worked under the assumption that the relative Pareto weight, $\overline{\mu}$, is a constant, meaning that the weight put on household member's individual utilities is independent on their relative bargaining positions, or 'power' in the household. This assumption complies with the 'unitary' model. However, in the last 1-2 decades the process of household decision making has been widely debated in the literature, and the unitary model's concept of households jointly maximizing overall household utility has been subject to criticism. In the following, we focus on the 'collective' model as an alternative to the unitary model, cf. Chiappori (1988, 1992) and Browning et al. (1994). The collective model assumes that household decisions lead to Pareto efficient outcomes. This seems reasonable for two reasons. First, the household decision process can be viewed as a repeated game in a (fairly) stable environment. Thus, household members are obviously interested in behaving in a cooperative manner, and the decision process will usually lead to results which are Pareto optimal. Second, the two members of the household can be assumed to have detailed information on each others' preferences and will be able to incorporate the preferences of the partner when optimizing on their own behalf. Therefore, although the collective model doesn't specify the bargaining process, the outcome of the collective model can be seen as the Pareto efficient result of a sufficiently restricted bargaining model. Moreover, due to the above description of the household decision environment, non-Pareto optimal outcomes of a non-cooperative decision process seem implausible (in the long run), cf. Browning and Lechene (2001).

In our empirical work we shall use a cross-section of Danish households. In this subsection we discuss informally how heterogeneity in the population relates to observables such as the distribution of private expenditures within the household. In our data we observe: $\{x_A, x_B, w_A, w_B, l_A, l_B, m_A, m_B, h_A, h_B\}$.[4] We also observe a good deal of the demographics on the household such as the age, education and work status of the partners, the household composi-

[4] In our data we actually only observe three sub-components of expenditures on private goods; we postpone how we deal with the missing information until the empirical section.

tion (mainly the numbers and ages of children) and household income. In our empirical work below we shall concentrate on the female relative leisure and household expenditure. In particular, we will investigate how these variables relate to observable characteristics.

We begin our discussion assuming that we have a sample of households from a population who all have the same observable characteristics, including relative wages w_A/w_B. In the model of the last subsection we had five parameters for each household: $\boldsymbol{\beta} = \left\{\mu, \theta_A, \overline{\theta}, \tau_A, \overline{\tau}\right\}$.[5] These parameters are distributed across our population. Given particular assumptions on the joint distribution of $\boldsymbol{\beta}$, we ask what are the implications for the joint distribution of $\{\rho_x, \rho_l\}$ for the population? The important implications for our work are:

- If there is variation in power across the population so that $\overline{\mu}$ has a non-degenerate distribution and $\left\{\overline{\theta} = \theta_A/\theta_B\right\}$ is independent of $\{\overline{\tau} = \tau_A/\tau_B\}$ then x_A/x_B and l_A/l_B and hence ρ_x and ρ_l will be *positively* correlated. This corresponds to the case in our introduction in which variations in expenditure and leisure shares derive from variations in the 'power' parameter $\overline{\mu}$.

- If, on the other hand, there is no variation in $\overline{\mu}$ but $\overline{\theta}$ and $\overline{\tau}$ are negatively correlated then x_A/x_B and l_A/l_B and hence ρ_x and ρ_l will be *negatively* correlated. That is, if the relative taste (between women and men) for leisure and the relative taste for private consumption are negatively correlated then shares will also be negatively correlated. This corresponds to the 'taste difference' case discussed in the introduction.

Having considered unobserved heterogeneity we can now consider observable heterogeneity. In our sample, households differ widely in their observable characteristics and we have to allow that $\boldsymbol{\beta}$ depends on these. To accommodate this, we assume that the parameters depend on observables. In the case of $\overline{\mu}$ the dependence is on what are termed *distribution factors*, $\mathbf{z}$, as well as on unobservable factors. Candidates for the observable distribution factors are household income and the relative wages, relative ages and relative educationel levels of the two partners. The unobservables could include, for example, the outside options the two partners have (contained in $\tilde{\mu}$ in equation (8)) and how much they care for each other (λ_A and λ_B in (6) and (7)).

[5] Given the objects of interest we have taken (shares) it is more convenient to include θ_B and τ_B in this ratio form rather than including the parameters themselves.

The impact of all observable distribution factors on the relative consumption and leisure, except for relative wages, should have the same sign. The exception for relative wages is because they also enter the relative leisure directly, as indicated above.

Usually it is assumed that A's power, as captured by μ, is increasing in A's relative wage. If this is the case, we find the following implications of a change in A's relative wage on the relative consumption and leisure:

$$\frac{\partial(x_A/x_B)}{\partial(w_A/w_B)} = \overline{\theta}\overline{\mu}' > 0 \tag{28}$$

$$\frac{\partial(l_A/l_B)}{\partial(w_A/w_B)} = -\overline{\mu\tau}\left(\frac{w_B}{w_A}\right)^2 + \overline{\tau}\frac{w_B}{w_A}\overline{\mu}' \tag{29}$$

where $\overline{\mu}' = \frac{\partial\overline{\mu}}{\partial(\frac{w_A}{w_B})}$.

The response of the relative consumption to a change in relative wages is positive since $\overline{\mu}'$ is positive if μ is an increasing function of relative wages.

The response of the female relative leisure to a change in relative wages is ambiguous. The first, direct effect, which we can call the 'unitary' term, is *negative*. This is the familiar substitution effect from the labour supply decision. The second, indirect effect, which we can call the 'collective' term, is *positive*. We would usually assume that the effect of relative wages on $\overline{\mu}$ is relatively small and would not outweigh the direct effect seen in (29); in that case, relative wages still have a negative effect on the relative leisure.

The total effect on relative leisure is positive, if the indirect, collective, effect dominates the direct, unitary, effect, that is if:

$$-\overline{\mu\tau}\left(\frac{w_B}{w_A}\right)^2 + \overline{\tau}\frac{w_B}{w_A}\overline{\mu}' > 0 \Rightarrow$$

$$\epsilon_{\overline{\mu},w_A/w_B} = \frac{\partial\overline{\mu}}{\partial(w_A/w_B)} * \frac{w_A/w_B}{\overline{\mu}} > 1 \tag{30}$$

Thus, the collective term dominates the unitary term if the elasticity of A's relative weight in household utility, $\overline{\mu} = \mu/(1-\mu)$, with respect to the relative wage, w_A/w_B, is larger than 1. Assuming a general functional form for μ as e.g. a form of logistic function, we find that in general $\epsilon_{\overline{\mu},w_A/w_B} > 1$

if $(w_A/w_B) > 1$.[6] Thus, for couples with the woman earning more than her husband, the collective effect could very well dominate the unitary effect.

The other four parameters are taste parameters that may depend on an observable vector of *preference factors* such as the age and education of the two partners and the presence of children, as well as unobservables such as the inherent taste for work. Accounting for children is particularly important. To avoid setting up a full structural model that includes the consumptions of children, we simply assume that τ_A and τ_B, for example, are higher if there are young children in the household. This corresponds to assuming that caring for children is a 'leisure' item for the parents.

As discussed before, we have assumed that female and male leisure are substitutes in order to obtain a fairly simple framework for analyzing allocation within the household. Allowing for complementarity by extending the household utility function to incorporate a term consisting e.g. of the product of the two spouses' leisure choices makes the model much more complicated. Moreover, introducing complementarity would not change the *sign* of the effects analyzed below, but would only tend to diminish the numerical *size* of the effects since the two partners will tend to make their individual leisure choice approach the leisure approach of their partner.

As we shall see in the empirical part of the paper, couples do seem to choose fairly similar levels of leisure which is probably an indication of the fact that complementarity between leisure choices is an important empirical factor. Previous contributions by Hamermesh (2000), Hallberg (2003) and Ruuskanen (2004) address the issue of couples synchronising their time in both marketwork, housework and leisure and analyze the effects of economic and demographic variables on jointness in time-use. A central feature in these contributions is the distinction between a general time synchronization in society - due to the organisation of the labour market, shop opening hours, etc. - and the intended synchronization of couples' time based on their wish to spend some time together. This distinction is usually analyzed based on the difference between synchronization of time in 'pseudo couples' who have been matched based on a number of observable characteristics and in real couples, cf. Hallberg (2003). Based on Finnish time-use data with a highly detailed level of activities, Ruuskanen (2004) finds that couples tend to spend around 20-25 pct. of their leisure together during weekdays, while around

[6] We assume a special form of logistic function $\mu = \frac{\exp(w_A/w_B)}{e+\exp(w_A/w_B)}$ where $e = \exp(1)$ to ensure that $\mu \in]0;1[$ and $\mu(1) = 0.5$.

1/3 of the leisure is spent together during weekends. The overall conclusion in the contributions by Hamermesh (2000), Hallberg (2003) and Ruuskanen (2004) is that jointness in the timing of leisure and housework is important. However, the evidence regarding the sign and size of the effects of economic and demographic variables is somewhat mixed. Ruuskanen (2004) finds that the spouse's annual income has a negative effect of the share of joint leisure out of total leisure, while the male educational level has a positive effect on the share of joint time use. On the other hand, Hallberg's results indicate that high-income spouses experience more time together, which is interpreted as a possible consequence of these couples having more funds to buy market services thus getting more pure leisure together. Ruuskanen also finds that the number of children has a negative effect on joint leisure. Hamermesh (2000) finds that it is the presence of children that is most important for the lack of joint leisure among married couples. This is consistent with Hallberg's results. Hallberg also finds that time together is low among older couples compared to younger ones. On the other hand, Ruuskanen finds that dummies for older cohorts have a positive effect on joint time-use in both leisure and housework, which could be interpreted as evidence for the hypothesis that couples tend to increase their synchronization of activities the longer they have been married.

3 Empirical specification

As mentioned above, in our empirical work, we concentrate on the female relative expenditure (consumption) leisure share for which we have data. We also have information on wages, w_A and w_B, but we do not have any measures for $\overline{\mu}$, $\overline{\theta}$ and $\overline{\tau}$. In the household allocation literature, it is usually suggested that the utility weight - or Pareto weight - $\overline{\mu}$ depends on a set of socalled distribution factors including the difference in age, wages, education etc. of the two spouses as well as environmental factors as the population (or regional) sex ratio. All these factors impact each of the spouses opportunities outside the marriage and are therefore argued to affect each of the partners 'power' within the marriage. In the empirical specification of the model, we model $\overline{\mu}$ in the following way:

$$\overline{\mu} = \exp(\alpha' z_d + \delta \ln \left(\frac{w_A}{w_B} \right) + \varepsilon_\mu) \tag{31}$$

where z_d are distribution factors including e.g. relative age and relative education of person A. Another traditional distribution factor, the relative wage, is accounted for explicitly in this model, as the relative wage also enters ρ_l, the leisure share, through the labour supply decision. ε_μ is an error term which captures other factors affecting $\overline{\mu}$ which we have not been able to account for explicitly in the model.

Parallel to this, we model A's relative taste for consumption, $\overline{\theta}$, as a function of a set of household characteristics, z_θ. Furthermore, A's relative taste for leisure, $\overline{\tau}$, is assumed to depend on a set of household characteristics, z_τ:

$$\overline{\theta} = \exp(\gamma'_\theta z_\theta + \varepsilon_\theta) \tag{32}$$

$$\overline{\tau} = \exp(\gamma'_\tau z_\tau + \varepsilon_\tau) \tag{33}$$

Entering (31), (32) and (33) into (25) and (27), respectively, and taking logs, we get the following system of equations for the relative expenditure x_A/x_B and the relative leisure l_A/l_B:

$$\ln \frac{x_A}{x_B} = \alpha' z_d + \gamma'_\theta z_\theta + \delta \ln\left(\frac{w_A}{w_B}\right) + \varepsilon_\theta + \varepsilon_\mu = \beta_x Z_x + \varepsilon_x \tag{34}$$

$$\ln \frac{l_A}{l_B} = \alpha' z_d + \gamma'_\tau z_\tau + (\delta - 1) \ln\left(\frac{w_A}{w_B}\right) + \varepsilon_\tau + \varepsilon_\mu = \beta_l Z_l + \varepsilon_l \tag{35}$$

In both equations, the composite error terms, ε_x and ε_l, comprise of two elements: an error term related to the modelling of relative taste for leisure and consumption in the households, and an error term related to the mapping from distribution factors, z_d and relative wage, $\frac{w_A}{w_B}$.

4 Data

Data are from the Danish Time Use Survey (TUS) for 2001. This survey entails detailed information on time use for more than 2000 Danish individuals in 2001. The Danish Time Use Survey complies with methodologies developed at the EU level for conducting time use surveys. See Bonke (2003) for a more detailed description of the Danish Time Use Survey. For married and cohabiting respondents, the partner in the household was also asked to

participate in the survey. The respondents were asked to fill in a diary stating their activities at a detailed level every 15 minutes in two 24-hour days, a week-day and a week-end day. Furthermore, the respondents answered a questionnaire asking questions about personal and household characteristics as well as about the usual distribution of tasks in the household, consumption patterns, usage of domestic appliances, individual perception of economic situation etc. Survey data has been linked to register information from Denmarks Statistics on the respondent, giving access to further personal and household information, information on housing, usage of public child care facilities etc.

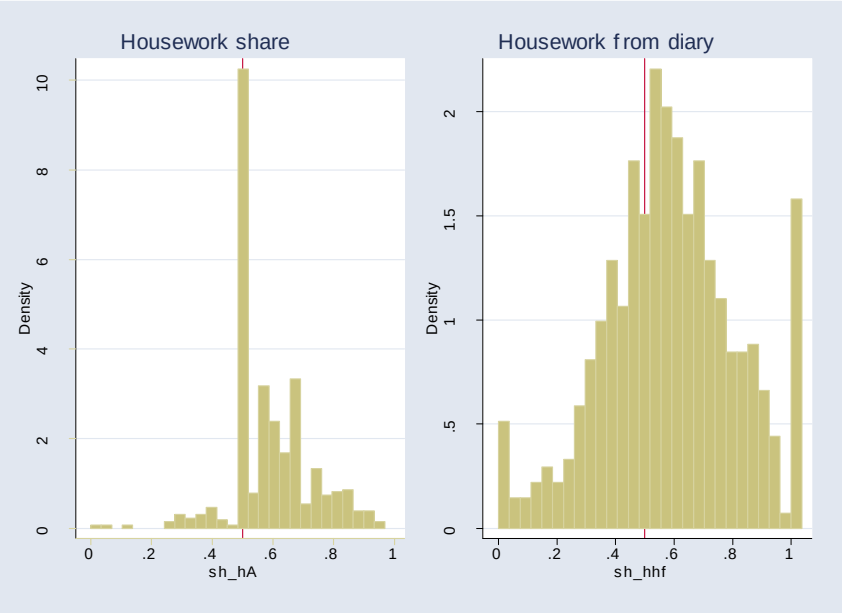
Thus, the TUS contains information on both time use and consumption in more than 1200 couples. Time use was the primary motivation for this survey and therefore the dataset is most detailed on information on how individuals spend their time. However, there is also a (limited) set of information on consumption. In this respect, the Danish TUS is unique in an international context.

In this analysis, we concentrate on couples where both spouses work in in the labour market. We also need to have information on hourly wages, hours worked in the market and hours worked at home for both partners. Moreover, it is essential that all couples provided information on personal consumption for a list of consumption items for both husband and wife. Thus, the analysis is performed on a subset of the original dataset of around 564 respondents where all the above mentioned information was available.

In the questionnaire, respondents were both asked to fill in a time diary and asked about the time they *normally* spend on housework and in the labour market in a typical week. In general, it is observed that surveys asking about *normal* time use have a smaller variance, but perhaps a more imprecise mean of time use, while diary information gives more precise means, but with a larger variance, cf. Juster and Stafford (1992). As we want to reduce the variance of time use across individuals, we have chosen to use *normal* time use instead of the diary information.

Individuals in the dataset are aged between 18 and 80 years. In the selected dataset of working couples, the average age for men is 44 years and 41 years for women. In this group, men work approximately 10.7 hours in the house per week, whereas women spend 15.6 hours each week doing housework. In this context, housework time includes normal housework, i.e. cleaning, laundry, shopping, cooking etc., gardening, repairs and other do-it-yourself work and childcare. Thus, on average, women work 5 hours per week

Figure 1: **Female housework share, usual and diary**



or more than 45 pct. more in the house than men. Thus, the female share of total housework is around 60 percent, based on information on 'usual' time use. This result is in accordance with the averages from the time diary. Figure 1 below compares the distributions of women's housework share from the question on usual time use for housework and the information from the time diaries. It appears that by using information on usual time use, we get a smaller variance - in fact a large proportion of households report than husband and wife use nearly exactly the same amount of time in housework. The advantage of using usual time use is that we avoid the strange 'tails' in the diary information stemming from the fact that housework on one particular day may not be representative of the normal distribution of housework in the household. A disadvantage might be that the large share of households with exact equal sharing might not be quite realistic.

Table 2 shows that both male and female jobsituation is important for total housework.

Table 2: Male and female time in housework, average number of hours per week

Jobsituation	Male housework	Female housework	No. of obs.
Both in job	10.3	15.5	891
Only female in job	15.2	14.8	65
Only male in job	9.0	20.6	102
None in job	13.9	20.8	150
All households	10.9	16.6	1260

Source: Danish Time Use Survey 2001.
Note: Columns do not necessarily sum to column total due to missing information on employment status of some households.

In the following, we focus on the above mentioned sample of households where both husband and wife work in the labour market and where we have information on all the variables of interest for this analysis. The load of housework (including child care) naturally depends on whether there are children under 18 years in the household, and the number of children. Around 56 percent of the households in our sample have children below 18. For men, the average housework load increases from 9.7 hours per week without any children in the household to 10.6 if there is one child, cf. table 3. For women without children, the workload is 13.9 hours per week, whereas women with 1 or 2 children work respectively 15.8 and 18.1 hours per week at home. As the sample only comprises couples where both spouses work in the labour market, we have excluded couples where the woman is on maternity leave or where one of these spouses has specialized fully in housework. Such couples might very well have a higher degree of specialization. The difference between husband and wife's housework time is around 0.6 hours per day in couples without any children. This difference is enhanced by the number of children to almost 1 hour per day for families with 3 or more children, indicating increased specialization as the family grows. However, the proportion of the total housework load taken on by the woman is more or less constant, irrespective of the number of children.

Figure 2: **Female and male housework and housework share**

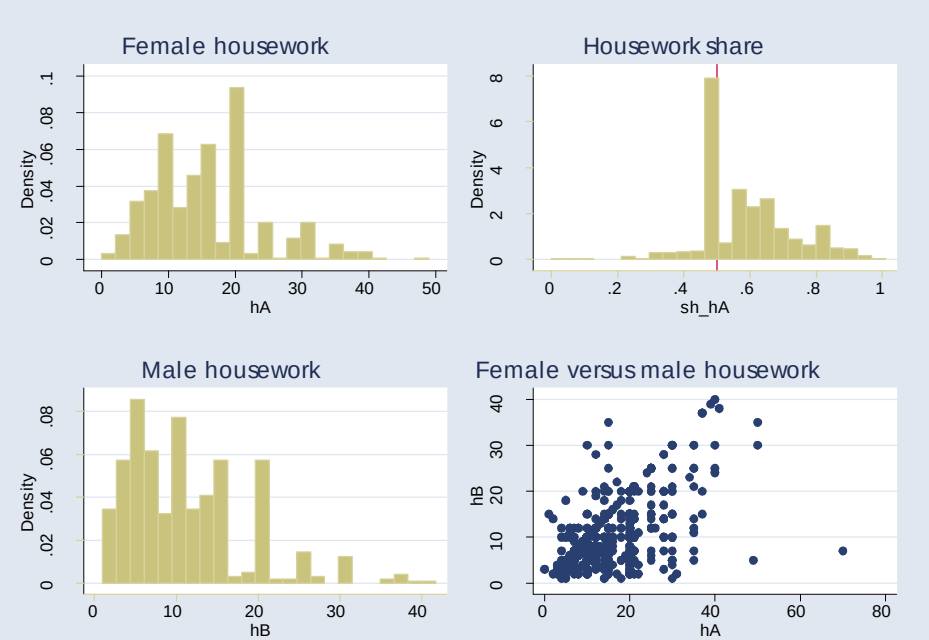


Table 3. Housework and children in household, average number of hours per week

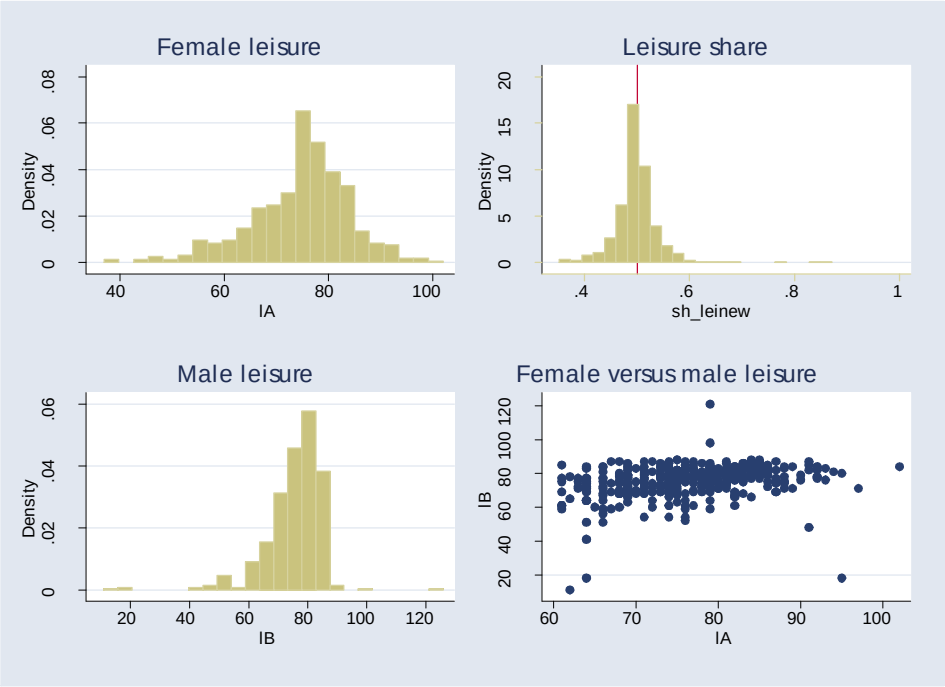
No. of children	Male time	Female time	No. of obs.
0	9.7	13.9	246
1	10.6	15.8	130
2	13.3	18.1	132
3 or more	13.8	20.7	56

Source: Danish Time Use Survey 2001.

Figure 2 shows the distribution of female housework, male housework, female housework shares and a plot of female versus male housework. It appears that there is a positive correlation between the two.

TUS also gives us information on time spent on market work and usual time spent commuting to and from work (including child collecting). Based

Figure 3: **Female and male leisure and leisure share**



on this, we can calculate 'pure' leisure for both man and woman. The female share of 'pure' leisure is around 50 percent. Thus, it seems that men compensate for the fewer hours of housework by working more in the market, as expected. The distribution of pure leisure is shown in figure 3 below. It appears again that husband's and wife's leisure are positively correlated.

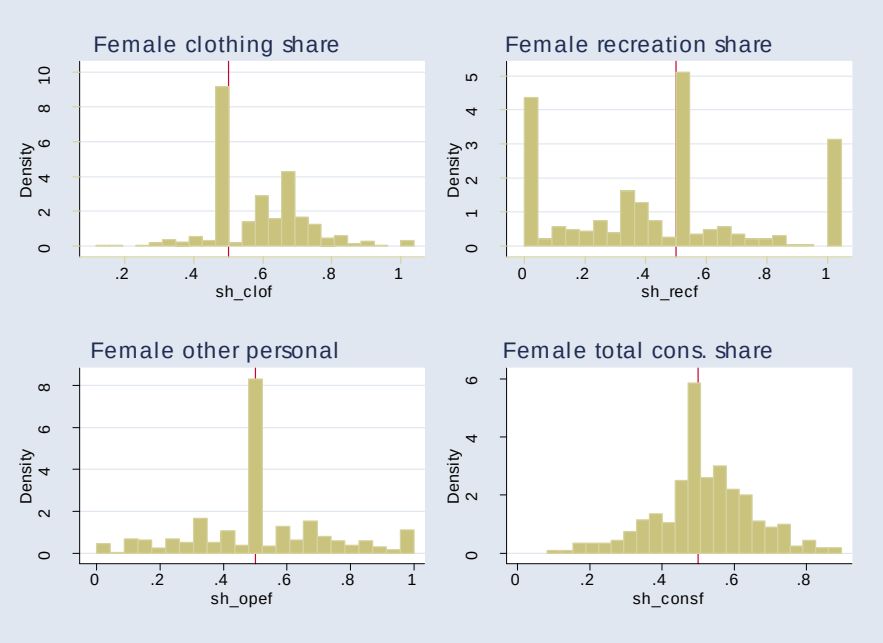
4.1 Consumption data

As mentioned above, the primary objective of the TUS 2001 survey was to collect information on time use. Thus, information on consumption is limited. Concerning consumption questions, the following questions were asked to the respondents:

'When you think of your own personal consumption, how large do you estimate it normally is on the following items during one month

- 'Shoes, clothing'

Figure 4: **Female share of consumption**



- 'Leisure activities, hobbies etc.'
- 'Other personal consumption'

  The respondent was asked the same questions about personal consumption of spouse/cohabitant. The female consumption share for the three consumption groups, 'clothing', 'recreation' and 'other personal consumption' and the sum of these three groups, 'total consumption' is shown in the figures below. It appears that there seems to be an extremely equal sharing of consumption in Danish households. Thus, around 10-20 percent of all observations report shares exactly equal to 50 percent. On average, women spend around 59 percent of the budget for clothing, they spend 41 percent of the money for recreation, and they use around 49 percent of the budget for other personal consumption. On average for the sum of the three consumption groups, women spend around 52 percent of the budget for male and female consumption.

To check the validity of the consumption information in the TUS, we com-

pared information with the Danish Household Expenditure Survey (HES). For 'clothing' and 'recreation', the consumption shares are very close to the corresponding groups from HES. For 'other personal consumption', the difference is quite large, but this may very well be attributed to differences in the definition of this group. See Browning, Crossley and Weber (2002) for a discussion of pros and cons of using information on 'usual' consumption from general purpose surveys.

Obviously, the Time Use Survey's information on consumption is limited. First, respondents were only asked questions on three specific consumption groups. Compared to information from the HES survey, these three consumption groups account for around 38 percent of total household consumption. Secondly, consumption within these three consumption groups is not attributable to either the husband or the wife. Part of consumption within these groups may be consumed jointly of by children or other household members. In the HES survey, around 57 percent of expenditure on clothing is attributable to either husband or wife, 23 percent of recreation expenditures are attributable to husband or wife, and around 56 percent of 'other personal consumption' was spent by either the man of the woman for themselves. Thus, based on information from HES, we can estimate that the fraction of total household consumption covered by the three questions in the TUS survey accounts for around 16 percent of total household consumption. In the following, we will assume that the remaining household consumption is allocated between husband and wife according to the distribution of the sum of these three consumption groups. Thus, we assume that *within* a given household h, if these three consumption groups taken together constitute κ_h of the woman's private consumption, then the sum of these three consumption groups will also constitute κ_h of her husband's private consumption. Evidently, this assumption can be crucial. However, κ_h can vary *across* households without jeopardizing our assumption.

5 Results

Our empirical model consists of a linear system of two for the female relative leisure share and the female relative consumption As distribution factors, z_d, we have used the relative age of the woman, her relative educational level (measured in years of schooling) and relative educational level squared. Initially, we also applied duration of the marriage as a distribution factor,

but duration of marriage is strongly and positively correlated with male age which showed up being a much more significant explanatory variable. The last distribution factor is the relative wage, $\ln(\frac{w_A}{w_B})$, which has been accounted for separately in our model. Factors which we suspect can affect the relative tastes for consumption and leisure of the partners in the household are household income, educational level (of the male), age (of the male) and the presence of children. Descriptive statistics for our data are shown in table 4.

Table 4: Summary statistics

	Mean	**Std. dev.**	**Minimum**	**Maximum**
Relative female consumption	1.29	0.95	0.09	8.67
Relative female leisure	1.02	0.32	0.54	5.63
Relative female age	0.95	0.09	0.61	1.37
Relative female education	1.04	0.21	0.56	1.80
Relative female wage	0.82	0.28	0.11	2.25
Level of male education	13.23	2.59	10	18
Dummy for young children	0.36	0.48	0	1
Dummy for older children	0.34	0.47	0	1
Male age	43.59	9.69	22	66
Gross household income, Dkr.	630,211	224,011	260,596	2,719,736

We estimate the model by a linear system GMM estimator. The standard errors are heteroskedasticity robust. The results of the initial GMM estimations are shown in table 4, columns 1-2.

We test linear restrictions on the parameters by the minimum chi-square test. Given our empirical model in (34) and (35), we expect that the parameters for the distribution factors in z_d, i.e. α, are the same in the consumption and in the leisure equation, and we therefore test each of the distribution factors, female relative age, female relative education and female relative education squared. These hypotheses are all rejected. Furthermore, we test whether the relative wage parameter in the relative consumption equation equals 1 plus the relative wage parameter in the relative leisure equation, as suggested by our empirical model. and household income. This is also rejected. Finally, we perform cross-equation restrictions on the remaining controll variables. These tests lead to reject that the presence of older children (7-17) and male educational level has the same effect on female relative consumption and female relative leisure. But we accept that log gross house-

hold income, male age and the presence of young children have the same effect on relative consumption and relative leisure. Based on these test results, we impose linear restrictions on the system by using classical minimum distance (CMD) estimation, cf. table 5, column 3-4.

Table 5: Estimation results

	GMM			**With restrictions**		
	Coeff.		**t-value**	**Coeff.**		**t-value**
Relative female consumption						
Constant	0.430		0.607	0.143		0.237
Relative female age	-0.467	*	-1.679	-0.443	(*)	-1.636
Relative female education	1.106	(*)	1.285	1.248	(*)	1.474
Relative education squared	-0.619	(*)	-1.609	-0.664	*	-1.739
Relative female wage	**0.267**	****	**3.477**	**0.237**	****	**3.288**
Level of male education	-0.016		-1.254	-0.007		-0.717
Dummy for young children	-0.034		-0.604	-0.038	*	-1.886
Dummy for older children	0.098	*	1.707	0.105	*	1.874
Male age	-0.001		-0.413	-0.002	(*)	-1.535
Gross household income	0.120		1.111	-0.009		-0.278
Relative female leisure						
Constant	-0.274		-1.267	-0.241		-1.127
Relative female age	0.140	*	1.649	0.127	(*)	1.500
Relative female education	0.093		0.323	0.076		0.264
Relative education squared	-0.024		-0.194	-0.017		-0.143
Relative female wage	**-0.062**	****	**-1.900**	**-0.055**	****	**-1.708**
Level of male education	0.011	**	2.626	0.010	**	2.440
Dummy for young children	-0.042	*	-1.905	-0.038	*	-1.886
Dummy for older children	-0.010		-0.649	-0.008		-0.497
Male age	-0.002	(*)	-1.584	-0.002	(*)	-1.535
Gross household income	-0.023		-0.699	-0.009		-0.278

** Significant at 5 pct. level
* Significant at 10 pct. level
(*) Significant at 20 pct. level

The estimation results lead to the following conclusions for female relative consumption: Relative wage, which is our primary parameter of interest, has a positive and significant effect on the female relative consumption. Thus,

if the female wage increases by 10 percent compared to the wage of her husband, she will attain a consumption surplus of 2.7 percent.

Relative age has a negative and significant (on a 10 pct. level) effect on the female relative consumption. Thus, if we compare two households where both men have the same age and with otherwise similar characteristics except female age, we would expect that an age difference of 10 percent (which is around 4 years for the average woman) would imply that the older wife has a 4.5 percent lower private consumption level than the younger wife. Both results are in accordance with our expectations on what drives "power" in the household discussed above. We also find that the presence of teenagers has a positive (and significant at 10 percent level) effect on female relative consumption.

Relative education has a positive effect and relative education squared has a negative impact on female relative consumption. The overall effect of a change in relative education thus depends on the level of female relative education. For the average woman who is longer educated than her husband, the overall effect is negative, meaning that her attaining even longer education does not benefit her share of household private consumption. This results apparently contradicts what we what expect about what drives the distribution of power in the household. On the other hand, if her educational level is lower than her husbands, then she can improve her share of household consumption by taking one extra year of education.

Furthermore, we find that the presence of both young and older children has a significant effect on women's relative consumption, but the effects have opposite signs. Thus, it seems to harm female relative consumption to have young children, while the effect of having older children seems to work in the other direction. The husband's age (which is obviously strongly positively correlated with his wife's age) seems to have a negative effect on his wife's consumption share.

In the equation for female relative leisure, we observe the following: Relative wage has a negative and significant (at 10 pct. level) impact on female relative leisure. This is consistent with both the unitary and the collective framework according to our theoretical discussion above. As discussed above, the relative wage is treated differently from the other distribution factors, as the relative wage impacts the leisure choice through two channels: There is a negative effect - what we have above termed as the "unitary" effect - on the relative female leisure through the familiar labour supply decision. And a positive effect - the "collective" on the relative female leisure as a higher

relative wage for the woman enhances her power in the household. In this case, the net effect is negative, implying that the unitary effect dominates the collective effect. A positive net effect would have been strong evidence for the collective model. On the other hand, a negative net effect is in accordance with both the unitary and the collective model.

Relative education has an overall positive (but insignificant) impact on female relative leisure. We also find that the husband's educational level has a positive effect on the female leisure share. And the man's age negatively affects his wife's relative leisure.

Furthermore, we find that the presence of young children has a negative and significant (although small) effect on female relative leisure. This is consistent with our finding that especially female housework rises with the number of children in the household, cf. table 2.

We also find that the residuals from the consumption and leisure equations are positively correlated. This is consistent with what we expected from the empirical specification of the model, as the error terms of the two equations consider of two elements. First, an error term for the taste parameters, ε_θ and ε_τ, These are specific for each equation and could be either positively or negatively correlated. Secondly, an error term ε_μ which is common for the two equations and probably resulting in the the positive correlation of the compositive error terms. The overall explanatory power of our empirical model is modest, and the results should be interpreted with cautioun.

6 Discussion/conclusion

This paper treats the interactions between allocation of time and allocation of consumption. Our theoretical discussion underlines the importance of being specific about the decision process in the household. In particular, it is important to take into account the fact that the household constitutes of several (here: two) members which often have conflicting preferences and goals. These intra-household differences are in focus in Chiappori's (1988) collective model . The implications of assuming a unitary decision process versus a collective decision process lead to quite different predictions.

The main contribution of our paper is to provide an empirical analysis of these questions, making use of a by international standards unique Danish dataset with information on both time use and private consumption for more than 600 Danish households. Our estimations seem to confirm that

it is important to incorporate the socalled distribution factors, i.e. factors that we believe describe the distribution of "power" in the household. We find that the woman's relative wage has a positive and significant impact on the female relative consumption share. This is evidence in favour of the collective model. Other results from our regressions point in the same direction. However, our results should be interpreted with caution; the results are somewhat mixed and the overall explanatory power of the empirical analysis is modest. However, we believe that our results are robust and confirm prior studies of intra-household allocation. Furthermore, we believe that our results underline the importance of continuing the work on collecting more and better data on households' use of time and expenditure in order to improve our means of analyzing intra-household distributional issues.

References

[1] Apps, P. (2003): Gender, Time Use and Models of the Household. IZA DP No. 796. IZA, Bonn.

[2] Apps and Rees (2002):

[3] Apps and Rees (1997): Collective Labour Supply and Household Production. The Journal of Political Economy, Volume 105, Issue 1 (Feb., 1997), pp. 178-190.

[4] Aronsson, T., S.-O. Daunfeldt and M. Wikström (2001): Estimating intrahousehold allocation in a collective model with household production. Journal of Population Economics, 14, pp. 569-584.

[5] Becker, G. S. (1994): A Treatise on the Family. Cambridge, Mass. Harvard University Press. Cambridge, Massachusetts. London, England.

[6] Becker, G. S. (1965): A Theory of the Allocation of Time. The Economic Journal, Vol. 75, No. 299 (Sep., 1965), pp. 493-517.

[7] Bonke, J. (2003): Paid and unpaid work - diary information versus questionnaire information.

[8] Browning, Martin; François Bourguignon; Pierre-André Chiappori and Valérie Lechene (1994), "Income and outcomes: a structural model of intrahousehold allocation", *Journal of Political Economy*, 102(6), 1067-96.

[9] Browning, Martin and Pierre-André Chiappori, (1998), "Efficient intra-household allocation: a characterisation and tests", *Econometrica,* Vol66, n6, p*1241-78.*

[10] Browning, Crossley and Weber (2002): Asking Consumption Questions in General Purpose Surveys. CAM Working Paper. University of Copenhagen.

[11] Chiappori, P.-A. (1997): Introducing Household Production in Collective Models of Labor Supply. The Journal of Political Economy, Volume 105, Issue 1 (Feb., 1997), pp. 191-209.

[12] Chiappori, P.-A. (1992): Collective Labour Supply and Welfare. The Journal of Political Economy, Volume 100, Issue 3 (Jun., 1992), pp. 493-467.

[13] Hallberg, D. and A. Klevmarken: Time for children: A study of parent's time allocation. Journal of Population Economics (2003) 16: 205-226.

[14] Hersch, J. and L. Stratton (19xx):

[15] Juster, F.T. and F.P. Stafford (1992): The Allocation of Time: Empirical Findings, Behavourial Models, and Problems of Measurement. Journal of Economic Literature, Volume 29, Issue 2 (June, 1991), pp. 471-522.

[16] Kerkhofs, M. and P. Kooreman (2003): Identification and Estimation of Household Production Models. Journal of Applied Econometrics. 18, pp. 337-369.

[17] Lundberg, S.J., R.A. Pollak and T.J. Wales (1996): Do Husbands and Wives Pool Their Resources? Evidence from the United Kingdom Child Benefit. The Journal of Human Resources. XXXII-3.

[18] Phipps, Shelley and Peter Burton (1998), "What's mine is yours? The influence of male and female incomes on patterns of household expenditure", *Economica*, Vol65, n260, p599-613.