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## Infusing time diary evidence into panel data: an exercise in calibrating time-use estimates for the BHPS

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Infusing Time Diary Evidence into Panel Data:  
An exercise in calibrating time-use estimates for the BHPS

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## **ABSTRACT**

In this paper, we calibrate a set of time use variables for a long-running panel survey (the British Household Panel Survey, BHPS, 1994 – 2004) from evidence derived from a smaller scale panel survey that collected time use information by both the survey method and the diary method from the same respondents (the Home On-line Study, HoL, 1999 - 2001). Past research has suggested that the time diary method produces more accurate and reliable measures of time use than the survey approach. The diary approach, however, usually has a low response rate and is not practicable for a large-scale panel study like the BHPS. On the other hand, direct questioning in survey interviews is a relatively flexible approach to collect time use data. We therefore propose a method to combine the strengths of the survey approach and the diary method to produce time use data. The survey part of the HoL study shares the same questionnaire-derived time-use predictor variables with the BHPS. We use regression of the predictors on the time diary data in the HoL study to calibrate time use in the BHPS by multiplying the resulting regression coefficients with the same predictor variables in the BHPS. Then we get a calibrated index of time-use patterns based on BHPS questionnaire items. The calibrated time use variables cover all major categories of daily activities and are available in Wave 4 (1994) to Wave 14 (2004) of the BHPS. They are useful resources for the study of time use practices and the life course.

**Infusing Time Diary Evidence into Panel Data:  
An exercise in calibrating time-use estimates for the BHPS**

INTRODUCTION

This paper reports an exercise in calibrating time use estimates for the British Household Panel Survey (BHPS). The BHPS collects “stylised estimates” of time use on a regular basis, i.e., respondents were asked about how frequently they were engaged in certain activities, and to report the usual time they spent at paid work and housework per week. These measurements provide useful information about how individuals allocate their time to different activities. Together with the strong panel characteristic of the BHPS, they provide useful and vivid information about changes in people’s behaviour (i.e., what people actually *do*) over the life course and the implications for their social and economic well being.

Research, however, has shown that these sorts of stylised estimates of time use have systematic biases (e.g., Gershuny, 2005; Kan, 2006; Niemi, 1993). Comparing diary estimates and stylised estimates of housework hours of the same respondents, Kan (2006) found that the gap between the two types of estimates is smaller in the case of women and it is larger when dependent children are present in the household; it is also associated with irregularity in housework hours, amount of housework undertaken as a simultaneous activity and traditionalism in gender role attitudes. In a similar vein, Gershuny (2005) found that in the case of paid work hours, the gap between stylised and diary-based estimates is associated significantly with irregularity of work hours over the week. These results suggest that the accuracy of stylised time use estimates recorded in survey interviews may be biased towards certain characteristics of the respondents.

Moreover, the stylised estimates in the BHPS do not cover all activities on a single day. And even if the stylised estimates did comprehensively cover all the activities of the day, as in some UK 1980s dataset, they would not regularly add up to 1440 minutes of the day, but rather to something like 1600 or 1700 minutes (Gershuny & Robinson, 1994). Hence there are limitations in using these estimates to provide a full picture of an individual’s time budget.

Compared to the survey approach, the time-diary method is less dependent on respondents’ calculation and augmentation of the time they spend on various

activities, and can therefore produce more accurate data on time use. Central to the diary method is that individuals' time use at various activities during the day is recorded in a continuous sequence of "slots" in diaries that can be summed to 1440 minutes (i.e., 24 hours). These diary records constitute "round-the-clock" evidence of daily time use. But this method is often not practicable because it is very expensive for researchers and onerous for respondents. It is particularly difficult to produce time diary data within a panel study framework. Since diary-keeping is burdensome, this method has a relatively low response rate and it is likely that only people with certain characteristics will maintain this practice over extended periods of time.

This exercise, hence, proposes an innovative method to combine the strengths of panel survey studies and time diary studies. We have a time-diary data set, the Home On-line (HoL) Study, which shares the same questionnaire-derived time-use predictor variables with a large long-term panel study (BHPS). We use regression of the predictors on the time diary data in HoL to calibrate time use in the BHPS by multiplying the resulting regression coefficients with the same predictor variables in the BHPS. Then we get a calibrated index of time-use patterns based on BHPS questionnaire items. In what follows, we will give details of the estimating procedures and the data.

### THE ESTIMATING PROCEDURES

Our approach to calibrating data relies on identifying, in two separate surveys, identical predictors of some variables that occur in only one of the surveys. Regression coefficients derived from the "donor" survey with both the predictor and the target variables can then be combined with the predictor variables in the "recipient" survey to estimate the target variables. We first use the "donor" survey data and regress time use variables derived from the diary method on other variables related to time use collected by the survey method. We then multiply the coefficients of the regression equations with the same set of predictive time use variables in the "recipient" data set to yield a differentiated category of calibrated time-use estimates.

It is worth mentioning that our approach is different from the data imputation method. It attempts to improve the quality of stylised time-use estimates with information derived from diary-based estimates. In our approach, the diary-based estimates are regressed primarily with stylised estimates of time use, rather than, as in

the data imputation approach, with a set of socio-economic and demographic variables that are not directly concerned with time use. In a nutshell, the calibrated time use variables are derived from time-use evidence itself. In addition, we include a wide range of stylised time use variables (e.g., time spent on housework and paid work, frequency of leisure activities and responsibilities for household chores) in the RHS of the equations that estimate the time spent on all the main categories of daily activities. This should produce better estimates of time use on a particular activity (e.g., paid work and housework) than if only one or few stylised time use variables were put on the RHS of the equations. The calibrated estimates of paid work time and housework time in the recipient data set (i.e., the BHPS) should therefore be more accurate than the original stylised estimates.

#### *Data*

Our “donor” data come from the Home On-line Study (HoL), which consists of three annual waves of household panel data (1999 – 2001). This study contains about 1,000 households drawn from a national random sample. But it was originally intended for the estimation of changes in time-use practices as a result of the everyday use of information-and-computer technology (ICT), and therefore has an over-sample to make sure that 50% of the households have a personal computer. Individuals aged 16 or over in the selected households were interviewed in all waves. A one-week self-completion diary designed to record what respondents were doing each day of that week every quarter hour of a day was left after the interview. Respondents were asked to fill in the diary with 35 pre-coded activities (see Appendix I) at least once each day and then return it at the end of the designated week. The HoL study collected around 2,300 diaries (i.e., 16,100 diary days) from respondents in all the three waves. The survey parts of the study contained stylised time use estimates of categories that were also used in the BHPS, the “recipient” survey. In fact, the HoL study was designed by the same research team that is also responsible for the BHPS, with such an exercise of calibrating time use estimates in mind. Therefore the two surveys match well for the purpose of this data calibration exercise.

The BHPS is a longitudinal survey that interviewed all members of a random selection of households in 1991, and re-interviews all the original household members, their natural descendents, and all their current household co-residents

annually. The first wave interviewed about 5,000 households and 10,300 individuals. Additional samples of 1,500 households in Scotland and the same number in Wales were added to the main sample in 1999, and a sample of 1,000 households in Northern Ireland was added in 2001. The BHPS currently contains 14 waves of data from around 9,000 households. From Wave 4 (1994) onwards, the BHPS has collected a number of potential predictors of time use by stylised estimate questions. These questions asked about respondents' normal weekly hours of paid work and housework, their frequency of participation in various leisure activities, and the distribution of various domestic work tasks within the households<sup>1</sup>. As mentioned earlier, the survey part of the HoL study also collected these variables, using the same or very similar question wordings in most cases.

#### *Creating a Calibrating Index from HoL Data*

We first estimate the regression coefficients for data calibration from the HoL data. We run separate regressions for men and women, since gender is a key predictor of time use patterns and it interacts with most of variables of time use. The regression takes the following form:

$$M_{ki} = \mu_{0k} + \mu_{1k}age_i + \mu_{2k}agesq_i + \mu_{3k}parent_i + \mu_{4k}age_i * parent_i + \mu_{5k}emphrs_i + \mu_{6k}househrs_i + \mu_{7k}emphrs_i * parent_i + \mu_{8k}shop_i + \mu_{9k}cook_i + \mu_{10k}clean_i + \mu_{11k}wash_i + \mu_{12k}lesiurea_i + \mu_{13k}leisureb_i + \mu_{14k}leisurec_i + \mu_{15k}leisured_i + \mu_{16k}leisuree_i + \varepsilon_k$$

where  $k = 1$  to 5, indicating the following five main activities respectively: (1) labour market work, study and travel related to work/study; (2) routine housework, such as cleaning, ironing and washing; (3) other household works, including caring for family members, DIY, and shopping for household groceries; (4) sleep, personal care, and rest; (5) consumption and leisure. For a respondent  $i$ ,  $M_{ki}$  is the dependent variable

indicating the number of minutes per day spent at activity  $k$ , where  $\sum_{k=1}^5 M_{ki} = 1440$ ,

calculated from the respondent's diary.

The predictor variables are:

- $age$  and  $agesq$ : age and age square respectively;

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<sup>1</sup> Full documentation of the BHPS is available at <http://www.iser.essex.ac.uk/ulsc/bhps/doc/>.



- *parent*: indicates whether the respondent has a child aged under 16 (*Yes = 1*; *No = 0*);
- *emphrs* and *househrs*: usual weekly hours spent at labour market work (plus travelling time) and routine housework respectively, reported by the respondent in the interview;
- *shop*, *cook*, *clean*, and *wash*, denote whether the respondent is responsible for shopping, cooking, cleaning and washing in the household respectively (*Yes = 1*; *No = 0*);
- *leisurea* to *leisuree* represent the frequency in participating in the following five leisure activities: (a) doing sports, keeping fit, and walking, (b) watching live sport, (c) going to cinema, theatre and concerts, (d) dining or drinking out, (e) attending leisure groups (*coded 1 = Most days; 2 = At least once a week; 3 = At least once a month; 4 = Several times a year; 5 = Almost never/Never*).
- $\mu_{0k}$  to  $\mu_{16k}$  are parameters to be estimated and  $\varepsilon_k$  is an error term.

Age and parental status are selected as predictor variables because they are strongly associated with time use, particularly with housework time and paid work time; other predictor variables are chosen because they are stylised estimates of time use and are available both in the BHPS and HoL Study<sup>2</sup>.

Tables 1a and 1b show the summary of the OLS regression models predicting the number of minutes per day that men and women spend at the five categories of daily activities. Since the coefficients of the set of regression equations represent the effect of each of the characteristics on each of the comprehensive list of time-use categories, and given that more time spent by a person with a particular characteristic in one of the activities must imply less time devoted to another, it follows that the sum of each coefficient across all the time use categories must be zero. Similarly, the sum of the intercepts is 1440.

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<sup>2</sup> There are a number of missing cases for travelling time to work (about 10% of the sample) in both the HoL study and the BHPS. These missing values are imputed using information about region of the household, whether the respondent is employed or self-employed, whether the respondent works in the private sector, and the respondent's socio-economic group.

Table 1a. *Unstandardized Coefficients of OLS Models of Time Use on Categorized Activities – Men only*

Variable	Labour market work, study, travelling	Routine housework	Other unpaid household works	Sleep, personal care, and rest	Consumption and leisure	<i>Sum of row</i>
<i>Intercept</i>	355.14***	10.80	-65.19**	631.13***	508.12***	1440
<i>househrs</i>	-1.34*	2.48***	1.47***	-1.64**	-0.97	0
<i>emphrs</i>	5.28***	-0.09	-0.76***	-1.60***	-2.84***	0
<i>age</i>	-2.43	-0.43	4.68***	-2.54*	0.72	0
<i>agesq</i>	-0.01	0.01*	-0.03**	0.03*	0.00	0
<i>shop</i>	-10.95	7.84	23.90*	-30.59*	9.80	0
<i>cook</i>	-3.92	9.41*	-13.97	14.01	-5.52	0
<i>clean</i>	26.65	15.60**	9.16	-24.91	-26.50	0
<i>wash</i>	-17.93	-5.71	7.34	26.53	-10.23	0
<i>parent</i>	-123.93*	22.03	305.59***	-100.67*	-103.03*	0
<i>emphrs*parent</i>	0.52	-0.13	-1.61***	0.77	0.46	0
<i>age*parent</i>	2.51**	-0.28	-4.29***	1.25	0.81	0
<i>leisurea</i>	-0.39	-1.64	-2.92	3.61	1.34	0
<i>leisureb</i>	1.37	0.11	8.54***	-3.18	-6.83*	0
<i>leisurec</i>	-8.35*	1.06	-3.34	11.46**	-0.83	0
<i>leisured</i>	-0.66	0.33	-3.34	0.81	2.86	0
<i>leisuree</i>	-8.87**	0.49	3.76	5.43	-0.81	0
<i>R-squared</i>	0.71	0.32	0.25	0.20	0.41	

Note: The sample is pooled from all three waves of the Home On-line Study, 1999 – 2001.  $N = 1,076$ .

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

Table 1b. *Unstandardized Coefficients of OLS Models of Time Use on Categorized Activities – Women only*

Variable	Labour market work, study, travelling	Routine housework	Other unpaid household works	Sleep, personal care, and rest	Consumption and leisure	<i>Sum of row</i>
<i>Intercept</i>	375.90***	-77.18***	8.59	665.86***	466.83***	1440
<i>househrs</i>	-1.36***	1.47***	0.67*	-0.37	-0.42	0
<i>emphrs</i>	5.26***	-0.76***	-0.75***	-1.29***	-2.46***	0
<i>age</i>	-4.16***	4.87***	3.02**	-3.79***	0.05	0
<i>agesq</i>	0.01	-0.04***	-0.03**	0.04***	0.02	0
<i>shop</i>	16.93*	2.12	10.72	-9.54	-20.24**	0
<i>cook</i>	13.25	20.37***	-18.43*	-3.20	-11.99	0
<i>clean</i>	-34.57***	11.48**	21.35**	-10.69	12.43	0
<i>wash</i>	0.55	6.14	-0.46	1.27	-7.51	0
<i>parent</i>	-199.90***	-23.04	404.03***	-22.78	-158.32***	0
<i>emphrs*parent</i>	0.02	-0.16	-1.40***	0.80**	0.74*	0
<i>age*parent</i>	4.50***	0.95*	-7.20***	-0.23	1.98**	0
<i>leisurea</i>	-0.82	-1.10	-3.33	5.16**	0.09	0
<i>leisureb</i>	-3.07	3.59*	1.15	-1.07	-0.59	0
<i>leisurec</i>	-12.75***	3.87*	0.77	8.54**	-0.43	0
<i>leisured</i>	5.58	2.45	0.64	-0.75	-7.92*	0
<i>leisuree</i>	-4.21*	0.54	0.50	4.52*	-1.35	0
<i>R-squared</i>	0.66	0.43	0.33	0.20	0.38	

Note: The sample is pooled from all three waves of the Home On-line Study, 1999 – 2001.  $N = 1,369$ .

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

To cater for research interest in social capital, networking and consumption, we apply the same techniques and divide further the consumption and leisure category into two sub-categories, i.e., “social leisure”, which includes leisure and consumption activities involving meeting or talking with people and “passive leisure”, which is leisure or pastime usually consumed by an individual alone and are not usually conducive to establishing social networks. Alternatively, we subdivide the category into “home leisure” and “leisure outside the home” according to whether the consumption and leisure take place in the home or outside the home. (Definitions of the categories of daily activities are provided in Appendix II).

Coefficients of the OLS models predicting the number of minutes that men and women spend per day on these refined categories of daily activities are shown in Tables 2a and 2b.

Table 2a. *Unstandardized Coefficients of OLS Models of Time Use in Sub-categories of Consumption and Leisure – Men only*

	“Passive leisure” e.g. eating at home, watching TV, magazines	“Social leisure” e.g. visiting friends, playing sports.	Leisure and consumption at home	Leisure and consumption outside home
<i>Intercept</i>	231.78***	276.34***	256.32***	251.80***
<i>househrs</i>	-0.78	-0.19	-0.82	-0.15
<i>emphrs</i>	-1.92***	-0.91***	-2.04***	-0.80***
<i>age</i>	-0.10	0.81	-0.05	0.77
<i>agesq</i>	0.02	-0.02	0.02	-0.02
<i>shop</i>	8.92	0.88	5.76	4.04
<i>cook</i>	9.85	-15.37	10.94	-16.46
<i>clean</i>	-18.64	-7.86	-15.67	-10.83
<i>wash</i>	-5.00	-5.23	-8.96	-1.27
<i>parent</i>	-32.98	-70.04	-42.20	-60.82
<i>emphrs*parent</i>	0.25	0.20	0.23	0.22
<i>age*parent</i>	0.33	0.48	0.39	0.41
<i>leisurea</i>	5.88*	-4.54*	5.63*	-4.29*
<i>leisureb</i>	0.77	-7.60**	0.40	-7.23**
<i>leisurec</i>	5.64	-6.47*	4.30	-5.14
<i>leisured</i>	12.41***	-9.54***	12.28***	-9.41***
<i>leisuree</i>	0.21	-1.01	1.13	-1.93
<i>R-squared</i>	0.38	0.17	0.39	0.15

Note: The sample is pooled from all three waves of the Home On-line Study, 1999 – 2001.  $N = 1,076$ .

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

Table 2b. *Unstandardized Coefficients of OLS Models of Time Use in Sub-categories of Consumption and Leisure – Women only*

	“Passive leisure” e.g. eating at home, watching TV, magazines	“Social leisure” e.g. visiting friends, playing sports.	Leisure and consumption at home	Leisure and consumption outside home
<i>Intercept</i>	172.98***	293.85***	197.54***	269.28***
<i>househrs</i>	-0.54*	0.12	-0.26	-0.16
<i>emphrs</i>	-1.50***	-0.95***	-1.77***	-0.69***
<i>age</i>	0.52	-0.47	1.34	-1.28
<i>agesq</i>	0.01	0.00	0.01	0.01
<i>shop</i>	-23.83***	3.59	-29.38***	9.14
<i>cook</i>	2.54	-14.53*	-0.29	-11.70*
<i>clean</i>	9.18	3.24	10.54	1.88
<i>wash</i>	7.10	-14.61*	2.47	-9.97
<i>parent</i>	-58.56*	-99.76***	-75.51**	-82.81***
<i>emphrs*parent</i>	0.51	0.22	0.71*	0.03
<i>age*parent</i>	0.43	1.55**	0.62	1.36**
<i>leisurea</i>	2.73	-2.64	3.22	-3.13*
<i>leisureb</i>	-0.77	0.18	0.78	-1.37
<i>leisurec</i>	9.27**	-9.70**	5.40	-5.83*
<i>leisured</i>	3.92	-11.84***	3.64	-11.56***
<i>leisuree</i>	2.43	-3.78*	2.47	-3.82**
<i>R-squared</i>	0.37	0.15	0.39	0.14

Note: The sample is pooled from all three waves of the Home On-line Study, 1999 – 2001.  $N = 1,369$ .

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

Table 3 presents the average time spent on the major daily activities estimated by coefficients of the regression models of Tables 1a and 1b. It also shows the stylised estimates of paid work time and routine housework time. We can see that the average labour market work time estimated by the regression equation is higher than that derived from the survey data. This is, however, within our expectation. We have taken account of time spent at training and studying in the calibrated estimates of labour work time, but these activities were not included in the stylised question. We can also see that the average time at routine housework estimated by the equation is lower than that computed from the survey data. This is consistent with findings of past studies, which suggest that respondents generally report longer hours of housework in surveys than in diaries (see, for example, Bianchi, Milkie, Sayer, & Robinson, 2000; Robinson, 1985). Since the diary recorded time spent at a number of items of household work that distinguish routine housework from non-routine

household work (e.g., care and shopping), while respondents might not distinguish these two categories clearly in their minds and therefore might not report them accurately in the survey interview. Furthermore, it is likely that respondents count housework that is undertaken simultaneously with other activities when reporting their housework time in surveys. In the diary approach, respondents can distinguish between primary and secondary activities performed in a given time slot. The correlations between the values estimated by the two methods are actually very high (being 0.948 and 0.818 respectively in the case of men, and 0.916 and 0.707 in the case of women). So we proceed to applying the coefficients to the relevant waves of the BHPS.

#### *Calibrating Time Use Estimates for the BHPS*

Our next step is to multiply the coefficients that we have obtained with the same set of stylised time use estimates in the BHPS. First of all, however, we have to combine some measures of the leisure activities in order to make them compatible with those in the HoL Study. Frequencies of cinema going, and theatre and concert going are measured in two separate questions in the BHPS but in a single question in the HoL Study. Therefore, we combine the two items in the BHPS and take the higher frequency of the original two items. Similarly, eating out and drinking out are measured in two questions in the BHPS but only one in the HoL Study. These two items are also combined and the higher frequency of the two is taken. Furthermore, we need to interpolate the variables of leisure activities in some waves of the BHPS. The BHPS asked respondents about their habits of leisure and consumption in Waves 6, 8, 10, 12 and 14. Since this calibration exercise is for BHPS Waves 4 – 14, we therefore interpolate values of leisure consumption for the waves that did not collect this information. First, any missing values of leisure activities in Waves 6, 8, 10, 12 and 14 are replaced by the mean of the values in other available waves that have no missing values. Second, for Waves 7, 9, 11, and 13 the values are interpolated by taking the mean of the values of the two adjacent waves. The values for Waves 4 and 5 are taken as those of Wave 6 (the closest available wave).

Table 3. *Mean Values of Predicted and Stylised Estimates of Time Use (Standard Deviation in Parentheses), Home On-line Study 1999 – 2001*

Activities	Minutes per day		Correlations between predicted values and stylised estimates
	Predicted values	Stylised estimates	
<u>Men</u>			
Paid work, study and travel	291 (173)	248 (218)	0.948
Routine housework	40 (25)	56 (58)	0.818
Other domestic work	102 (48)	-	-
Sleep, rest, and personal care	588 (51)	-	-
Consumption and leisure	418 (92)	-	-
“Passive leisure”	291 (77)	-	-
“Social leisure”	128 (36)	-	-
Leisure at home	307 (81)	-	-
Leisure outside home	111 (32)	-	-
<u>Women</u>			
Paid work, study and travel	201 (143)	151 (173)	0.916
Routine housework	118 (48)	126 (95)	0.707
Other domestic work	116 (65)	-	-
Sleep, rest, and personal care	613 (43)	-	-
Consumption and leisure	392 (81)	-	-
“Passive leisure”	254 (66)	-	-
“Social leisure”	138 (34)	-	-
Leisure at home	286 (72)	-	-
Leisure outside home	106 (29)	-	-

*Note:* The sample is pooled from all three waves of the Home on Line Study, 1999 – 2001. All values are unweighted and rounded to the nearest minute.  
For men.  $N = 1,076$ ; for women,  $N = 1,369$ .

Table 4. *Mean Values of Stylised and Calibrated Time Use Estimates (Minutes per Day) by Year*

Year	Stylised estimates		Calibrated estimates								
	Paid work/travel	Routine housework	Paid work/study/travel	Routine housework	Other domestic work	Sleep, rest, personal care	Consumption and leisure	“Passive leisure”	“Social leisure”	Leisure at home	Leisure outside the home
<b>Men</b>											
1994	263	52	315	37	94	574	420	266	154	284	136
1995	267	53	312	38	96	576	418	269	149	287	131
1996	265	52	309	38	96	578	419	271	147	289	130
1997	275	52	312	38	96	578	417	271	147	288	129
1998	276	49	311	37	96	578	417	271	146	288	128
1999	272	49	311	37	95	578	418	271	147	289	129
2000	272	50	310	38	96	578	419	272	147	290	129
2001	276	50	311	38	96	576	418	271	147	289	129
2002	265	49	306	38	96	578	422	273	149	291	131
2003	263	50	306	38	95	577	423	273	150	291	132
2004	264	50	304	39	96	579	423	274	149	292	131
<b>Women</b>											
1994	151	150	201	112	104	609	414	253	161	288	126
1995	152	145	200	112	103	611	414	256	158	291	123
1996	154	141	198	112	103	613	413	258	155	293	121
1997	158	154	202	111	100	613	414	258	156	292	121
1998	161	134	203	110	100	614	413	257	156	292	121
1999	161	129	203	109	99	615	415	259	156	293	122
2000	159	130	203	109	99	614	416	258	157	292	123
2001	159	124	203	108	99	614	417	259	158	293	124
2002	161	123	205	106	99	613	417	257	159	292	125
2003	159	122	203	107	98	613	420	259	160	294	126
2004	160	119	203	106	97	614	420	260	160	294	125

Note: Data from the British Household Panel Survey, 1994 – 2004. The figures are weighted and rounded to the nearest minute.

Finally, by multiplying the variables with the coefficients obtained from the regression models of HoL data, we obtain calibrated time use estimates for the BHPS. These results are given in Table 4.

As we can see, the calibrated time-use values in the BHPS correspond reasonably well to the diary data in the HoL Study (Table 3).

## THE DATA SET

The calibrated time use estimates for the BHPS are kept in the *calibrated\_time* file. Data users can match this data set with other files in the BHPS readily by PID, the cross wave person identifier. The data set contains 9 calibrated time use end-variables for Waves 4 – 14 of the BHPS that are prefixed with the wave number (indexed by “d” to “n”). The first five times use end-variables represent a complete categorization of all activities on a single day. Users are reminded that the last four end-variables (wCSOCLE and wCPASLE; wCHOMLE and wCOUTLE) are subcategories of the category of consumption and leisure. Descriptions of the data set are given in Table 5.

Table 5. *Description of Variables in the calibrated\_time File*

Variable	Description
PID	Cross Wave Person Identifier
wCPWORK	Calibrated time: minutes per day doing paid work, studying, and travelling
wCHWORK	Calibrated time: minutes per day doing routine housework, e.g. cooking, cleaning, and washing
wCOTHDOM	Calibrated time: minutes per day doing other unpaid domestic work, e.g. DIY, care, and shopping
wCSLEEP	Calibrated time: minutes per day sleeping, resting, and personal care
wCCONS	Calibrated time: minutes per day for leisure, consumption and other activities
wCPASLE	Calibrated time: minutes per day for “passive leisure”, e.g. watching video, reading books and magazines
wCSOCLE	Calibrated time: minutes per day for “social leisure”, e.g., meeting friends, playing sports, and cinema going
wCHOMLE	Calibrated time: minutes per day having leisure at home
wCOUTLE	Calibrated time: minutes per day having leisure outside the home

*Note:* w = d – n, indicating Wave Number



### CONCLUDING REMARKS

We have proposed and used a new method to produce calibrated time use estimates for a large-scale panel survey from evidence derived from a relatively small scale study that has both survey and diary data. This method has enabled us to enhance the quality of the time use estimates of the BHPS. The calibrated time use estimates produced cover all main categories of activities during a day. In addition to the strong panel characteristic of the BHPS, they are useful resources for the analysis of lifestyle patterns among different social groups and of how behaviours change over time. Specimen results derived from the calibrated time use estimates can be found in our forthcoming paper, which aims to investigate men's and women's use of time over the life course (See Kan & Gershuny, forthcoming).

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## APPENDIX I

## The 35 Pre-coded Activities in Home On-line Study

1. Sleep, rest
2. Washing, dressing
3. Eating at home
4. Cooking
5. Child-adult care
6. Housework
7. DIY, odd jobs, gardening
8. Travel
9. At the workplace
10. Paid work at home
11. Study at home
12. Study out of home
13. Voluntary work
14. Shopping etc
15. Concerts, cinema, theatre, etc
16. Walking, outings etc
17. Eating/drinking out
18. Visiting friends
19. Sports activity
20. Hobbies, games
21. TV
22. Videos
23. Radio, CD etc
24. Books/papers/magazines
25. Visited by friends
26. Getting phone calls
27. Making phone calls
28. PC games or consoles
29. Emailing
30. Using the internet
31. Using a PC for education
32. Using a PC for work at home
33. Using a PC for other purposes
34. Doing nothing, may include illness
35. Doing other things, not elsewhere specified

## APPENDIX II

Definitions of the Categories of Activities in the *calibrated\_time* file

Variable	Description of activities	Pre-coded activities in the HoL Study
wCPWORK	Paid work, study and travel	8 – 12, 32
wCHWORK,	Routine housework	4, 6
wCOTHDOM	Other unpaid domestic work	5, 7, 13, 14
wCSLEEP	Sleep, rest and personal care	1, 2, 34, 35
wCCONS	Consumption and leisure	3, 15 – 31, 33
wCPASLE	“Passive leisure”	3, 21 – 24, 28 – 31, 33
wCSOCLE	“Social leisure”	15 – 20, 25 – 27
wCHOMLE	Leisure at home	3, 21 – 31, 33
wCOUTLE	Leisure outside the home	15 – 20