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**Working Paper**

## Parental child care in single parent, cohabiting, and married couple families: time diary evidence from the United States and the United Kingdom

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## Working Paper No. 440

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### **Parental Child Care in Single Parent, Cohabiting, and Married Couple Families: Time Diary Evidence from the United States and the United Kingdom**

by  
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## I. INTRODUCTION

The time that parents devote to caring for, educating, and raising their children represents an enormous, yet sometimes under-appreciated, component of a society's investment in human capital. These investments in time are tremendously worthwhile in terms of keeping children safe and healthy and in furthering their physical, emotional, and intellectual development. However, the value and extent of these contributions have been hard to measure because of a lack of regular time-use data.

A better understanding of the determinants of parental time investments in child care is important in light of recent trends, including increased market work by women and a growing proportion of single-parent families, that may put these investments at risk. To the extent that women substitute market time for child care time, the supply of unpaid care providers—both inside and outside the home—will decrease. At the same time, the ongoing rise in single-parent households means that fewer families can rely on the services of two adults to care for children or specialize in caregiving. While we would expect that the total amount of parental child care has decreased over time given these trends, Bianchi (2000) has reported that the time that mothers devote to caregiving activities has actually increased slightly, with the mix of specific care activities changing to emphasize primary, and presumably higher-quality, activities.

In this study, we investigate the determinants of mothers' and fathers' investments in primary child care activities, passive child care activities, and market work using newly-available time-diary data from the 2003 American Time Use Survey (ATUS) and data from the 2000 United Kingdom Time Use Study (UKTUS). Besides providing up-to-date information on patterns of time use, the American and British surveys have several useful features that help us to investigate some new questions. First, both surveys collect information through time diaries rather than through narrowly-structured activity recall questions. The diaries not only record the activities in which people are engaged but also who is present during these activities. The structure of the diaries allows us to distinguish between primary care activities—activities such as playing with a child or changing a diaper which are done for the direct benefit of a child—and passive activities—activities which are done with a child present in the household but which do not directly involve the child.

Second, both of the surveys are relatively large. Each has over 20,000 daily diaries. The size of the surveys allows us to look at how parents' time spent in child care differs with the parents' living arrangements. Thus, unlike previous economic studies, such as Kooreman and Kapteyn (1987) and Hallberg and Klevmarken (2003), which have analyzed alternative child care activities but only among two-parent families, we examine differences among married, cohabiting, and single-parent families. The large sample sizes also allow us to investigate patterns separately for men and women.

Third, the surveys balance reports between weekdays and weekends—the ATUS does this by oversampling weekend days, while the BTUS does this by asking for two reports from each survey subject. These design features coupled with the large sample sizes allow us to analyze time use for weekdays and weekends separately. Fourth, the surveys include numerous other measures in addition to the time diary information. Because of this, we can estimate multivariate models that include rich sets of controls.

We estimate correlated tobit models of the time parents spend in primary child care, passive child care, and market work. The tobit framework accounts for the modest proportions of people who report spending no time in each given activity on a particular day. We estimate correlated specifications because multiple uses of time are reported by every respondent and because each respondent's total daily time allotment is constrained to 24 hours. For the UKTUS, which records two diaries for each person and provides information for both parents in two-parent households, we modify our estimation procedure to account for additional clustering in the data.

The rest of this paper is organized as follows. We discuss conceptual models of time use, most notably the economic household production model, in the next section and briefly review previous studies on time allocation. We describe the ATUS and UKTUS data sets in Section III and discuss how we construct our measures and select our observations for the empirical analysis. In Section IV we present our correlated tobit model. Estimation results from this model are reported and analyzed in Section V. Concluding remarks appear in Section VI.

## II. LITERATURE REVIEW

The primary conceptual framework that economists use to analyze people's use of market and non-market time is Becker's (1965) time allocation, or household production, model. In this model, people derive utility or satisfaction from household-produced goods such as their children's health, development, and well-being. A fundamental insight provided by this model is that the production and enjoyment of these outcomes require purchases of goods and services and contributions of time. In effect, people face a technological constraint, similar to the constraint faced by firms, regarding how inputs of goods and time can be combined to generate the desired outcomes. Alternative "production" techniques for these outcomes are feasible. For instance, to foster their children's intellectual and emotional development, parents' possible strategies range from spending a great deal of their own time teaching and caring for their children to engaging the services of a day-care provider. As in other consumer and labor models, people also have constraints on their financial resources and time. The model assumes that people rationally choose the amounts of time that they spend in different activities, including child care and market labor, and the amounts of goods that they purchase to maximize their utility subject to the technological, financial, and time constraints they face.

Family structure is presumed to affect caregiving through a number of mechanisms in the household production model. First, changes in family structure affect resources and needs. Adding an able-bodied adult through marriage or cohabitation increases the household's available time and money resources, which could increase the amount of caregiving, the purchase of care services, or both. An added child increases the household's need for care. Second, family structure affects the opportunities for specialization. With multiple household members, one person can focus on market work while another focuses on caregiving (Becker 1985). Marriages, by virtue of being longer lasting and more stable, are likely to promote higher levels of specialization than other relationships (Willis and Michael 1994). Third, family structure might directly influence the production of well-being outcomes by affecting the levels of stability and stress in the household (see, e.g., Wu and Martinson 1993) or by providing role models for children (see the discussion in Haveman and Wolfe 1995). Fourth, family structure could affect the amount of conflict in the household. On the one hand, co-residence helps to reduce the coordination problems in caregiving (Weiss and Willis 1985). On the other hand,

adding a decisionmaker to the household increases the opportunities for conflict. When we consider these mechanisms together, the net impact of family structure is ambiguous.

Gender may also affect caregiving in the household production model. The model implies that specialization is likely to occur in households with two adults if there are increasing returns to time spent in household and market activities and the adults can share or transfer their resources and output (Becker 1985). Specialization could also be a reasonable strategy if there are fixed costs (Cogan 1980) or quasi-fixed costs (Oi 1962) of labor. The economic model, by itself, does not explain the sex-typing of tasks. However, the model does suggest that small, initial differences in relative abilities or circumstances can lead to specialization. Thus, if women are brought up to have a slight advantage in caregiving or housework or, alternatively, if childbearing places them at a temporary disadvantage in the labor market, there could be profound gender differences in specialized activities. Discrimination in the labor market could also contribute to specialization.

An analysis of the time devoted to the market and to caregiving requires that such time be measured. A number of studies have relied on responses to survey questions intended to collect information on the “typical” frequency and duration of particular activities (e.g., Aldous et al. 1998 and Muller 1995). Yet, there may be problems with these measures because people tend to over-report time when answering questions about time use in surveys (Robinson 1985). Overreporting is especially severe for tasks like child care that are performed as secondary activities (Robinson 1985, Fedick et al. 2003). Time-diary data suffer less from this recall bias than questionnaire data (Robinson 2002; Juster and Stafford 1985, 1991; Robinson and Bostrom 1994; and Marini and Shelton 1993). This is because the recall period is usually short and the diary measures actual rather than typical time spent on particular activities on a specified day or days.

Even with time diary data, however, there exists some debate regarding the measurement of time. Many time diaries collect information on both primary and secondary activities. Some even collect information on a third simultaneous activity. All typically also collect information on the other persons present. While these are usually not viewed as important issues for measuring the amount of market work, they are acutely relevant for measuring child care activities, which can range from physically caring for or interacting with a child to loose monitoring or simply providing custodial care. Empirical research has tended to distinguish

between two types of child care activities: primary child care, which involves direct interactions with or activities on behalf of a child, and passive child care, which encompasses all other activities performed in the presence of a child.<sup>1</sup> Each is important in its own right. Bianchi (2000) has argued that primary child care time is an important measure of quality time spent with children and that by this measure, there has been little change in child care time over time or between two-career and one-career couples. At the same time, she reports that time spent in the presence of children does differ with the employment status of the mother. Mothers who work outside the home spend substantially less time in the presence of their children than do other mothers.

The limited availability of time-diary data means that only a few multivariate studies of child care have employed such data. Kooreman and Kapteyn (1987) used U.S. time-diary data from the 1975-1981 Time Use Longitudinal Panel on married couples to estimate models of time spent in child care and other activities. They found that higher wages for fathers increased care provided by mothers, that mothers' provision of care did not respond to changes in their own wages, and that fathers' provision of care did not respond to changes in either's wages. Examining married parents from the same survey, Nock and Kingston (1988) regressed aggregate time with children and time spent in particular care activities against measures of mothers' and fathers' work schedules, reporting that mothers' employment, especially employment during after-school hours, decreased their time spent with children. However, the effects on children were partially mitigated because the reductions were concentrated in secondary activities with children and not in child and baby care *per se*. There was little evidence that fathers compensated by increasing their direct care activities or substituting among activities.

Bryant and Zick (1996) used a larger U.S. sample of two-parent, two-child families and estimated instrumental variable models that attempted to account for the endogeneity of mothers' employment. They also found that the hours that mothers spent in market labor reduced the time that they devoted to child care; however, this effect appeared mainly for older children. Like Nock and Kingston, they found little evidence that fathers compensated with more child care time of their own. Finally, Hallberg and Klevmarken (2003) used Swedish data

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<sup>1</sup> Folbre, Yoon, Finnoff, and Fuligni (2005) argue for an even more inclusive measure that includes time spent while the child is sleeping. Bianchi (2000) and Kalenkoski, Ribar, and Stratton (2005) look at time spent on secondary child care.

on dual-earner, married and cohabiting couples to investigate the determinants of child care, instrumenting for the parents' wages, the parents' market time, and the children's time spent in external care. They found that the time a spouse spends in child care has a positive impact on own time spent in child care, that neither own nor spousal wages affect child care time, that own hours worked have a negative effect on own time spent in child care, and that spousal hours worked have a positive effect.

These studies all focus on couple households. Few investigate the effects of family structure. One exception is Sandberg and Hofferth (2001) who examine time spent in the presence of children and find single parent households spend substantially less time with children. Another is Kalenkoski, Ribar, and Stratton (2005) who use British data to jointly examine primary and secondary child care time as well as time in the market. They find that married and cohabiting parents allocate their time similarly while single parents spend more time on child care and less time on the job. This paper is an extension of the latter work to include U.S. as well as British data and to distinguish further between weekday and weekend days.

### **III. DATA**

#### **American Time Use Survey**

The ATUS is one of two key sources of data for the empirical analysis. It is an ongoing national survey that has been conducted monthly by the U.S. Bureau of the Census for the U.S. Bureau of Labor Statistics since January 2003. For this study, we use data from all of 2003. Subjects for the ATUS are drawn from households in their last month of participation in the Current Population Survey (CPS). One person aged 15 or over within each outgoing CPS household is randomly-selected to participate in the ATUS.

The most distinctive feature of this survey is its time-use component which consists of a short (24-hour), retrospective time diary describing how an individual spends his or her time, including time spent working in the labor market and caring for children. Respondents describe what they were doing at different times during the day, and the descriptions are later coded into standardized activities with three levels of detail. The information for each primary activity includes a descriptive code for the activity, the duration and location of the activity, and who else was present during the activity. The interviews are conducted every month of the year and



every day of the week, with a higher proportion of interviews occurring on weekends to achieve an approximate balance between weekday and weekend reports.

The survey also collects household roster and demographic information. The survey subjects are asked to identify who else lives in the household and to list the members' genders, ages, and relationships to the subject. They are also asked whether or not they have any children of their own living outside the household and if so, their genders and ages as well. The respondent is also asked questions regarding his/her individual characteristics such as employment, earnings, and demographic information to update some of the information from the CPS survey.

In 2003, there were a total of 20,720 respondents to the ATUS. However, we do not use all of these observations. Instead we focus on time use reported by parents of co-resident children under the age of 18 or the spouses and unmarried partners of parents. This is a necessary restriction to exclude those not in the risk set for caregiving and accounts for the majority of our sample exclusions. Because of the difficulty in identifying parent-child relationships in complex households, we exclude observations from households with multiple families, households with same-sex couples, and households where a child's caregiver is unable to be determined due to the presence of other related or non-related individuals in the household. Because we are keenly interested in work issues, we also exclude respondents who were enrolled in school full time and those who were themselves or whose partners were at retirement age (age 62 or above). We also delete observations with allocated data or with inconsistent demographic information between the CPS and ATUS surveys. These exclusions reduce our analysis sample to 6,864 caregivers, each living in a separate household.

For our empirical analyses, we focus on three uses of time: primary child care, passive child care, and market work. Primary child care activities are defined with respect to household children and include physical care, reading, playing (including sports), arts and crafts, talking/listening, helping/teaching, organizing and planning, supervising, attending events, waiting, picking up or dropping off, and travel related to caring for or helping children. We construct the corresponding time-use measure by summing up all minutes spent on child care as a primary activity. Our measure of passive care is constructed by summing up all time spent with children aged 14 and under (to be comparable to the UK measure to be discussed) that is not spent in child care as a primary activity, excluding time spent sleeping, working in the

market, or in personal care activities. Our market work measure includes time spent at a main job or other jobs, time spent in security procedures related to work, time spent in work-related activities such as socializing that is part of a job, and time spent in other income generating activities. Time spent searching or interviewing for jobs is not included in the market work measure.

Along with gender, key conditioning variables are the respondent's living arrangement (married, cohabiting, or single), the number of other adults in the household, the number of children in different age ranges in the household, and whether the diary is for a weekday or a weekend day. Controls for the season of the year and holidays are also included as they likely affect children's need for care. In addition to these measures, the empirical analysis utilizes other standard demographic variables, including race/ethnicity, age, and educational attainment of the potential caregiver, and geographic information, including the region of residence, non-metro status, and the state unemployment rate as controls.

### **United Kingdom Time Use Survey**

The UKTUS is a national household-based study that has multiple questionnaire and time diary components. The questionnaires ask about household characteristics including income and family composition and individual characteristics of the household members, including their educations, employment status, earnings and other demographic information. Time diary data were also collected for each household member age 8 and older. These diaries identify primary and secondary time activities, the location of the activity, and who else was present during the activity for every 10-minute interval during two 24 hour periods: one weekday and one weekend day. In sum, the UKTUS obtained 20,981 time diaries from 11,664 people living in 6,414 households.

We employ sample selection criteria as similar as possible to that used for the ATUS, focusing on the time use reported by parents of children under the age of 18 and the parents' spouses or unmarried partners of these parents, excluding those who live in complex households, who were enrolled in school, who were at or above the retirement age (60 for women and 65 for men), or who provided incomplete questionnaire information. Furthermore, we exclude diaries containing fewer than five different activity codes and those missing more than one hour of information. These various exclusions reduce the final sample to 5,134 diaries for 2,715 adults living in 1,639 households. In contrast to the U.S. data, the UK data are

designed to include multiple diaries per respondent and diaries for both partners in the household. These richer data allow us to control for more intrahousehold factors in our analysis of the UK data as compared to the U.S. data.

As with the analysis of the ATUS data, we focus on three uses of time: primary child care, passive child care, and market work. Primary child care activities are defined here to include physical care, teaching, playing, talking, escorting, and transporting children living in one's own household (child care for others is excluded) as well as transportation to and from educational activities. Our measure of passive child care time includes all time spent with household children age 14 or younger that is not reported as time spent primarily engaged in child care or time spent in sleep, market work, or personal care activities. Note that the age restriction on children for this variable differs from our general definition. While we generally define a household with children as one having children below the age of 18, the UKTUS only codes information on who else is present during an activity by general category and there is no category for household children age 15-17. That passive time is not extended to include time spent sleeping or working or in personal care activities is driven by restrictions in the ATUS data for which the presence of others is not reported for most such activities. In addition, one should note that although a measure of "active" secondary time spent on child care is available within the UKTUS, it is clear that this measure captures something far different from passive child care. The sample mean for this variable indicates that on average 47 minutes are spent on this activity. By comparison, the U.S. measure of passive child care indicates that on average 283 minutes are spent on this activity. Market work activities are always coded as a primary activity and are specified to include first and second jobs, travel related to work (not commuting time), and lunch/coffee breaks.

As with the ATUS, our analysis will focus on caregiving as a function of living arrangements, the number of children in different age ranges in the household, and the weekday/weekend status of the diary. Other covariates common to the ATUS include the number of other adults present, seasonal dummies, own age and education, region of residence, urbanicity, and the local unemployment rate. Information on race/ethnicity is not employed, but dummy variables identifying whether or not the respondent suffers from a health limitation affecting work and whether or not there are any disabled children in the household as well as the availability of household non-labor income are employed.

## Descriptive Statistics

Table 1 reports the average daily minutes spent on primary child care, passive child care and market work by gender (female/male), living arrangement (single, cohabiting, married), and day of the week (weekday/weekend). Panel A reports these statistics for the U.S. sample, while Panel B reports these statistics for the UK sample.

The number of diaries for each gender-day combination is substantial for both samples: exceeding 1,000 for each combination. The distribution by living arrangement is, however, quite different by country. Within our U.S. sample, about 71% of the women were married, 3% were cohabiting, and 26% were single. The corresponding numbers for men were 91%, 2% and 8%. By contrast, in the UK sample, over three times as many parents were cohabiting (10% of the women and 12% of the men) and about five percent fewer parents were single (21% of the women and 3% of the men). A comparison of the UK sample distribution with statistics for the UK population at large indicates that this sample distribution is a close match for the population.<sup>2</sup> A substantial fraction of the cross-country differences are driven by cross-country differences in cohabitation rates. National figures indicate that only 5.7% of all American children less than age 18 lived in households with unmarried partners in 2000 and this overstates the fraction living with cohabiting parents.

A comparison of the time-use measures across countries indicates some interesting similarities and differences. Gender differences are similar and substantial in both countries. Women report spending over twice as much time on primary child care as men on weekdays and about 50% more on weekends in both the United States and the United Kingdom. Passive child care time is more evenly distributed except in the United States on weekdays, when women report about 50% more. In both countries, women devote on average only half as much time to market work as men. On average, on both weekends and weekdays parents in the United States spend more time on primary child care than parents in the United Kingdom. This differential is primarily driven by married women, and single and married men. Perhaps in compensation for this, British parents (except cohabiting men) report spending much more time in passive child care on weekdays. Weekend differences in passive child care time are substantially more modest except in so far as cohabiting and married men in the United States report more such time. Finally, reports of market work are on average higher in the United

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<sup>2</sup> According to comparable statistics for dependent children published by the Office of National Statistics in the UK (<http://www.statistics.gov.uk/cci/nugget.asp?id=1163>), in 2004, 67% of the women (men) were married, 11% were cohabiting, and 22% were single. The corresponding figures for men were 84%, 14%, and 2.5% respectively.

States on weekdays, but similar on weekends.

Descriptive statistics for the other variables used in the analysis are reported in Table 2. These statistics indicate that the number of children between the ages of two and six is greater in the United States than in the United Kingdom, while about 2% more households in the United Kingdom have other adults in residence. Many other variables are difficult to compare cross-country.

#### IV. ECONOMETRIC SPECIFICATION

We estimate multivariate models of the determinants of the time that parents devote during a day to primary child care, passive child care, and market work using the analysis samples from the ATUS and UKTUS. Market time as well as child care time is modeled in recognition of the importance and the endogeneity of labor supply decisions in all time allocation decisions. A reduced form specification is employed throughout and our results should be interpreted with this in mind. For both samples, the multivariate models account for the fact that each respondent reports on several uses of time, which may be related. For the UKTUS sample, the models also account for the survey's sampling design, which collects multiple reports for each person and collects information for multiple people in each couple household. Separate specifications are also estimated for weekend and weekday days, in recognition of the different demands upon time on these different days of the week.

Nonnegative time constraints are imposed by modeling each activity using gender- and day-specific Tobit specifications. The Tobit specification is advantageous because significant fractions of the samples report spending no time on an activity. For example, in the ATUS sample, 10% report spending no time on passive child care, 33% report spending no time on primary child care, and 54% report spending no time in employment. The figures for the UKTUS are slightly higher in each category.

Let  $g$  ( $= f, m$ ) denote the gender of the parent and  $d$  ( $= 1, 2$ ) denote the type of day, weekday or weekend. To simplify notation, we omit subscripts that would otherwise identify the household. The parent's latent, or desired, total time spent in primary child care activities,  $PrimCC_{g,d}^*$ , is specified as a linear function of the parent's living arrangements,  $L$ ; other observed characteristics of the household, person and day,  $X_{g,d}$ ; and a person- and day-specific unobserved component,  $\varepsilon_{P,g,d}$ , such that

$$PrimCC_{g,d}^* = \gamma'_{P,g,d}L + \beta'_{P,g,d}X_{g,d} + \varepsilon_{P,g,d} \quad (1)$$

Note that the specification includes separate coefficients for each gender and type of day.

We do not observe the parent's latent time in primary child care activities in all circumstances. We only observe  $PrimCC_{g,d}^*$  if it is positive; otherwise, reported primary child care time is censored at zero.

The parent's latent minutes spent in passive child care activities and work activities during a day are similarly specified as

$$SecCC_{g,d}^* = \gamma'_{S,g,d}L + \beta'_{S,g,d}X_{g,d} + \varepsilon_{S,g,d} \quad (2)$$

$$MktWork_{g,d}^* = \gamma'_{M,g,d}L + \beta'_{M,g,d}X_{g,d} + \varepsilon_{M,g,d} \quad (3)$$

As with the primary care specification, the coefficients in the passive care and market work specifications vary depending on the parent's gender and by whether the report refers to a weekday or weekend day. Also as with the primary care specification, latent minutes devoted to passive child care activities and market work are each observed only if they are positive and censored at zero, otherwise.

For each parent on each day, the unobserved components (errors) are distributed

$$\begin{bmatrix} \varepsilon_{P,g,d} \\ \varepsilon_{S,g,d} \\ \varepsilon_{M,g,d} \end{bmatrix} \sim N \left( \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \sigma_{P,g,d}^2 & \rho_{PS,g,d}\sigma_{P,g,d}\sigma_{S,g,d} & \rho_{PM,g,d}\sigma_{P,g,d}\sigma_{M,g,d} \\ \rho_{PS,g,d}\sigma_{P,g,d}\sigma_{S,g,d} & \sigma_{S,g,d}^2 & \rho_{SM,g,d}\sigma_{S,g,d}\sigma_{M,g,d} \\ \rho_{PM,g,d}\sigma_{P,g,d}\sigma_{M,g,d} & \rho_{SM,g,d}\sigma_{S,g,d}\sigma_{M,g,d} & \sigma_{M,g,d}^2 \end{bmatrix} \right) \quad (4)$$

This specification, which is akin to a Seemingly Unrelated Regressions framework, accounts for the overarching time constraint that may require individuals spending more time on one activity to spend less time on another. For the models estimated with the ATUS sample, the errors are assumed to be uncorrelated across households. Because there is only one report per person per household, this means that the errors are uncorrelated across individuals in the ATUS sample.

The models that are estimated with the UKTUS sample use a similar framework. However, to account for possible correlations in the repeated reports of time use for people and for possible correlations in reports from the same household, we add a pair of factor-analytic, unobserved controls to our models. In particular, we respecify the latent time-use models (1), (2) and (3) to include a person-specific unobserved variable,  $\mu_g$ , such that

$$PrimCC_{g,d}^* = \gamma'_{P,g,d}L + \beta'_{P,g,d}X_{g,d} + \mu_g + \varepsilon_{P,g,d} \quad (1')$$

$$SecCC_{g,d}^* = \gamma'_{S,g,d}L + \beta'_{S,g,d}X_{g,d} + \lambda_{S,g,d}\mu_g + \varepsilon_{S,g,d} \quad (2')$$

$$MktWork_{g,d}^* = \gamma'_{M,g,d}L + \beta'_{M,g,d}X_{g,d} + \lambda_{M,g,d}\mu_g + \varepsilon_{M,g,d} \cdot \quad (3')$$

Within a household, the person-specific random effects are assumed to be distributed

$$\begin{bmatrix} \mu_f \\ \mu_m \end{bmatrix} \sim N \left( \begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \sigma_{\mu,f}^2 & \rho_\mu \sigma_{\mu,f} \sigma_{\mu,m} \\ \rho_\mu \sigma_{\mu,f} \sigma_{\mu,m} & \sigma_{\mu,m}^2 \end{bmatrix} \right). \quad (5)$$

The presence of the person-specific random effect in equations (1'), (2') and (3') leads to correlations across days for the same person. The correlation coefficient,  $\rho_\mu$ , in specification (5) leads to correlations across parents in the same household, and the coefficients  $\lambda_{S,g,d}$  and  $\lambda_{M,g,d}$  in equations (2') and (3') represent factor loadings on the random effects that moderate the correlations for different types of time use. The random effects are assumed to be distributed independently of the other errors in the time use models. With these assumptions, the model is a system of correlated Tobit models with a moderately complicated, yet estimable covariance structure. We obtain estimates of the parameters of the models that do and do not include factor-analytic controls using a maximum likelihood procedure in the aML software package.

## V. RESULTS

Results from the correlated tobit models of time use for the ATUS sample are reported in Table 3. The parameter estimates are classified first by activity type, then by gender, then by day type. The dependent variable for the first four columns is daily minutes spent in child care as a primary activity. The first two of these columns contain the estimates for men, on weekday and weekend days respectively, while the second two columns contain the corresponding estimates for women. The next four columns are similarly arranged but the dependent variable is daily minutes spent in passive child care. The final four columns refer to daily minutes spent in market work for these same combinations. Each model includes observed controls for the parents' living arrangements; the number of children in different age ranges; the number of other adults; the parents' age, age squared, race, ethnicity, and education; region of residence; whether the residence is located in a non-metro area; the statewide unemployment rate for the interview month; and dummy variables to identify whether the diary day was a holiday and in what season of the year the diary was completed. The table also includes estimates of the

standard errors and correlation coefficients for the unobserved terms from specification (4) of the previous section.

Estimation reveals that single fathers spend significantly more time in primary child care on weekdays and substantially less time in passive child care on weekends than their married or cohabiting counterparts. Primary and passive child care among single mothers, however, does not appear to differ greatly from that among married or cohabiting mothers. Single fathers also spend less time in market work on weekdays than married or cohabiting fathers, while single mothers spend more time in market work than married or cohabiting mothers. The differences here between men and women could reflect differences in other resources.

None of the coefficients on cohabiting is statistically significant, either for men or women. In many cases, the lack of significance is a result of coefficients that are approximately zero, indicating little or no effect. However, in several other cases, the lack of significance reflects a lack of precision, probably due to the small proportion of cohabiters. For instance, the coefficients on cohabiting for weekend passive care for men and women, weekend market work for men and weekday market work for women are all relatively large but with very large standard errors.

The number of children aged 11 and younger is a statistically and substantively important determinant of time use for men and women. For both men and women, minutes spent in both primary and passive child care increase with the number of young children and the effect is larger for younger children. This effect is found on both weekdays and weekends, and is expected as increasing the number of children increases the need for child care. An additional child aged 12-17 also increases a mother's primary and passive child care time on weekdays but not on weekends. Perhaps this time is related to transporting children to and from school and other schooling-related activities. An additional child in this age range also reduces primary child care time for both mothers and fathers on weekends, perhaps because such children act as substitute caregivers for the parents when they are not in school.

With the exception of a marginally significant negative effect of having an additional child aged 7-11 on fathers' weekday market work, additional children do not appear to affect the time fathers spend in market work. For mothers, however, an additional child of any age reduces the time women spend in market work on weekdays, with larger effects for younger children. An additional child aged 0-1 reduces market work time for mothers on weekends as



well. An additional child aged 12-17, however, actually increases mothers' weekend work time, again, perhaps because such children are substituting for mothers' in providing child care.

Having additional adults in the household reduces the amount of time fathers spend in both primary and passive child care on the weekends, the amount of time mothers spend in primary care on weekdays, and the amount of time mothers spend in passive care on the weekends. Hence, it appears that other adults in the household do act as substitute caregivers. An additional adult does not affect either mothers' or fathers' market work time.

Education is also an important determinant of time use. More education results in both mothers and fathers spending more time in primary child care and market work than those with the least amount of education and the effects are larger for greater levels of education. These results are especially interesting because, as with Bianchi's (2000) findings, they indicate that better job opportunities do not necessarily come at the expense of child care time. More educated parents appear to find a way to work more yet also provide more child care time.

Older parents devote more weekend time to primary and passive child care, though at a decreasing rate—with 40 year olds spending the most primary time and 30 year olds the most passive child care time. While Asians and Hispanics appear to allocate their time similarly to Whites, African Americans appear to allocate less time to primary child care on weekends. In the case of African American women, this may be attributable to their greater market commitment on weekends, but such is not the case for African American men who spend substantially less time on market work during the weekend than their white counterparts. African American women also appear to spend less time on primary child care on weekdays.

It is of some interest to note the effect of holidays and seasons on the allocation of time. As expected, holidays falling on a weekday result in a substantial reduction in market time and a substantial increase in passive child care time. However, women considerably reduce their primary child care time on holiday weekdays, perhaps with men taking up the slack in passive supervision. Ex ante, we expected summer to increase time spent on child care on weekdays but not weekend days as school age children are typically home all week during the summer. While summer has no impact on weekend child care time, it has a negative rather than a positive effect on primary child care time on weekdays. We plan to interact the summer dummy with child age to see if the impact is age specific. For pre-schoolers, summer may not matter. For older children, long days at camp or at work may be more than adequate substitutes for school time.

The correlation coefficients on the unobserved terms indicate that fathers who spend more time in primary care on weekdays also spend more time in secondary care on weekdays. Perhaps the unobserved component is an inclination toward caregiving, but it could also reflect greater unmeasured needs for caregiving in these households. However, it appears that mothers trade off primary and secondary time on the weekend. In addition, the unobserved determinants of market work are strongly, negatively correlated with the unobserved determinants of primary and passive care for both fathers and mothers. These results are likely driven by time constraint considerations.

Results from the correlated models of time use for the UKTUS sample are reported in Table 4. The format of this table is similar to that found in Table 3 for the ATUS sample. The set of explanatory variables included in these models is also largely similar to the ATUS models. While we are unable to control for racial or ethnic differences or holiday diaries, we are able to identify whether any children or the respondent has a disability and whether the household has any non-labor income.

The first controls in the table are for living arrangement. Like the results for the United States, single fathers in the United Kingdom are estimated to spend more time in primary child care and less time in market work than married fathers, though the coefficient on primary care falls short of being statistically significant ( $p$ -value = .15). Also like the U.S., there are no statistically significant differences in either primary or passive child care time between single and married women in the UK. There are also no statistically significant differences between cohabiters and married parents of either gender in the UK. Other results, however, do differ between the two countries. While single fathers in the United States spend less time in passive care on the weekend than married fathers, single fathers in the United Kingdom spend more time on passive child care on weekdays. Also single mothers in the U.S. perform more market work than married mothers, while the opposite appears to be the case in the UK.

As in the United States, additional children aged 11 and under increase time spent by both mothers and fathers in primary and passive child care, with larger effects for younger children. Similarly, an additional child aged 12-17 reduces fathers' and mothers' weekend primary child care time, perhaps because such children serve as substitute caregivers. Unlike in the United States, however, mothers' weekday passive child care time is not significantly influenced by the presence of older children.

As in the United States, women's time in market work is reduced by each additional child and the effects are larger for younger children. The presence of a disabled child, a variable not available in the ATUS, increases mothers' primary child care time on both weekdays and weekends as expected given that such children have a greater need for care. The presence of a disabled child also acts to reduce mothers' weekday market work.

As in the United States, the presence of other adults in the household negatively affects parents' child care time, suggesting that these other adults act as substitute caregivers. Again, the effect is primarily upon passive child care time and thus likely does not reflect a substantial decrease in quality child care time.

Education does not appear to be as important a determinant of child care time in the United Kingdom as it is in the United States. While in the United States, both men and women with more education devoted more time to primary child care, in the United Kingdom only an advanced degree increases primary child care time, and only by women on the weekend. Other positive effects of higher education are limited to passive child care activities. Education is, however, an important determinant of market work. As in the United States, more educated women spend more time on market work on weekdays. While there is a similar correlation for men in the United States, the primary impact of education on men's market time in the United Kingdom is to reduce their market time on weekend days.

Having a work-related health limitation impacts time use in a number of ways. It positively affects the amount of time men spend in primary child care during the week and the amount of passive child care time fathers spend on the weekend. It also strongly negatively affects fathers' work time on both weekdays and weekends and mothers' work time on weekdays.

While in the United States, higher local unemployment rates are associated with higher passive child care time for men on weekdays, in the United Kingdom, local unemployment rates negatively affect the time fathers spend in weekend passive care. Higher unemployment in the United Kingdom is also associated with less market work for women on all days.

The only significant seasonal differences in time in the United Kingdom occur in the summer. As in the United States, mothers reduce their primary child care time, but in the United Kingdom they also increase their passive child care time and reduce their market time. Again, it would be of some interest to break this effect down by age of children.

The correlation coefficients on the unobserved terms indicate that primary and passive child care time spent by father is positively correlated. This is also true for mothers on weekends, and the sign on this correlation is the opposite of that found for mothers in the United States. The correlation coefficients also indicate, as in the United States, that time spent by either parent on any day in market work is negatively correlated with either type of child care time. Finally, the availability of multiple diaries per individual and of diaries for multiple persons per household in the British sample allows estimation of additional correlation terms. Specifically we find that men to some extent and women even more who spend more time on a given activity on the weekend, are also likely to spend more time on that activity during the week. We also find a positive correlation between the time reports of men and women within the same household, suggesting that fathers and mothers have similar preferences regarding how they spend their time or similar unmeasured demands on their time.

## **VI. CONCLUSION**

The time that parents devote to caring for their children is an enormous and under-appreciated component of society's investment in human capital. However, these investments may be at risk due to the increased market work of women and the growing proportion of single parent families. In this paper we investigate the determinants of parental time investments in primary child care activities, passive child care activities, and market work using newly-available time-diary data from the 2003 American Time Use Study (ATUS) and data from the 2000 United Kingdom Time Use Study (UKTUS). We focus in particular on the effects of parents' living arrangements (married, cohabiting, or single) because previous economic studies using time diary data have analyzed only two-parent families. We ask how whether a child lives with a single parent or with married or cohabiting parents affects the amount of primary child care provided by his or her parents. Because of the richness of the data, we are able to examine this separately by the gender of the caregiver and by whether or not the activities occur on a weekday or weekend.

We estimate correlated tobit models of the time parents spend in primary child care, passive child care, and market work. These models account for reports of multiple uses of time in a day by a single individual and, for the UKTUS sample, reports for multiple days by the same individual and for multiple members in a household. In conclusion, we find no evidence

that cohabiting and married parents allocate different amounts of time to child care in either country. Nor do we find evidence that single parenthood affects either the primary or the passive child care of mothers—although the total time spent in the presence of a parent is still likely to be smaller. However, there are some statistically significant differences between single fathers and their married or cohabiting counterparts in both countries. In the United States, single fathers spend significantly more time in primary child care on weekdays and substantially less time in passive child care on weekends than their married or cohabiting counterparts. In the United Kingdom, single fathers spend significantly more time in passive child care on weekdays than their married or cohabiting counterparts. The analysis of child care time by single parents (especially single fathers) is further complicated by possible joint custody issues which may place the child in the household on some days and out on others. Given the lower time generally allocated toward child care by men, it is somewhat encouraging that single fathers show an increased contribution in some dimensions.

An analysis of the impact living arrangements have on market time also yields some interesting findings. Again, there are also no substantial differences in market time for married versus cohabiting parents, in either country, on either weekdays or weekends. Not surprisingly, single fathers in each country report less time at work on weekdays than their married or cohabiting counterparts. There is, however, a striking cross-country difference with respect to single mothers. In the United States, single mothers work more than married or cohabiting mothers on weekdays while single mothers in the United Kingdom work less than married or cohabiting mothers on all days.

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Table 1  
Mean Time Spent on Child Care and Employment by Gender, Union Status, Day of Week, and Country

Panel A: United States

		Women				Men			
		All	Living Arrangement			All	Living Arrangement		
			Single	Cohabiting	Married		Single	Cohabiting	Married
Weekday	Primary Child Care Time	130	107	104	140	59	73	40	59
	Passive Child Care Time	222	197	230	231	150	160	186	149
	Work Time	243	287	261	226	438	360	382	445
	# of Obs.	1972	513	61	1398	1369	103	25	1241
	% of Obs.	100%	26.0%	3.1%	70.9%	100%	7.5%	1.8%	90.6%
Weekend	Primary Child Care Time	93	71	102	100	65	36	56	68
	Passive Child Care Time	378	370	360	381	353	275	345	359
	Work Time	57	74	53	51	108	97	165	107
	# of Obs.	2052	530	48	1474	1471	111	35	1325
	% of Obs.	100%	25.8%	2.3%	71.8%	100%	7.5%	2.4%	90.1%

Table 1 - Continued

## Panel B: United Kingdom

		Women				Men			
		All	Living Arrangement			All	Living Arrangement		
			Single	Cohabiting	Married		Single	Cohabiting	Married
Weekday	Primary Child Care Time	108	111	126	104	39	50	38	38
	Passive Child Care Time	283	295	317	275	168	268	169	165
	Work Time	187	144	179	201	405	240	392	412
	# of Obs.	1489	310	150	1029	1120	31	140	949
	% of Obs.	100%	20.8%	10.1%	69.1%	100%	2.8%	12.5%	84.7%
Weekend	Primary Child Care Time	80	71	112	78	47	20	61	45
	Passive Child Care Time	375	360	387	377	315	291	297	318
	Work Time	53	45	49	56	108	124	130	105
	# of Obs.	1455	304	150	1001	1070	30	137	903
	% of Obs.	100%	20.9%	10.3%	68.8%	100%	2.8%	12.8%	84.4%

Table 2A  
 ATUS Sample  
 Sample Means and Standard Deviations

	Men		Women	
	<u>Mean</u>	<u>Std Dev</u>	<u>Mean</u>	<u>Std Dev</u>
Single	0.075	0.264	0.259	0.438
Cohabiting	0.021	0.144	0.027	0.162
Children 0-1	0.194	0.424	0.187	0.411
Children 2-3	0.215	0.435	0.212	0.441
Children 4-6	0.350	0.558	0.323	0.534
Children 7-11	0.584	0.722	0.593	0.728
Children 12-17	0.560	0.733	0.552	0.721
Other adults	0.152	0.450	0.173	0.481
Age	39.803	7.660	37.392	7.698
White (Base Case)	0.891	0.312	0.856	0.351
African American	0.071	0.256	0.114	0.317
Hispanic	0.111	0.314	0.115	0.319
Asian	0.038	0.192	0.031	0.172
Less than high school (Base Case)	0.089	0.284	0.087	0.283
High school graduate	0.267	0.442	0.271	0.444
Some college	0.258	0.438	0.307	0.461
Bachelor's degree	0.241	0.428	0.226	0.418
Graduate or prof. school	0.145	0.352	0.109	0.311
Northeast (Base Case)	0.205	0.404	0.200	0.400
Midwest	0.254	0.435	0.265	0.441
South	0.337	0.473	0.334	0.472
West	0.204	0.403	0.201	0.401
Non-metro area	0.201	0.401	0.196	0.397
Unemployment rate	5.961	0.900	5.975	0.874
Holiday	0.010	0.099	0.012	0.109
Winter	0.255	0.436	0.259	0.438
Spring	0.241	0.428	0.243	0.429
Summer	0.251	0.434	0.256	0.436
Fall (Base Case)	0.253	0.435	0.243	0.429
Number of Observations	2840		4024	

**Table 2B**  
**UKTUS Sample**  
**Sample Means and Standard Deviations**

	Men		Women	
	<u>Mean</u>	<u>Std Dev</u>	<u>Mean</u>	<u>Std Dev</u>
Single	0.028	0.165	0.209	0.406
Cohabiting	0.126	0.332	0.102	0.303
Children 0-1	0.184	0.411	0.176	0.402
Children 2-3	0.186	0.403	0.185	0.400
Children 4-6	0.276	0.516	0.274	0.510
Children 7-11	0.569	0.749	0.595	0.756
Children 12-17	0.637	0.804	0.628	0.795
Disabled child	0.018	0.134	0.023	0.150
Other adults	0.177	0.510	0.190	0.523
Household Income	0.237	0.425	0.218	0.413
Age	39.756	8.182	36.986	7.815
No qualifications (Base Case)	0.304	0.460	0.309	0.462
Unknown qualification	0.030	0.171	0.004	0.066
Other known qualification	0.028	0.165	0.018	0.132
Qual. below gcse/o level	0.015	0.120	0.021	0.142
gcse below grade c	0.041	0.197	0.055	0.229
"O" level, gcse grade a-c	0.161	0.367	0.228	0.420
"A" level or voc. level 3	0.152	0.359	0.097	0.296
Some higher education	0.100	0.299	0.140	0.347
Other higher educ. degree	0.052	0.221	0.017	0.129
First or post-grad. degree	0.119	0.324	0.110	0.313
Parent's health	0.085	0.280	0.094	0.292
North East	0.041	0.197	0.047	0.212
North West	0.109	0.311	0.107	0.309
Yorkshire and Humberside	0.090	0.287	0.092	0.289
East Midlands	0.091	0.288	0.094	0.292
West Midlands	0.081	0.273	0.080	0.271
Eastern	0.113	0.317	0.108	0.310
London (Base Case)	0.070	0.256	0.079	0.270
South East (exc. London)	0.139	0.346	0.130	0.336
South West	0.085	0.280	0.089	0.285
Wales	0.041	0.199	0.042	0.201
Scotland	0.111	0.315	0.105	0.307
Northern Ireland	0.027	0.163	0.026	0.161
Rural area	0.437	0.496	0.413	0.492
Unemployment rate	6.408	3.755	6.617	3.869
Winter	0.209	0.407	0.217	0.413
Spring	0.259	0.438	0.253	0.435
Summer	0.246	0.431	0.229	0.420
Fall (Base Case)	0.286	0.452	0.300	0.458
Number of Observations	2190		2944	



**Table 3. Coefficient Estimates from Correlated Tobit Models of Time-Use: ATUS Sample**

	Daily minutes of primary child care				Daily minutes of passive child care				Daily minutes of market work			
	Men		Women		Men		Women		Men		Women	
	Weekday	Weekend	Weekday	Weekend	Weekday	Weekend	Weekday	Weekend	Weekday	Weekend	Weekday	Weekend
Intercept	-118.9 (94.6)	-532.9 *** (130.5)	-28.1 (64.8)	-199.6 *** (65.2)	20.9 (131.3)	105.6 (173.9)	337.1 *** (102.1)	149.6 (130.0)	301.1 (204.0)	-528.9 (353.5)	-449.1 ** (207.2)	-629.1 * (364.5)
Single	47.8 *** (13.4)	2.3 (22.4)	7.9 (7.9)	4.0 (8.9)	27.0 (20.8)	-145.6 *** (27.3)	-12.0 (11.9)	-20.4 (13.9)	-108.0 *** (31.0)	-69.4 (57.3)	81.5 *** (24.0)	45.5 (37.4)
Cohabiting	-30.7 (28.3)	23.0 (38.6)	-23.3 (20.1)	10.8 (19.5)	7.8 (40.4)	-60.1 (50.1)	-1.5 (26.1)	-60.2 (43.7)	-37.9 (60.0)	123.6 (88.0)	74.9 (55.0)	-1.8 (112.2)
Children 0-1	45.4 *** (8.8)	114.2 *** (12.7)	132.8 *** (6.7)	137.4 *** (8.6)	27.0 * (15.0)	52.6 ** (25.4)	106.6 *** (12.7)	75.0 *** (21.5)	-22.8 (21.4)	-54.3 (42.1)	-173.6 *** (26.8)	-147.6 *** (52.9)
Children 2-3	32.2 *** (9.2)	86.2 *** (11.9)	78.2 *** (6.6)	67.0 *** (8.0)	40.9 *** (14.1)	57.5 *** (21.3)	83.1 *** (11.4)	53.8 *** (17.1)	-24.6 (21.0)	-12.6 (38.2)	-93.9 *** (23.8)	-63.9 (40.3)
Children 4-6	32.0 *** (7.1)	61.8 *** (9.5)	56.2 *** (5.4)	44.3 *** (6.7)	39.9 *** (10.9)	18.4 (16.8)	75.4 *** (9.6)	42.6 *** (13.5)	20.5 (16.2)	28.1 (29.3)	-75.9 *** (19.0)	-8.1 (34.0)
Children 7-11	16.8 *** (5.7)	28.7 *** (8.0)	37.1 *** (4.5)	9.9 * (5.3)	40.8 *** (8.5)	75.1 *** (11.3)	61.0 *** (7.4)	72.3 *** (9.1)	-21.2 * (12.2)	-13.5 (22.8)	-54.6 *** (14.5)	-21.0 (23.0)
Children 12-17	-4.7 (6.0)	-17.7 ** (8.2)	11.9 ** (4.7)	-17.6 *** (5.4)	-3.0 (9.1)	-5.6 (12.9)	18.2 ** (8.0)	-14.1 (10.2)	-0.6 (13.4)	-17.5 (22.6)	-35.4 ** (15.4)	66.6 ** (25.9)
Other adults	-3.4 (7.0)	-25.8 * (14.0)	-19.0 *** (7.2)	-5.2 (7.1)	-2.0 (12.0)	-49.7 *** (16.6)	-21.9 ** (10.5)	-36.6 *** (12.3)	-7.0 (18.1)	11.9 (34.7)	29.1 (19.7)	30.4 (33.0)
Age	4.4 (4.5)	20.7 *** (6.3)	4.5 (3.1)	12.0 *** (3.5)	0.0 (6.2)	15.5 * (7.9)	-12.6 ** (4.9)	14.4 ** (6.4)	10.4 (9.8)	12.3 (16.5)	35.0 *** (10.4)	4.1 (18.7)
Age squared (/100)	-6.2 (5.6)	-25.2 *** (7.8)	-67.0 * (4.1)	-16.7 *** (4.6)	-1.8 (7.6)	-25.0 *** (9.4)	12.2 * (6.5)	-27.5 *** (8.2)	-15.2 (12.2)	-14.7 (19.8)	-48.3 *** (13.7)	-12.3 (24.6)
African American	14.2 (13.5)	-49.8 ** (21.6)	-31.0 *** (10.8)	-26.4 ** (11.3)	-28.1 (25.0)	-54.1 * (28.6)	-18.0 (15.4)	7.5 (19.0)	-40.3 (33.8)	-148.7 ** (61.0)	-26.2 (31.9)	23.2 (51.4)
Hispanic	-2.5 (13.1)	1.9 (17.6)	-14.8 (9.4)	-5.4 (11.5)	11.2 (20.5)	15.6 (28.6)	9.6 (17.7)	53.0 ** (21.2)	-50.9 * (29.0)	74.5 (51.3)	40.0 (33.2)	-16.2 (59.1)
Asian	-8.7 (17.5)	-56.9 * (32.7)	-12.5 (17.5)	-2.9 (18.6)	33.2 (24.3)	0.9 (49.1)	35.8 (28.2)	41.5 (36.3)	-59.3 (41.5)	134.9 * (80.5)	21.0 (55.9)	29.3 (92.6)
High school graduate	38.6 ** (15.7)	37.8 * (22.3)	21.7 * (11.1)	25.5 * (15.5)	-27.6 (21.8)	-14.6 (29.5)	30.2 (18.5)	-0.1 (22.5)	53.5 (32.7)	96.0 (59.6)	90.5 ** (36.0)	88.4 (73.7)
Some college	57.1 *** (16.0)	54.4 ** (21.8)	21.5 * (11.2)	42.3 *** (15.3)	-45.8 ** (22.7)	10.7 (30.8)	22.2 (19.5)	-2.3 (22.7)	59.9 * (33.5)	88.1 (62.5)	169.8 *** (37.8)	89.2 (73.7)
Bachelor's degree	63.4 *** (16.8)	86.3 *** (22.6)	48.0 *** (12.2)	68.8 *** (16.3)	-5.6 (22.7)	-26.6 (32.1)	14.7 (21.0)	5.9 (25.2)	57.0 * (34.5)	94.2 (63.7)	152.0 *** (40.4)	110.8 (79.4)

**Table 3 continued**

Graduate or prof. school	68.9 *** (17.9)	115.0 *** (25.1)	42.3 *** (14.1)	85.9 *** (17.9)	-40.7 (25.5)	6.4 (36.6)	-3.7 (23.7)	17.2 (30.5)	122.1 *** (37.8)	141.3 * (73.2)	231.0 *** (46.4)	162.3 * (92.3)
Midwest	-8.6 (11.3)	-11.4 (15.4)	-17.9 ** (8.9)	-6.4 (10.1)	11.0 (16.2)	9.8 (23.8)	-2.1 (14.0)	-7.2 (18.1)	9.7 (24.6)	37.8 (44.0)	51.8 * (27.9)	1.9 (48.3)
South	-14.7 (10.5)	-2.9 (14.5)	-9.2 (8.0)	-16.3 (9.9)	-16.0 (16.0)	-11.1 (23.0)	6.4 (13.6)	20.5 (17.6)	31.6 (23.0)	4.1 (41.6)	33.1 (26.4)	-1.3 (45.8)
West	-14.3 (11.8)	-25.8 (17.7)	-9.9 (9.4)	-25.6 ** (11.6)	-0.1 (18.8)	49.4 * (26.4)	44.3 *** (16.0)	21.1 (20.6)	6.7 (26.4)	-61.5 (49.5)	-38.4 (30.6)	-19.3 (53.0)
Non-metro area	-1.7 (9.5)	-15.5 (13.9)	-18.1 ** (8.6)	-14.8 (9.0)	17.5 (14.1)	-26.6 (19.8)	20.7 * (12.2)	12.7 (15.6)	-10.6 (21.5)	96.0 ** (37.6)	20.7 (24.6)	94.9 ** (38.8)
Unemployment rate	2.6 (4.4)	0.2 (6.3)	1.0 (3.6)	-4.1 (3.7)	11.1 * (6.2)	-11.8 (9.1)	-2.1 (5.8)	-4.7 (7.1)	-14.6 (9.7)	-2.4 (17.8)	-13.1 (11.3)	24.4 (19.1)
Holiday	-59.2 (38.9)	-55.9 (168.3)	-108.6 *** (30.4)	15.2 (49.3)	195.5 *** (27.9)	243.2 * (138.4)	247.6 *** (35.5)	43.3 (67.8)	-526.5 *** (61.7)	-280.2 (379.1)	-628.3 *** (121.2)	184.6 (125.3)
Winter	-9.8 (9.4)	5.3 (14.2)	-16.3 ** (8.1)	0.3 (9.6)	42.8 *** (15.8)	17.6 (21.3)	24.3 * (14.0)	1.7 (17.1)	-24.8 (22.5)	5.2 (42.3)	5.7 (26.5)	-21.1 (43.7)
Spring	-39.3 *** (10.8)	11.1 (14.6)	-11.6 (8.5)	2.7 (9.9)	-0.5 (17.4)	5.5 (22.1)	23.3 (14.3)	-27.1 (17.5)	39.1 (24.5)	37.1 (42.3)	3.0 (27.5)	-22.2 (45.0)
Summer	-40.4 *** (10.4)	-16.7 (14.8)	-55.9 *** (8.5)	-4.1 (9.9)	24.2 (16.8)	-2.6 (21.5)	55.4 *** (12.8)	-0.5 (16.9)	19.2 (24.3)	47.4 (40.8)	-18.5 (26.0)	-73.0 (45.6)

Variance and covariance terms:

Transitory error variance	115.6 *** (2.3)	163.9 *** (3.7)	121.6 *** (1.5)	135.8 *** (1.9)	185.5 *** (3.5)	281.4 *** (6.9)	196.8 *** (3.5)	259.1 *** (5.3)	279.2 *** (7.0)	460.5 *** (21.1)	371.5 *** (14.3)	491.7 *** (29.4)
Transitory error correlations	$\rho_{PS,m,1}$ 0.109 *** (0.035)	$\rho_{PS,m,2}$ 0.034 (0.040)	$\rho_{PS,f,1}$ 0.013 (0.026)	$\rho_{PS,f,2}$ -0.049 * (0.029)	$\rho_{PM,m,1}$ -0.292 *** (0.029)	$\rho_{PM,m,2}$ -0.199 *** (0.041)	$\rho_{PM,f,1}$ -0.302 *** (0.025)	$\rho_{PM,f,2}$ -0.124 *** (0.039)	$\rho_{SM,m,1}$ -0.419 *** (0.025)	$\rho_{SM,m,2}$ -0.444 *** (0.032)	$\rho_{SM,f,1}$ -0.493 *** (0.021)	$\rho_{SM,f,2}$ -0.332 *** (0.033)

Log likelihood

-94,955.06

Notes: Coefficient estimates from correlated tobit models estimated using 1,369 weekday and 1,471 weekend diaries for men and 1,972 weekday and 2,052 weekend diaries for women from the 2003 ATUS. All diaries are assumed to be independent. Estimated standard errors appear in parentheses.

\* Significant at 10% level.

\*\* Significant at 5% level.

\*\*\* Significant at 1% level.

**Table 4. Coefficient Estimates from Correlated Tobit Models of Time-Use: UKTUS Sample**

	Daily minutes of primary child care				Daily minutes of passive child care				Daily minutes of market work			
	Men		Women		Men		Women		Men		Women	
	Weekday	Weekend	Weekday	Weekend	Weekday	Weekend	Weekday	Weekend	Weekday	Weekend	Weekday	Weekend
Intercept	-31.2 (109.3)	-67.8 (111.1)	68.1 (68.6)	-32.8 (79.2)	124.2 (203.4)	337.7 (277.7)	163.5 (157.3)	151.2 (227.6)	-67.3 (273.5)	-973.6 (623.6)	-622.6 ** (308.0)	-113.5 (601.4)
Single	39.2 (27.0)	-19.5 (52.9)	12.7 (9.0)	8.4 (10.1)	160.5 *** (47.0)	43.8 (71.4)	28.4 (19.5)	-10.1 (24.4)	-221.6 *** (71.8)	15.7 (162.5)	-95.7 *** (32.1)	-125.0 * (67.8)
Cohabiting	-20.3 (16.2)	-3.9 (16.9)	-18.7 (12.5)	0.8 (13.4)	-17.7 (30.0)	-60.3 (39.9)	-14.1 (30.4)	-43.5 (35.9)	-29.0 (39.5)	56.1 (78.0)	21.2 (42.9)	-69.8 (93.1)
Children 0-1	63.9 *** (11.6)	81.1 *** (14.2)	146.5 *** (9.4)	151.3 *** (11.1)	100.0 *** (27.4)	78.9 ** (39.2)	179.5 *** (25.7)	138.0 *** (39.1)	-67.0 * (37.9)	14.8 (85.6)	-256.7 *** (47.7)	-203.2 ** (91.2)
Children 2-3	48.5 *** (10.6)	58.8 *** (14.3)	64.1 *** (9.8)	56.0 *** (10.8)	87.7 *** (25.0)	106.3 *** (37.1)	164.0 *** (22.9)	111.1 *** (33.3)	-34.0 (33.1)	15.1 (77.0)	-155.2 *** (39.1)	-149.2 * (87.3)
Children 4-6	32.2 *** (9.4)	33.1 *** (11.0)	51.2 *** (7.5)	36.5 *** (8.0)	66.9 *** (20.2)	115.2 *** (28.9)	72.7 *** (18.1)	112.5 *** (25.9)	-35.1 (25.6)	5.1 (57.6)	-83.2 *** (29.0)	-58.1 (63.8)
Children 7-11	14.1 ** (6.5)	8.9 (8.0)	22.5 *** (5.7)	14.0 ** (6.1)	75.1 *** (14.2)	99.7 *** (19.4)	104.6 *** (11.5)	99.7 *** (15.7)	-31.2 (19.3)	-26.7 (47.4)	-68.9 *** (20.2)	-30.9 (40.7)
Children 12-17	-4.2 (6.8)	-21.1 ** (9.0)	-16.7 *** (6.1)	-17.2 *** (5.9)	6.5 (14.5)	-23.1 (20.0)	9.3 (12.6)	4.9 (15.0)	-43.0 ** (19.4)	33.7 (45.3)	-15.0 (21.2)	-6.2 (41.3)
Disabled child	-0.6 (38.7)	0.5 (73.3)	68.2 *** (22.3)	58.2 ** (29.6)	71.9 (105.1)	-16.9 (122.1)	44.7 (61.2)	18.4 (67.4)	-117.6 (97.9)	83.6 (200.4)	-224.1 * (134.9)	117.7 (214.8)
Other adults	-14.4 (12.5)	-9.3 (16.1)	-9.2 (7.7)	-25.8 *** (8.8)	-33.4 (26.0)	-97.8 *** (28.3)	-63.9 *** (18.7)	-111.0 *** (22.4)	-0.3 (32.0)	-8.8 (54.1)	-31.4 (29.2)	-17.4 (51.4)
Household income	-1.2 (11.3)	13.9 (14.0)	14.8 * (8.5)	14.3 (9.8)	12.7 (23.8)	35.9 (31.0)	-2.4 (19.5)	29.2 (25.7)	-6.9 (31.3)	-44.8 (65.4)	16.4 (31.7)	-50.2 (66.5)
Age	1.8 (5.2)	5.8 (5.3)	1.9 (3.8)	4.2 (4.2)	-1.2 (9.8)	-2.7 (12.8)	-2.4 (8.1)	7.5 (11.8)	30.1 ** (12.9)	33.8 (29.5)	40.2 ** (16.2)	-13.1 (30.7)
Age squared (/100)	-3.0 (6.3)	-9.4 (6.5)	-5.9 (5.2)	-8.0 (5.7)	0.6 (12.0)	-0.2 (15.1)	-2.4 (10.9)	-17.8 (15.5)	-39.7 *** (15.3)	-41.7 (36.0)	-49.5 ** (21.2)	14.9 (39.6)
First or post-grad. degree	9.7 (15.4)	27.4 (19.7)	15.9 (12.0)	34.4 ** (14.7)	0.4 (30.2)	76.9 * (40.9)	17.6 (26.2)	91.1 *** (33.8)	-7.4 (41.6)	-131.6 (96.5)	141.9 *** (47.8)	72.0 (95.4)
Other higher educ. degree	-17.0 (21.8)	8.8 (26.6)	-8.4 (26.1)	22.8 (26.9)	-21.7 (38.9)	26.8 (47.7)	-32.1 (66.0)	12.3 (90.5)	12.8 (59.0)	-226.7 * (136.6)	175.7 * (100.4)	-89.6 (235.5)



**Table 4 continued**

Some higher education	2.1 (15.7)	25.0 (18.4)	9.4 (12.0)	9.5 (12.6)	24.1 (29.6)	74.0 * (38.0)	5.6 (23.5)	28.7 (31.7)	19.1 (45.0)	-222.8 ** (100.6)	129.2 *** (38.6)	77.5 (78.3)
“A” level or voc. level 3	17.5 (13.4)	9.2 (17.7)	-5.3 (12.6)	7.9 (14.1)	16.7 (29.1)	52.2 (37.6)	-33.5 (27.1)	35.0 (38.2)	4.7 (36.7)	26.8 (81.9)	163.2 *** (46.4)	-11.2 (91.6)
“O” level, gcse grade a-c	16.1 (13.7)	-4.7 (17.7)	-4.2 (10.0)	-5.0 (10.2)	28.5 (26.5)	59.4 * (35.7)	14.6 (20.9)	66.2 *** (25.1)	-3.5 (36.7)	-93.6 (80.8)	115.7 *** (35.5)	-57.2 (69.6)
gcse below grade c	2.9 (25.6)	1.1 (27.8)	-15.2 (17.6)	-23.7 (18.5)	34.1 (50.4)	34.8 (69.8)	-6.8 (34.3)	1.4 (41.9)	39.9 (65.0)	216.6 * (130.7)	89.7 (58.2)	-212.4 (134.6)
Qual. below gcse/o level	12.0 (39.7)	33.1 (34.1)	-24.5 (35.6)	-35.7 (30.0)	-86.4 (94.2)	31.2 (102.0)	38.1 (64.8)	-30.2 (62.8)	44.2 (121.9)	-72.3 (287.0)	21.7 (110.7)	-20.1 (186.6)
Other known qualification	-13.1 (28.4)	-18.9 (39.3)	5.6 (34.9)	4.0 (32.9)	-21.3 (54.0)	-78.7 (76.7)	74.4 (55.6)	46.5 (73.6)	109.3 (88.0)	106.2 (162.8)	-66.0 (130.0)	-455.6 (381.7)
Unknown qualification	-7.9 (33.3)	10.2 (31.1)	36.9 (348.2)	35.6 (365.8)	-72.5 (55.9)	-49.8 (68.1)	158.8 (272.5)	-96.7 (137.9)	61.8 (79.3)	-78.9 (149.6)	-319.9 (1349.8)	362.1 (1048.7)
Parent’s health	27.5 * (16.3)	1.1 (19.8)	13.8 (12.5)	-5.3 (15.8)	48.9 (31.2)	81.1 * (45.5)	-7.2 (24.0)	-14.1 (32.3)	-323.4 *** (43.8)	-312.9 *** (115.2)	-167.7 *** (45.2)	24.8 (91.1)
North East	0.2 (33.8)	-20.8 (40.5)	-18.1 (23.5)	-28.5 (24.4)	-1.2 (61.1)	-14.6 (73.7)	22.7 (46.6)	-1.3 (55.6)	-83.2 (87.7)	-213.5 (170.8)	112.1 (73.4)	254.2 * (146.0)
North West	-4.3 (21.3)	-32.2 (26.0)	-15.4 (17.0)	-13.4 (16.4)	-50.3 (42.9)	-55.4 (59.2)	7.2 (40.6)	-0.2 (46.2)	-25.0 (63.0)	-57.6 (133.4)	112.9 ** (57.3)	7.0 (125.2)
Yorkshire and Humberside	-2.3 (22.8)	5.7 (25.4)	-21.9 (17.6)	-16.1 (17.6)	-34.7 (44.6)	-18.1 (62.7)	56.6 (40.4)	6.6 (49.3)	32.6 (69.8)	-34.6 (135.5)	70.8 (61.2)	178.0 (126.4)
East Midlands	-28.1 (23.0)	-25.9 (28.8)	-35.4 * (19.6)	-35.0 * (19.6)	-65.2 (47.1)	-61.6 (66.3)	-4.5 (41.8)	-29.1 (51.8)	21.2 (70.4)	-35.8 (140.5)	128.8 ** (63.0)	270.5 ** (131.7)
West Midlands	-7.8 (21.3)	-30.8 (27.8)	-11.2 (17.4)	-11.1 (19.0)	-36.0 (47.6)	11.3 (62.3)	62.1 (43.2)	81.4 (54.7)	30.1 (68.1)	-9.5 (143.4)	94.6 (62.2)	40.4 (138.7)
Eastern	-2.7 (21.1)	-9.9 (26.8)	-10.7 (16.6)	-7.0 (17.6)	-34.6 (44.0)	14.0 (61.8)	29.4 (40.0)	27.1 (48.7)	43.4 (68.6)	22.8 (140.0)	89.0 (59.5)	141.6 (125.2)
South East (exc. London)	-14.9 (19.9)	-13.4 (23.5)	-9.8 (15.9)	-4.6 (16.5)	-62.7 (43.0)	-25.8 (56.2)	22.7 (39.5)	-10.3 (46.8)	32.7 (66.5)	-22.0 (129.0)	72.7 (57.3)	102.3 (120.0)
South West	-8.0 (22.3)	-23.5 (26.9)	-15.7 (17.5)	6.9 (17.9)	-38.2 (44.2)	15.4 (63.8)	52.1 (41.3)	44.9 (50.6)	39.6 (67.6)	-11.9 (143.7)	48.4 (59.9)	149.8 (134.1)
Wales	-2.4 (28.1)	-31.6 (34.4)	-10.8 (22.2)	8.9 (21.8)	-36.1 (60.5)	-85.0 (87.0)	33.0 (51.1)	19.9 (68.7)	4.0 (86.3)	210.8 (186.9)	95.8 (79.6)	237.1 (173.8)

**Table 4 continued**

Scotland	7.3 (20.7)	-31.9 (26.6)	-20.7 (17.5)	-14.2 (18.2)	-57.0 (43.9)	-58.3 (58.6)	39.4 (40.3)	2.5 (48.8)	23.6 (68.7)	-90.6 (134.8)	77.8 (60.1)	21.6 (124.3)
Northern Ireland	-24.7 (38.7)	-84.9 * (51.6)	-16.7 (25.2)	-23.0 (33.4)	-42.8 (78.0)	-188.7 * (107.0)	78.2 (58.1)	83.8 (77.9)	33.3 (109.3)	147.3 (215.8)	-3.2 (103.3)	-96.1 (216.7)
Rural area	-8.6 (10.5)	-11.9 (12.4)	1.0 (8.3)	1.6 (8.8)	-13.9 (21.1)	-30.5 (28.4)	12.0 (17.8)	-23.7 (23.7)	22.4 (27.1)	18.9 (60.9)	-52.4 * (28.9)	-20.4 (57.0)
Unemployment rate	-1.2 (1.5)	-2.1 (1.7)	-0.3 (1.2)	0.0 (1.2)	-2.9 (3.1)	-9.0 ** (4.1)	0.0 (2.5)	-1.9 (3.2)	-2.8 (4.1)	9.0 (8.3)	-8.0 ** (3.9)	-15.6 * (9.2)
Winter	-15.1 (13.0)	-5.8 (16.0)	9.2 (9.9)	8.9 (10.5)	4.1 (27.9)	-15.5 (36.3)	8.9 (22.2)	9.6 (27.9)	48.8 (39.7)	59.5 (78.5)	-10.0 (36.4)	45.8 (74.8)
Spring	-14.5 (12.1)	-7.6 (15.9)	-5.1 (9.9)	5.7 (10.6)	14.3 (25.9)	5.3 (31.9)	36.8 * (21.9)	21.1 (26.7)	-27.4 (33.8)	-4.7 (72.5)	-34.3 (33.6)	15.5 (67.2)
Summer	-14.7 (11.8)	-14.5 (15.2)	-29.5 *** (10.0)	-0.1 (10.9)	24.3 (24.1)	-30.7 (33.7)	77.0 *** (20.1)	13.8 (27.2)	-58.1 * (33.1)	30.0 (73.6)	-88.9 ** (35.7)	-30.4 (73.0)

Variance and covariance terms:

Transitory error variance	92.2 *** (3.3)	105.8 *** (4.0)	93.4 *** (2.1)	95.4 *** (2.6)	177.3 *** (6.7)	185.6 *** (16.0)	174.2 *** (6.6)	191.1 *** (11.1)	294.0 *** (11.6)	531.6 *** (50.9)	347.6 *** (19.3)	515.5 *** (63.2)
Transitory error correlations	$\rho_{PS,m,1}$ 0.344 *** (0.053)	$\rho_{PS,m,2}$ 0.308 *** (0.078)	$\rho_{PS,f,1}$ 0.029 (0.048)	$\rho_{PS,f,2}$ 0.119 ** (0.060)	$\rho_{PM,m,1}$ -0.350 *** (0.039)	$\rho_{PM,m,2}$ -0.239 *** (0.064)	$\rho_{PM,f,1}$ -0.285 *** (0.040)	$\rho_{PM,f,2}$ -0.169 ** (0.068)	$\rho_{SM,m,1}$ -0.505 *** (0.036)	$\rho_{SM,m,2}$ -0.586 *** (0.079)	$\rho_{SM,f,1}$ -0.467 *** (0.043)	$\rho_{SM,f,2}$ -0.537 *** (0.076)
Permanent error components	$\sigma_{\mu,m}$ 7.5 * (3.8)	$\sigma_{\mu,f}$ 23.5 *** (2.8)	$\rho_{\mu}$ 0.826 *** (0.033)	$\lambda_{S,m,1}$ 19.061 ** (9.587)	$\lambda_{S,m,2}$ 36.085 ** (18.376)	$\lambda_{S,f,1}$ 7.055 *** (0.896)	$\lambda_{S,f,2}$ 10.815 *** (1.325)	$\lambda_{M,m,1}$ -4.374 (2.671)	$\lambda_{M,m,2}$ -5.290 (5.323)	$\lambda_{M,f,1}$ -1.126 * (0.600)	$\lambda_{M,f,2}$ -0.511 (1.408)	

Log likelihood

-65,929.24

Notes: Coefficient estimates from correlated tobit models estimated using 1,120 weekday and 1,070 weekend diaries for men and 1,489 weekday and 1,455 weekend diaries for women from the UKTUS. Models account for multiple diaries for individuals and within households. Estimated standard errors appear in parentheses.

\* Significant at 10% level.

\*\* Significant at 5% level.

\*\*\* Significant at 1% level.