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contents

Jens Bonke and James McIntosh: Household time allocation – Theoretical and empirical results from Denmark	1
Ragni Hege Kitterød and Torkild Hovde Lyngstad: Diary versus questionnaire information on time spent on housework – The case of Norway	13
Casey B. Mulligan, Barbara Schneider and Rustin Wolfe: Non-response and population representation in studies of adolescent time use	33
Michael Bittman, Kimberly Fisher, Patricia Hill and Cathy Thomson: The time cost of care	54
Cara B. Fedick, Shelley Pacholok and Anne H. Gauthier: Methodological issues in the estimation of parental time – Analysis of measures in a Canadian time-use survey	67
Time pieces	88
New developments in time-technology – projects, data, computing, services	88
Book reviews by Kimberly Fisher	92



Household time allocation – Theoretical and empirical results from Denmark

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Abstract

Using data from a sample of households in 1994 we find that Danish household labour allocation choices are best described by a collective model in which decisions are made cooperatively. Individual preferences are similar but there are important differences due to the differences in educational attainment. Households can be characterized as utilitarian with a sharing rule which depends on household income and is feminist rather than egalitarian. The allocation of tasks within the family depends on both the individuals' comparative advantage in labour markets and individual preferences for paid work as well as the intra-household distribution of income. These results do not require explicit assumptions about labour supply that are often employed in the household time allocation literature.

JEL-Codes: D13, J22

Keywords: Household time allocations, unitary and cooperative models, Denmark

1 Introduction

Economic theory has focused largely on explaining individual behaviour. However, individuals live with other individuals in families or households whose membership confers rights and obligations that may influence the decisions that individuals make. This has been recognized since the seminal work of Becker (1965) but the subject is still in its infancy and while considerable progress has been made in developing theoretical models with empirically testable propositions there is much to be done.

The purpose of this research is to test recent models of household decision making on a sample of Danish households using data which was collected in 1994 as part of the European Community Household Panel study. The main model tested here is a version of the Browning-Chiappori (1998) cooperative household decision making model in which the objective function is the weighted sum of the individual utility functions of the adult family members with a time budget constraint induced by household production activities. One of our objectives is to examine the determinants of $\mu()$, the weighting function, or sharing rule as it is sometimes referred to in the literature. We also examine a class of non-cooperative models to see how well they compare with the cooperative model.

To summarize our results we find that Danish household decision making is best described by a collective model where decisions are made cooperatively. Individual preferences are similar but there are important differences due to differences in educational attainment. Households can be characterized as utilitarian with a sharing rule which depends on the amount of household income and places a higher weight on women in the household's objective function. The allocation of tasks within the family depends on both the individuals' comparative advantage in labour markets and individual preferences for paid work as well as the intra-household distribution of earned income. As a result the collective model rather than the unitary model gives the better description of time allocations. One of the main contributions of the paper is that these results do not require the explicit but questionable assumptions about labour supply behaviour that are often employed in the household time allocation literature.

The paper has the following format. The next section reviews the recent theoretical and empirical literature on household time allocations. Section 3 describes the data. In section 4 a theoretical model is developed and this is tested in section 5. An alternative non-cooperative model is examined in section 6 and the paper ends with some general comments.

2 A brief review of the literature

Models of household activity start with Becker's (1965) classic contribution which assumes that family members behave as if they were maximizing a household utility function subject to a household budget constraint. These are referred to as unitary models. Behaviour in models of this sort, as represented by their demand functions, mimics the standard model of consumer behaviour in the sense that Slutsky symmetry obtains with respect to cross-effects. For example, the partial derivatives of compensated labour supply functions with respect to the 'other wage' are equal. Non-wage income enters the budget constraint as the sum of individual receipts so that its distribution within the household plays no role in behaviour. Fortin and Lacroix (1997 p. 933) note that "At the empirical level, the specific restrictions imposed by the unitary model have received little empirical support".

There are serious theoretical limitations as well. Families consist of individuals with different

values and perhaps different and possibly conflicting objectives. At a minimum the unitary model should contain additional individual rationality and incentive compatibility constraints to ensure that the quantities in the objective function are actually provided by the participants.¹ Of course, there may be no enforcement mechanisms within the household that can compel members to conform to what is required of them in which case they are free to pursue their own interests.

When individuals can follow their own policies even when they are constrained by the actions of other family members unitary models are inadequate to describe their behaviour and game theoretic models are required. This has been recognized by researchers in this area and there is now a considerable literature in which both non-cooperative and cooperative game theoretic models are employed in the explanation of household decision making processes. There is some variety in the type of model considered but they all come under the general rubric of ‘collective models’.

Cooperative model applications subdivide further into cooperative Nash bargaining models and models whose cooperative structure is represented by the Pareto efficiency of the intra-household allocation process. Other models rely on the repetitive nature of household decisions for their cooperative and efficient structure. Two recent additions to the Nash bargaining literature are Konrad and Lommerud (2000) and Chen and Wooley (2001). As readers will recall the solution to the Nash bargaining model maximizes the product, $(u_i - d_i) \cdot (u_j - d_j)$ where d_i and d_j are the threat points of i and j subject to u_i and u_j , the utilities of i and j , being feasible.²

While the individual contributions to household activities result in a Pareto efficient outcome the model has two deficiencies. First, like the unitary model, there is no enforcement mechanism present so it gives no explanation as to why individual family members should behave in a cooperative fashion. Secondly, it also ignores the repetitive nature of this process.

However, there are models which are based on the assumption that intra-household welfare allocations are efficient. Examples are Chiappori (1992, 1997), Apps and Rees (1996, 1997), Browning and Chiappori (1998), and Blundell et al, (2001). Here the utility of one player is maximized subject to the constraints that the household faces together with a minimum utility constraint for the other player. Alternatively, Browning and Chiappori appeal directly to the repeated nature of the household decision making process and obtain efficiency by maximizing a weighted sum of utilities. Repetition can support the cooperative efficient solution in the form of a ‘trigger strategy’³ as a subgame perfect equilibrium provided the one period gains from deviating from the cooperative solution are less than the present discounted value of continued cooperation. The fact that these decisions are made repeatedly serves as an enforcement mechanism that makes cooperation an incentive compatible strategy.

There is an empirical side to this literature as well. Some of the more prominent contributions are Fortin and Lacroix (1997), Browning and Chiappori (1998) and Blundell et al (2001). The last two papers also make major contributions to the theory of household decision making in terms of deriving identification conditions for determining the reservation wage functions and the sharing rule. On balance, the evidence from these papers points against the unitary model although some care should be exercised in interpreting these results. Browning and Chiappori assume labour supplies and household income are exogenous and both Fortin and Lacroix and Blundell et al assume that individuals are on their labour supply curves and the time budget does not include

¹ This is a mechanism design problem and a good introduction to the literature in this area is Fudenberg and Tirole (1992 ch. 7).

² These can be exogenous or, as some writers prefer, they can be the Cournot-Nash solution. In the latter case it makes more sense to us to assume that the threat points can be implemented as dominant strategies.

³ See Friedman (1986 p. 85) for details.

the time allocated to household activities.⁴

Given the characteristics of our sample in which 65% of paid male employees work a fixed work week of 35 or 40 hours we are skeptical of the proposition that workers are actually providing their preferred number of hours to their employers given their working conditions and rates of remuneration. Add to this the possibility that there is an involuntary element in determining whether an individual has a job; then the assumption that individuals are on their labour supply curves becomes very dubious, indeed.

As Klevmarken (1998, p. 7) notes, when there is household work activity that requires time allocations from each individual family member, this will distort the amounts of leisure in the utility function and produce biased estimates of labour supply functions in models when this distinction is ignored. This is clearly more than a measurement error problem since the differences between measured leisure and actual leisure are not random. Moreover, these distortions are likely to be serious. Apps and Rees (1996 p. 211) show that uncompensated wage labour supply elasticities are very sensitive to whether leisure is defined net of household work time or not.

Fortunately, there is a growing empirical literature which deals specifically with household time allocations. Two recent papers in this area are Aronsson et al (2001) and Souza-Poza et al (2001). The first paper relies on a constant returns to scale aggregate household production function. Their sharing rule, based on 1993 Swedish data, depends significantly on relative education and wage differences which lead the authors to conclude that the collective model best describes the data. The second paper, although less theoretical, represents the whole of household production, which in reality is an extremely complex process involving multiple inputs and outputs, by a single time constraint. We find this an attractive way of incorporating household production into time allocation models because of its simplicity as well as the fact that no assumption on the scale efficiency of household technology is required. We will use a variant of this procedure later in our own work.

Our objective is examine some of the issues that were mentioned above by estimating a model of Danish time allocations using a framework which closely resembles the model of Browning and Chiappori (1998). This model is a convenient vehicle for testing the ‘collective hypothesis’. The assumptions we make allow the sharing rule to be recovered. As result we can then determine the variables upon which the sharing rule depends. To see how well the model performs we estimate a non-cooperative model and then compare the results of the two approaches.

3 Data

The data used in this study was collected as part of the Danish contribution to the European Community Household Panel Study. A random sample of 3481 Danish households all of whose members were born before 1977 were contacted. Of these, 1647 had files with enough information on the household’s and the individual’s characteristics to be included in this econometric study. Means and standard deviations of the data used in the analysis are contained in Table 1.

⁴ Added realism is achieved by modeling male participation as an all or nothing decision rather than a choice of the optimal number of hours

Table 1
Means and (standard deviations) $i = m, f$.

Variables	Symbol	Male $i=m$	Female $i=f$
Age	A_i	46.52 (15.29)	43.53 (14.66)
Education (Completed years of school)	E_i	11.89 (2.49)	11.84 (2.67)
Number of Children	n	0.98 (1.06)	0.98 (1.06)
Household Income per Month	y_h	19837 (8876)	19837 (8876)
Monthly Income if Working	y_i	20522 (7879)	11858 (8646)
Hours Worked Per Week(Paid Employment)	h_i	39.83 (6.81)	27.44 (15.53)
Hours Worked Per Week(Household Activities)	t_i	12.88 (7.87)	8.85 (9.10)
Employment Rate	e_i	74.56 (43.57)	65.39 (47.57)

Education is measured as the number of years of formal schooling. Monthly income for individuals is just the average income of those with positive paid hours worked and involves participants with both full time and part time paid employment. Unlike income, hours worked in paid employment and in household activities are measured on a weekly basis. Employment rates are just the percentage of each gender involved in paid work. The symbols e_i $i = m, f$ will be used to represent two dummy variables which take on the value one if the individual undertakes paid work. Of course, their averages in Table 1 are the just the employment rates for each gender.

Before turning to the analytics of household time allocations it is worth pointing out a number of interesting features of the data. First, like the situation in the UK, for example, about 75 % of Danish males are involved in paid work but there is a much higher percentage working less than thirty hours per week than in Britain. Blundell *et al* (2001 p. 35) also note similar participation rates for men and women whereas female participation rate in Denmark is about 85% of the male rate. Denmark also differs from Sweden with respect to hours worked by each gender. Aronsson *et al* (2001 p. 574) report a figure of 0.8 for the ratio of female to male hours worked. In the sample for Denmark this figure is 0.67. Social and economic conditions governing participation in labour markets are changing rapidly throughout Western Europe but these rates of change may be different across countries so it should not be surprising if the empirical results are different as well.

4 A model of household time allocation

Consider a family with two adult individuals, a man and a woman. Let the subscripts m and f refer to male and female and let ℓ_m and ℓ_f be the amounts of leisure time that each of the adults has. There are weekly time budgets for each adult

$$\ell_m + t_m + h_m = 168 \quad (1)$$

and

$$\ell_f + t_f + h_f = 168 \quad (2)$$

where t_m , t_f , h_m , and h_f are the amounts of labour time contributed to household activities and the hours worked in paid employment outside the household, respectively. Household expenditure on goods is constrained by income which is the sum of individual incomes by both

adults. This constraint is, therefore,

$$p(x_m + x_f) \leq y_m(h_m) + y_f(h_f) + z_m + z_f \quad (3)$$

where y_m and y_f are the incomes from employment for men and women, respectively and are assumed to be functions of hours worked as well as the characteristics of the individuals. z_m and z_f are the incomes from sources other than employment and (x_m, x_f) are the goods consumption vectors of the adults. The left hand side of equation (3) is household expenditure on goods and p is the price vector associated with these goods. Both adults have separable utility functions of the form

$$\widehat{U}_i(\ell_i, x_i, c_i) = U_i(\ell_i, c_i) + V_i(x_i, c_i) \quad i = m, f \quad (4)$$

where $c = (c_m, c_f, c_h)$ is a vector of male, female and household characteristics. Separability is assumed because it allows the sharing rule to be determined, a point noted by Chiappori (1992 p. 439), and it allows us to avoid some of the difficulties that arise when household goods consumption is not observed. Moreover, these utility functions are also ‘egoistic’, as in Chiappori (1997 p. 193), because ‘altruistic’ utility functions can not be identified. There is, however, some altruism implied by our utilitarian approach to the representation of household preferences.

Household production also requires time allocations from the adults. This is described by the constraint

$$t_m + t_f = t = G(c, z_G) \quad (5)$$

which indicates how much time is required for the household to function properly and $G(c, z_G)$ is a function of the adults characteristics and the household’s characteristics and a set of variables z_G which will be determined later. It arises as a consequence of the fact that goods and services are produced by members of the household for consumption within the household and these production activities require time as well as other purchased inputs. Some researchers, Becker (1965) or more recently, Chiappori (1997) or Aronsson *et al* (2001), for example, model the production of household intermediate inputs directly as functions of time inputs or possibly other purchased inputs. In certain circumstances this may be appropriate but, as Souza-Poza *et al* (2001 p. 601) noted, these relationships can be captured by a reduced form equation like equation (5) above.

Labour supplies, time allocations within and outside the household, and individual consumption activities are assumed to be determined in a cooperative and utilitarian fashion. Following Browning and Chiappori (1998) we assume that these decisions are determined as the outcome of the following constrained maximization problem:

$$\text{Max}[\mu(c, z_\mu)(\widehat{U}_m(\ell_m, x_m, c_m) + \{1 - \mu(c, z_\mu)\}\widehat{U}_f(\ell_f, x_f, c_f))] \quad (6)$$

with respect to $(\ell_m, \ell_f, x_m, x_f, t_m, t_f, h_m, h_f)$ subject to the above constraints. The function, $\mu(c, z_\mu)$, will be allowed to depend on the characteristic vector, c , as well as a set of individual or household variables which we denote as z_μ , unlike Browning and Chiappori who specified $\mu()$ as function of consumption expenditure and prices.

When (1) and (2) are substituted into (5) routine calculations reveal that the first order condition for this problem with respect to leisure choices is

$$\mu(c, z_\mu) \partial U_m / \partial \ell_m - \{1 - \mu(c, z_\mu)\} \partial U_f / \partial \ell_f = 0 \quad (7)$$

Although the model is very simple it is capable of explaining some of the features that are observed in the data. For example, there is less than complete specialization in household activities and employment activities but it is possible and likely that the individual with the largest amount of paid employment will devote a smaller amount of time to household activities. Secondly, it is possible for household income and the total time required for household activities to be substitutes. Thirdly, although the solution is cooperative there are still possibilities for unequal treatment of the genders since the utility functions are not the same and weights in the household welfare function may not be the same for each gender. In section 6 we consider alternative models which are explicitly non-cooperative.

5 Empirical application

To make the model estimable, functional forms for the utility functions, $G(c, z_G)$, and $\mu(c, z_\mu)$ have to be chosen. These are assumed to be

$$U_m(\ell_m, c_m) = m_0 \ell_m^{m_\ell} E_m^{m_E} e^{m_e e_m} \quad (8)$$

and

$$U_f(\ell_f, c_f) = f_0 \ell_f^{f_\ell} E_f^{f_E} e^{f_e e_f} \quad (9)$$

$G(c, z_G)$ is also assumed to have a constant elasticity form. And, for reasons outlined later

$$\mu(c, z_\mu) = \Phi(\gamma \ln(y_h)) \quad (10)$$

where $\Phi()$ is the cumulative normal distribution function.⁵

The first order condition, (7), generates the following structural equation

$$\begin{aligned} \ln(\ell_m) = & [\ln(f_0 f_\ell) + f_\ell \ln \ell_f + f_E \ln E_f + w_e e_w + \ln(1 - \mu) \\ & - \ln(m_0 m_\ell) - m_E \ln E_m - m_e e_m - \ln \mu] / (m_\ell - 1) \end{aligned} \quad (11)$$

Since there is no consumption data equation (11) together with the time budget equation

$$\ln(t_m + t_f) = \sum \beta_j \ln(c_j) + \sum \beta_{z_k} z_k \quad (12)$$

exhausts the empirical application of the model. As we mentioned earlier, we felt that it was unwise to assume that individuals were on their labour supply curves. However, we did attempt to model the relationships between earned incomes and hours worked. The results here were unsatisfactory. Without reasonable specifications for $y_i(h_i)$ it is impossible to include a first order condition for hours worked as one of our structural equations. As a result our explanation of household time allocations does not depend on any particular theory of labour supply.

Parameter estimates for the model's two equations are shown in Table 2. These were obtained by applying the Generalized Method of Moments estimation procedure to equations (11) and (12) using the vector, $(A_m, A_f, E_m, E_f, n_h, Y_m, Y_f)$, as instruments. (Y_m, Y_f) are the average incomes earned in the respondent's occupation. The definitions of the other variables appear in Table 1.

⁵ Using the logistic distribution yields the same empirical results.

This is perhaps the most general procedure available for estimating systems of non-linear structural equations. It allows for heteroscedasticity of unknown form and makes no distributional assumptions about the error structure. The procedure minimizes the quadratic form,

$$d = \bar{m}' V^{-1} \bar{m} \quad (13)$$

where $\bar{m}$ is the vector of sample moments and moments and V is the asymptotic variance-covariance matrix of $\bar{m}$. The estimated value of d , $\hat{d}$, has a χ_s^2 distribution which can be used to test the orthogonality of the exogenous variables to the residuals in each of the equations. The degrees of freedom parameter, s , is equal to the number of overidentifying moment restrictions less the number of estimated parameters. The variables which are not included on the instrument list are implicitly treated as endogenous. So variables like hours worked, participation in paid work, and earned incomes are endogenous in this model although there are no equations for them. It should be pointed out that no parameter biases will result from estimating incomplete models as long as all the variables are properly categorized, although the results will be inefficient.

In our preferred specification the weighting function $\mu(c, z_\mu)$ depends only on household income, y_h . $\mu(c, z_\mu)$, was first allowed to depend on various exogenous individual characteristics. None of these was significant. Various other specifications were considered and $\mu(c, z_\mu)$ was allowed to depend on household income, the work participation dummies, the largest earned income, ages, number of children, etc. of which only household income was significant. This is not surprising since Aronsson *et al* (2001 p. 576) found the same results for their 1984 sample but found that educational and wage differentials were significant arguments in their sharing rule for 1993. They, like Fortin and Lacroix (1997 p. 938), noted that when $\mu(c, z_\mu)$ has no significant arguments and is equal to one half the model becomes a separable version of the Becker unitary model. The value of $\mu(c, z_\mu)$ at the sample mean for household income is 0.394 with a standard error of 0.049 which gives a weight to males which is significantly less than the equal weighting of an egalitarian distribution of household welfare. Since the weighting function favours the women in the household we refer to it as a feminist allocation rule for lack of a better term.

As was seen in section 2 one of the characteristics of the unitary model is that individual behaviour does not depend on the source of non-wage income. In the model above household income was the only significant variable in the sharing rule. However, we also included the share of income earned by the male, $r = y_m/y_h$, as a regressor in equation (12). Since this variable is significant the source of earned income has an impact on labour time contributed to household production so that, in spite of the fact that intra-household income distribution has no influence on the sharing rule, the significance of r in the time equation should be taken as evidence in favour of the collective model over the unitary model.

Although many of the coefficients in Table 2 are significant their significance is not particularly informative about the signs or the significance of the structural parameters in the utility functions. The signs of the elasticities of utility with respect to leisure, m_ℓ and f_ℓ , are expected to be positive but the sign of $(m_\ell - 1)$ is ambiguous so that it is difficult sign the other parameters in equation (11). What is important, however, is that the coefficient, $m_E/(m_\ell - 1)$, of $\ln(E_m)$ is significant and $f_E/(m_\ell - 1)$, the coefficient of $\ln(E_f)$, is not. A simple Wald test shows that

$m_E \neq f_E$ so that the utility functions are different although the restrictions $m_\ell = f_\ell$, $m_e = f_e$, and $m_{y_h} = f_{y_h}$ are satisfied by the data. In addition, the overidentifying moment restrictions are satisfied.

Table 2
Parameter estimates cooperative model

Coefficient	Associated Variable	Estimate (Standard Error)
$f_\ell / (m_\ell - 1)$	$\ln(\ell_f)$	1.024 (0.129) *
$f_e / (m_e - 1)$	e_f	0.163 (0.023) *
$m_e / (m_\ell - 1)$	e_m	0.211 (0.011) *
$f_E / (m_\ell - 1)$	$\ln(E_f)$	-0.029 (0.019)
$m_E / (m_\ell - 1)$	$\ln(E_m)$	0.078 (0.022) *
β_n	$\ln(n)$	0.296 (0.019) *
β_{y_h}	$\ln(y_h)$	-0.314 (0.037) *
β_{A_m}	$\ln(A_m)$	0.197 (0.078) *
β_{A_f}	$\ln(A_f)$	0.220 (0.075) *
β_r	r	0.107 (0.039) *
γ	$\ln(y_h)$	-0.027 (0.013)
Criterion Function $\hat{d}$		0.768

Standard errors are in brackets. * indicates significant at $\alpha = 0.05$

Participation in paid work is significant in for both genders. This indicates that where individuals spend their time working matters in terms of their well-being. The presumption is that m_e and f_e are positive indicating that an hour worked in paid employment is preferable to an hour spent on household activities. But that requires $m_\ell > 1$ which may not be the case. Consequently, the model indicates that labour allocations are determined jointly by individual preferences for household work in addition to the characteristics that each individual brings to the household like ability, educational attainment and occupation, characteristics which determine the comparative advantages for each type of work. This feature of the model differs from the household models of Blundell *et al* (2001) and Browning and Chiappori (1998) in which the explicit treatment of paid/household labour allocation mechanisms is not examined.

In this sample both men and women work about the same number of hours in total with women spending more time in the home. Yet men work in better paid occupations and have higher incomes. To account for these features of Danish households opportunity costs and the potential gains from specialization should be allowed to play some role in models which explain the household labour allocations. This aspect of household behaviour is treated implicitly by using variables which represent opportunity costs: the average incomes earned by members of the respondent's occupation, together with years of schooling and ages as instruments in the estimation procedure.

In this model decisions are made cooperatively so that the number of hours that are required to run the household reflect commonly agreed needs. These depend positively on the women's age and the number of children in the household but negatively on the household's total income. While it is not obvious that women should contribute more hours to household activities as they grow older, the fact that households with higher incomes have lower time requirements is not surprising. Families with larger incomes can afford appliances, cars, and hired help for domestic

chores. All of these allow households to reduce the time required to run their domestic operations. As noted above, households which get more of their income from the male require more time in household production. This result, at first sight, is difficult to interpret but it may arise as a consequence of women doing tasks in which men have a comparative advantage but do not have time to do because of outside work commitments.

6 Non-cooperative models

Some of the earlier literature reviewed in section 2 emphasized the role of non-cooperative models as possible candidates for explaining household labour time allocations. Our preferred model is the cooperative model for the reasons outlined in section 2. While the arguments are compelling as to why these models should provide the best explanation of household labour allocations we thought that it would be informative to consider various non-cooperative models to see how they compared with the cooperative model.

Among many alternative structures, we considered the following non-cooperative model whose objective functions are

$$\widehat{u}_i(\ell_i, h, K) = u_i(\ell_i, c_i, c_h) + v_i(t, c_i, c_h) \quad i = m, f \quad (14)$$

When households do not operate cooperatively the participants do not agree on a time budget and act strategically in determining their household time contributions. These time allocations are driven by the value of total household time as represented by the second term in (14). Nash equilibria $(\ell_i^*, t_i^*) \quad i = m, f$ satisfy the inequalities

$$\widehat{u}_m(\ell_m^*, t_m^* + t_f^*, c_i, c_h) \geq \widehat{u}_m(\ell_m, t_m + t_f^*, c_i, c_h) \quad \forall (\ell_m, t_m) \quad (15)$$

$$\widehat{u}_f(\ell_f^*, t_m^* + t_f^*, c_i, c_h) \geq \widehat{u}_f(\ell_f, t_m^* + t_f, c_i, c_h) \quad \forall (\ell_f, t_f)$$

Parameter estimates for this model is shown in Table 3 where the endogenous variables are $\ln(\ell_i) \quad i = m, f$ model. Both $u_i(\ell_i, c_i, c_h)$ and $v_i(t, c_i, c_h)$ are characterized by constant elasticity functional forms so that the resulting first order conditions are linear in the natural logarithms of the variables.⁶ The model is not particularly satisfactory. Although it satisfies the overidentifying restrictions with respect to the exogenous variables,⁷ women do not appear to value total household time.

⁶ Using the fact that $t = 168 - \ell_m - h_m + 168 - \ell_m - h_m$ the first order conditions which generate the best reply functions are $\partial u_i(\ell_i, c_i, c_h) / \partial \ell_i - \partial v_i(t, c_i, c_h) / \partial t = 0$. Assuming constant elasticity sub-utility functions and that $(c_i, c_h) = (\ln(A_i), \ln(y_h), \ln(n))$ leads to the ln-linear equations whose parameter estimates appear in Table 3. These have the same structure as equation (11).

⁷ The exogenous variables are the same as those used in the model of the previous section.

Table 3
Parameter estimates non-cooperative model

Variable	Males: $\ln(\ell_m)$	Females: $\ln(\ell_f)$
$\ln(t)$	0.155 (0.037)	0.026 (0.045)
$\ln(A_m), \ln(A_f)$	-0.036 (0.022)	-0.016 (0.011)
$\ln(y_h)$	-0.013 (0.001) *	-0.019 (0.001) *
$\ln(n)$	-0.104 (0.013) *	-0.049 (0.006) *
Criterion Function	$\hat{d}$	5.215

Standard errors are in brackets indicates significant at $\alpha = 0.05$

7 Concluding remarks

Our approach to explaining the allocation of household labour has been to avoid specific formulations of individual labour market behaviour. However, (h_m, h_f) and (e_m, e_f) were treated as endogenous variables in the estimation procedure and when they were added to the instrument list the over-identifying moment restrictions were rejected. These variables can not be treated as exogenous variables so the question of what determines hours worked is an unresolved problem. It is probably the case that hours are predetermined for some but not others. Consequently, future sample surveys should ask respondents whether they receive salaries or wages and whether the number of hours that they work is satisfactory to them. This would allow the model to reflect differences in labour market conditions facing the respondents.

Hours worked within the household is a substantial proportion of total work for both men and women. It is sufficiently large that it can not be ignored in the computation of leisure. As an experiment we redefined leisure by dropping t_m and t_f from equations (1) and (2). The estimated parameters are considerably different from those reported in Table 2, just as Apps and Rees (1996) found, so that considerable caution should be exercised in interpreting results from models where there are serious measurement errors in the leisure variables.

One final word caution is necessary. It is more than slightly improbable that one kind of model can fit all households. It is standard practice in the literature not to allow for the possibility that some households might be at the stage where breakdown is immanent. For these households some sort of non-cooperative model would be more appropriate. It is not clear whether in these cases an equilibrium concept is appropriate unless it involves dominant strategies. Nonetheless, some differentiation over household types will probably lead to better results and future sample surveys could be improved by including questions on how well respondents think their household works relative to the other alternatives that are available. Like differences in labour market conditions these differences could also be built into the models. In our survey there were some questions which related to individual satisfaction. However, running the two models over various subgroups defined by satisfaction levels was not informative. We expected that for respondents who reported low levels of satisfaction the non-cooperative models would perform better than the cooperative models for this subsample and better than non-cooperative models for the whole sample. Neither of these expectations were realized so we could only conclude that the variables measuring satisfaction referred to their own personal well-being and not an expression of how well their households performed.

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Diary versus questionnaire information on time spent on housework – The case of Norway

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Abstract

Information on housework-time is important for understanding the daily life organisation of different population groups, especially parents. However, time-use surveys, which are usually seen as the best method for capturing information on unpaid work, are very costly and are conducted rather rarely in Norway. Hence, we want to assess whether housework can be adequately measured by other methods. Internationally, a great deal of work has been undertaken in cross validating diaries and questionnaires. It is often found that questionnaires generate somewhat larger estimates for housework-time than diaries, but the reporting gap varies between groups of people. It is assumed that social desirability plays an important role so that people feeling pressures to do much housework over-report their contributions more than others. In Norway, the housewife role has nearly vanished, and people now rarely meet social prescriptions to do much housework. This might imply less over-reporting in questionnaires. The present paper compares estimates for housework-time from the diary-section and the questionnaire-section in the latest Norwegian Time Use Survey with particular focus on parents. Looking at all adults we find only modest differences in the time-estimates between the two methods, but the gap varies considerably between age groups.

JEL-Codes: C81, D13, J16, O17, R20

Keywords: Time allocation, data collection and data estimation technology, housework, measuring time-use

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1 Introduction

In Norway, as in many other countries, the significant raise in women's labour market participation during recent decades has entailed an increased interest in issues concerning peoples', and particularly parents', organisation of housework and childcare, and hence, also in high quality data on unpaid labour. The Norwegian Time Use Surveys reveal major changes in people's time-use since the beginning of the 1970s, and one of the most significant alterations is found in time spent on housework such as meal preparation, cleaning, laundry etc. (Kitterød 2002a, Vaage 2002, pp. 38-40). Consistent with findings in many other countries (Bianchi et al. 2000, Gershuny 2000, Robinson and Godbey 1997) we see that women's housework-time has decreased considerably, whereas there has been a slight increase among men. This is true for parents as well as for other demographic groups. Consequently, the gender difference has dramatically diminished, although in most couples women still do the bulk of the household chores. Such observations are based on two types of information, questionnaire data and diary data, the congruence of which is in question. As diary data are rather expensive to collect, the need for alternative measurements of housework-time is widely recognized, and the importance of methodological research in this field is emphasized. The purpose of this paper is to compare measurements of time spent on housework from the questionnaire-section and the diary-section in the latest Norwegian Time Use Survey in order to assess whether questionnaire information in this field can be used to analyse people's daily life practices.

It is well established that time spent on unpaid work is most accurately measured through time-use studies where respondents give an account of their activities in a structured diary covering one or more days. Since people report their activities in their naturally occurring order and shortly after they have been undertaken, over- or under-reporting of certain tasks is minimized. All time periods are to be accounted for, and the 24 hours frame of the diary has to be respected. Hence, estimates from time use studies are often utilised as a benchmark against which measures generated by alternative methods are assessed (see for instance Press and Townsley 1998, Robinson and Godbey 1997, Marini and Shelton 1993, Niemi 1993). Most of these methodological studies have shown that direct questions about housework-time produce somewhat higher estimates than time diaries. However, in a recent analysis of a Danish Time Use Survey, Bonke (2004) reports the opposite finding, namely that the questionnaire approach gives less reported household work than the diary approach. Although direct questions on housework-time are usually seen as less reliable and valid than diary estimates in identifying precisely how much time people spend on domestic labour, such questionnaire information is often used in analyses of various aspects of people's daily lives, for instance of the division of household chores among spouses and of parents' time-use more generally (see for instance Kitterød 2002b, Bond and Sales 2001, Bianchi et al. 2000, Greenstein 2000, Hellevik 2000, Brines 1994).

As information on housework-time is most urgently needed in analyses of parents' balancing between family work and employment, and in exploring the division of unpaid labour between mothers and fathers, special attention is paid to parents with children living in the household. Since diary-based time use surveys have until now been conducted only every tenth year in Norway, information on housework-time collected through other methods is at times utilised in analyses in this field. However, questionnaire information on housework-time has usually been captured by questions with pre-categorized alternatives such as 0-4 hours per week, 5-9 hours,

10-14 hours etc. Hence, until now good comparisons between measures from diaries and questionnaires were not possible. In the Norwegian Time Use Survey 2000-01 time spent on housework was registered in hours per week in an interview prior to the participants' diary keeping. Thus we can now explore possible discrepancies between measures of housework-time from the diary and the questionnaire. In the present paper we look at averages for various population groups and undertake multivariate analyses for parents.

2 Possible explanations of observed discrepancies between diary and questionnaire measures

Whereas extensive methodological work has revealed a reporting bias across methods regarding time spent on housework, the mechanisms causing this reporting gap are disputed. In a review article Marini and Shelton (1993) mention random error, recall or memory problems in questionnaires, and double counting of simultaneous tasks as some possible explanations. As housework is usually carried out at irregular intervals and in spells of varying duration, there is, it is argued, reason to believe that people have difficulties in estimating accurately the number of hours spent on housework per week in a direct question. As for double counting, it is claimed that people, and particularly women, sometimes carry out housework as a secondary activity while a primary activity is undertaken simultaneously. In such cases the primary activity is registered as a main activity in the time diary whereas simultaneous household chores are recorded as secondary activities and as such excluded in most reports on time-use. If respondents include simultaneous housework tasks when asked direct questions about their time input, we get higher estimates.

Reporting gaps on housework-time between methods may also be due to varying conceptions of which activities are to be counted as housework (Baxter and Bittman 1995). In time use studies, activities are usually categorized according to a pre-defined coding list. Hence, the researchers decide which tasks are to be classified as housework. Survey questions asking how much time people usually spend on housework per day or week leave it more to the respondents to decide what activities to include.

Although a reporting bias across methods is found for most groups, the size of this gap varies. Analyses in the USA as well in Australia suggest that women over-report somewhat more than men. For instance, using the Jackson validity study to compare respondents' weekly estimates of their time spent on housework from stylised questions, with estimates from time diaries, Robinson (1985, p. 47) finds a more substantial over-reporting for women than men. Baxter and Bittman (1995, pp. 41-42) report a similar finding when they compare the estimates for time spent on housework based on an Australian survey using stylised questions, with those from the Australian Time Use Survey 1992. According to Marini and Shelton (1993) the more serious over-reporting among women than men stems from the fact that women continue to do the majority of the housework, and that much housework entails more over-reporting (Marini and Shelton 1993). Press and Townsley (1998) argue that one might also expect less reporting bias for women than for men because spending much time on housework entails better information on the time required for various chores. However, they too find a more significant reporting gap between the questionnaire and the diary for women than for men.

Whereas diaries and questionnaires produce somewhat different estimates for time spent on housework, the two methods often reveal roughly similar patterns of variation between subgroups (Baxter and Bittman 1995, Marini and Shelton 1993, Robinson 1985). Therefore, it is argued, in

spite of the fact that direct questions tend to entail somewhat biased estimates, they can provide a fairly good ordinal scaling and thus be useful for multivariate analyses of life-style differences in people's contributions at home.

However, Press and Townsley (1998) contend that the reporting gap on housework-time across methods cannot be fully explained by memory, double counting, or differing conceptions of what is to be counted as housework, but rather seems to be deeply gendered and associated with social desirability and social norms. The inflation in the direct question context is, they maintain, the outcome of different and uneven social perceptions of the appropriate roles for men and women regarding their contributions at home. Their analysis shows that while both men and women tend to over-report their housework in direct questions, there are significant gender and class differences in the level and structure of the reporting gap across surveys. Gender attitudes play a crucial role in this context and affect husbands' and wives' reporting in opposite directions. Husbands with egalitarian attitudes tend to over-report their contributions more than traditional husbands, whereas the reverse pattern is found for wives. Egalitarian wives are less vulnerable to normative expectations concerning women's duties at home and hence are less prone, than other wives, to over-report in questionnaires. The authors argue that gender attitudes are correlated with age and education, so that more educated and young husbands are likely to feel pressure to do much housework and therefore exaggerate their time input. For women, egalitarian attitudes combined with employment entail more precise reporting of housework among the young than the old.

In Norway, the traditional housewife role has nearly vanished, at least among young women and those in their 40s and 50s (Danielsen 2002, pp. 175-180). Women now rarely look upon themselves as housewives (Bø and Molden 2000), and mothers of small children usually have paid employment. Periods of leave or non-employment are chosen primarily in order to take care of children and not to do housework. In general, childcare now constitutes a far more central part of parents' identity than housework. Hence, social pressures to do much housework are less pronounced than before, and this is true for both women and men. Although Norwegian work-family policies aim at encouraging fathers to participate more actively at home, the focus is more on involvement in children than in housework (Brandth and Kvande 2003, pp. 149-169). Egalitarian fathers are probably more likely to overstate their childcare than their housework. Hence, over-reporting of housework in direct questions because of social desirability is presumably rather modest among the young and the middle aged in Norway. Elderly women, however, who married and had children in the 1950s and 1960s, often have a rather strong "housewife identity" (Thorsen 2003) and should, according to Press and Townsley's reasoning, be expected to exaggerate their housework-time in questionnaires.

Inaccurate reporting in questionnaires because of recall problems or varying conceptions of which activities should be considered as housework is of course likely to come about in Norway as in other countries. However, as the amount of housework has been significantly reduced and as housework chores are increasingly being planned and organized in order to be conducted as efficiently and quickly as possible (see for instance Kristjansson 1999, Bjørnberg 1992, p. 94) it might be expected that people can more easily keep track of their time-use and report this rather accurately in direct questions.

Whereas most researchers regard the higher time-estimates produced in questionnaires compared to time diaries as a consequence of the inferior character of the questionnaire approach in measuring housework-time, it has also been argued that diary estimates on housework-time may

be somewhat incorrect. Rydenstam (2001) maintains that diary-based estimates for unpaid work time are in fact extreme net measurements. Short breaks in order to rest, drink coffee, read the newspaper etc. are coded as leisure time or personal needs and not included in the estimates for housework-time. As far as paid work is concerned, such short breaks are incorporated in the estimates. Rydenstam shows that if short breaks in periods of unpaid work are regarded as inevitable parts of this work, estimates for housework-time increase significantly, especially for women. If people conceive such breaks as an integrated and unavoidable part of their housework, their understanding of their time inputs will necessarily differ from what is revealed through time diaries. Hence, somewhat higher estimates in questionnaires than in diaries should be expected.

3 Recording housework-time in the Norwegian time use survey

The fourth Norwegian Time Use Survey was carried out in 2000-01. The sample was randomly drawn from people 9-79 years of age. Each participant kept a diary for two consecutive days, and data were collected during a whole year. The diaries had fixed ten-minute time intervals, and for each time-slot participants were asked to write down their most important activity in their own words. Simultaneous activities were captured as well, and so was time spent alone and with various groups of people. Activities were subsequently coded according to a list with 176 activity codes, developed in accordance with the Eurostat recommendations. The following activities were categorised as housework: Preparation of food, laying the table, cleaning the table, doing the dishes, house cleaning, doing laundry, ironing and mending clothes, private production of food and heating, wood chopping and water fetching. Consistent with results from time use surveys in many other Western countries, the Norwegian survey showed that most time was spent on food preparation, laundry and housecleaning, whereas very little time was allocated to mending clothes, production of food, heating, chopping wood, and fetching water (Vaage 2002, pp. 112-114).

Prior to the diary keeping an interview was carried out with each respondent. Towards the end of the interview, people were asked the following summary question about time spent on housework: *About how many hours do you usually spend on housework per week? Housework includes activities as food preparation, house cleaning, laundry and mending of clothes, but not looking after and caring for children or ill people.* The exact numbers of reported hours were recorded. This way of asking differs somewhat from the practice in surveys in many other countries where time-use is captured for various household chores separately (see for instance Baxter and Bittman 1995), or where participation in various tasks is recorded first, followed by a summary question on time spent on all the relevant tasks together (see for instance Bonke 2004). Whereas questionnaires sometimes also capture time spent on childcare and/or maintenance work, only ordinary housework was recorded in the questionnaire-section in the latest Norwegian Time Use Survey.

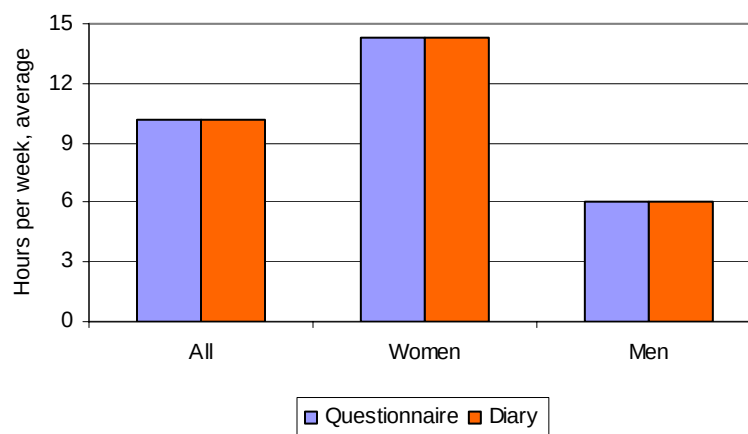
In the present paper, we compare estimates of the average number of hours spent on housework obtained from diary and questionnaire data. Reporting gaps are examined for the total population as well as for men and women and various age groups, and special attention is paid to mothers and fathers with children living in the household. Since the direct question in the questionnaire-section refers to approximately the same activities that are coded as housework in the diary-section, all the housework activities from the diary are included in the analyses. Consistent with most methodological work in the field, only the primary activities from the diary are considered.

However, some information on secondary activities is presented in order to demonstrate that very little housework was recorded as simultaneous activities. The diary estimates are based on two diary days per participant, whereas the questionnaire estimates are, of course, based on one observation per respondent. In comparing time-use estimates from the diary and the questionnaire in the latest Danish Times Use Survey, Bonke (2004) included only diary observations representing "rather normal" days according to a question asked at the end of each diary day. In Norway participants were asked at the end of each day whether they had spent their time approximately as they usually did on this weekday, or if the day had been particular in some way. Since as much as 38 per cent of the days were characterised as particular days,² it seems that particular days are rather normal. Hence, we decided to include them in the analyses.

4 Estimates by gender and age

Figure 1 shows the estimated average weekly housework hours from the questionnaire and the diary for all adults 16-79 years of age, and for women and men separately. Only main activities are included in the diary estimates. The two methods produce almost identical results. For all adults the reporting gap constitutes only 0.03 hours per week. For women there is no discrepancy at all between methods, whereas the discrepancy is 0.04 hours per week for men. Table 1 demonstrates that if secondary activities are included in the diary estimates, the diary actually produces slightly larger measures for weekly housework-time than the questionnaire, and this is true for both women and men. However, the difference is small and hardly statistical significant. In agreement with most of the previous methodological research in the field we chose to incorporate only main activities in the following. Table 1 reveals that the time allocated to housework as a secondary activity is rather modest. It amounts to 0.34 hours per week for all adults, - about half an hour per week for women, and 0.18 hours per week for men.

Figure 1
Time spent on housework, from questionnaire
and diary information, among women and men 16-79 years.



Source: The Norwegian Time Use Survey 2000-01.

² The proportion is almost identical for women and men, but is somewhat higher for weekend days than for weekdays, 44 per cent and 36 per cent respectively.

Contrary to other researchers' findings (Marini and Shelton 1993, Press and Townsley 1998), we do not see a larger reporting gap for women than for men, at least not when we look all adults. Both the diary and the questionnaire show that women spend far more time on housework than men, and the instruments produce quite similar gender differences. According to the questionnaire, men's housework-time constitutes 43 per cent of women's time. The diary-based proportion is 42 per cent.

Table 1
Time spent on housework, from questionnaire and diary information, among women and men 16-79 years. Average number of hours per week (standard errors in parenthesis).

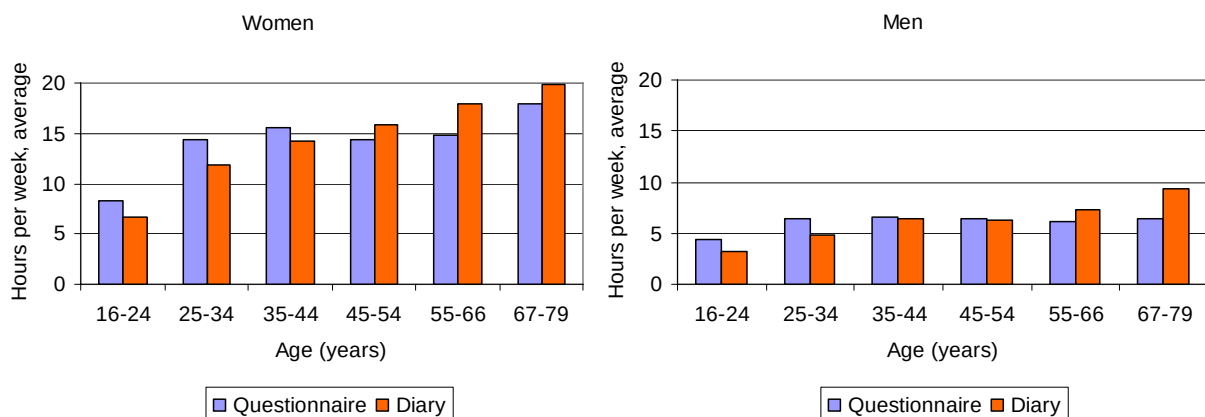
	Questionnaire	Diary, main activity	Diary, main + secondary activity	Diff I (Q - D, main activity)		Diff II (Q - D, main + secondary Activity)		Number of observations
	Hours	Hours	Hours	Hours	%	Hours	%	Questionnaire/diary ¹
Women	14.25 (0.24)	14.25 (0.21)	14.75 (0.21)	0.00	0	-0.50	-4	1461/2920
Men	6.09 (0.14)	6.05 (0.14)	6.23 (0.14)	0.04	1	-0.14	-2	1516/3031
All	10.17 (0.16)	10.14 (0.13)	10.48 (0.14)	0.03	0	-0.31	-3	2977/5951

¹ As each respondent kept a diary for two days, the number of diary days is twice the number of respondents. The time-estimates from the diary are based on the diary days, whereas the time-estimates from the questionnaire are based on the number of respondents.

Source: The Norwegian Time Use Survey 2000-01.

However, looking at different age groups reveals more significant discrepancies between questionnaire and diary estimates, and the differences also have opposite directions for some groups (figure 2 and table 2).

Figure 2
Time spent on housework, from questionnaire and diary information, by gender and age



Source: The Norwegian Time Use Survey 2000-01.

Both for women and men we see that for the youngest age groups, 16-34 years, questionnaires produce somewhat higher estimates for housework-time than diaries, whereas the contrary applies to the older age groups. For the middle-aged the difference across methods is rather

modest, while it is more significant for the young and the elderly. These results are not easily explainable. The finding that elderly women report less housework-time in the questionnaire than in the diary goes against the pattern we should expect if social desirability were at play. These women belong to cohorts with a strong housewife identity, and should, according to the social desirability hypothesis, exaggerate their contributions at home in the questionnaire. One possible explanation for the higher time-estimates in diaries than in questionnaires among the elderly might be that old people consider some of their housework chores as leisure activities and consequently do not account for these in the questionnaire. For the youngest age groups the higher estimates in questionnaires than in diaries may be associated with the fact that most young people find housework rather boring and thus misconceive their own time inputs as more extensive than they really are. As today's young Norwegians rarely feel social pressure to do much housework, this discrepancy across methods is hardly due to deliberate over-reporting in the questionnaire.

Table 2
Time spent on housework, from questionnaire and diary information, by gender and age
Average number of hours per week (standard errors in parenthesis)

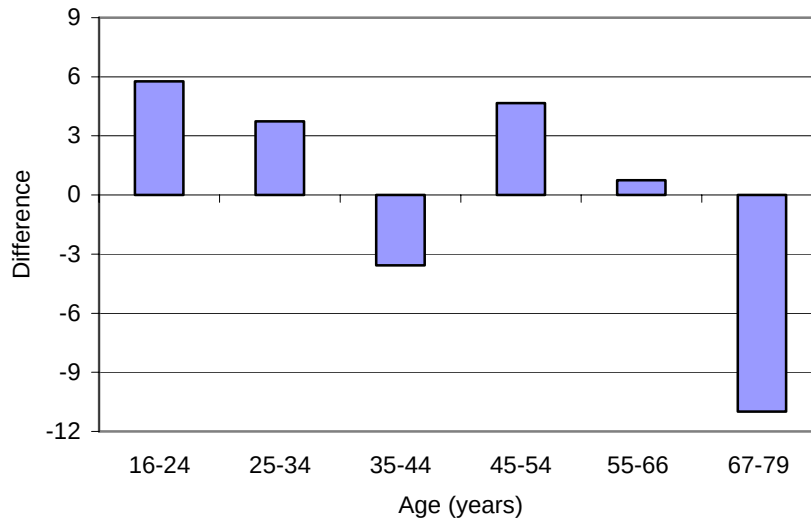
	Questionnaire	Diary	Difference (Q-D)		Number of observations Questionnaire/diary ¹
	Hours		Hours	%	
Women					
16-24 years	8.31 (0.54)	6.63 (0.39)	1.68	20	181/362
25-34 years	14.38 (0.59)	11.80 (0.37)	2.58	18	305/610
35-44 years	15.54 (0.51)	14.25 (0.41)	1.29	8	309/617
45-54 years	14.32 (0.54)	15.85 (0.47)	-1.53	-11	247/494
55-66 years	14.84 (0.46)	17.89 (0.54)	-3.05	-21	281/561
67-79 years	17.89 (0.77)	19.91 (0.70)	-2.02	-11	138/276
Men					
16-24 years	4.44 (0.29)	3.16 (0.22)	1.28	29	209/419
25-34 years	6.42 (0.30)	4.82 (0.24)	1.59	25	300/600
35-44 years	6.50 (0.32)	6.47 (0.31)	0.03	0	293/585
45-54 years	6.36 (0.31)	6.30 (0.32)	0.06	1	262/524
55-66 years	6.20 (0.33)	7.34 (0.36)	-1.14	-18	307/613
67-79 years	6.39 (0.55)	9.30 (0.55)	-2.91	-46	145/290

¹ As each respondent kept a diary for two days, the number of diary days is twice the number of respondents. The time-estimates from the diary are based on the diary days, whereas the time-estimates from the questionnaire are based on the number of respondents.

Source: The Norwegian Time Use Survey 2000-01.

Both questionnaires and diaries demonstrate that elderly people spend more time on household chores than younger people, but questionnaires seem to generate somewhat more modest differences among age groups than diaries. Also concerning gender differences the two methods produce rather similar results in demonstrating that irrespective of age, women spend far more time on housework than men (figure 3). Again, the magnitude of the gender difference varies somewhat across methods. For most age groups the questionnaire produces slightly smaller gender differences than the diary, but for certain categories, particularly for the oldest ones, the diary generates the smallest gender difference.

Figure 3
Differences between questionnaire and diary estimates
(questionnaire - diary) when it comes to men's time spent
on housework as a per cent of women's time, by age



Source: The Norwegian Time Use Survey 2000-01.

5 Estimates for mothers and fathers

In the Norwegian context knowledge about housework-time is particularly salient for parents with children in the household. The work-family balance of mothers and fathers has been a central issue in policy and research in Norway for decades, and information on housework contributions is a crucial factor in analyses in the field. Therefore it is important to cross-validate various approaches for capturing parents' time inputs at home in order to see if different methods produce similar or diverging conclusions. Table 3 shows estimates for housework-time from the questionnaire and the diary for women and men in different family phases.³ We see that for married fathers with young children as well as for those with older children, the discrepancy between the two approaches is fairly modest. For those with children 0-6 years of age the questionnaire produces somewhat larger estimates than the diary, the difference being about 1 hour per week on average. For fathers with older children the difference between the methods is even smaller, about half an hour per week. In fact, the divergence across methods is more modest for married fathers than for men in most other family phases.

³ Family phase classifies individuals mainly by age, marital status, and whether or not they have children. The classification distinguishes between married and single persons. Cohabitants are regarded as married, and single persons include both unmarried and previously married individuals. The respondents were asked if they were married or lived in a stable relationship as cohabitants, with the possibility of answering "married", "cohabitant" or "no". Those choosing the second alternative are counted as cohabitants. The term "single" refers to an individual's marital or cohabitational status, not to whether one lives alone or with others. The categories with children include individuals with children (biological children, step-children or adopted children) under the age of 20 living in the household. As there are rather few single parents in the sample, especially single fathers, the analyses in this section focus primarily on married and cohabiting parents.

Table 3
Time spent on housework, from questionnaire and diary information, by gender and family phase. Average number of hours per week (standard errors in parenthesis).

	Question- naire	Diary	Difference (Q - D)		Number of observations Questionnaire/diary ¹
	Hours	Hours	Hours	%	
WOMEN					
Single, 16-24 years in parents' household	4.87 (0.63)	4.90 (0.55)	-0.03	-1	76/152
Other single, 16-24 years	8.04 (0.65)	5.28 (0.55)	2.76	34	49/98
Single, 25-44 years	6.50 (0.43)	7.13 (0.60)	-0.63	-10	76/151
Married, 16-44 years, no children	10.81 (0.64)	9.64 (0.56)	1.17	11	107/214
Single parents	15.38 (0.83)	14.26 (0.78)	2.10	13	71/142
Married, children 0-6 years	18.26 (0.69)	14.68 (0.44)	3.58	20	253/506
Married, youngest child 7-19 years	16.29 (0.51)	15.40 (0.50)	0.89	5	237/474
Married, 44-66 years, no children	14.72 (0.40)	17.41 (0.47)	- 2.69	-18	331/662
Married, 67-79 years, no children	21.00 (0.96)	22.51 (0.88)	-1.51	-7	85/170
Single, 44-66 years, no children	12.07 (0.98)	13.39 (0.67)	-1.32	-11	115/229
Single, 67-79 years, no children	13.68 (0.95)	16.60 (0.98)	-2.92	-21	61/122
MEN					
Single, 16-24 years in parents' household	3.04 (0.26)	2.32 (0.23)	0.72	24	135/271
Other single, 16-24 years	7.17 (0.74)	3.91 (0.49)	3.26	45	36/72
Single, 25-44 years	5.98 (0.34)	4.34 (0.32)	1.64	27	147/293
Married, 16-44 years, no children	5.87 (0.42)	4.61 (0.35)	1.26	21	111/222
Married, children 0-6 years	7.19 (0.41)	6.15 (0.31)	1.04	14	244/487
Married, youngest child 7-19 years	6.05 (0.30)	6.38 (0.35)	-0.33	-5	237/475
Married, 44-66 years, no children	5.18 (0.25)	6.16 (0.31)	-0.98	-19	348/695
Married, 67-79 years, no children	5.61 (0.60)	8.16 (0.58)	-2.55	-45	121/242
Single, 44-66 years, no children	10.31 (0.76)	9.46 (0.70)	0.85	8	87/174
Single, 67-79 years, no children	9.15 (0.97)	13.63 (1.23)	-4.48	-49	32/64

¹ As each respondent kept a diary for two days, the number of diary days is twice the number of respondents. The time-estimates from the diary are based on the diary days, whereas the time-estimates from the questionnaire are based on the number of respondents

Source: The Norwegian Time Use Survey 2000-01.

For mothers the discrepancy between questionnaire and diary estimates is somewhat more pronounced, and unlike the case for fathers, with particularly modest reporting gaps across methods, mothers do not stand out in the family phase. For mothers with young children the diary gives an average of 3.58 hours, or 20 per cent, less housework per week than the questionnaire. For those with older children, the difference between methods is only 0.89 hours per week. As today's mothers barely meet normative prescriptions for doing much housework, it is unlikely that conscious over-reporting in the questionnaire causes these discrepancies. A more plausible explanation is probably that housework chores are often intermingled with other activities in this family phase, especially with childcare, so that at times it is difficult to tell where one activity ends and another starts. An alternative or supplementary explanation is that having small children entails rather fragmented housework patterns for mothers so that exact calculation in direct questions is difficult. Rydenstam (2001) has shown that women's housework is actually rather fragmented and include more interruptions than men's housework. Hence, it is also possible that

mothers calculate gross accounts of their housework-time in the questionnaire by including short breaks of resting.

Table 4
Men's time spent on housework as a per cent of women's time,
from questionnaire and diary information, by family phase

	Questionnaire %	Diary %
Married, 16-44 years, no children	54.30	47.82
Married, children 0-6 years	39.38	41.90
Married, youngest child 7-19 years	37.14	41.43
Married, 44-66 years, no children	35.19	35.38
Married, 67-79 years, no children	26.71	36.25

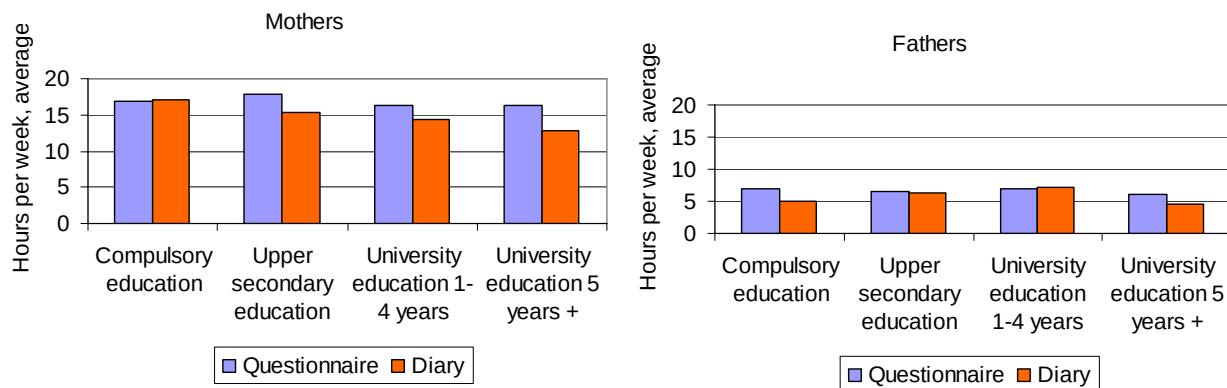
Source: The Norwegian Time Use Survey 2000-01.

Gender differences in time spent on housework according to the questionnaire and the diary in some family phases are illustrated in table 4. Calculations are made for married individuals only. As explained in footnote 3, cohabitants are included among the married in the analyses in this paper. For most groups the questionnaire generates somewhat more pronounced gender differences than the diary, albeit for parents with children in the household, the differences are rather modest. Looking at parents with small children we see that fathers' housework-time makes up about 39 per cent of mothers' time according to the questionnaire and 42 per cent according to the diary. For parents with older children the difference between the methods is somewhat more pronounced.

As previously mentioned, Press and Townsley (1998) argue that the over-reporting of housework-time in direct questions is associated with social desirability. More educated and young husbands are likely to feel pressure to do much housework and therefore tend to exaggerate their time input, whereas the opposite is the case for wives. Figure 4 shows questionnaire and diary estimates for average weekly housework-time for married mothers and fathers in various educational groups in Norway (more detailed information is presented in table 5).

The time-estimates from the diary are based on the diary days, whereas the time-estimates from the questionnaire are based on the number of respondents. Concerning mothers, we see that except for those with compulsory education only, the questionnaire gives larger estimates than the diary for all educational groups. According to Press and Townsley we should expect smaller differences for the most well educated than for those with less education, but this pattern does not seem to apply for Norwegian mothers, at least not in the simple bivariate analysis undertaken here. However, due to the small number of respondents at the highest educational level, the difference between questionnaire and diary estimates is not statistical significant for this group of mothers.

Figure 4:
Time spent on housework, from questionnaire and diary information, among married mothers and fathers with children 0-19 years in different educational groups



Source: The Norwegian Time Use Survey 2000-01

Table 5
Time spent on housework, from questionnaire and diary information, among married mothers and fathers with children 0-19 years in different educational groups. Average number of hours per week (standard errors in parenthesis).

	Questionnaire	Diary	Difference (Q - D)		Number of observations Questionnaire/diary ¹
	Hours	Hours	Hours	%	
Mothers					
Compulsory education	16.83 (1.35)	17.06 (1.35)	-0.23	-1	33/66
Upper secondary education	17.87 (0.59)	15.28 (0.44)	2.59	14	284/568
University/high school 1-4 years	16.32 (0.68)	14.44 (0.58)	1.88	12	146/292
University/high school 5 years +	16.28 (3.13)	12.82 (1.35)	3.46	21	24/48
All	17.30 (0.44)	15.04 (0.33)	2.26	13	490/980
Fathers					
Compulsory education	6.93 (1.15)	5.06 (0.79)	1.87	27	35/70
Upper secondary education	6.51 (0.37)	6.24 (0.30)	0.27	4	273/545
University/high school 1-4 years	7.03 (0.42)	7.14 (0.53)	-0.11	-2	118/236
University/high school 5 years +	6.14 (0.64)	4.67 (0.49)	1.47	24	53/107
All	6.63 (0.26)	6.26 (0.23)	0.37	6	481/962

¹ As each respondent kept a diary for two days, the number of diary days is twice the number of respondents

Source: The Norwegian Time Use Survey 2000-01.

For fathers we should expect most salient over-reporting in questionnaires among the most educated, and least for those with compulsory education only. While the Norwegian data suggest a certain discrepancy between questionnaire and diary estimates both for fathers with many years of education and for those with few years of education, the differences are very modest for those with upper secondary education and for those with 1-4 years of university education. This lends

support to the presumptions that social norms and perceptions do not affect Norwegian parents' housework reporting in direct questions so that discrepancies between methods must be attributed to other factors. However, with the small number of respondents at the lowest and the highest educational level, the differences between the questionnaire and diary estimates are not statistically significant.

6 Multivariate analyses of mothers' and fathers' housework-time. Questionnaire and diary information

As referred to in a previous section, it has been argued that even though diaries and questionnaires produce somewhat different estimates for housework-time, the methods reveal roughly similar patterns of variation among subgroups. Hence, direct questions can provide a fairly good ordinal scaling and are useful for multivariate analyses to sort out covariates of people's contributions at home. In order to assess whether this is the case for parents in Norway, multiple regression analyses are undertaken for time spent on housework based on questionnaire and diary data. As the daily life organisation of parents with children is high on the political agenda in Norway, good data on parents' unpaid work is strongly demanded. The debate concerning modern families' time crunch, as well as the debate regarding mothers' and fathers' reconciliation of paid employment and family work, calls for research based on valid and reliable data on parents' time spent on paid and unpaid work. Hence, we choose to focus on parents in the following. The analyses are conducted for married and cohabiting mothers and for married and cohabiting fathers with children 0-19 years in the household. For both groups the same sets of independent variables are included in the models based on the diary-section and the model based on the questionnaire-section of the time use survey. Our concern here is not primarily to identify the best models for predicting the number of hours spent on housework by parents, but rather to explore whether questionnaires and diaries produce similar patterns of associations between the independent variables and housework-time.

In the analyses of mothers' housework-time, the independent variables are defined as follows:

- Mother's age is treated as a categorical variable differentiating between four age groups. Three dummies are constructed, with the youngest ones as the reference.
- Mother's educational level is treated as a continuous variable measuring number of years of education beyond the mandatory level (secondary modern school), which is defined as zero. In the data, the variable capturing the respondents' educational level has 9 values corresponding to the various levels in the Norwegian educational system. In the analyses, we have converted this to number of years of education beyond the mandatory level, which has the value "two" in the original variable, and "zero" in the variable utilised in our analyses. The highest level, 8 in the original data, refers to researchers, and is defined as 11 years of education beyond the mandatory level in our analyses; three years at high school and 8 years at the university.
- Mother's weekly working hours refer to the number of hours of paid work in an ordinary week, measured in the questionnaire. Non-employed and those on leave are set to zero. Weekly working hours is defined as a continuous variable with zero as the bottom value.
- The age of the youngest child is treated as a categorical variable with four groups. Three dummies are constructed and those with the youngest children are chosen as the reference.

- The number of children in the household is defined as a continuous variable and refers to children below 19 years of age.

The dependent variables are defined as the weekly number of hours spent on housework, based on questionnaire and diary information. As the unit of analysis in the diary is a single day and not the individual person, we get some more zero values in the diary than in the questionnaire. However, as most mothers do spend some time doing housework almost every day, the proportion of zeroes is low in the diary, too, only 2 per cent for those with children 0-19 years of age. In the questionnaire, less than 0.5 per cent of the mothers report zero hours of housework in an ordinary week. As each participant in the survey kept a diary for two consecutive days, the analyses of the diary data are based on twice as many observations as is the analysis of the questionnaire. The results from the ordinary least square regressions (OLS) for mothers' housework-time are presented in table 6. Estimates that are statistical significant at the 0.05 level or lower, are italicised.

Table 6
Time spent on housework among married mothers with children 0-19 years of age, from questionnaire and diary information. Multiple regression results in hours per week¹

	Questionnaire			Diary			Q-D (estimates)
	Estimate	S. e.	t	Estimate	S. e.	t	
Constant term	14.19	1.52	9.32	12.46	1.24	10.02	1.73
Mother's age (ref.: -29 years)							
30-34 years	2.00	1.31	1.52	1.28	1.07	1.20	0.72
35-39 years	1.11	1.46	0.80	1.81	1.20	1.51	-0.70
40 years +	2.08	1.57	1.32	4.91	1.28	3.84	-2.91
Mother's level of education (continuous)	- 0.04	0.17	0.26	- 0.17	0.13	1.26	0.13
Mother's weekly working hours (continuous, 0-60 hours)	- 0.15	0.03	5.33	- 0.10	0.02	4.18	-0.05
Age of youngest child (ref.: 0-2 years)							
3-6 years	- 0.09	1.25	0.07	- 0.73	1.02	0.71	0.64
7-10 years	- 0.21	1.44	0.15	- 0.65	1.18	0.55	0.44
11-19 years	- 1.06	1.54	0.69	- 1.11	1.26	0.88	0.05
Number of children in the household (continuous, 1-6 children)	3.09	0.51	6.07	1.96	0.42	4.72	1.15

¹ For the questionnaire the specified model gives an R² of 0.18. For the diary the R² is 0.07.

Source: The Norwegian Time Use Survey 2000-01.

By and large, the analyses of the questionnaire-section and the diary-section reveal rather similar patterns concerning the relationship between the mother's housework-time and the independent variables in the analyses. However, the strength of the association between the variables differs to some extent, as does the size of the constant terms. The somewhat higher constant term in the first model reflects that questionnaires generate slightly higher estimates for the mother's housework-time than diaries. Both models indicate that older mothers spend more time on housework than younger mothers, but the association is statistically significant only for the diary, and is also stronger for the diary than the questionnaire. According to the diary, mothers aged 40 years + spend almost 5 hours more per week on housework than do those below 30 years of age. The corresponding OLS-estimate from the questionnaire information is 2.08 hours per week,

which is not significant at the 0.05 level. The model based on questionnaire-data as well as the one based on diary-data reveal a strong negative relationship between the mother's housework-time and her weekly hours of paid work, and a significant positive relationship between the mother's housework and the number of children in the household. However, the effect of the number of children is stronger in the first than in the second model. Mothers' level of education has no significant effect in any of the two models, and the same is true for the age of the youngest child.

On the whole, it seems that for married/cohabiting mothers, questionnaires and diaries produce rather similar patterns of variations between subgroups in multivariate analyses. This finding is consistent with results from some other studies (Baxter and Bittman 1995, Marini and Shelton 1993, Robinson 1985). It seems safe to conclude then, that at least for mothers in Norway, questionnaire information can be utilized as an alternative to diary information on time spent on housework to sort out associations in multivariate analyses. However, questionnaire estimates may exaggerate mothers' housework-time somewhat, but the bias is not very serious.

In analysing fathers' housework-time, some of the independent variables are defined a little differently than in the analyses of mothers' housework. Since there are fewer young fathers than mothers, the two youngest age groups are collapsed. As there is less variation in fathers' than in mothers' employed working hours, we define working hours as a categorical variable for fathers. Three dummies were constructed, with the non-employed / part-timers as reference. Supposing that the father's contribution at home is associated with his partner's working hours in the labour market, we have included a continuous variable for partners' weekly working hours in the models. Level of education, number of children in the household and age of the youngest child is defined in the same way as in the analyses of mothers.

Unlike mothers, a rather large proportion of fathers did not spend any time on housework during their diary days. This applies to 19 per cent of the diary days for the fathers included in the present analyses. With a high proportion of zeroes in the distribution, the distribution can be viewed as being censored with respect to the latent variable we want to measure. Parameter estimates from an OLS regression model may in these cases be severely biased. There are several ways to adjust for such left censoring, of which one is to use a Tobit regression model rather than OLS (Breen 1996). Tobit regression estimates relate to the latent, uncensored distribution of the dependent variable, in this case the fathers' propensity to spend time on housework. However, we also present the results from an OLS-regression from the diary. As only 6 per cent of the fathers reported zero hours of housework per week in the questionnaire, OLS is used analysing these. The results of the OLS-regression from the questionnaire-section are shown in table 7, and the results of the Tobit-regression as well as of the OLS-regression from the diary-section are demonstrated in table 8. Estimates significant at the 0.05-level or lower are italicised.

The analyses reveal agreement as well as disagreement across the questionnaire and the diary data about the relationship between the independent variables and the father's housework-time. Both datasets indicate that fathers who work long hours in the labour market spend less time on housework than non-employed and part-time working fathers. However, according to the questionnaire data, only very long working hours for the father (at least 45 hours per week) affects his housework contribution negatively. According to the diary data, also moderately long working hours, 40-44 hours per week, has a negative effect on the father's time input in housework.

Table 7
Time spent on housework among married fathers with children
0-19 years of age, from questionnaire information.
Estimates in hours per week from an OLS-regression.

	Questionnaire		
	Estimate	S. e.	t
Constant term	6.05	1.20	5.03
Father's age (ref.: -34 years)			
35-39 years	0.48	0.78	0.61
40 years +	- 0.33	0.89	0.37
Father's level of education			
(continuous)	- 0.00	0.10	0.02
Father's weekly working hours			
(ref.: non-employed/working 1-35 hours)			
36-39 hours	0.44	0.91	0.48
40-44 hours	- 1.41	0.99	1.43
45 hours +	- 2.64	0.92	2.87
Partner's weekly working hours			
(continuous, 0-60 hours)	0.06	0.02	3.22
Age of youngest child (ref.: 0-2 years)			
3-6 years	- 0.86	0.75	1.16
7-10 years	- 1.32	0.92	1.43
11-19 years	- 1.19	1.01	1.18
Number of children in the household			
(continuous, 1-6 children)	0.47	0.35	1.36

¹ The specified model gives an R² of 0.09.

Source: The Norwegian Time Use Survey 2000-01.

The two datasets are consistent in showing that neither the father's level of education, age of the youngest child, nor the number of children in the household significantly affect his housework-time. However, unlike the questionnaire, the diary reveals a certain association between the father's age and his housework-time in that 35-39 year old fathers spend somewhat more time on housework than younger fathers. This is true in the Tobit-regression as well as in the OLS-regression of the diary data. Moreover, the questionnaire, but not the diary, shows a significant positive relationship between the father's housework-time and his partner's working hours. Hence, questionnaires and diaries produce fairly close aggregate averages for the father's housework contributions, but the two approaches give somewhat divergent pictures in multivariate analysis. As for the diary data, it turns out that the Tobit analysis and the OLS-model produce fairly similar results concerning the factors affecting the father's housework-time.

Table 8
Time spent on housework among married fathers with children 0-19 years of age, from diary information. Estimates in hours per week from Tobit analysis and OLS regression and differences from estimates reported in table 7

	Diary, Tobit				Diary, OLS			
	Estimate	S. e.	χ^2	Q-D	Estimate	S. e.	t	Q-D
Constant term	5.46	1.27	18.54	0.59	6.67	1.08	6.18	-0.62
Father's age (ref.: -34 years)								
35-39 years	1.76	0.83	4.56	-1.28	1.63	0.70	2.31	-1.15
40 years +	0.01	0.94	0.00	-0.34	-0.26	0.80	0.32	-0.07
Father's level of education (continuous)	0.05	0.10	0.26	-0.05	0.05	0.09	0.53	-0.05
Father's weekly working hours (ref.: non-employed/working 1-35 hours)								
36-39 hours	-1.06	0.96	1.21	1.50	-1.29	0.83	1.56	1.73
40-44 hours	-3.78	1.05	12.95	2.37	-3.39	0.90	3.78	1.98
45 hours +	-3.34	0.98	11.67	0.70	-2.83	0.83	3.40	0.19
Partner's weekly working hours (continuous, 0-60 hours)	-0.00	0.02	0.01	0.06	-0.01	0.02	0.58	0.07
Age of youngest child (ref.: 0-2 years)								
3-6 years	0.06	0.79	0.01	-0.92	-0.21	0.67	-0.31	-0.65
7-10 years	-0.11	0.98	0.01	-1.21	-0.10	0.83	0.12	-1.22
11-19 years	1.29	1.06	1.48	-2.48	1.26	0.91	1.39	-2.45
Number of children in the household (continuous, 1-6 children)	0.59	0.37	2.65	-0.12	0.58	0.31	1.87	-0.11

¹ For the Tobit analyses, the specified model gives a log likelihood of -2973.92, and the OLS-regression gives an R^2 of 0.04.

Source: The Norwegian Time Use Survey 2000-01.

7 Conclusions

This paper compares estimates for time spent on housework from the diary-section and the questionnaire-section in the latest Norwegian Time Use Survey. Contrary to results in many other studies, we do not see a consistent pattern of higher time-estimates in questionnaires than in diaries. For the adult population as a whole, we find only minor differences between the methods. However, looking at different age groups reveals larger divergences between diary and questionnaire estimates. For young people questionnaires tend to produce slightly higher estimates for housework-time than diaries, whereas the contrary holds for the older age groups. For all age groups except the oldest one, the methods produce fairly similar gender differences in housework-time.

For parents with children in the household, the questionnaire generates somewhat higher time measures than the diary, but the discrepancy is rather modest, especially for fathers. For mothers the divergence is more prominent for those with small children than for those with older children. Although the two methods generate somewhat different time-estimates for mothers' housework-time, they produce rather similar patterns of variation between subgroups in multivariate analysis. They also generate quite similar differences between mothers' and fathers' contributions. Hence,

it seems that at least for mothers, direct questions can be used as a substitute for time diary data in analysing time inputs in housework and differences between groups of parents. Yet, it is important to keep in mind that such measures may give a somewhat exaggerated impression of mothers' time inputs compared to those obtained through the diary. Whereas the two approaches produce rather similar averages for fathers' housework-time, multivariate analyses of the factors predicting fathers' time inputs at home generate somewhat dissimilar results. To be sure, for most of the independent variables included in the analyses the two methods show quite similar association with fathers' housework-time, but two of the variables turn out to have significant effects in one of the datasets only.

The fact that questionnaires tend to produce higher estimates for housework-time than diaries has been attributed to various mechanisms. Random error, recall problems, double counting of activities and diverging conceptions of what activities are to be regarded as housework are often mentioned as possible explanations. The reporting gap across methods has also been explained by social desirability implying more serious over-reporting by certain groups than others. It is argued in this paper that over-reporting of housework in direct questions because of social desirability and perceived pressures to do much housework is probably rather modest in Norway. The other mechanisms mentioned above are likely to play an important role in Norway as in other countries. It is also argued in the paper that time diaries may underestimate peoples' housework-time somewhat because short breaks to rest is being subtracted in the calculations. When reporting their housework-time in direct questions, people presumably include such breaks. Hence, somewhat higher estimates in questionnaires than in diaries should be expected and it is not a matter of course that diary estimates should straight away be defined as the benchmark against which survey information is validated.

Taken as a whole, the work here suggests that questionnaire and diary data may supplement each other, or provide different kinds of information. It was noted that both approaches seemed to arrive at the same total housework-time overall and by gender. Hence, either can be used to get at aggregate time and to look at the gender division of labour. This will help some in establishing household accounts. Taking the two approaches together provides greater insights into how housework is distributed across members of society.

Even though questionnaires seem to produce fairly good estimates for time spent on housework for certain demographic groups in Norway, such direct questions can of course never provide the rich analytical possibilities obtained through time diaries. In order to explore the rhythms and structures of people's housework, diary information is undoubtedly indispensable. Variation between weekdays, seasons, and time of the day, and also the duration of housework episodes, can hardly be captured by structured questionnaires. Moreover, time spent on childcare is probably harder to measure through direct questions than ordinary housework. However, when it comes to recording average time spent on ordinary housework, the analyses in this paper indicate that at least for some demographic groups questionnaires generate fairly reasonable results. More methodological work is of course required in order to assess whether questionnaires create similar associations as diaries between housework-time and different independent variables for other demographic groups than mothers and fathers. Besides, further research needs to be undertaken in order to explore whether different questionnaire surveys produce similar estimates for parents' housework-time. Hence, data from the survey-section in the Time Use Survey should be compared with data from other surveys containing similar questions on weekly housework-time.

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Ragni Hege Kitterød and Torkild Hovde Lyngstad: Diary versus questionnaire information on time spent on housework – The case of Norway

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Non-response and population representation in studies of adolescent time use

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Abstract

Researchers have debated which methods are most valid and reliable for studying time use. One key instrument for measuring time use is the time diary, which has unique analytic properties that, if not adjusted for, can bias estimates. To assess sampling and non-response bias and potential under- or overreports of various activities, we use three different datasets to compare adolescents' time use. Results of these comparisons are used to show how investigators can statistically adjust time use data to obtain more accurate estimates of time spent in various activities.

JEL-Codes: C80, C81

Keywords: Methodology for collecting, estimating, and organizing microeconomic data; correcting for sampling and non-response bias; comparing survey and ESM measures of time use

1 Non-response and population representation in studies of adolescent time use¹

In January 2003 the Bureau of Labor Statistics (BLS) began the American Time Use Survey (ATUS), the largest time use survey ever conducted in the U.S. Approximately 3,200 households, a subsample of the Current Population Survey (CPS), were asked to recall their activities throughout a twenty-four hour period using a time diary. For each activity, sampled respondents identified where they were, whom they were with, and whether they were engaged in another activity (to capture multiple activities that occur simultaneously). It is expected that within a few years, analyses of the ATUS time diaries will be as extensive as those currently being used with the CPS questionnaires. Time diaries have unique analytic properties that, if not adjusted for, can bias estimates. As economists and sociologists tackle this new body of information, whether estimating labor supply, productivity, household behavior, or leisure time, questions of sampling bias, instrument burden, and non-response must be considered. This paper addresses some of the methodological problems associated with studies of time use and offers solutions for this type of analytic work.

One of the most frequently asked questions of time use studies, particularly those that rely on time diaries, is whether the demands of the instrument interfere too much with the lives of the subjects. Are those who agree to participate in such studies a biased sample of the population? It has been argued by some, such as Hochschild (1989) and Leete and Schor (1994), that time diary studies are burdensome, and that those who are willing to participate and who successfully complete the instrument represent a select sample of the general population. Determining whether and to what degree hypotheses such as these are valid, and advising analysts on the best use of time diary data, requires comparing time diary participants with other similar populations.

Juster and Stafford (1991), Robinson and Godbey (1997), and others have defended the time diary methodology, arguing that the errors associated with time diary estimates of time spent on certain activities appear to be random.² Supporters of time use studies have, for the most part, examined the responses of time use participants and compared them to single-item responses of individuals from other national studies. What has yet to be examined in detail are the characteristics of time use participants in contrast to nonparticipants. Specifically, are the characteristics of the nonparticipant population patterned in such a way that indicates a bias that could potentially alter the results of the responding population?

The purpose of this paper is to identify and quantify instances of sampling and non-response bias and potential under- or overreports of various activities among adolescents across three datasets: the Alfred P. Sloan Study of Youth and Social Development, the Current Population Survey (CPS) October 1992 and May 1993, and the National Education Longitudinal Study of 1988-

¹ We appreciate the research assistance of Ananth Ramanarayanan and Jaeki Jeong with this paper.

² Other studies on the reliability of time diary studies include Gershuny et al. (1986) who report some effects of the nature of the sample responding and the length of the study on response rates in studies of adult time use. Jacobs (1998) examined differences between self-reported work time from the 1992 National Survey of the Changing Workforce and the March 1997 CPS. He found that the standard self-reported measure of working time is a reasonably reliable indicator of time use.

1992 (NELS:88-92).³ We chose the Sloan Study of Youth and Social Development because it is the largest study of adolescent time use based on the Experience Sampling Method (ESM), a form of time diary that relies on immediate reports of time use rather than reconstructed accounts of a day's or a week's activities. The other two datasets also include measures of adolescent employment based on survey responses. Because both NELS and the CPS are nationally representative samples, it is possible to compare estimates of time use, specifically adolescents' weekly work hours, across these datasets. Such comparisons of smaller with larger nationally representative datasets allow investigators to systematically address issues of non-response, reliability of measures, and representativeness. Although these results are based on adolescent samples, they have broader implications for studies estimating time use, specifically the development of procedures that correct for non-response bias.

2 Measuring time use

Sociologists interested in time use have directed their attention to understanding time use as a mechanism for viewing and analyzing social life and societal change, whereas those more interested in social psychology tend to consider time use as a concrete measure of human preferences, values, and behaviors. Regardless of how one frames the study of time use, one of the key concerns is finding the most efficient and accurate method for recording human behaviors. This task is challenging because it is known that people have a tendency to exaggerate the time spent on socially desirable activities and underreport time spent on activities that most view as socially undesirable, such as fighting and gambling.

How one collects time use information is subject to inherent sources of bias. Direct, unobtrusive, non-detectable observations of human lives, while certainly the most accurate method for measuring time use, are clearly logistically problematic as well as prohibitively expensive. If subjects know they are being observed, they may change their behaviors, thus producing non-typical estimates of time use, such as hours spent at work, with family, or recreating. The most common type of method is to ask subjects retrospective questions, such as those traditionally used by the Census Bureau, which ask a subject to report how many hours he/she worked the previous week. While this method has the advantage of brevity, it has been shown to produce somewhat unreliable time use estimates.

An alternative to retrospective survey questions is the time diary method, which requires individuals to record their activities and the times at which they occurred. There are several types of time diary. Perhaps the most well known is the full-day diary, used in a series of studies at the Universities of Maryland and Michigan. In this type of study, respondents are asked to name the activity or activities they were engaged in during each of 96 15-minute intervals over a 24-hour period. These full-day diaries are collected using a variety of procedures, including in-person interviews, telephone interviews, or return mail surveys. Some studies ask individuals to report their previous day's activities, while others introduce respondents to the diary and ask

³ CPS and NELS use sampling procedures specifically designed to represent the general adolescent population, and their respective sampling parameter estimates are robust. We selected these two national datasets because they were fielded within several years of the Sloan study and contained comparable items related to demographic characteristics and time use.

them to begin using it when they wake up the next day. Another form of time diary, used primarily for estimating the number of hours worked, is the travel schedule diary. Individuals report what time they leave for work, how much time they spend commuting, and what time they return home.

The Experience Sampling Method (ESM) is yet another method for studying time use. Individuals are randomly notified by a beeper and, when signaled, record what they are doing and feeling. Participants typically respond to eight signals a day over the course of a week, which has the advantage of sampling over seven consecutive days rather than on a given day. Developed by Mihaly Csikszentmihalyi and colleagues (Csikszentmihalyi and Csikszentmihalyi, 1988; Csikszentmihalyi and Larson, 1984), the ESM was designed to examine how individuals spend their time, what they do, and how they feel during specific activities. The ESM has been used with diverse populations, including adults and adolescents, and has provided estimates on how much time adults watch television (Kubey and Csikszentmihalyi, 1990), and how much time adolescents spend on homework, socializing with friends, or being home alone (Csikszentmihalyi, Rathunde, and Whalen, 1993; Csikszentmihalyi and Schneider, 2000).⁴

Much like time diaries, the ESM has been criticized as being too burdensome; that is, the time and cognitive demands made on the respondent are more excessive than the demands typically made by surveys. There may also be an inherent selection bias with the method if people who agree to participate in the study differ systematically from those who do not agree to participate (Zuzanek, 1999). Critics have also suggested that individuals may underreport what they are doing simply because they do not wish to be interrupted. Such underreporting is often thought to occur more frequently during activities outside the home where respondents may be unwilling to answer the beep. However, these criticisms have yet to be explored systematically.

2.1 Specific problems in measuring time use

2.1.1 Retrospective duration

Although survey questions that measure time use avoid the problem of respondent burden, they are subject to a variety of inaccuracies. Horvath (1982), Bound et al. (1990), and others have shown that retrospective duration (RD) questions often suffer from recall biases, with some people forgetting episodes of time use altogether. Respondents may also erroneously estimate the time they spend on a given activity or activities during the period in question. When such retrospective items are compared with answers obtained through other methods, they have been shown to be somewhat unreliable, with individuals tending to overestimate the amount of time spent on certain activities such as paid work or housework (Robinson and Bostrum 1994; Lee and Waite, 2001).

Using the ongoing CPS, which interviews Americans throughout the year and asks them about their work situation in the prior week and in the prior year, Horvath (1982) constructed two estimates of unemployment during the calendar year. The first estimate aggregated the “last week” reports in all of the surveys for the calendar year, while the second used “last year”

⁴ For a detailed description of the ESM and how it was used in the Sloan Study of Youth and Social Development, see Csikszentmihalyi and Schneider, 2000.

reports from the surveys of the following calendar year. He systematically found more unemployment with the first estimate, a discrepancy which is consistent with the hypothesis that more episodes of time use are forgotten when the time period to be recalled is longer and/or farther in the past. Bound et al. (1990) used the Panel Study of Income Dynamics Validation Study, which sampled hourly workers from a manufacturing firm for whom responses to RD questions could be cross-checked with their employer's records, to demonstrate how their retrospective reports of hours worked differed from those of the company. Juster and Stafford (1985) and the National Research Council (2000) have argued that RD questions encourage individuals to round off their responses, thus leading to exaggerated time use patterns. They also maintain that RD questions tend to evoke stereotypical or socially desirable responses rather than actual time allocations.⁵

Discrepancies in estimates of time spent on various activities have also been found between RD items and time diaries. Using several RD responses from the 1987 National Survey of Families and Households (NSFH), Marini and Shelton (1993) estimated that women spend a total of 31 hours per week on core housework, whereas men spend 16 hours. However, Juster and Stafford (1985), using 1981 time diary information, found that women spend 19 hours per week on core housework, and men spend 8 hours. Estimates consistent with those of Juster and Stafford were reported by Robinson (1985), who used 1985 time diary data for the same activities and found that women spend 19 hours per week on core housework, whereas men spend 10 hours. Based on their analyses and the results of other studies, Marini and Shelton (1993) conclude that time diaries may be the most valid and reliable method for estimating time use.

Another problem with RD questions relates to their wording, which takes on major significance since these items are asked only once and often not in conjunction with other items that could clarify specific time periods. For example, questions such as "Are you employed?" can be interpreted in many ways by the respondent. Does "being employed" mean working sometime during the month of the interview, during the week of the interview, or at the moment of the interview? Seemingly small differences in question wording can lead to very different estimates of time use.

One method for estimating the errors in RD questions is to ask the respondent at what times certain activities started and ended and then have the researcher calculate the actual time spent. This method, typically used to document travel schedules, has been successfully used to measure time worked. Duration of work is calculated based on arrival and departure times, taking into account travel times. Jacobs (1998) points out that many respondents might reliably report departure and arrival times because they must be aware of them in order to coordinate with employers, clients, and public transit. Furthermore, departure and arrival reports might be reliable even if the respondent does not accurately calculate durations of work time. The process of thinking about departure and arrival times may actually improve the accuracy of estimated

⁵ To quantitatively illustrate these kinds of biases, we used the CPS web page to study employed men ages 25 to 54 who were surveyed in the March 2000 CPS. We found that more than 40 percent of these respondents indicated working exactly 40 hours in the week prior to the interview, while less than 1 percent reported working 39 or 41 hours (although Pencavel [1986] interprets the 40-hour week reported by the overwhelming percentage of employees as an accurate response showing how strict employers are regarding the time worked by their employees). This pattern suggests that people who work long hours tend to underreport their hours, and people who work less tend to overreport their hours.

time spent at work. While obtaining time estimates using a travel schedule may increase the precision of estimating hours worked over standard RD questions, there are several problems with these estimates, especially for people who combine child care or leisure activities with travel to and from work, and for those who work at home and do not commute.

2.1.2 Inference and burden in time use studies

One of the benefits of time diaries is that they account for an entire 24-hour period so that random errors occurring in one time use category are cancelled out by random errors occurring in another category. Further, time diaries obtain specific information about the day and time when an activity occurs. This is also the case for the ESM since respondents report their activities at the moment signaled. But while time diaries can provide very comprehensive information on the daily life of a person, they do not necessarily provide accurate estimates of time use over the course of a week or a month. For example, suppose an individual, using the single-day diary method, reports spending eight hours at work. Can we infer that person worked 40 hours in the week? Or 56 hours?⁶ Gershuny et al. (1986) suggest that people tend to organize their lives by a weekly schedule. A study of one day may misrepresent a person's weekly schedule; for example, a person may typically work longer on Tuesdays but leave earlier on Fridays. The ATUS, which uses a full-day diary for a single day, may encounter such difficulties.

There are other inference problems using full-day time diaries that relate to reporting activities of short duration. Diaries may cause substantial under- or overestimates of activities of short duration, primarily because respondents may feel encouraged to report time use in regular blocks, such as 15 or 20 minute intervals, during which a short duration activity would either be ignored or grossly overstated. For this reason, it is important, regardless of the instrument, to include units of shorter and longer duration.

Another problem with time diaries relates to respondent burden. Assume time diaries could be obtained from an individual over the course of a week. Having to complete a diary every day may in fact be too burdensome, and individuals might over- or underreport activities, or simply stop participating. Now assume a group of individuals agreed to participate in such a project. One might suspect that they represent a biased group since it is likely that few respondents would tolerate the burden of reporting for seven consecutive days.⁷ The ATUS may be an improvement over other methods since it makes fewer demands on respondents. That is an empirical question, however.

The ESM shares many of the problems of time diaries, including respondent burden, but has several advantages over both surveys and time diaries, including immediate response to signals, which minimizes recall bias, randomization of beeps, which eliminates stereotypical categorizations of time use, and data collection over several consecutive days rather than on a

⁶ Some full-day diary studies have tried to address this problem by gathering diaries for a few selected days during the year and then constructing a synthetic week. Nevertheless, a synthetic week is not the same as a calendar week.

⁷ The Economic and Social Research Council commissioned a seven-day diary study in Britain in 1983 and 1984. Gershuny et al. (1986) describe the study and explain how a similar one-day diary study had an 81 percent response rate, while the seven-day study had a 52 percent response rate.

single day. Although the ESM has been taken as the standard against which other time measurement methods should be evaluated (Robinson, 1985), there has been limited quantitative work comparing the ESM with other instruments. In this paper, we evaluate the burden of the ESM and its effects on response bias and compare it with other instruments. These comparisons show some of the ESM's limitations and strengths compared with other methods of studying time use.

3 Our approach

In our analyses we estimate whether Sloan adolescents' time use, which is constructed from repeated measures, is similar to estimates of time use obtained through single-point RD responses reported by adolescents in other studies. Attention is directed to those variables that (1) serve as proxies for time use, such as hours worked outside of school, or (2) are asked of the Sloan ESM sample and adolescents in other studies, such as gender, age, parents' employment status, and the days of the week and time of year the student works for pay.

Two dimensions of sample selection bias are examined: representativeness of the sample and non-response bias. The Sloan adolescent sample was not designed to randomly sample American teenagers nor was it seasonally representative, since more observations occurred in April, May, and October. However, the Sloan sample includes a significant number of observations for all nine months of the academic year and is therefore more seasonally representative than a number of other studies of adolescents. In our first analysis, we determine how representative the Sloan study is compared with two nationally representative samples of adolescents. To measure non-response to the ESM, ESM participants are compared to a larger sample of students who completed surveys but not the ESM. On the basis of both of these analyses, weights are constructed that can be used to estimate characteristics of the general adolescent population. The methods used here can be applied to other random and purposive samples to determine the generalizability of results from time use studies, such as the ATUS.

3.1 Sloan study design

The Alfred P. Sloan Study of Youth and Social Development is a national longitudinal study designed to examine adolescent's transitions into adulthood (see Csikszentmihalyi and Schneider, 2000). The study began in 1992 with 1,221 students in sixth, eighth, tenth, and twelfth grades who were followed over a five-year period at twelve sites across the U.S.⁸ Localities were selected to satisfy the following criteria: variation in urbanicity, labor force composition, and race and ethnicity. Using 1990 U.S. census information, the sites were selected based on the degree to which their local economies were concentrated in manufacturing or service, as well as in their trend toward economic growth, stability, or decline over the past decade. The twelve sites were matched so that comparisons could be made among the school communities with respect to school size and the socioeconomic status and racial and ethnic

⁸ The twelve sites included 33 schools: 20 middle schools and 13 high schools. To provide variation in high school programs, two specialized schools were included in the sample: a mathematics and science academy and a magnet language academy. The remaining 11 high schools had more traditional comprehensive curricular programs.

diversity of the school populations. To ensure racial and ethnic diversity within schools, middle class African Americans and Hispanics were oversampled relative to their proportions in the national population.

For each school, two student samples were selected: ESM focal students, who were followed longitudinally, and Questionnaire-only (Q) students, who were not included in the longitudinal sample. The focal students were chosen from school-prepared enrollment lists of grades 6, 8, 10, and 12. Using a stratified design at each school, student selections at each grade level were made so that they were proportionately representative of gender, race, ethnicity, and level of academic performance. Based on student records, teachers rated each of these students as academically successful, working at grade level, or having academic problems. At each school, twenty-four students from each grade level were selected from lists prepared by the school using a random table of numbers.

The Q sample was selected using the same criteria as the focal sample. Specifically, the Q sample was designed to provide more information about the school and peer networks for each of the focal panel grades. Each year in the field, new Q samples were drawn from the grade the focal students were in. If a grade enrolled no more than 150 students, the Q sample consisted of the entire grade. Otherwise a random sample of 150 students was chosen from the grade enrollment lists. The Q students were administered the same questionnaires as the focal students, making it possible to aggregate information from both sample groups.⁹

Data were obtained using: (1) the Experience Sampling Method; (2) an in-depth interview; and (3) a battery of questionnaires, including a modification of instruments used in the National Education Longitudinal Study of 1988-1992. The Q students completed the questionnaires but were not interviewed and did not participate in the Experience Sampling Method; ESM students completed all instruments.

After completing a questionnaire pertaining to family characteristics, experiences in school, and plans for the future, the ESM students wore wristwatches programmed to beep randomly eight times daily in intervals between 7:30 am and 10:30 pm. The total schedule of beeps occurred over seven days and consisted of 56 signals.¹⁰ Students completed a short questionnaire describing their activities and thoughts at the time of the beep. After the data were gathered, eight time slots were generated to categorize the various time slots across sites, schools, and cohorts: 7:29-9:17 am, 9:18-11:10 am, 11:11 am-1:03 pm, 1:04-2:57 pm, 2:58-4:49 pm, 4:50-6:42 pm, 6:43-8:35 pm, and 8:36-10:14 pm.

As explained below, subjects did not respond to all beeps, but the number of beeps to which a subject responded while engaging in a particular activity can be used to approximate a percentage of time engaged, and an absolute amount of time for the week. To do this, we first

⁹ When the focal and Q samples are combined over the five years of the study, the total Sloan study sample is over 8,000 students. Analyses of the focal and Q samples revealed no differences in demographic characteristics, attitudes toward school, educational expectations, occupational aspirations, and other key variables used in this study.

¹⁰ A seven-day schedule was used for all subjects, although the day of the week on which the schedule began varied by site, school, and cohort. While the beep-cycle starting day and ending days varied, the study was designed to begin between 11:11 am and 1:03 pm of the first day and to end between 9:18 am and 11:10 am of the seventh day—a total of seven complete days and 56 beeps.

calculated the ratio r of beep responses while engaged in the activity to the total beep responses. Since beeping occurred during approximately 15 “waking” hours (more precisely from 7:29 am to 10:14 pm, or 886 minutes) each day over a seven-day week, 105 waking hours (more precisely, 6,202 minutes) per week are represented. Each percentage point of r thus corresponds to 1.05 weekly hours (more precisely, 62.02 minutes). For example, 10.6 percent of beep responses occurred while subjects watched television (as a primary activity, see below), resulting in an estimate of 11 weekly waking hours (657 weekly waking minutes) of watching television.

3.2 Comparison groups

Comparison groups include the Census Bureau’s October 1992 and May 1993 Current Population Surveys (CPS) and the U.S. Department of Education’s 1988-1992 National Education Longitudinal Study (NELS:88-92). The two studies each share one advantage: they are designed exclusively to obtain national estimates of population demographics and labor force activity (U.S. Bureau of the Census, 2000). Unlike the decennial Census, which relies on a great many citizens completing and returning the questionnaire under no direct Bureau supervision, the CPS respondents are statistically sampled, and then located and questioned by trained interviewers (U.S. Bureau of the Census, 2000).¹¹ Teenage employment may be seasonal, so another advantage of the CPS is that its monthly surveys can be used to examine and, if necessary, correct for the effects of seasonality in our data. In case teenage employment seasonality is important, the May 1993 CPS is used for comparison with the first wave of the ESM (conducted in April and May of 1993). The May CPS does not measure grade in school, and does not measure employment for anyone less than 15 years old, so it does not allow for accurate measurement of the employment situation of students in sixth, eighth, or tenth grade. We therefore also used the October 1992 CPS to more accurately identify students by grade, and then to measure the October employment situation of twelfth graders.

Because the CPS provides limited information on adolescents, the NELS: 88-92 student survey was also used for purposes of comparison. NELS: 88-92 is a nationally representative study of adolescents that began in 1988 when 25,000 eighth graders in public and private high schools across the U.S. were surveyed. These students have been resurveyed four times: in 1990, 1992, 1994, and 2000. In our comparisons, we primarily use data from the NELS Second Follow-up (1992) since it was conducted at approximately the same time as the first wave of the Sloan study. The data collected include information from students, parents, teachers, and school administrators. In addition to basic demographic and family information, NELS: 88-92 includes variables measuring performance in school, educational aspirations, experiences in school, and experiences at work.

The purpose of these comparison groups is to isolate the two dimensions of sample selection bias: representativeness and non-response bias. With respect to determining the representativeness of the Sloan sample, we compare the Sloan “Q-only+ESM” sample of teenagers responding to a questionnaire—but not necessarily to the ESM—with CPS and NELS samples, under the assumption that CPS and/or NELS respondents adequately represent the

¹¹ See Hogan and Robinson (1993) for a discussion of how the Census Bureau uses statistical sampling to estimate undercounting in the decennial census, and how it appears that black and other minorities are undercounted in the census. Also note that the CPS serves as the sampling frame for the ATUS.

teenage population. With respect to potential non-response bias in the ESM we compare the Sloan full ESM sample with the sample of students who completed at least 15 of their 56 beeps (the ESM-15 sample). On average, the response rate was approximately 32 beeps per participant. As other studies have shown, this response rate is not unusual for adolescents (see e.g., Hoogstra, forthcoming). Given that adolescents are likely to respond to only half their scheduled beeps, it is important to examine patterns of non-response in the data.

4 Results - representativeness and non-response in the sloan sample

4.1 Age, gender, and parent employment comparisons

To examine the representativeness of the Sloan ESM samples, we compared the age and gender distributions in these samples with those in the CPS. Analyses of the ESM and CPS samples indicate that although age differences between the ESM and ESM-15 samples are statistically significant at the .95 confidence level, they are not substantively different. The age differences between the ESM-15 and CPS samples are statistically insignificant. The overall ESM sample is representative of the age distribution of those in school, and reflects the 11 percent high school dropout rate seen in the CPS and other surveys. The propensity of an ESM student to respond to at least 15 beeps declines with age. Seniors have a lower response rate to the ESM, and will be somewhat undercounted in an unweighted beep-level analysis (analyses not shown).

Table 1
Work Status of parents of CPS, NELS, and sloan study high school students

	Oct 1992 CPS	1992 NELS	1992-93 Sloan Q-only + ESM	1992-93 Sloan ESM students	1992-93 Sloan ESM students w/ $\geq$ 15 beeps
Neither parent works	6.8	2.9	2.1	2.0	2.0
Only father	27.7	10.6	13.6	15.1	15.7
Only mother	6.7	10.9	4.5	4.0	4.0
Both work	58.8	75.6	79.9	78.9	78.3
TOTAL	100	100	100	100	100
Respondents	5873	19379	2851	697	599

Note: NELS responses reported above are based on the student survey. When the parent survey is used to measure employment status of parents, then the numbers more closely resemble those of the CPS: neither parent works 8.8; only father 19.6; only mother 20.4; and both work 51.1.

Source: October 1992 Current Population Survey, National Education Longitudinal Study, Second Follow-up (1992) Student Survey; Sloan Study of Youth and Social Development Wave 1 (1992-93) Student Survey.

Analyses of the gender composition of the ESM and CPS samples show that girls are more

likely to participate in the Sloan study, and are more likely to provide 15 or more responses during the week (overall, 55 percent of ESM participants are female; of those who responded to 15 or more beeps, 59 percent are female, a pattern that is consistent across grades). Tabulations for the CPS sample show more boys than girls (except among twelfth graders) in the school population, suggesting that ESM participation and response rates are greater among girls (analyses not shown).¹²

To further examine the representativeness of the Sloan ESM samples, we compared parent employment status across datasets. Table 1 shows that the distribution of work statuses of parents in the Sloan samples is similar to that reported in the NELS sample; both measures are based on student responses. The CPS numbers, however, are based on parent responses and are higher. Similarly, numbers based on the NELS parent survey resemble those in the CPS (see note in Table 1 below). As shown in the last three columns of the table, there is a slight, but statistically insignificant tendency for the ESM-15 sample to overrepresent students with father only working; it also slightly underrepresents students with both parents working relative to the ESM and Q-only+ESM samples.

4.2 ESM response rates by day of week

To examine patterns of non-response in the Sloan ESM samples, we compared ESM response rates across different times of the week. As described earlier, ESM beeps occurred at regular intervals during waking hours for a calendar week. Beeps were categorized according to four partitions of the week: “school time” (7:29am-2:57pm Monday-Friday), “after school weekday” (2:58pm-6:42pm Monday-Thursday), “school night” (6:43pm-10:14pm Sunday-Thursday), and “weekend” (2:58pm-10:14pm Friday, all day Saturday, and 7:29am-6:42pm Sunday). Analyses comparing response rates across these partitions indicate that the response rate differential is substantively and statistically significant, with response rates higher during school time than on school nights (analyses not shown). Response rates are related to gender, as noted earlier, but the time-of-week differential response is not. Although participation in the sample of students responding to at least 15 beeps declines with age, no systematic relationship between age and beep response rate was found, even when time of the week was taken into account.

4.3 Comparing teenage employment using the sloan, CPS, and NELS surveys

When it comes to using the ESM to measure time use, and work time in particular, there are three issues that must be addressed. First, how well do those Sloan students reporting at least 15 beeps represent the teenage population in terms of work histories or current work status?

¹² In addition to examining the representativeness of the Sloan sample with respect to age and gender through comparisons with the CPS sample, we also examined its representativeness with respect to school performance, using comparisons with the NELS: 88-92 sample. Both the NELS and Sloan questionnaires include questions posed for tenth graders about grades in four subjects (English, math, science, and social studies). Responses to these questions were aggregated for each respondent in both studies to compute a grade point average on a four-point scale. A comparison of the grade point averages for tenth grade students in the NELS sample and in the Sloan study ESM and questionnaire samples showed that averages were fairly similar for all of the samples, although there was a small and statistically significant gap between NELS and Sloan, with Sloan students having slightly higher GPAs. This difference appeared to be due to the schools sampled by the Sloan and NELS studies rather than non-response within the Sloan study.

Second, are Sloan work-related RD survey items comparable to work-related RD survey items from the NELS or CPS? Third, how do ESM estimates of time use compare with estimates derived from RD survey responses?

The Sloan study's work-related retrospective duration questions are different from those in the CPS. The Sloan study asks "Are you currently employed (have a paying job) or have you ever been employed?" to which valid responses are "never," "not employed now but was employed during this school year," "not employed this school year but was employed last summer," "was employed prior to last summer," or "currently employed." Note in particular that "currently" is rather open-ended. Does it refer to the day of the interview, the week of the interview, the month of the interview, or the semester of the interview? Also, does baby-sitting, yard work, or work at the family business count? These distinctions are expected to be more important for teenagers than for adults, since the former are less attached to the labor force, and time spent at school makes irregular, intermittent, and/or informal employment relatively more attractive.

Table 2
Percentage of high school seniors currently working -
a comparison of survey responses across three data sets

	10/92 CPS	5/93 CPS	1992 NELS	1992-93 Sloan Q-only +ESM	1992-93 Sloan ESM	1992-93 Sloan ESM w/ $\exists$ 15 beeps
Percent of currently working 12 th graders (from surveys)	36.5 [1778]	39.5 [1927]	51.7 [16,070]	52.5 [708]	54.7 [170]	54.3 [138]
Average hours among currently working 12 th graders (from surveys)	17.3 [666]	17.4 [778]	16.7 [7601]	19.0 [365]	18.8* [93]	17.7 [75]

Second Follow-up (1992) Student Survey; Sloan Study of Youth and Social Development Wave 1 (1992-93) Student Survey.

¹ The following criteria were used in identifying 5/93 CPS 12th graders: those age 17, 18, or 19, enrolled in high school, who had completed the 11th grade, but did not have a high school diploma.

² CPS observations are weighted using the household head's CPS weight.

³ Number of observations is reported in brackets.

⁴ In the Sloan study (Questionnaire-only and ESM samples), working is indicated by a "currently employed" response to the question "What is your job situation?"

⁵ In the Sloan study, hours worked at current job is reported in 0-10, 11-20, 21-30, 31-40, and 41+ hour intervals. We used the Sloan distribution of responses across these intervals, and CPS interval averages for seniors (7.0, 16.8, 25.8, 36.5, and 46, respectively), to compute Sloan average hours worked.

⁶ NELS statistics are weighted according to the NELS variable F2QWT, which weights the Second Follow-up sample to represent the 1992 U.S. population of twelfth graders.

* Significant at the $p < .05$ level in comparing ESM samples.

Source: October 1992 and May 1993 Current Population Survey; National Education Longitudinal Study

As shown in the last three columns of Table 2, which summarize Sloan survey responses, there are only minor differences across Sloan samples in the fraction of high school seniors "currently" employed. The NELS question about current employment, "What is your job

situation?” is comparable to the question in the Sloan survey which is fairly open-ended. As might be expected, the percentages of those “currently working” are similar in both the NELS and Sloan samples (see Table 2).

In the CPS, RD questions about employment status are more specific, and we use the Census Bureau’s concept of “currently employed and working” derived from those questions. In particular, “currently employed and working” refers to those who worked for pay some time during the survey week, plus those working 15 hours or more as unpaid family workers during the survey week. Table 2 shows that according to the various questionnaires, the CPS fractions of seniors currently working are substantially lower than in the NELS and Sloan samples. Given that NELS and CPS adequately represent the teenage population, this difference appears to be attributable to the survey question rather than the populations sampled (see also Committee on the Health and Safety Implications of Child Labor, 1998).

Sloan, NELS, and CPS asked about weekly hours usually worked on the current or most recent job, and we report the average for those “currently employed” in the second row of Table 2. The average hours reported by working twelfth grades is similar across datasets with most students working approximately 17 hours per week.¹³ Note that the 17 percent of ESM participants who responded to fewer than 15 beeps tended to work longer hours if they were employed.¹⁴ The average hours differences between the ESM and ESM-15 samples are statistically significant but the actual difference in terms of hours worked is small.¹⁵ There are no statistically significant differences between either the ESM or the ESM-15 sample and the Q-only+ESM sample.

Table 3
High school seniors who ever worked: NELS and Sloan surveys

	1992 NELS	1992-93 Sloan Q- only + ESM	1992-93 Sloan ESM Students	1992-93 Sloan ESM Students w/ ≥ 15 beeps
Percent of 12 th graders who ever worked (from surveys)	85.8 [16,070]	84.5 [708]	87.1 [170]	85.5 [138]

Note: Number of observations is reported in brackets.

Source: National Education Longitudinal Study of Second Follow-up (1992) Student Survey; Sloan Study of Youth and Social Development Wave 1 (1992-93) Student Survey.

As discussed above, the Sloan employment RD question can be used to measure whether a respondent has ever worked in his/her lifetime. NELS responses to the “What is your job

¹³ We further analyzed subgroup differences (e.g., gender) across these datasets to provide additional evidence of comparability. Analyses of the CPS data show that males are more likely to work than females; however, this difference is insignificant. Boys are more likely to work longer hours than girls and this difference is statistically significant. Similar trends were found for the Sloan survey sample (see Csikszentmihalyi and Schneider, 2000).

¹⁴ Not reported in the Table 2, but obtained by calculating the difference between the ESM and ESM-15 samples.

¹⁵ Although the ESM samples are relatively small in comparison to CPS and NELS, the fact that we are able to find statistically significant differences suggests that the size of the sample is large enough to detect differences across samples. However, it is important to note that while there is a statistical difference between the ESM and the ESM-15 samples, the actual difference in terms of hours worked amounts to only one hour per week.

situation?” question can also be used to determine whether a respondent ever had a job in his/her lifetime. There is almost no variation in the percentage of twelfth graders who have ever worked in either the NELS or Sloan datasets. Table 3 suggests that the sample of ESM students reporting at least 15 beeps is representative of the overall population in terms of propensity to work or have worked; the differences between the fraction working in that sample is not significantly different from that for the ESM and Q-only+ESM samples either substantively or statistically.

4.4 The ESM as a measure of work time

The ESM can be used to measure employment and hours, and in a way that is comparable to the CPS’s “survey” week definition of “currently employed and working.”¹⁶ To measure employment in the sample of students responding to 15 or more beeps during the week, we took the fraction of those reporting at least one beep in the workplace, as shown in Table 4. We found an “employment rate” for seniors that was both similar to the CPS survey-based estimate and substantially different from the fraction of those responding affirmatively to the Sloan study’s rather open-ended “currently” employed question.

Table 4
Working beeps of sloan ESM students compared with CPS survey responses

	CPS Questionnaire (1992-93)		Sloan ESM Responses (1992-93)	
			Unweighted	Weighted
	Oct 1992	May 1993	ESM w/ ≥ 15 beeps	ESM w/ ≥ 15 beeps
Percent working 12 th graders	36.5 [1778]	39.5 [1927]	39.3 [168]	36.7 [168]
Average hours among working 12 th graders	17.3 [666]	17.4 [778]	15.2 [67]	15.9 [67]

¹ Number of observations is reported in brackets.

² A “work beep” is one that occurred while the subject was at his or her workplace (e.g., even if during break time).

³ The sample of ESM students with 15 or more beeps consists of 168 students; 30 of those students failed to provide survey responses regarding their current employment. Therefore the ESM-15 sample size reported in Table 1 (n=138) is lower than the sample size reported above.

Source: October 1992 and May 1993 Current Population Survey; Sloan Study of Youth and Social Development Wave 1 (1992-93) Experience Sampling Method.

The reporting of *at least one* beep in the workplace is an obvious measure of employment, but beeps can be aggregated to obtain an estimate of the number of hours worked during the survey week. To do so, we first calculated the ratio r of beep responses at work to the total beep responses. The beeping schedule encompassed approximately 886 minutes per day over a seven-day week, which totaled 6,202 minutes per week. Each percentage point of r thus corresponds to

¹⁶ The CPS is conducted during the week of the 19th of a given month and asks about the previous week, so a more strict comparison of ESM and CPS would discard ESM responses provided during any week other than the week of the 12th. We have not found much CPS or Sloan study evidence of within-school-year seasonality of teen employment. Therefore, to maintain a larger sample size, we do not discard such ESM observations.

62.02 minutes. (For example, for all students who reported at least one beep at work, 11.0 percent of beep responses occurred while they were at work; we therefore estimated 11.3 weekly waking hours at work for those who worked at all.)

ESM response rates vary by time of week, and by gender, so ESM responses can be weighted by the inverse of the response rate for that gender/time of week to obtain a more accurate estimate of hours worked. A time-of-week-weighted estimate of work time is expected to be higher, since students are more likely to respond to ESM signals during the school day (when not engaged in paid work) and are less likely to respond at other times of the day.

The weighted and unweighted work hour estimates can be compared with hours estimates based on responses to questionnaires (retrospective duration questions). ESM estimates of the employment rate, and weighted ESM estimates of hours worked, are very similar to CPS RD questionnaire-based estimates.¹⁷ To the extent that there are differences, they might be interpreted in three ways:

- 1) Reported beeps are imperfectly representative of adolescent time use (e.g., ESM non-response is especially high when the respondent is at work);
- 2) RD questionnaire estimates of the length of the workweek are imperfect; and
- 3) The CPS and Sloan study sample different populations.

The second interpretation has been made by authors of time diary studies of the workweek. For example, Robinson and Bostrum (1994) found that adults with shorter than average workweeks according to full-day diaries have RD workweek estimates that are longer than their diary estimates. While Robinson and Bostrum (1994) and Jacobs (1998) have different interpretations of those findings, both conclude that RD questionnaire estimates must be imperfect.¹⁸ If this reporting bias carries over to teenagers, we would expect questionnaires to overestimate teenage work, since their workweeks are short relative to that of an average adult. However, there are a few reasons to suspect RD questionnaire biases to be different for teenagers than for adults. First, teenagers are typically “clock punching” hourly employees, and the process of punching the clock enables them to better estimate work hours than typical adult salaried employees. Second, teenage work schedules are much less regular (Committee, 1998), which makes it less likely that a teenager would accurately estimate his work hours for any given week.

¹⁷ The calculations for the weights used in Table 4 are described in section 3.5 below.

¹⁸ Mulligan (1998) used males from the 1985 full-day time diary study to compare diary with RD questionnaire time-worked estimates by age group (ages 25 to 64). He found RD estimates to exceed diary estimates the most for men in their 50’s and early 60’s—the group of men expected to have the shortest average workweek (see also Ruhm’s [1990] study of “bridge jobs and partial retirement”). His study is consistent with the finding of significant imperfections in RD workweek estimates, and perhaps also confirms Jacobs’ (1998) interpretation that RD questionnaires overestimate workweeks the most for adults with short workweeks.

Table 5
Work activities of sloan wave 1 students with at least 15 ESM responses

	Percent of beeps at work	
	Unweighted	Weighted
Working as primary activity	73.4	73.8
Working as secondary activity	6.4	5.9
Working neither as primary nor secondary activity:		
Homework	0.6	0.6
Talking with friends, in person	6.8	6.7
Talking with friends, other	1.4	1.3
Playing games	1.6	2.0
Watching television	3.9	4.0
Listening to music/radio	0.2	0.3
Doing a hobby	1.6	1.9
Personal care	3.9	4.0
Smoking	0.2	0.2

Note: The following activities were coded as “work” when done at the workplace: “thinking,” “standing,” “walking,” “waiting,” “driving,” “nothing,” “missing the beep,” or “this study.”

Source: The Sloan Study of Youth and Social Development Wave 1 (1992-93)
Experience Sampling Method (ESM).

As shown in Table 4, when the survey question is restricted to a specific time period as in the CPS, then the responses regarding hours worked are similar to ESM responses which also are specific.¹⁹ However, as shown in Table 5, teenage time at the workplace is not the same as teenage time worked. The difference between teenage time at the workplace and teenage time worked can be seen by looking at what teenagers actually do at work. When beeped at work, teenagers reported working 80 percent of the time; the other 20 percent of the time they reported doing homework, talking with friends, playing games, watching television, listening to music/radio, doing a hobby, personal care, or smoking. These activities may be considered something other than “work”—even though done at work. The ESM shows that they are nontrivial and offers researchers some quantitative indicators of those activities.

4.5 Constructing weights

Although unweighted ESM estimates of time use are fairly close to estimates from other studies, these results suggest that ESM non-response is substantively significant in two dimensions: time of week and gender.²⁰ Estimates that better characterize the wider adolescent population and more closely match estimates from other studies might therefore be obtained by weighting beeps

¹⁹ Gershuny et al. (1986) report a similar finding in their British study of adult time use. They found average hours worked to be similar in a time diary sample and in a more standard employment-questionnaire sample. Perhaps surprisingly, their point estimates suggest that those who work long hours are *more* likely to respond in a diary study than in an employment-questionnaire study.

²⁰ As Kalton (1985) notes, day of week is typically not randomly sampled in time diary studies and therefore has to be adjusted for. Since the ESM is typically conducted over a period of a week, with participants beginning the beeping schedule on different days, variation in response rates over days of the week can be computed and response rates can be adjusted accordingly (see Jeong, forthcoming).

according to their time of week and the gender of the respondent. Table 6 reports the weights used in this analysis. There are six weights: two in the gender dimension (w^m and w^f , with $w^m + w^f = 1$) and four in the time-of-week dimension (w_1, w_2, w_3, w_4 , which sum to one). The gender weights are reported in the last row of the table, and the time-of-week weights in the last column. The weight for each type of beep (e.g., a school-time beep, or a beep from a male subject) is proportional to the inverse of the frequency of that type of beep in the sample of beeps obtained from those providing at least 15 responses to the ESM. The weights for subtypes of beeps (e.g., male school-time beeps) were calculated as the product of the corresponding beep-type weights and are reported in the interior of the table.

Table 6
Time-of-week and gender weights for sloan ESM wave 1 beeps
(in sample of those reporting at least 15 beeps)

Time of week	Gender		
	Male	Female	Either
School time	0.122	0.082	0.204
After school weekday	0.135	0.092	0.227
School night	0.160	0.109	0.269
Weekend	0.179	0.121	0.300
Any time	0.596	0.404	1

Note: Each of the eight weights in the interior is the product of its time-of-week weight (from the last column) with its gender weight (from the last row).

Source: Sloan Study of Youth and Social Development Wave 1 (1992-93)
Student Questionnaire and Experience Sampling Method (ESM).

The probability that a male (or female) respondent would be included in the ESM-15 sample is inferred by comparing October 1992 CPS and ESM-15 participation rates by gender; this comparison is used to calculate the column sums w^m and w^f in Table 6. Algebraically,

CPS_g (ESM_g) is the number of CPS (ESM-15) respondents of gender g , respectively.

$$w^g \equiv \frac{CPS_g / ESM_g}{\sum_{i=mf} CPS_i / ESM_i} \quad (1)$$

Note that this equation has the two properties required of weights: (1) summing to one across groups (gender in this case); and (2) proportional to the inverse sampling probability (in this case, gender g is ESM-sampled with probability ESM_g/CPS_g).

The probability that a beep at a particular time of week would be included in the sample is inferred from the response rates by time of week, and used to calculate the row sums.²¹ Algebraically, the weight w_s for time-of-week s is the inverse of the probability of inclusion:

²¹ For example, the school-time beep response rate was 0.686. The inverse of 0.686 is 1.458. Summing inverse response rates for all four time slots (1.458+1.618+1.923+2.146), we get 7.145. The school-time beep weight of 20.4 percent is then calculated as 1.458/7.145. In this way, the weights sum to one across time slots, and each slot's weight is inversely proportional to its response rate.

$$w_s \equiv \frac{1/r_s}{\sum_{i=1}^4 1/r_i} \quad (2)$$

where r_s is the response rate for time slot s . The eight subtype weights shown in the interior of Table 6 were calculated as the product of the corresponding column and row sums. For example, $w_1^m = 0.122 = 0.596 \cdot 0.204 = w^m \cdot w_1$.

5 Conclusions

5.1 Tradeoffs between ESM and retrospective duration questions

In selecting a particular method to measure time use, a researcher is confronted with several decisions. How can the study be economically administered? Can responses be compiled from a sufficiently representative sample? Can responses be expected to be accurate, and interpreted by subjects as they are interpreted by study designers? Retrospective duration surveys such as the CPS and NELS:88-92 are practically useful in that they can be administered in a single session. In contrast, the ESM is certainly more difficult to administer since participants are required to fill out response forms several times a day over an extended period of time. We suspected that selecting a population of subjects willing to complete the ESM would introduce some respondent selection bias. And, in fact, girls are overrepresented in the Sloan ESM sample and among those who filled out the ESM. Older students were less likely to respond to beeps, although this difference does not appear to be significant. However, with respect to specific characteristics of parents' employment, the work status of parents of ESM students appears to be representative of the overall population of households with adolescent children.

But as some have suggested, people who agree to complete the ESM may be more organized and diligent. Students who completed the ESM had slightly higher grade point averages than students in the NELS sample, with the highest grades being reported by those students who completed 15 or more beeps. These higher rates may be confounded by the fact that there are more females in the ESM sample, and girls tend to have higher grades than boys in elementary and high school.

The other more problematic issue regarding the ESM is response rates by activity and time of week. We found that after-school and weekend beeps were underreported. This problem can be handled through weighting procedures, and we have shown how it is possible to weight the sample, adjusting for non-response by time of week and for the overrepresentation of females. What is perhaps most surprising is that even though the ESM tends to have lower response rates after school and on weekends, when estimating the percent of adolescents who have worked, the results from the ESM are nearly identical with national samples. These results suggest that ESM responses reporting on activities outside the household and outside of school are not as spurious as some have assumed that they may be (Jacobs, 1998). This comparability is also achieved when comparing CPS and ESM estimates of the average hours worked by high school seniors. However, if we weight the ESM sample by differential response patterns, the percent who are working remains consistent with national samples, but the average hours worked by seniors is

slightly lower than the CPS.

5.2 Implications for other studies of time use

Overall, there is little tendency for a potentially burdensome instrument like the ESM to undercount the activities performed by “busy” people, like teenagers with jobs or students with good grades. While “busy-ness” may not be an important factor in discouraging responses, “compliance” may be an important factor in encouraging it, and there are systematic differences across people in this regard. Response rates were significantly different between the genders, and somewhat different according to grades received in school. These two results are likely to generalize to other potentially burdensome time use instruments, and it seems that a demographic-weighting strategy, as shown above, is one strategy for adjusting for some of this non-response.²² When it comes to analysis of the ATUS, it may also be advisable to add variables that predict compliance, like GPA, to the CPS questionnaire items.

We also used weights to adjust for time-of-week differences in response rates. A precise analogue for this kind of bias may not exist for time diary studies, but there is the question of the level of detail a time diary respondent might provide, and whether this level of detail might vary with the time of week. Recall that a completed time diary consists of a sequence of activities and their time intervals, with the partitioning of time largely an object of choice by the respondent. For example, a time diary respondent is free to respond “at work from 9 am to 5 pm,” or to offer an additional level of detail for the activities he performed at work (or elsewhere) between 9 am and 5 pm. It seems likely that the level of detail provided will be a function of time of week (perhaps with less detail during work time), so that short duration activities will be undercounted to a degree determined by the time of week in which they tend to occur. One strategy for dealing with this problem is to weight time diary measures of short duration activities according to their time of week, as we did with all activities in the ESM, to obtain noticeably more accurate estimates of time use.

Ideally, comparison of time use measures should examine different methods for obtaining time use data, such as time diaries versus ESM and survey responses. Since there were no time diary studies of adolescents collected during the early 1990s, when other studies used in these analyses were conducted, it was not possible to compare time diary with data obtained using surveys and ESM. It would be beneficial if future studies included multiple methods for obtaining time use data so that estimates based on these different methods could be compared. When different measures of time use are available for the same sample, issues of non-response are more obvious. If the sample is not representative, however, weighting procedures will still need to be employed, and comparisons with nationally representative samples will help identify how the data should be weighted.

²² In fact, since the CPS forms the sampling frame for the ATUS, ATUS users should have an easier time creating demographic weights because they do not have to account for a difference in sampling frames, as we did with the Sloan study.

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The time cost of care

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Abstract

Extensive small scale studies have documented that when people assume the role of assisting a person with impairments or an older person, care activities account for a significant portion of their daily routines. Nevertheless, little research has investigated the problem of measuring the time that carers spend in care-related activities. This paper contrasts two different measures of care time – an estimated average weekly hours question in the 1998 Australian Survey of Disability, Ageing and Carers, and diary estimates from the 1997 national Australian Time Use Survey. This study finds that diaries provide information for a more robust estimate, but only after one models the time use patterns in the days of carers to identify care-related activities, which diarists do not necessarily record as care. Such a measure of care time reveals that even people who offer only occasional assistance to a person with impairments tend to spend the equivalent of more than 10 minutes a day providing care. Most caregivers undertake the equivalent of a part-time job to help a friend or family member. Summing the average caregiving time provided by all household members reveals that over a quarter of Australian households caring for an adult or child provide the equivalent of a full-time employee's labour, and another quarter work between 20 and 39 total weekly hours to provide informal care.

JEL-Codes: C13, J14, J16, J17, J19, J20

Keywords: Care, unpaid work, time estimation, family and gender roles, informal economic activity

1 Introduction to the problem of measuring time spent in care¹

Informal care of people with disabilities and the frail elderly constitutes an important element of unpaid work in many industrialised countries (OECD 1999). In Australia, over 2.6 million people help a person with impairments perform tasks of daily living (ABS, 2003), providing services worth 18.3 billion per annum (Carers Australia, 2003). Some carers may offer only occasional help, such as collecting shopping or performing periodic repairs around the home of an older person. Other carers assist a person who needs more regular help for such activities as getting out of bed and dressed in the morning.

As the average age of Australians increases, the need for care also will expand. A number of motivations have prompted the transfer of care from state-sponsored institutions to the community. Policies emphasising community care acknowledge that those needing assistance prefer to live at home (Dalley, 1988). Conscious of the potential impact on state and national budgets which state-provided care might entail, successive Australian governments since the 1980s have striven to transfer an increasing share of the responsibility for care to families and communities (Ungerson and Kember, 1997; Schofield et al, 1998; Fine, 1999). This transfer has involved positive incentives (such as payments to carers looking after an elderly or disabled person in their homes) and well as the restriction of services, both through the reduction of time in which people needing longer term care may remain in hospitals and other public facilities and also through the cutting back of government-funded services or tightening of criteria to access some services. By the mid-1990s, informal carers provided 74 percent of all the care that enabled elderly and disabled Australians to remain at home (Department of Human Services and Health, 1995). Similar trends emphasising de-institutionalisation and care in the community have emerged in other industrialised countries (National Commission of Audit, 1996; OECD, 1998; OECD, 1999).

In some respects, care of a person with a long-term condition is similar to care of a person of any age with a temporary illness or injury or to the care of children. In many significant ways, however, people looking after someone with a disability or long-term illness face more difficult circumstances than people looking after children or adults with temporary difficulties. Valerie Braithwaite (1990) has observed that carers of the elderly and people with long-term disabilities differ fundamentally from carers of children and people with temporary illness and injuries. Societies celebrate the recovery of people with temporary medical conditions and the development of children into independent adulthood. Parents and temporary carers can look forward to milestones of achievement for the care recipients, which also mark milestones in the decreased needs of the person for whom they provide aid. Governments, religious institutions, and businesses contribute to the care of children and people with temporary injuries by providing such services as public education, special meals and activity packs for children, temporary leave and pay provisions to aid recovery from injury, and baby changing facilities in public toilets. Societies tend not to celebrate prolonged incapacity or the decline of basic functions (Braithwaite

¹ Though the authors conducted the research reported here at the Social Policy Research Centre, the New South Wales Department for Women, the NSW Department of Ageing, Disability and Home Care, the NSW Department of Community Services, NSW Health and Carers NSW were partners in the larger project and provided advice and comment during this research. Nevertheless, this chapter represents the views of the authors and does not necessarily represent the views of the other partners.

1990). Carers do not have milestones marking decreased dependence to which they can look forward (indeed some will face the reverse experience of the declining capacities and increased dependency of the person whom they aid), and the number of facilities and services available to providers of care are few compared to support for raising children (Braithwaite 1990; Bittman and Fisher 2003). Societies tend to develop social expectations of the role of parents – while such expectations are not as developed or as strong in relation to care, leaving many carers with a lack of sense of direction for their role as carers (Braithwaite 1990). Consequently, the circumstances of carers deserve academic consideration.

Australian government agencies providing services to older residents and people with disabilities or long-term illnesses have developed concern for the welfare of informal carers. In part, the rising cost of providing services for carers has generated concerns among those managing public budgets (National Commission of Audit, 1996). After all, if informal carers lose the capacity to continue in this role, both the care recipient and the carer may have to turn to the state for publicly funded assistance. At the same time, service providers have noted that a significant number of carers who could benefit from support do not take up the public services to which they are entitled (Brodaty et al, 2005; McCabe et al, 1995; Yeatman, 1996; Schofield et al, 1998).

Most care relationships emerge from pre-existing close relationships, and carers do not always recognise that a change in their loved one's health has changed the nature of their relationship – that is some carers simply do not recognise that they have assumed the role of carer (Parker 2000: 3). Denying the necessity of providing care also can provide some people with a coping strategy for distressing circumstances. If accepting services means facing up to the reality of a loved one's poor health, some carer's prefer to avoid services (Brodaty et al 2005; McCabe et al 1995; Schofield et al, 1998). Some people whose applications for public assistance for carers have been declined may accept that they are not actually carers (Bittman, Fast, Fisher, and Thomson 2004). Carers may be isolated from support because potentially useful services are not accessible in their area due to hours of operation or cost. Some carers from cultural or linguistic minority backgrounds find services culturally inappropriate or insensitive (Thomson, Fine and Brodaty 1997). Other reasons carers may not use services are lack of information and their perceptions that they do not need services (Hill et al. 2005). Carers who do not receive sufficient support from public agencies, charities, or their informal social and family networks can experience social isolation, develop financial problems, drop out of the labour market, and experience poor health and stress (Brodaty and Hadzi-Pavlovic, 1990; Schofield et al, 1998; Watson and Mears, 1999). International research shows that community services designed to support carers can make a significant difference to their health and welfare (Schofield et al, 1998; Braithwaite 1998; Watson and Mears, 1999; Parker, 2000; Zarit et al, 1998). Charitable organisations aiding people with disabilities and academic researchers have additionally expressed concern that women assume a disproportionate share of the burden of informal care (Fine, 1999; Schofield, et al 1998; Watson and Mears, 1999). Again, concerns for carers in Australian have also emerged in other industrialised countries (OECD, 1998; OECD, 1999).

One element of understanding the experience of being a carer – an essential task to inform policy relating to carers – is to examine the range of time requirements the different groups of carers typically commit to this role. This paper aims to address a gap in the literature on caring and time use by investigating the conceptual and technical issues involved in understanding the time costs of care. Two different nationally representative data sets in Australia allow the estimation of the time constraints caring imposes on the daily activities of the people providing informal care. The 1998 Australian Bureau of Statistics (ABS) Survey of Disability, Ageing and Carers (SDAC) included a weekly time estimate question, asking co-resident primary carers if their typical

weekly care commitment required fewer than 20 hours, 20 to 39 hours, or 40 or more hours of work. The 1997 ABS Time Use Survey (TUS) collected self-reported accounts of daily activities of all members aged 15 or more of a sample of Australian households over each five minute interval for two consecutive 24 hour days.² The two studies generate very different estimates of the time required for care. Indeed, the time use study can also produce divergent estimations depending on how the researcher defines a carer and how time spent caring is measured. While the data sets analysed here are Australia-specific, similar data are available in other countries. This paper explores procedures that can aid the investigation of care in a range of national contexts.

We address the question of how researchers might best measure the time cost of care by contrasting the estimates generated by these two studies.³ We argue that time diary data provides the more robust estimate, but only if the researcher engages in an extended process to identify the range of daily activities affected by care. Nevertheless, when the time recorded in the diaries is aggregated to the household level, and household care time estimates are compared against the SDAC results, both surveys suggest that a significant proportion of households included members whose care activities amount to the equivalent full-time employment hours. Consequently, care constitutes a significant and largely unmeasured dimension of informal economic activity.

2 The importance of examining time spent providing care

The major official source of information about carers in Australia, the Australian Bureau of Statistics' *Disability, Ageing and Carers Survey* contains limited information about the time devoted to care. Consequently, there is hardly any systematic knowledge about what determines the quantity of labour required for informal care, its nature or its intensity and the demands it places on families. Therefore it is not possible to estimate the demands placed on carers, how they vary according to changes in circumstances and to make informed judgements about the supply of caring labour.

Informal care has been described as the submerged portion of the 'iceberg of welfare' as it remains unseen because it is unpaid and does not register in conventional accounting for welfare expenditure. Although unpaid activities leave no cash trail, they do leave a trace in terms of the expenditure of time⁴.

² We removed 236 poor-quality diaries which either had unrealistically low numbers of activities recorded or had in excess of one hour of time when no activity was recorded and the missing time slots could not be imputed as travel by unknown means or as falling within a similar limited range of possible activities.

³ Though the authors conducted the research reported here, the New South Wales Department for Women, the NSW Department of Disability, Ageing and Home Care, the NSW Department of Community Services, NSW Health and Carers NSW were partners in the larger project and provided advice and comment during this research. Nevertheless, this paper represents the views of the authors and does not necessarily represent the views of the other partners.

⁴ The only official estimate of the cash value of informal care is provided by the Australian Institute of Health and Welfare. Using information from the Time Use Survey and some conservative assumptions, the Australian Institute of Health and Welfare, has calculated that the dollar value of unpaid caring labour is approximately double the total (monetary) welfare service expenditure in Australia (Australian Institute of Health and Welfare, 2003:76)

3 Defining a 'carer'

The population of carers, like the population of people needing assistance, is diverse. The degree of time required to look after any particular person in need of aid depends in part upon: the degree of independence retained by the care recipient; the degree of impairment this person experiences, the range of tasks with which the person needs assistance; the range of support services available to the carer and the care recipient; and whether other informal carers share the role or one person assumes the responsibility alone. Nevertheless, some caring relationships have a greater degree of intensity than others. Four groups of carers are considered in the subsequent analysis.

Both the SDAC and the TUS distinguish between *primary carers*; people who supply the main source of help to another person who needs regular assistance; and *other carers*; people who either supply supporting assistance alongside a primary carer or who help a person whose need is less profound. The SDAC only asked primary carers for information about the time they spent on care. The TUS asked all diarists if they supplied main (or primary) care to an adult or children with disabilities, if they supplied a less intensive degree of care (other care), or did not care for an person needing assistance. The 1998 SDAC included 918 primary carers, while the 1997 TUS included diaries from 262 primary carers and 627 other carers. These 918 respondents to the SDAC and 889 respondents in the TUS all identified themselves as carers to the survey teams.

Nevertheless, some people who provide care do not self-identify as carers (Bittman, Fast, Fisher, and Thomson 2004) and hence are unlikely to classify themselves as carers in a survey. As previously noted in the introduction, there are many reasons why carers may not self-identify. The Time Use Survey, however, also offers the possibility to distinguish two groups of carers who do not identify themselves as carers on questionnaire items. We found that 240 diarists who did not report that they provided help to another person nonetheless recorded an activity coded as 'care' in one or both of their time diaries (such as reporting helping their elderly father get out of bed and get dressed, or reporting assisting a grandparent with getting into and out of the bath then taking medication). We categorised these people who performed care but who did not claim to be carers as 'non-identified carers' (we discuss this issue in more detail in Bittman, Fisher, Hill, Thompson, and Thomson. 2004).

We profiled the daily activities of these three groups of carers – primary carers, other carers, and non-identified carers, and identified variations in patterns of behaviour which distinguished carers from the rest of the survey population. We then identified 1263 diarists in the remaining population who exhibited similar behaviour patterns to carers, and whose behaviour we could not explain as arising from a reason other than care. We grouped these diarists into a category of 'possible carers' (full details of our methodology for locating non-identified carers who did not record care activity in their time diaries appears in Bittman, Fisher, Hill, Thompson, and Thomson 2004). Over half of these possible carers (56.2%) live in a household with another person who needs care (Bittman, Fisher, Hill, Thompson, and Thomson. 2004). We now compare the time primary carers report spending in care in the SDAC and the TUS, and also examine the time other carers, non-identified carers and possible carers spend in care in the time diary data.

4 Estimates of time spent caring

The SDAC asked primary carers (though, unfortunately, not other non-primary carers) to estimate their weekly care commitments. In addition to limiting the possible responses to the number of hours spent in care to a three point range, the age categories in the SDAC are limited to four age groups. These are under 25; 25-39; 40-64; and 65 or more. Some general trends emerge in the SDAC data. For co-resident female primary carers, the proportion indicating that their care time consumes 40 or more hours per week increases with age. Among all female primary carers, the proportion spending 40 or more hours per week in care is lowest in the under 25 age group (19.7%), plateaus in the middle age groups (34.6% and 33.8% respectively), and rises among women aged 65 or more (60.6%). The youngest male primary carers did not report spending over 40 hours or the equivalent of full time employment hours in care. Two-thirds of both co-resident male primary carers and all male primary carers indicated that they spent fewer than 20 hours per week providing care. Around one-third of both male and female primary carers performing 20 to 39 hours of care work per week are in the youngest age group. It should be noted that young carers are the largest proportion among carers who provide 20 to 39 hours per week of care.

The 1997 Time Use Survey collected information on time spent caring at a number of levels. Diarists wrote down what they were doing, using their own words to describe the main focus of their attention, any other activities they did at the same time, for whom they performed each activity, who else was present, and where they were. The ABS used the same series of activity codes to classify both main activities and secondary activities.

Of diarists who recorded care on one or both of their diary days (this set of diarists includes all non-identified carers and a proportion of the self-identified primary carers and self-identified other carers), 81 percent recorded this care as a main activity that did not overlap other activities. A further 12 percent of these diarists recorded care as a secondary activity only, while the remaining 7 percent reported their care tasks as both primary and secondary activities. Even when overlaid with another activity, such as socialising with the care recipient or listening to the radio while undertaking care, care time imposes constraints on the range of potential activities in which the carer can engage and, like main activity care time, tends to cover a significant need for the care recipient. We argue that secondary care time counts equally with main activity care time in terms of summing the time commitment from care provided that one does not double-count periods where both the main activity and secondary activity are care.

The coding of “for whom the diarist performed the activity” column distinguishes activities which the diarist reported they did for a person with a disability on account of that person’s disability. Again, with the proviso that such time not be included if the main or secondary activity is already recorded as care, we argue that such time likewise properly fits into the domain of care time.

Summing these various definitions of care time (main activity recorded as care + secondary activity recorded as care when main activity is not care + time spent for people with a disability when neither the main nor the secondary activity is recorded as care), however, we find very low estimates of time spent caring, particularly compared to the SDAC estimates. The 80 percentile carer score (where the total minutes spent in care by the 20 percent of carers who reported the longest time in care is at this level or higher, and the total minutes spent in care by all other carers

is lower) is 23 minutes per day – and the median minutes in care for all four types of carers is no time spent caring.

The differences in the basic estimates suggested by the two studies are striking, and points to a conceptual issue related to defining care. Carers know that their responsibilities can make a big impact on their daily routines, but when they write down what they do during the day, carers list very few explicitly care-related activities. There are good reasons why this phenomenon should occur. Some aspects of care are closely related to domestic activities. Looking after a person who has continence problems, who regularly spills drinks and food on account of a hand tremor, or who sweats profusely, among other difficulties, likely entails more time washing clothing, sheets and towels than might be undertaken in a household with a similar number of members of the same sex and age. Nevertheless, it is highly unlikely that any carer in such a position could accurately estimate how much of the time they spend doing laundry is simply part of their routine domestic needs and how much of that laundry time is extra time generated by their caring role. The time diaries have particular value in enabling us to work out the average laundry time of similar households where no care takes place to work out what that difference is likely to be.

5 Revising the time diary estimates

This paper developed from a larger project assessing the needs of hidden and vulnerable carers in Australia. As part of this project, we profiled the daily activity patterns of carers using the 1997 Time Use Survey. The quantitative profiling revealed that carers spend more time in voluntary work, spend more time on domestic work, spend less time on paid work and related activities, spend less time and personal care; perform more total activities on an average day; and have more restricted leisure time than other people (Bittman, Fisher, Hill, Thompson, and Thomson. 2004). These findings were also supported by focus groups we conducted with carers in a previous study (Bittman and Thomson 2000). Having identified the patterns of daily activities associated with self-identified and non-identified carers, we could use this information to build more precise estimates of the average daily minutes different groups of carers spend undertaking care-related activities.

Even so, we cannot simply add up extra time spent doing laundry or other activities where we have already identified that carers typically expend more time. People who are not carers also may spend particularly long periods performing activities that dominate the days of carers (on account of cleaning the house after the visit of many guests or preparation for a large celebration, for example). Similarly, carers themselves will sometimes spend longer periods on activities that can be extended by care commitments for reasons entirely unrelated to their role as carers. Account must be made to exclude as much time not related to care as possible. To make such an account, we experimented with the effect of including 30 percent, 40 percent, 50 percent, and 75 percent of the extra time expended by carers in care related activities after subtracting out the mean score all non-carers spent in extra time in these same activities. We found the 75 percent score performed sufficiently robustly for use in the estimate compared to the benchmark of self-identified carer.

Table 1 shows the resulting estimates of care time yielded by this procedure. The first feature to note is that some residual time (time which is resembles a care-style pattern) remains for some non-carers, but this residual time is considerably lower than the time invested by all types of carers. The next striking feature is the similarities between the care times of primary and other carers – though primary carers record marginally higher care times, this difference is not significant.

Table 1
Estimates of average daily time ranges spent in care (in hours and minutes per day)
by the carer types

Carer Type	20 percentile	median time	80 percentile
Self-identified primary carers	2 minutes	1 hour 19 min	3 hours 16 min
Self-identified other carers	0 minutes	1 hour 14 min	3 hours 8 min
Non-identified carers	37 minutes	1 hour 59 min	4 hours 29 min
Possible carers	12 minutes	1 hour 27 min	3 hours 33 min
All carer types	10 minutes	1 hour 27 min	3 hours 31 min
Non-carers with no other care responsibilities	0 minutes	10 minutes	1 hour 39 min

Source: 1997 Australian Bureau of Statistics Time Use Survey

Indeed, one reason why the average time spent by non-identified carers undertaking care is higher than the care time reported by identified carers may be that the time diary data are picking up only a selected portion of non-identified carers on the days when they undertake care, and that we are failing to identify an element of the non-identified carer population that performs less intensive care as these individuals did not complete a diary on a care day – though it is also possible that non-identified carers spend more time in care, or that a combination of these reasons accounts for the higher time estimates for the non-identified and possible carer populations.

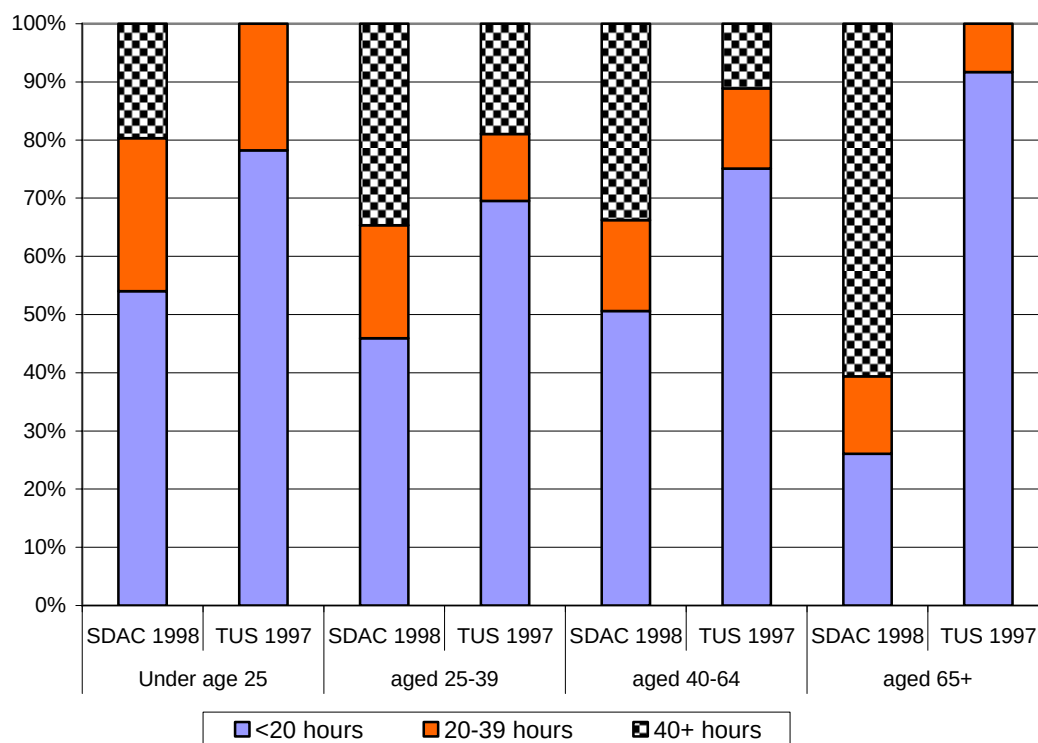
6 Comparing the 1998 SDAC and the revised 1997 TUS estimates

Figures 1 and 2 compare the revised Time Use with the SDAC estimates for women and men by the four age categories available in the 1998 SDAC data.

A similar picture emerges for primary co-resident carers. These comparisons suggest that women of all ages and men 25 or older may possibly over-estimate their hours of care time when using a retrospective recall method, though men aged 25 to 39 appear to make smaller over-estimates than female carers or older male carers, while women aged 65 or more appear to make the highest over-estimates. Nonetheless, Figures 1 and 2 also suggest that male carers aged less than 25 may be significantly underestimating their care time in the diary method, compared to the SDAC estimations.

Figures 1 and 2 indicate that we have two pieces of apparently contradictory evidence. First the SDAC estimates suggest that carers view their caring role as occupying a significant proportion of their daily life. Our second estimate of the time spent caring, based on activities recorded in the TUS diaries, suggest that caring involves a smaller time commitment. Broadly there are two ways of reconciling these apparently divergent pieces of information together. A decision can be made that one method is superior to the other. For example it could be decided that retrospective recall tends to exaggerate the demands of their care situation. Conversely one can rely on the known quality of the time diary data and conclude that an accurate assessment of time spent in caring activities is found by this method. However, it might be possible to accept the findings produced by each method and seek ways of reconciling apparent contradictions.

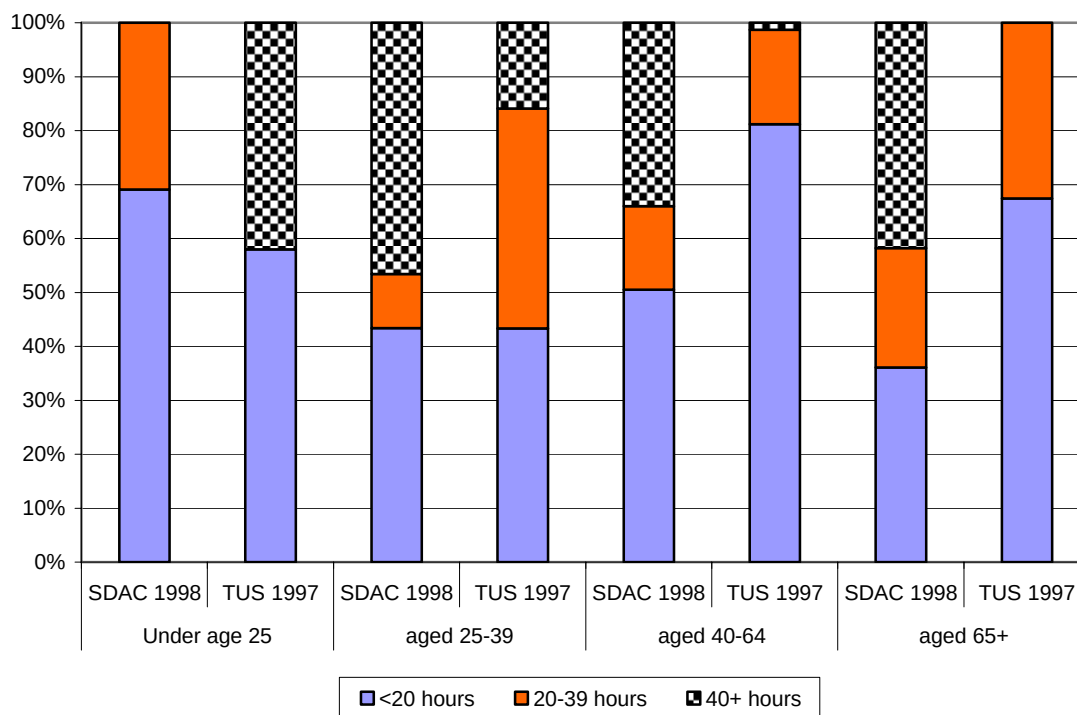
Figure 1
Time spent by women performing care from the 1998 SDAC and 1997 TUS,
primary carers (women) by grouped hours of care



Source: 1998 Survey of Disability, Ageing and Carers and 1997 Australian Bureau of Statistics Time Use Survey

The time use data may well miss out some supervisory time, and not always indicate the extent to which carers rearrange their schedules to be nearby to the care recipient in case they are needed. It is possible that the weekly estimates carers provide to the SDAC include such rearranged schedule time. It may also be that the carers in the SDAC survey look after people with more profound disabilities. Consequently, these respondents may have a higher average time commitment to care than the total primary carers population in the time use data. It may also be the case that primary carers are including some hours of care actually provided by other household members in their estimate of their personal hours spent in care. It may be that it is easier to calculate an estimate of care time without using a diary by summing the typical time the care recipient needs help with a given activity rather than to try to estimate both the recipient's care time need and the proportion of that need fulfilled by the person making the estimate. As we shall see in the next section, the people living in the over one-fifth of households where a person needs care collectively put in the equivalent of forty or more hours of care per week. Even if the SDAC data are reflecting over-estimates of the time individual carers spend in care, the average care median time of ten hours per week of care is a significant commitment of personal resources by a considerable number of Australian carers.

Figure 2
Time spent by men performing care from the 1998 SDAC and 1997 TUS,
primary carers (men) by grouped hours of care



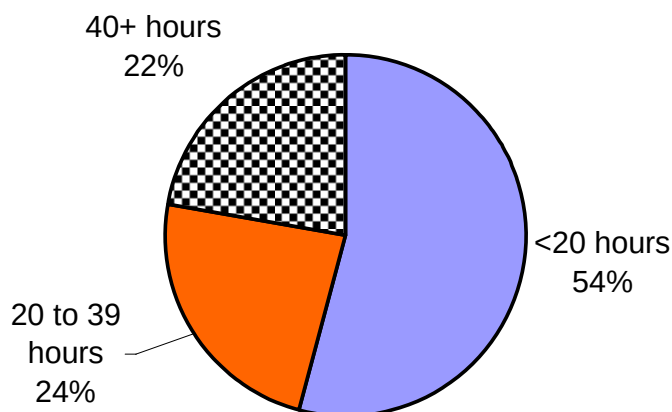
Source: 1998 Survey of Disability, Ageing and Carers and 1997 Australian Bureau of Statistics Time Use Survey

7 Hours of care provided at the household level

As the 1997 Time Use Survey collected diaries from all adult household members, we can consider the total weekly hours of care provided by all carers in households where at least one person provides care. The level of care provided at the household level does not differ greatly by the number of carers in the household. The 1053 households in the 1997 Time Use Survey where we identified one carer, the 520 households where we identified two carers, and the 74 households where we identified three carers each undertook a median weekly time of over 13 hours of care work. The 18 households with four carers performed a median of nine weekly hours of care, and the one household with five carers reported an estimated 2 hours and twenty minutes of care time, though the numbers of households in these latter groups is too small for more meaningful examination.

Figure 3 shows the breakdown of grouped weekly hours of care provided at the household level in Australia in 1997. Just under one quarter of carer households provide 40 or more hours of care per week, while another nearly quarter of carer households perform between 20 and 39 hours of care per week. This means that roughly half of all carer households in Australia perform the equivalent of at least a part-time job when they look after one or more people.

Figure 3
Percentage of carer households by grouped weekly hours of care provided by all carers living in the same household



Source: 1997 Australian Bureau of Statistics Time Use Survey

8 Conclusions

The estimates of the weekly hours devoted to care differ considerably between the two surveys. These differences may in part arise from the different sample populations and the different means of data collection, or they may reflect limitations in either or both of the data sets. In particular, the level of hours in the three categories offered to respondents in the SDAC may have skewed results. Carers who perform around 13 hours of care per week may recognise that their caring responsibilities make a considerable impact on their week, and feel reluctant to choose the smallest category of time on offer. Time diary researchers often argue that diary-based estimates of most activities are more reliable than direct questions asking people to estimate the time they spend performing activities (Gershuny 2000; Niemi 1993); however, time diary data has been shown to significantly underestimate time spent performing child care (Ironmonger 2002). It may well be that time diaries also under-report care – especially by not capturing supervisory time or time where carers rearrange their schedules to be nearby to their care recipient in case their services are needed.

These limitations aside, both quantitative data sets confirm qualitative research findings that the caring role makes a significant impact on the daily lives of carers. The time diary data also raise a curious issue of definition – as carers tended to report many of their care activities as unpaid domestic work rather than as care. By facilitating the estimation of the proportion of extra unpaid domestic work carers assume as a consequence of looking after another person, time diary data thus have the potential to significantly contribute to future research into policies affecting carers and people with impairments.

Carers commit a median time of over an hour of care each day, thus making a significant contribution to the informal economic activity of Australian society taking place on any given day. Nearly half of all carer households perform the equivalent of part-time or full-time working

hours to look after their friends and family members. Thus the costs to public service providers to replace such informal present care arrangements at the same standard of care would be considerable.

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Methodological issues in the estimation of parental time – Analysis of measures in a Canadian time-use survey

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Abstract

Accurately measuring parental time is a serious issue. This paper aims to estimate and better understand the quantity of time that parents devote to child care activities, the nature of these activities, and the variability of parental time survey instruments, by comparing and contrasting four estimates from the 1998 Canadian General Social Survey (GSS). In addition to reporting GSS estimates, our analysis sheds light on dimensions of parental time not yet explored in the literature including a detailed analysis of estimates based on time spent 'with children' and the special GSS child care module. Key findings include: child care activities reported as primary activities give the most conservative estimate of parental time; total time spent with children gives estimates 2.5-3.5 times higher than child care activities reported as primary activities; total time spent with children gives estimates on the same magnitude as estimates based on child care as secondary activities. The stylized estimate of parental time gives an estimate on a magnitude similar to those of total time spent with children and time spent on child care from the child care module. Our paper concludes by discussing potential implications surrounding the definition of parental time, particularly with respect to issues of reliability and validity.

JEL-Codes: D1, J29

Keywords: Parental time, measurement of parental time, child care, time-use, methodology of time-use

1 Introduction

The recent sociological and economic literature has seen a growing interest in parents' time investment in children both as a determinant of children's cognitive development (McCain, 2000) and as an indicator of the time pressure confronting today's parents (Presser, 1989). However, this interest in parental time has led to divergent discourses with reports of increasing family time famine, time poverty, and time stress on the one hand (Rocky Mountain Family Council, 2003), and evidence of an actual increase in the time devoted to children by parents since the 1960s on the other (Bianchi, 2000; Gauthier, Smeeding, & Furstenberg, 2004; Sayer, Bianchi, & Robinson, 2004). This contradiction in parental time investment in children is partly the result of methodological difficulties that are inherent to the measurement of parental time. While parents can accurately account for the time that they spend playing with their children or helping them with their homework, much of the time devoted to other child care tasks is carried out in parallel to other activities—cooking, driving, etc.—and is consequently less likely to be accurately estimated.

A general consensus in the literature is that parental time is difficult to measure and that different instruments for doing so give widely varying estimates. The literature suggests that estimates of parental time based on primary activities are smaller than those based on secondary activities (those reported simultaneously with another activity) or stylized data (typical frequency and duration of activities during a fixed recall period) (Kitterod, 2001; Paille, 1994). What remains unclear is the extent to which the different estimates of parental time are measuring different types of child care activities and the extent to which these estimates overlap temporally.

In this paper we aim to estimate and better understand the quantity of time that parents devote to child care activities, the nature of these activities, and the variability of parental time depending on the type of survey instrument used to measure it. In particular, we compare and contrast four estimates of parental time from the 1998 Canadian General Social Survey (GSS). This paper is divided into four main parts: first, a brief review of the existing literature on methodological issues surrounding the definition and measurement of parental time is provided; then, a discussion of the data used in our analyses and the procedures by which these analyses were carried out. The paper then moves to a presentation and discussion of our results and answers our research questions. A discussion of the implications of our results for time-use research concludes the paper.

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2 Theoretical background

2.1 Definition of parental time

Parental time varies both in terms of the kinds of activities involved, and the intensity of these activities. For instance, some studies make distinctions between the physical care of children (such as feeding and bathing) and the interactive care of children (such as talking and playing) (Nock & Kingston, 1988; Sanik & Mauldin, 1986). Taken together these are often referred to as “active” (Baydar, Greek, & Gritz, 1991), “focused” (Milkie et al., 2004), or “engaged” (Lamb, Pleck, Charnov, & Levine, 1985) child care. In addition, some researchers include time spent in passive supervision—time when a parent is directly responsible for children but not involved in either physical or interactive care—in the definition of parental time (Baydar et al., 1991; Lamb et al., 1985). The 2003 American National Time-use Survey measures both active and passive child care, child care being defined as any time that a respondent is aware of what a child in his or her care is doing and is near enough to provide immediate assistance (Budig & Folbre, 2004). Active and passive care measures tap into the amount of time that parents are responsible for children but unfortunately, time-use surveys generally focus on activities—such as sleep, personal care, leisure, and work—rather than responsibilities or constraints on time. This is because activities are simple to categorize and measure; however, child care is not simply a set of activities, it is also a responsibility that requires parents to be “on call” for a large majority of the time (Budig & Folbre, 2004). This “on call” component of child care is normally excluded from measures of primary and secondary time, and may explain why parents’ answers to stylized child care questions (see *Measurement of Parental Time* below) yield much larger estimates than time diaries (Budig & Folbre, 2004).

2.2 Measurement of parental time

Time diaries are widely recognized as the most valid, reliable, and cost-effective way of gathering time allocation data (Budig & Folbre, 2004; Juster & Stafford, 1991; Kitterod, 2001; Marini & Shelton, 1993; Mattingly & Bianchi, 2003; Robinson & Godbey, 1997; Zick, 2002). The diary method generally involves guiding respondents through a 24-hour period with open-ended probes about their activities (Mattingly & Bianchi, 2003). Time diary data can be collected via personal interviews, over the phone, and by mail. Robinson and Godbey (1997) found that time estimates obtained by all three of these methods were similar.

Another common method used to collect time-use data are stylized questions. This method involves defining a list of activities, then collecting information on their typical frequency and duration during a fixed recall period of one week, one month, or one year (Juster & Stafford, 1985). This method tends to produce higher estimates than time diaries, especially for activities that occur frequently (Marini & Shelton, 1993) or in conjunction with other activities, such as child care (Juster & Stafford, 1991; Juster & Stafford, 1985). For example, Paille (1994) found that respondents’ stylized estimates of child care time in Canada were almost four times that reported in time diaries.

Time-use research also reveals that measures of parental time based on primary activities (where the parent’s attention is fully occupied in the care of children) represent a very conservative estimate of time spent caring for children (Bittman, 2000; Ironmonger, 2004). The reported hours of time spent on child care greatly expand when secondary activities are reported, as respondents

often list child care as a secondary activity (Bittman, 2000). Zick and Bryant (1996) found that between 30 and 34 percent of all parental child care is done as a secondary activity, Robinson (2002) argues that child care as a secondary activity adds up to 50 percent more time, while Bianchi (2000) reports that secondary time amounts to about 65 percent of primary child care time. Using Australian survey data, Bittman (2000) found that for every hour recorded as a primary child care activity there are three more hours recorded of child care as a secondary activity; similarly, Ironmonger (2004) found that child care estimates are four times higher when secondary activities are included. The differences in primary/secondary time ratios likely reflect differences in definitions of care (Budig & Folbre, 2004). However, it is also possible that these differences are due to the ways that secondary activities are measured. While main activity 24-hour diaries capture a total of 24 hours of activities for each respondent, secondary activities do not necessarily sum to 24 hours. In addition, secondary activity results have two components; how much time is devoted to secondary activities and the distribution of this time on various activities. This presents some methodological challenges, including how time spent in multiple activities should be classified (for example, see Ironmonger (2004)) and the identification of what counts as a secondary activity. If secondary activities, such as having the television on while doing homework, are not counted as "watching television" then those activities that are often secondary may appear underestimated (Hofferth & Sandberg, 2001). Due to these factors, it is likely that secondary activity outcomes will have greater variability and be more easily affected by the way the question(s) are phrased, producing different results across studies. Although there is no clear consensus as to the ratio of primary and secondary activities, we do know that estimates based solely on primary activities are smaller than those that include primary and secondary activities.

A great deal of parental time research focuses on time spent in primary child care (Coverman & Sheley, 1986; Gershuny & Robinson, 1988; Hill & Stafford, 1985; Shelton, 1990; Zick & Bryant, 1996). This may be because national surveys that include information on both primary and secondary activities are relatively rare in North America (Zick & Bryant, 1996). However, a number of more recent surveys (e.g. the 1997 Panel Study of Income Dynamics-Child Development supplement (PSID-CD) and Bianchi and Robinson (1998-1999)), and many European and Australian time-use surveys, have collected data on secondary activities, allowing researchers to further evaluate the nature and magnitude of these activities. In contrast, secondary activities have not been the focal point of cross-national studies—a situation due in part to the fact that the current version of the Multinational Time Use Study² is restricted to primary activities.³ With the advent of the use of secondary activities in time-use surveys, some methodological challenges have been created that are not easily solved. For example, should one hour spent in housework (primary activity) and child care (secondary activity) be counted as one hour of cleaning plus one hour of child care, or should 30 minutes be attributed to housework, and 30 minutes to child care (Ironmonger, 2004)?

² This is a continually growing collection of national studies organized by the University of Essex and currently containing around 50 studies from 22 countries harmonized for the purposes of comparative research. See <http://iserwww.essex.ac.uk/mtus/> for details.

³ For example, the paper by Gauthier, Smeeding, and Furstenberg (2004) is therefore restricted to primary activities.

The literature has paid much attention to primary and, more recently, secondary activities, but far less is known about with whom these activities occur. Many time-use surveys collect information about with whom the activities occur (as part of the time diary)⁴ and this information is routinely reported in time-use reports produced by statistical agencies. However, this information has not been the topic of detailed investigation in journal articles on parental time (rare exceptions include Bryant and Zick (1996), Yeung, Sandberg, Davis-Kean and Hofferth (2001) and Milkie, Mattingly, Nomaguchi, Bianchi and Robinson (2004). The National Survey of Parents, designed and collected at the University of Maryland in 1999-2000 (Milkie et al., 2004), the survey administered by Bianchi and Robinson (1998-1999), and the PSID-CD all include questions about who was with the respondent when they were engaged in primary and secondary child care activities (Budig & Folbre, 2004). While this captures parent-child time in which parents are in contact with children but not necessarily directly interacting with them, the research to date has not shed much light on the nature of these activities, or how they differ from primary and secondary activities. It is plausible to expect that “with children” estimates of parental time will be higher than estimates based on primary activities only (Bianchi, 2000). However, it is not clear how much higher they would be (i.e. would they be similar in magnitude to secondary activities?). In addition, the nature of “with children” activities compared to primary activities is not clear. For example, when we use primary activities only are we capturing parent-child activities that are more engaged and involved? And, in contrast, are we getting less engaged activities including passive supervision when we use “with whom” data? Finally, are primary child care activities taking place at very different times of the day compared to activities “with children”? These questions are significant to an understanding of the methodological issues surrounding the measurement of parental time.

Statistics Canada introduced a series of questions into the GSS in what is often referred to as the ‘child care module’, partially to address the fact that secondary activities were not being collected. This set of questions was included in the Time Use section of the questionnaire and asked respondents to recall episodes of child care from the time the first child in the household awoke until the time that the last child in the household went to sleep on the designated diary day. As far as we know, this estimate of parental time is unique to Statistics Canada and was included for the first time in the 1992 survey when child care was identified as a secondary activity of interest and the burden on the respondent of reporting secondary activities was weighed against the utility of the information received. However, very little evaluation of the data collected from this child care module has been done (Frederick, 1993).

Currently, there is much debate and theorizing about the effects of time spent with children for future child outcomes (Bianchi, 2000; Bianchi & Robinson, 1997; Yeung, Duncan, & Hill, 2000; Zick, Bryant, & Osterbacka, 2001) as parental time investment in children is an indicator of time pressure confronting today’s parents (Bittman & Wajcman, 2000; Mattingly & Bianchi, 2003). With this in mind, our paper aims to add to the literature on the measurement of parental time in order to better understand the implications that different measures have for estimates of parental time investment.

⁴ The ‘with whom’ information is not included in the current version of the Multinational Time Use Study.

2.3 Research questions

Our study will contribute to the parental time literature in several ways. Using information collected in the 1998 GSS, this paper will provide estimates and illustrate the nature of parental time in a detailed analysis of the following available measures: 1) the total time spent on child care as a primary activity (from the diary), 2) the total time spent on activities done with children (also from the diary), 3) a measure of parental time from the special child care module, and 4) a stylized question about time spent on child care during the week prior to the survey. Specifically, we will not only uncover what the four measures of parental time in the GSS report and whether or not these measures agree with what the literature suggests, but we will also attempt to further understand child care measures as indicators of parental time by addressing the nature of, differences between, and biases inherent in these measures.

The research questions for this study are as follows:

- 1) What are the estimates of parental time reported by the four measures of child care in the 1998 GSS and do these estimates agree with the literature?
- 2) What is the nature of the ‘with children’ estimate? Does it produce estimates of parental time similar to those obtained by measures of child care as secondary activities? What does it tell us about the nature of the time parents are spending with children, namely, are activities reported ‘with children’ more/less engaged and involved or more/less supervisory? Do they take place at different times during the day than child care reported as primary activities?
- 3) What is the nature of the estimate given in the GSS child care module? Can we determine if it is presenting any additional information that cannot be gathered from the other three estimates? Consequently, is it an efficient way of capturing parental time?
- 4) Is the stylized estimate of parental time presenting any additional information that cannot be gathered from the other estimates? Or is it an inaccurate measure of parental time as suggested by the literature?
- 5) Are the GSS measures of parental time reliable and/or valid measures of parental time?

3 Data and methods

The data reported in this paper were taken from the twelfth cycle of Statistics Canada’s GSS, conducted from February 1998 through January 1999⁵. Although the GSS has been conducted every year since 1985 (with the exception of 1997), Cycle 12 is of particular interest because of its relatively recent survey date. The target population for Cycle 12 of the GSS (as in other cycles) was all persons fifteen years of age and over residing in Canada, excluding residents of the Yukon and Northwest Territories and full-time residents of institutions. Data were collected over a twelve-month period to capture seasonal variation in time-use patterns. The sample was selected using the Random Digit Dialing technique in which phone numbers were assigned a designated day and the number was called the following day. Of the phone numbers dialed, 46.8

⁵ The next cycle of the GSS that will collect time-use data will be conducted in 2006.

percent reached households and a GSS interview was attempted with one randomly selected person in each household. This resulted in a 77.6 percent response rate and yielded 10,749 respondents who provided usable data on their use of time during the day prior to the interview (the designated day).

The interview consisted of two parts: 1) a questionnaire which collected, among other things, basic demographic information, and 2) the time-use questionnaire which asked respondents to report their activities in a diary format. Both the demographic questionnaire and the time-use questionnaire were administered by an interviewer over the telephone and respondents' data was entered directly into a computer, using the Computer-Assisted Telephone Interviewing (CATI) technique and the Computer-Assisted Survey Execution software.

Since our focus in this paper is on describing estimates of parental time spent with children or on child care activities, we analyzed data only from respondents who indicated that they were married or cohabiting and who had at least one child under the age of five living with them⁶. Because of the possible impact of parents' employment status on their use of time, we further restricted our sub-sample to the following four demographic categories: 1) employed males (N=460), 2) non-employed males (N=118), 3) employed females (N=202), and 4) non-employed females (N=316). The respondent was designated as employed if he or she indicated that his or her main activity in the seven days prior to the date of interview was working at a paid job or business (including vacation from paid work). The resulting sub-sample consisted of a total of 1097 respondents, 578 males and 519 females.

Four estimates of parental time were computed from the 1998 GSS data: 1) time that child care activities were reported as the primary activity, 2) total time spent with children, 3) time spent on child care from the child care module, and 4) time spent on child care from the stylized question. Below, we provide further information on each of these estimates of parental time.

- 1) **Time that child care activities were reported as the primary activity** is based on a variable derived from the diary component of the survey and encompasses the number of hours spent on activities identified as child care during the designated diary day. Activities included general child care, putting children to bed, getting children ready for school, personal care for children of the household, helping/ teaching/ reprimanding, reading/ talking/ conversation with child, play with children, medical care – household child, unpaid babysitting, help and other care – household children and travel: household child. This estimate was based on the total amount of time that child care activities were reported in the time-use diary as the primary activity by the respondent. The time-use diary was completed by all respondents in the General Social Survey.
- 2) **Total time spent with children** is also based on a variable derived from the diary component of the survey. It corresponds to the number of hours spent in social contact with household children and respondents' non-household children less than 15 years of age. This estimate was based on the total time spent with the respondent's children (household and non-household) in the time-use diary by the respondent.

⁶ Although the time-use patterns of single parents would be an interesting topic to study, because of space constraints, it could not be addressed in this paper.

- 3) **Time spent on child care from the child care module** is a measure of parental time derived from the GSS special child care module. This estimate was based on questions about the times that the respondent's children woke up and went to sleep on the given day, and on the times that the respondent reported looking after those children. This question was asked only of respondents who reported having children under the age of 15 living in the household.
- 4) **Time spent on child care from the stylized question** is a stylized measure based on the subject's response to the question: "Last week, how many hours did you spend looking after one or more of your own children or the children of others, without pay?". The question was asked of all respondents, but a number of respondents were coded as "Don't know" or "Not stated", reducing the number of valid responses on which to compute the estimate.

The analysis was structured in order to address each of the research questions identified earlier. Data was utilized from both the 1998 GSS summary (for summary statistics) and episode (for detailed analysis of the diary component) data files, and weighted by a normalized version of the GSS population weight⁷. The results reported are essentially descriptive. Because of the nature of the questions asked in the paper, no statistical tests were carried out to establish the statistical significance of the differences between the various types of parental time estimates. The aim is instead here to illustrate the magnitude of the various parental time estimates and to shed further light on the nature of the activities captured by the different estimates, and their temporal nature.

4 Results

The mean values of each of the four estimates of parental time were computed for each of the four demographic categories and results are presented in Table 1.

Regardless of employment status or sex, the time that child care activities were reported as the primary activity clearly gives the lowest estimate of parental time in all four demographic categories. There is a gap of 2.2 to 5.7 hours between the time that child care activities were reported as the primary activity and the next lowest estimate, depending on the category, results that are in line with those reported by other authors (Bittman, 2000; Ironmonger, 2004). The estimate of time spent on child care from the stylized question gives the highest estimate of parental time in all demographic categories except for employed males, and the highest estimate in each category ranges from 0.5 to 2.9 hours higher than the next highest estimate. Overall, the lowest estimate of parental time seems to be for time that child care activities were reported as the primary activity for employed males (1.5 hours) and the highest estimate is for time spent on child care from the stylized question for non-employed females (12.5 hours).

To further understand the nature of the information captured in the estimate of total time spent with children, the episode data file of the GSS was analyzed and time spent on individual activities and the percentage of time that children were present or absent during these activities were computed. Table 2a presents the mean time in minutes spent on child care-related activities and the percentage of time children were absent during these activities, and shows that of the

⁷ The normalized weight was created by computing the mean weight of the 1097 cases in our sample, and then dividing each case's weight by this mean value. This resulted in a normalized weight which averages to 1 for the sample.

eleven child care activities coded for in the GSS, just over half (six) are always done in the presence of children across demographic categories. The remaining five activities, getting children ready for school, care of infants to 4 year-olds, medical care, travel for children and other child care, are being done to some extent, without the child being present. Table 2b presents the mean time spent on *non-child care activities* and the percentage of time that children were actually present when these activities were performed, and shows that up to 18.6 percent of time spent on work and educational activities, 32.2 to 88.0 percent of domestic work, meals, and shopping and errands, almost a quarter of personal services, the majority of religious, political and volunteer activities, and anywhere from 0.0 to 100.0 percent of time spent in social and leisure activities are done in the presence of children.

Table 1
Mean time (hours) spent on child care per day by married/cohabiting Canadians with at least one child under the age of five in the household.^{1,2,3}

Parental Time Estimate	Employed Males	Non-Employed Males	Employed Females	Non-Employed Females
Time that 'Child care' activities were reported as the primary activity	1.5 (1.7) n=460	1.6 (1.9) n=118	2.2 (1.9) n=202	3.6 (2.4) n=316
Total time spent with children	4.5 (3.9) n=460	5.7 (4.4) n=118	6.2 (4.2) n=202	9.4 (3.6) n=316
Time spent on child care (from the special child care module)	5.2 (4.3) n=251	4.0 (4.5) n=70	7.3 (4.3) n=122	9.6 (5.4) n=206
Time spent on child care (stylized question)	3.6 (2.4) n=452	6.4 (4.5) n=64	7.8 (4.8) n=196	12.6 (5.6) n=271

Notes:

¹ Results are based on weighted data.

² Standard deviations are in brackets.

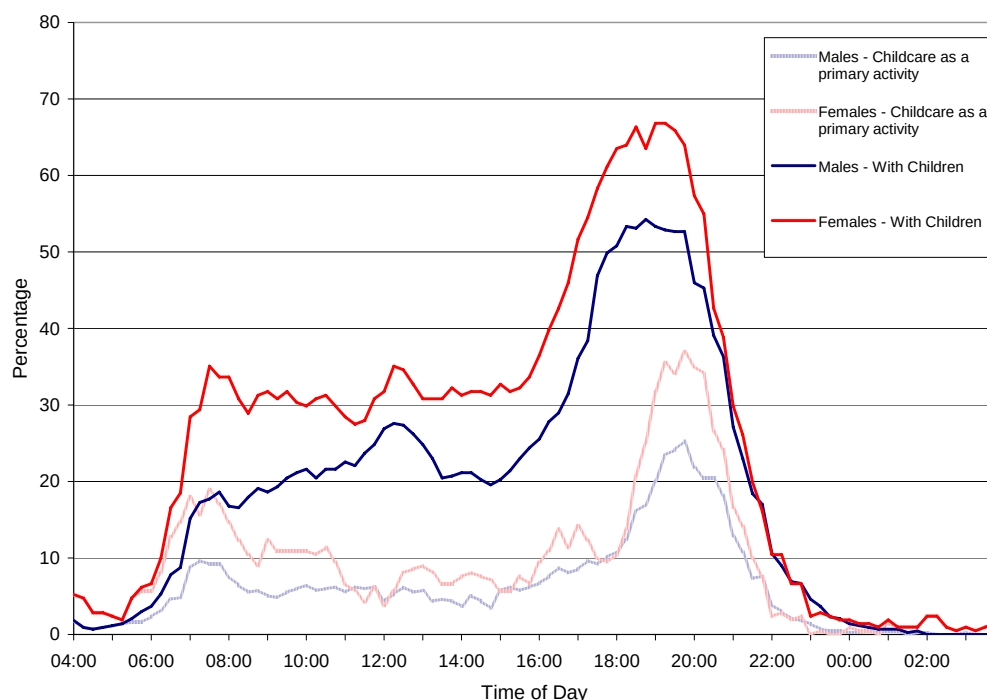
³ The number of cases (n) differ between estimates of child care since they are based on different sections of the survey. See Methods and Materials section for a detailed explanation of the sample group on which each estimate was based.

⁴ The authors acknowledge the possibility that the measures of Total time spent with children, Time spent on child care (from the special child care module) and Time spent on child care (stylized question) might not be statistically different; however, any statistical test to confirm this would have needed to be carried out on a reduced sample since sample size varied with each measure and not all respondents gave data on all measures.

Source: Authors' computation of data from Statistics Canada General Social Survey, 1998

To understand the extent to which activities reported ‘with children’ take place at different times during the day than child care reported as primary activities, Figure 1a plots the percentage of employed males and females reporting time spent on child care as a primary activity and time spent with children during 15-minute intervals across the designated diary day; Figure 1b plots the same information for non-employed males and females⁸.

Figure 1a
Percentage of employed males and females spending time on child care activities
and with children by married/cohabiting Canadians
with at least one child under the age of five



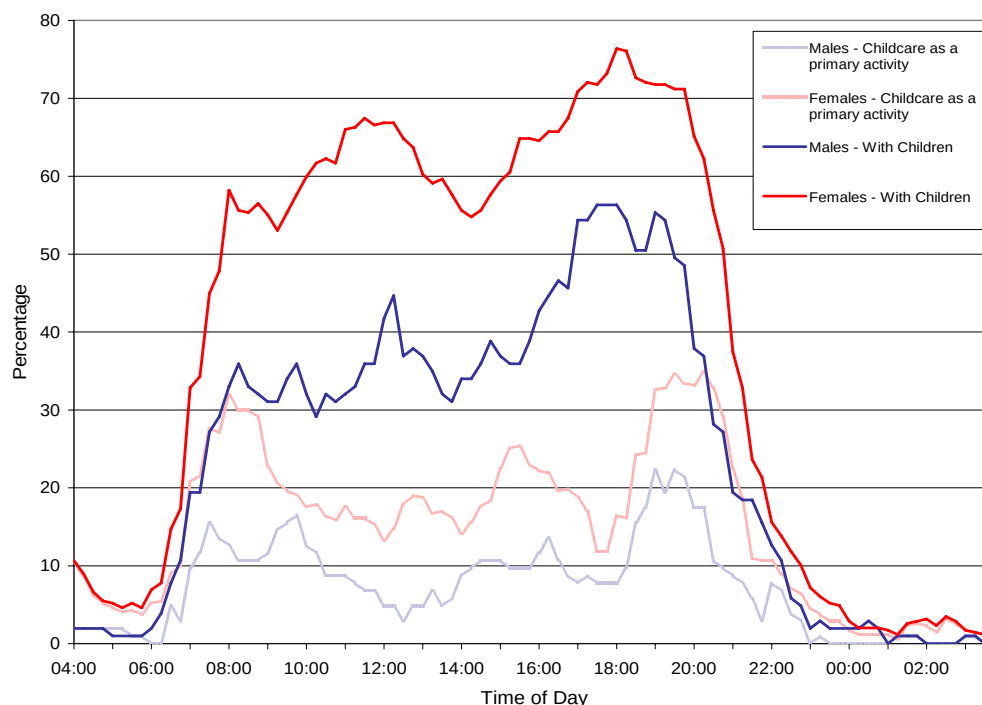
Source: Authors' computation of data from Statistics Canada General Social Survey, 1998

In both figures, a higher percentage of females report participation in both estimates of parental time than males, and although the percentage of respondents reporting time spent with children is substantially more than the percentage reporting time spent on child care as a primary activity, the two estimates appear to produce roughly the same-shaped plots for both males and females. Figure 1a shows the percentage of respondents reporting participation in both estimates of parental time climbing to the first peak of the day around 8:00, reaching a plateau until about 16:00 at which point the percentages climb again, reaching a second peak from about 18:30 to 20:30, then sharply decreasing to nearly 0 percent for both estimates by 23:30. Figure 1b depicts an initial climb in both estimates of parental time around 7:00, a rough plateau reached until about 18:00 when a second climb is observed that peaks around 19:00 for time spent with

⁸ The original data was not fixed into 15-minute intervals; this was done solely for our analyses.

children and around 20:30 for time spent on child care as a primary activity, and both estimates drop sharply to nearly 0 percent by 23:30.

Figure 1b
Percentage of non-employed males and females spending time on child care activities
and with children by married/cohabiting Canadians
with at least one child under the age of five



Source: Authors' computation of data from Statistics Canada General Social Survey, 1998

Although it is difficult to accurately assess the extent to which our four estimates of parental time are congruous, we attempt to do so and to better understand the nature of the estimate of time spent on child care from the child care module by analyzing a random selection of two of the 584 respondents in our sample with data on all four estimates of parental time, an analysis rarely done in the literature.

Table 2a
Mean time (minutes) and percentage of time in the absence of children on child care activities¹ per day by married/cohabiting Canadians with at least one child under the age of five in the household.²

Child care Activity	Employed Males (n=460)		Non-employed Males (n=118)		Employed Females (n=202)		Non-Employed Females (n=316)	
	Time (Minutes)	Children absent	Time (Minutes)	Children absent	Time (Minutes)	Children absent	Time (Minutes)	Children absent
Other child care	1	8.5%	0	100%	1	42.1%	4	27.8%
Travel - household child(ren)	5	23.9%	5	15.0%	10	27.9%	11	20.0%
Medical care - household child(ren)	0	0.0%	0	-	7	0.0%	2	8.8%
Child care – Infant to 4 years old	26	2.9%	22	7.8%	45	2.0%	94	3.6%
Getting children ready for school	1	2.2%	3	0.0%	5	3.2%	8	2.7%
Playing with child(ren)	33	0.0%	38	0.0%	33	0.0%	53	0.0%
Putting children to bed	16	0.0%	17	0.0%	21	0.0%	22	0.0%
Helping, teaching, reprimanding	3	0.0%	3	0.0%	4	0.0%	11	0.0%
Reading or conversation with child(ren)	3	0.0%	5	0.0%	4	0.0%	8	0.0%
Personal care for children of the household	2	0.0%	2	0.0%	3	0.0%	5	0.0%
Unpaid babysitting	1	0.0%	2	0.0%	0	-	0	0.0%
Total child care activities	90	2.9%	98	3.0%	133	3.4%	219	3.7%

¹ Child care activities were sorted by the percentage of children absent in the non-employed females category, which reports the highest overall number of minutes spent in child care activities.

² Results are based on weighted data.

Source: Authors' computation of data from Statistics Canada General Social Survey, 1998

Table 2b
Mean time (minutes) and percentage of time in the presence of children on non-child care activities¹ per day by married/cohabiting Canadians with at least one child under the age of five in the household.²

Non-Child care Activity	Employed Males		Non-Employed Males		Employed Females		Non-Employed Females	
	Time (Minutes)	Children present	Time (Minutes)	Children present	Time (Minutes)	Children present	Time (Minutes)	Children present
Paid work at home	1	0.0%	11	10.6%	0	0.0%	1	0.0%
Attending school and classes	2	0.0%	6	0.0%	5	9.2%	6	1.5%
At work	375	0.1%	146	0.0%	290	5.4%	47	9.1%
Studying researching on the computer	4	28.9%	14	2.0%	4	2.2%	7	12.4%
Other informal economic activities	8	18.7%	4	0.0%	0	100.0%	5	17.5%
Travelling to and from work or school	36	1.2%	18	0.0%	31	9.2%	5	18.6%
General housework activities	21	29.4%	41	24.0%	55	25.1%	92	32.3%
Odd jobs in and around the home	33	20.2%	35	8.4%	11	33.4%	21	33.6%
Preparing food and meals and associated clean-up	29	33.8%	31	48.4%	63	32.6%	95	47.0%
Outdoor gardening	10	13.9%	14	8.5%	4	47.8%	10	61.9%
Eating at restaurants, etc.	10	43.9%	11	47.8%	9	51.6%	8	63.7%
Travelling to and from shopping and errands	14	50.1%	22	47.3%	18	58.4%	18	67.3%
Shopping and running errands	18	55.9%	37	33.6%	33	52.5%	35	67.6%
Eating at home	54	77.3%	79	69.7%	47	85.6%	66	88.0%
Personal hygiene and self-care	32	0.0%	30	0.0%	45	0.0%	32	0.0%
Sleeping, napping and being sick in bed	458	0.0%	501	0.0%	481	0.0%	497	0.0%
Personal services, incl. visits to medical profs.	0	71.6%	4	83.8%	2	37.1%	4	24.5%
Performing civic duties, volunteer work, etc.	5	5.5%	4	0.0%	6	68.9%	7	69.2%
At church and other religious activities	3	52.7%	8	60.6%	3	90.8%	5	98.6%

Table 2b
(cont'd)

Non-Child care Activity	Employed Males		Non-Employed Males		Employed Females		Non-Employed Females	
	Time (Minutes)	Children present	Time (Minutes)	Children present	Time (Minutes)	Children present	Time (Minutes)	Children present
Social clubs or night clubs	6	0.0%	1	0.0%	5	0.0%	0	0.0%
Reading books	4	0.0%	5	0.0%	6	0.2%	9	12.3%
Reading newspapers, magazines, letters, etc.	8	11.9%	13	23.2%	4	11.1%	6	28.6%
Pastimes, hobbies, games, cards, computer	10	20.6%	16	1.6%	5	22.2%	13	36.5%
Watching television, videos, DVDs, etc.	91	25.8%	144	31.1%	66	33.7%	89	37.6%
On the telephone/discussions and conversations	12	37.6%	19	34.0%	12	34.8%	18	38.3%
Relaxing or doing nothing	7	23.6%	17	20.5%	6	30.7%	8	39.6%
Participating in sports and athletic activities	25	22.7%	5	50.7%	11	43.6%	9	49.7%
Movies, cinema, theatre, etc.	4	73.9%	1	25.1%	1	29.7%	1	52.9%
Parties, dances, gatherings outside homes, etc.	17	56.5%	25	32.3%	26	69.7%	36	75.2%
Visiting friends or relatives at their homes	18	73.8%	16	60.7%	31	88.2%	35	81.1%
Walking outside, hiking, etc.	8	84.1%	16	79.1%	7	78.9%	14	83.2%
Leisure travel, incl. travel to/from leisure activities	25	54.0%	34	63.9%	20	67.2%	21	86.8%
Watching sports and athletic activities	2	84.0%	2	0.0%	4	84.5%	2	87.7%
Listening to the radio	0	75.4%	1	100.0%	0	100.0%	1	89.8%
Listening to music, CDs, etc.	1	16.5%	0	-	1	18.9%	0	100.0%
Excursions to museums, libraries, etc	2	95.6%	12	100.0%	0	92.9%	2	100.0%

¹ The 36 non-child care activities were grouped into five main activity categories (indicated by thick, black lines) and then sorted within these categories by the percentage of children present during activities in the non-employed females column, which reports both the lowest overall number of minutes spent in non-child care activities (and, consequently, the highest overall number of minutes spent in child care activities) and the highest overall percentage of children present during those non-child care activities.

² Results are based on weighted data

Source: Authors' computation of data from Statistics Canada General Social Survey, 1998

The results of this analysis are presented in Tables 3a and 3b. Table 3a shows the time-use details of the first selected respondent, an employed female, and the three estimates of parental time.

Table 3a
Detailed analysis of activity patterns of respondent 1, employed female.

Episode Start Time	Episode Finish Time	Activity Label ¹	Activity Done With Child? ²	Child care Episode Start and Finish ³
400	600	Night sleep	No	
600	610	Meal preparation	No	
610	620	Meal preparation	No	
620	630	Washing, dressing	No	
630	640	Personal care for children	Yes	630
640	655	Child care (infant to 4 yrs. old)	Yes	
655	710	Child care (infant to 4 yrs. old)	Yes	
710	715	Getting children ready for school	Yes	
715	730	Food/meal cleanup	Yes	
730	800	Washing, dressing	No	800
800	845	Travel: To/from work	No	
845	850	Travel: To/from work	No	
850	930	Work for pay at main job	No	
930	1000	Work for pay at main job	No	
1000	1030	Work for pay at main job	No	
1030	1230	Work for pay at main job	No	
1230	1300	Travel during work	No	
1300	1430	Work for pay at main job	No	
1430	1500	Travel during work	No	
1500	1730	Work for pay at main job	No	1630
1730	1830	Travel: To/from work	No	
1830	1930	Helping/teaching/reprimanding	Yes	
1930	2000	Child care (infant to 4 yrs. old)	Yes	
2000	2030	Reading/talking/conversation with child	Yes	2030
2030	2045	Putting children to bed	Yes	
2045	2130	Meals/snacks/coffee at home	No	
2130	2330	Work for pay at main job	No	
2330	000	Washing, dressing	No	
000	400	Night sleep	No	

Time that child care activities were reported as the primary activity: 3.00 hours

Total time spent with children: 3.25 hours

Total time on child care – child care module: 5.50 hours

Total time on child care – stylized question: 5.00 hours

¹ Shaded areas indicate parental time recorded as Time that child care activities were reported as the primary activity.

² Shaded areas indicate parental time recorded as Total time spent with children.

³ Shaded areas indicate parental time recorded as Time spent on child care – child care module.

Source: Authors' computation of data from Statistics Canada General Social Survey, 1998

Time that child care activities were reported as the primary activity, total time spent with children, and time spent on child care from the child care module all appear to be reporting

similar estimates of parental time as indicated by the congruous shaded areas and the relatively close total parental time estimates: 3.00, 3.25, 5.50 hours respectively for the three mentioned estimates, and 5.00 hours for the estimate of time spent on child care from stylized question. Table 3b reports the time-use of a non-employed female, and displays a case where the estimates of total time spent with children and time spent on child care from the stylized question report similar estimates of parental time, both considerably more than time that child care activities were reported as the primary activity. This conclusion is supported by the total parental time estimates of 1.83, 15.25, 15.50 and 15.00 hours, respectively.

Table 3b
Detailed analysis of activity patterns of respondent 3, non-employed female.

Episode Start Time	Episode Finish Time	Activity Code ¹	Activity Done With Child? ²	Child care Episode Start and Finish ³
400	700	Night sleep	No	
700	710	Washing, dressing	No	700
710	830	Helping, teaching, reprimanding	Yes	
830	835	Meal preparation	No	
835	905	Meals, snacks, coffee at home	Yes	
905	910	Travel: Religious services	Yes	
910	1230	Religious services	Yes	
1230	1240	Travel: Religious services	Yes	
1240	1310	Meal preparation	Yes	
1310	1340	Meals, snacks, coffee at home	Yes	
1340	1440	Food (or meal) cleanup	Yes	
1440	1730	Home crafts mainly done for pleasure	Yes	
1730	1740	Travel: Religious services	Yes	
1740	1930	Religious services	Yes	
1930	1940	Travel: Religious services	Yes	
1940	2200	Other social gatherings (weddings, wakes)	Yes	
2200	2230	Indoor cleaning	No	
2230	2300	Putting children to bed	Yes	2230
2300	400	Night sleep	No	

Time that child care activities were reported as the primary activity: 1.83 hours

Total time spent with children: 15.25 hours

Total time on child care – child care module: 15.50 hours

Total time on child care – stylized question: 15.00 hours

¹ Shaded areas indicate parental time recorded as Time that child care activities were reported as the primary activity.

² Shaded areas indicate parental time recorded as Total time spent with children.

³ Shaded areas indicate parental time recorded as Time spent on child care – child care module.

Source: Authors' computation of data from Statistics Canada General Social Survey, 1998

5 Discussion

To answer our first research question what are the estimates of parental time reported by the four measures of child care in the 1998 GSS and do these estimates agree with the literature we find that the estimate of time that child care activities were reported as the primary activity clearly

gives the most conservative estimate of parental time in all four demographic categories; this is in agreement with conclusions reached by Bittman (2000) and Ironmonger (2004). Bianchi (2000) suggested it was plausible to expect that “with children” estimates of parental time would be higher than estimates based on primary activities only and this was indeed true with our results as the estimate of total time spent with children produced estimates about three times higher than time that child care activities were reported as the primary activity. Although we could find no literature specific to the estimate of time spent on child care from the child care module, it too produced estimates three to four times higher than the total time that child care activities were reported as the primary activity.

Our second research question was a series of inquiries about the estimate of the total time spent with children. We found that total time spent with children gives estimates of parental time 2.5 to 3.5 times higher than time that child care activities were reported as the primary activity, depending on the demographic category. Since both Bittman (2000) and Ironmonger (2004) report estimates of parental time that include secondary child care to be about three times higher than those reporting only primary child care, we might conclude that the estimate of time spent with children is reporting parental time similar to that reported in child care as secondary activities. Taking this further and attempting to understand the nature of the time parents are spending with children, we found that there are child care activities being reported as the primary activity even though children are not present at the time. Since one can understand that children need not be present all the time when parents are performing activities on their behalf, these results are more or less expected. However, it is worth noting that this point has not been mentioned in previous studies. Time spent on childcare as primary activities is usually taken as indicator of time spent being actively involved with children. Clearly, this is not always the case.

Also of interest is the fact that, when looking at the non-employed females category⁹, we find that a substantial percentage of time spent on work and educational activities, domestic work, meals, shopping and errands, personal services, religious, political and volunteer activities, and social and leisure activities are done with children *yet these activities are not being reported or recorded as child care activities and this time is not being factored into estimates of parental time based on primary activities*. The implications of this are two-fold: first, that the parental time estimated by time spent with children may have a larger component of less-engaged, supervisory, or “on call” time than the total time that child care activities are reported as the primary activity, since respondents have presumably made an active decision to categorize activities as child care or non child care on the basis of some sort of involvement or engagement and not merely the presence or absence of children. Secondly, one can see the potential utility of the opportunity to report secondary activities in diaries; many of the activities classified as non child care could conceivably contain some substantial element of child care and parental time.

With respect to our second research question then, the total time spent with children gives estimates of parental time on the same magnitude as estimates based on child care as secondary activities, but this alone does not provide enough information to conclude that the two estimates

⁹ Non-employed females report both the lowest overall number of minutes spent in non-child care activities (and, consequently, the highest overall number of minutes spent in child care activities) and the highest overall percentage of children present during those non-child care activities.

are reporting the same types of child care or parental time. Unfortunately, the Canadian survey does not allow us to examine this further as it did not collect data on secondary activities.

As to our third question, on the childcare module, although a random sample of two cases cannot be said to accurately represent our sample, let alone the population, our case-study analysis provides a window into the nature of the different estimates of parental time and illustrates the possible congruency (or lack thereof) that different estimates can have. It is clear that the estimate of time spent on child care from the child care module produces estimates of parental time that are similar to the other measures (except for the total time spent on child care as a primary activity); however, from the case-study analysis, at least at the case level, parents can report episodes of child care at times that correspond with both child care that they report as a primary activity and time spent with children (Respondent 1, 6:30 to 7:15 and 18:30 to 20:30), at times when they are with children but do not consider their primary activities as child care (Respondent 2, 8:35 to 22:00), and at seemingly odd times when neither their primary activities nor who they are with (Respondent 1, 16:30 to 18:30). We also see evidence of times where both the primary activity is reported as child care and parents report being in the presence of children, but do not report the time as a child care episode (Respondent 1, 20:30 to 20:45). In sum, it appears that the estimate of time spent on child care from the child care module, while providing an interesting look at what parents retrospectively consider as child care episode, does not really provide any additional information above and beyond the other estimates of parental time.

Our fourth question refers to the stylized estimate of parental time. Although there were no detailed analyses that could be done to further investigate the nature of the estimate of time spent on child care from the stylized estimate, results clearly revealed that it gives an estimate of parental time on a magnitude similar to the estimates of total time spent with children and time spent on child care from the child care module. Robinson and Godbey (1997) claim that stylized estimates are not useful; we conclude that although such an estimate opens the possibility for an analysis of why items of recall tend to produce higher estimates of time-use than measures from time-use diaries, it does not appear to be presenting any additional information that cannot be gathered from the other estimates.

Finally, our fifth and last question referred to the reliability and validity of various measures of parental time, which themselves depend largely on how parental time is defined. For example, if parental time is defined to include only activities that include direct interaction with children (such as feeding, bathing, or reading a story) then the GSS estimate based on time spent on child care as a primary activity would be both the most valid and reliable measure of parental time. On the other hand, if parental time also includes responsibility for children (as Budig and Folbre (2004) recommend), then the GSS estimate of total time spent with children may be more accurate. How researchers decide to operationalize parental time will depend upon their research objectives and the data available. Therefore, the reliability and validity of specific measures of parental time will necessarily vary across studies.

6 Conclusion

Parental time is a major form of investment into children and yet it is very difficult to measure. Our analysis nonetheless sheds some light on various dimensions of parental time that have not been explored previously in the literature. Our results indicate that the four available estimates of parental time in the 1998 GSS produce results similar to those cited in the available literature,

and that the total time spent with children gives estimates of parental time on the same magnitude as estimates based on child care as secondary activities—higher than estimates based on child care as primary activities alone—and measures parental time on a similar time frame as diary measures. The estimates from the child care module and the stylized question do not appear to provide any new information above and beyond the ‘standard’ estimates from time-use diaries, but can still be useful as a basis for comparison. However, more research is needed to determine whether this is also the case in other large surveys. In addition, our findings point to the need to consider the definition of parental time in research, as this has implications for reliability and validity issues. More theoretical debate is required to determine exactly what the construct of parental time encompasses so that standardized measures can be agreed upon. This will allow future researchers to compare results across studies.

Although the Canadian data is quite rich and detailed, the results presented in this paper were limited in at least three ways. First, because the Canadian survey does not include data on secondary activities, we were unable to use secondary activities as a basis for comparison with our estimates. The contrast between the ‘with children’ estimates and the estimates based on primary and secondary activities would have been very interesting and should be done in the future using a different survey. Second, a noted limitation of our study concerns the possible asymmetry between time that parents spend with their children and the time that children spend with their parents; two estimates of time that may not necessarily be congruent especially if some of the activities are done in the absence of children, and if there is more than one child in the family. Finally, although the literature points to the positive influence of parental time on child development, the absence of children’s outcome indicators in time-use surveys does not allow us to measure the impact of parental time, and of specific activities, on children. As argued by Ben-Arieh and Ofir (2002), positive children’s outcomes might have more to do with the time children spend with their parents than the time parents report spending with their child(ren).

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time-pieces

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AMERICAN TIME USE SURVEY (ATUS)

U.S. Bureau of Labor Statistics

In September 2005, the American Time Use Survey (ATUS) released its second annual set of time-use data. ATUS is the first federally administered, continuous survey on time use in the United States. The sample is drawn monthly and interviews are conducted nearly every day of the year. The goal of the survey is to measure how people divide their time among life's activities.

In ATUS, individuals are randomly selected from a subset of households that have completed their eighth and final month of interviews for the Current Population Survey, the monthly labor force survey in the United States. ATUS respondents are interviewed only one time about how they spent their time on the previous day, where they were, and whom they were with. The survey is sponsored by the Bureau of Labor Statistics and is conducted by the U.S. Census Bureau.

ATUS data represent the U.S. civilian non-institutionalized population ages 15 and over. The survey includes estimates of the amount of time Americans spend doing a range of activities commonly referred to as “unpaid work,” such as childcare and adult care, housework, and volunteering. It also provides information on the amount of time people spend in many other activities, such as religious activities, socializing, exercising, and relaxing. Respondents who report doing more than one activity at a time are asked to identify which activity was primary. Except for secondary childcare, activities done simultaneously with primary activities are not collected. Demographic information – including sex, race, age, educational attainment,

occupation, income, marital status, and the presence of children in the household—also is available for each respondent.

ATUS findings include these highlights from 2004:

- Employed persons worked 7.6 hours on average on the days that they worked. They also worked longer hours on weekdays than on weekend days—7.9 versus 5.8 hours.
- Married persons spent more time doing household activities than unmarried persons—2.1 versus 1.4 hours per day—and women, regardless of marital status, spent more time doing these activities than men.
- On an average day, persons age 65 and over spent the most time—7.3 hours—participating in leisure and sports activities of any age group; 35- to 44-year-olds spent the least time—4.2 hours.

See the September 20, 2005, ATUS news release for additional highlights of Americans' time use in 2004 (<http://www.bls.gov/news.release/pdf/atus.pdf>).

ATUS data collection began in January 2003 and is scheduled to continue indefinitely. Currently, microdata files are available for 2003 and 2004. In total, these files contain information provided from over 34,000 ATUS interviews.

The ATUS website is a resource for up-to-date information about the American Time Use Survey. It includes background information about the survey, as well as links to time-use news releases, publications, and the microdata files. The ATUS homepage is available at <http://www.bls.gov/tus/home.htm>. Information about ATUS also is available by e-mail (ATUSinfo@bls.gov) or by telephone (202-691-6339).

AMERICAN TIME USE SURVEY 1965 – 2003: THE CONSTRUCTION OF A HISTORICAL COMPARATIVE FILE

This project was one of the two funded by the Glaser Progress Foundation, as part of a wider programme based at Yale University and directed by William Nordhaus. The project (costing just under £150,000) has produced and tested a harmonised cross-time comparative micro-level file of diary-derived US time-use data spanning the period 1965-2003, suitable *inter alia* for the production of extensions to the national accounts to cover household and other unpaid production of goods and services. It was carried out by Muriel Egerton, Kimberly Fisher and Jonathan Gershuny (Institute for Social and Economic Research, University of Essex, UK) with contributions from John Robinson (University of Maryland), Anne Gauthier (University of Calgary), Nuno Torres and Andreas Pollmann (University of Essex)

Its main output is a new American Historical Time Use Study (AHTUS) which brings together major US national samples of time diary based studies from each decade since the 1960s. It

derives from a sequence of carefully controlled and fully documented data production activities; a complete collection of syntax files, providing a trail of transformations from the original data, will soon be made accessible over the web. The AHTUS is currently a 36000 case micro-data file covering drawn from surveys in 1965, 1975, 1985, 1992-4 and 2003, with 45 classificatory variables and a 90-category classification of time use. The AHTUS time use data is presented both in its original sequential format, and with totals of daily time in each of the 90 categories, and also estimates of “secondary” childcare.

A full report on this work (downloadable from www.iser.essex.ac.uk, following the [time use programme] and then [time use research] buttons) is devoted to testing of the usefulness of subsets of the time use data for estimating the National Accounts extensions. Section 2 of the report provides a brief overview of the theoretical considerations that lie behind the use of time-diary data in the calculation of extended National Accounts, identifying six distinct spheres of unpaid product. Section 3 deals with the major context variables in the study, concluding that the demographic characteristics of the weighted samples of days for each decade are close to Current Population Survey estimates. Section 4 works systematically through time use evidence on each of the six spheres of unpaid economic activity, considering in particular the plausibility of the historical trends of change, for people in various age, gender, employment and family categories.

Amongst the findings in the concluding section are:

- Limitations in the sample coverage and differences in instrument design mean that the most detailed comparisons of non-money national product from household and similar production will be possible only for 1975 and 2003, but some useful results will be derived from each of the survey periods.
- We strongly recommend a split-sample experiment to evaluate the effects of the different instruments used in the heritage and the Bureau of Labor Statistics (BLS) 2003 sample; we are particularly concerned to understand the very high levels of childcare found in the latter.
- It will be desirable to make arrangements for continued maintenance and improvement of the AHTUS, and in particular, for adding other heritage datasets as well as subsequent BLS materials to the study.

ASSESSING TIME USE DATASETS: IDENTIFYING AND VALIDATING AMERICAN TIME USE DATASETS TO SUPPORT HISTORICAL ESTIMATES

In January 2003 the United States Bureau of Labour Statistics commenced an ongoing time-use data collection regimen. The existence of the time-use data will facilitate the development of measures of non-market production and the establishment of a non-market production series. This fact has been recognized by a program *Designing Nonmarket Accounts for the United States*

established by the Committee on National Statistics (CNSTAT) with support from Yale University and The Glaser Progress Foundation. In their interim report the availability of the time-use data was seen as a huge step toward understanding the households use of time and valuing household production.

One of the most significant issues, noted over a quarter century ago, is the value of non-market production (Nordhaus and Tobin, 1972). Knowledge of such production has greater meaning if placed in historical context. As a new series is developed based on new and forthcoming American time-use data there is also interest in developing time series of estimates of non-market production. To do so requires the existence of historical datasets with which to construct historical estimates. Hence, historical datasets had to be identified and evaluated to determine the extent of their usefulness for constructing time series. The availability of several earlier university based American time-use studies, if compatible with the new ongoing government funded American time-use study (ATUS) promises to make possible the development of an historical series to provide the necessary context.

The purpose of the *Assessing Time-use Datasets Project*, has been the task of identifying and validating datasets ranging from 1965 to 1998 to support historical estimates. More specifically it reports a structured evaluation of the representativeness and usability of the existing time allocation data in providing the base for a historical time-use data series as an input to valuing non-market production.

Findings are presented with tests undertaken to measure quality, investigating and re-calibrating with regard to the demographic and diary date representativeness of each survey, and finally the context, duration and participation rates for activities. Further reports from this project will address in greater detail other aspects of time-use data related measuring non-market production.

The *Assessing Time-use Datasets* project, commissioned by Dr. William Nordhaus, is supported by The Glaser Progress Foundation and Yale University and is carried out by Andrew S. Harvey (project head), Time Use Research Program (TURP), at St. Mary's University, Halifax, NS, Canada; Ignace Glorieux, Tempus Omnia Revelat (TOR), Faculty of Economic, Social and Political Sciences, Vrije Universiteit Brussel, Belgium; Joachim Merz, Research Network on Time Use (RNTU), Research Institute on Professions (FFB), Department of Economics and Social Sciences, University of Lüneburg, Germany; and Klas Rydenstam, Statistics Sweden.

Book reviews

by Kimberly Fisher

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Publisher: Torino, Italy: Ed. Archivio Storico della Città di Torino

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This book considers a range of methodologies for collecting time use information from children, and places this discussion in the context of sociological studies of children. The book also makes a cross-time analysis of changes in the use of time by children aged 5 to 13 in the Italian city of Turin, giving particular emphasis to children's time with parents and children's leisure activities. The book draws on data from a time use study in Turin in 1979 and from time use studies collected in the present decade, including special surveys of children.

Eurostat

Comparable Time Use Statistics (2005)

Publisher: Luxembourg: Eurostat

Website: http://epp.eurostat.cec.eu.int/portal/page?_pageid=1073,1135281,1073_1135295&_dad=portal&_schema=PORTAL&p_product_code=KS-CC-05-001

Languages Available: English, French, German

The working paper presents comparable time use statistics for 10 European countries

(Belgium, Germany, Estonia, France, Hungary, Slovenia, Finland, Sweden, the United Kingdom and Norway). The main results were published in Pocketbook on How Europeans spend their time in 2004. The working paper includes for further analysis the working tables originally produced by each of the 10 participating countries. Information on how to prepare comparable tables in compliance with Harmonised European Time Use Surveys (HETUS) guidelines is also included.

Fuchs Epstein, C. and Kalleberg, A.L. (Eds.)

Fighting for Time: Shifting Boundaries of Work and Social Life (2004)

Contributing Authors: Blair-Loy, M., Bluedorn, A.C., Collinson, D.L., Collinson, M., Fenwick, R., Ferris, S.P., Fuchs Epstein, C., Gerson, K., Jacobs, J.A., Kalleberg, A.L., Levin, P., Presser, H.B., Sharone, O., Stewart, B., Tausig, M.

Publisher: New York: Russell Sage Foundation

Languages available: English

This book examines the changing patterns of working time in the United States, and how these patterns have influenced relations between co-workers and between working people and their families. The book also examines changing cultural expectations for the use of time by various social groups, and examines the social and health consequences for those who attempt to conform to or defy these expectations.

**Hamermesh, D.S. and Pfann, G.A. (Eds.)
The Economics of Time Use: Contributions to Economic Analysis (CEA) (2004)**

Contributing Authors: Ahn, N., Apps P., Bonke, J., de Galdeano, A.S., Fahr, R., Gupta, N.D., Hamermesh, D.S., Herz, D., Horrigan, M., Ichino, A.; Jacobsen, J.P., Jenkins, J.F., Jimeno, S.P., Klevmarken, N.A., Kooreman, P., Osberg, L., Pfann, G.A., Rees, R., Smith, N., Stafford, F.P., Ugidos, A., Yeung, W.J.

Publisher: New York: Elsevier Science
Languages Available: English

This book includes a selection of revised conference papers and is part of the Contributions to Economic Analysis series. The chapters consider how economic research benefits from understanding what people do during the day, when they undertake activities, and with whom they perform various tasks. The book includes a special section on childcare, and a chapter on the development of the American Time Use Survey.

**Michaelson, W.
Time Use: Expanding Explanation in the Social Sciences (2005)**

Publisher: Boulder, Colorado: Paradigm Publishers
Languages Available: English

This book reviews recent international time use research, but has a particular focus on time use studies from North America. The author considers how analysis of time use data might test and challenge assumptions in social science disciplines. The book also covers means by which time use data may reveal information about less visible social groups, multi-tasking, social interactions, risk behaviour.

**Pronovost, G.
Temps Sociaux et Pratiques Culturelles (2005)**

Publisher: Québec: Presses de l'Université du Québec
Languages Available: French

The book considers the changing patterns of daily activities, with particular consideration for time with children and the use of time within families. The book includes a focus on Canada.

**Ruuskanen, O.P.
An Economic Analysis of Time Use in Finnish Households (2004)**

Publisher: Kansantaloustiede, Helsinki School of Economics, Finland, Series A-246 (2004)
Website: <http://helecon3.hkkk.fi/diss/?cmd=list&electronic=yes>
Languages Available: Finnish, English

This published PhD thesis critically examines the applications of economic modelling to time use data, then covers four essays on the economic analysis of time use data from Finland. The first essay explores the sharing of household activities between couples and the time that people spend together in households. The second essay examines the daily variations in activity patterns. The third considers leisure time, and the fourth examines the simultaneous performance of multiple activities (or multi-tasking).

**van den Broek, A. and Breedveld, K.
(Eds.)**

Trends in Time: The Use and Organization of Time in the Netherlands, 1975-2000 (2004)

Contributing Authors: Breedveld, K., de Haan, J., de Hart, J., Huysmans, F., van den Broek, A.

Publisher: The Hague: Social and Cultural Planning Office of the Netherlands; USA/Canada distributor New Brunswick: Transaction Publishers

Languages Available: Dutch, English

This book tracks changes in daily activities in the Netherlands over 25 years, charting the impact of greater labour market participation and the increasing tendency of the Dutch to combine paid work and caring roles. The authors use the time use studies collected every 5 years in October in the Netherlands from 1975 to 2000. The authors also examine the use of ICTs, the structuring of time in Dutch society, and the extent to which Sundays remain special days.

time-pieces