Sampling, Nonresponse and Measurement Issues in the 1984/85 Swedish Time Budget Survey

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SAMPLING, NONRESPONSE AND MEASUREMENT ISSUES IN THE 1984/85 SWEDISH TIME BUDGET SURVEY *

by

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ABSTRACT

The 1984/85 Swedish Time Budget Survey (TBS) is a pilot survey aiming at testing a mixed mode design of administration of time diaries (face to face interviewing and self reporting) and studying nonresponse and adjustment for nonresponse. The survey also aims at producing some basic statistics about time use. The TBS sample comprises about 2,000 persons of which about 1,300 reported their time use for two days within one week. The dates for the self administered "today" diaries were assigned randomly and the interviews for recording the "yesterday" diaries were to take place four days prior to those designated dates. Almost 50 percent of the selected persons reported their time use for the designated day and some further 15 percent filled in the diary on a later date.

The response rates differed between interviewers, between demographic subgroups of the sample, and over time. There is no strong evidence of association between response behaviour and day of the week of the designated date, but Fridays and Saturdays were underrepresented for the "yesterday" diaries. Nonresponse adjustment based on estimated response probabilities within demographic groups slightly reduces the nonresponse bias for estimates of average income. Comparisons between estimates based on the two modes of data collection show no substantial differences in time spent on different activities as averaged over all respondents. There are, however, differences in the number of activities reported and in the mean duration among those who reported an activity.

KEYWORDS

time budget surveys, time nonresponse, diary surveys

CONTENT

1 INTRODUCTION

The demand for statistics on time use has increased steadily in Sweden since the early seventies. Due to financial constraints, however, only small-scale methodological studies or commissioned surveys limited in scope have been carried out by Statistics Sweden. For instance, the National Board for Consumer Policies (Konsumentverket) has funded some research work and participated with questions about time use in three consecutive mail omnibus surveys conducted by Statistics Sweden in 1982-83 (Konsumentverket, 1982 and 1984).

Awaiting funding of a full-scale survey, Statistics Sweden decided to carry out a pilot time budget survey in 1984/85. The purpose was twofold. First, there was a need to test if it was possible to obtain data with an acceptable quality by the time budget approach. Second, the pilot survey would provide some basic statistics on time use to illustrate the usefulness of this kind of statistics (to convince the users and, more importantly, the funding agencies, that a full-scale survey was needed). This second aim was given priority when it came to data processing and documentation. In fact, statistics from the survey were published before all planned methodological studies were finished (Statistiska centralbyrån, 1988). On the whole the survey is a low-budget project with several purposes of which some have been given priority to.

The design of the pilot survey as well as the motives for the choice of design are described in Section 2. The first subsection describes why a time budget approach was chosen and the content and coverage of the survey. The following subsections treat the design and administration of diaries, the sampling plan, and the estimation.

Section 3 is devoted to different aspects of the nonresponse issue; the survey climate, the interviewers' performance, nonresponse and adjustment for nonresponse, and the "time" nonresponse. In Section 4 results obtained from the two modes of diary administration are compared and discussed.

2 THE DESIGN OF THE PILOT SURVEY

2.1 General approach and motives for the choice of design

Statistics Sweden has reached the conclusion that a time budget approach with time diaries would be the best approach to provide statistics about time use. This approach is recommended in the literature and also used by most national statistical agencies that have conducted time use surveys (see, for instance, Robinson (1975) and the works edited by Szalai (1972) and by Juster and Stafford (1985)). The only reasons for not using this approach seem to be that it is rather expensive and that it might be difficult to get acceptable response rates and data quality. The alternative to a time budget approach would be a survey with more direct questions about the amount of time spent on selected activities. Discussions with potential users of statistics on time use, and a careful evaluation of their demands, made it quite clear, however, that a time budget approach would be necessary to produce some of the statistics they wanted (Hedlund and Rydenstam, 1983).

In addition, international studies have shown that a time budget approach is likely to provide more accurate estimates of average time spent on different activities than direct questions about frequency and duration of particular activities. The "activity" approach appears to yield larger estimates of time spent compared to a time budget approach (Robinson, 1977 and 1985 and Juster, 1985). The budget approach implies a direct consistency check of the aggregated

time and thus assures that the total time use becomes correct. Both approaches have drawbacks concerning the measuring of time spent on simultaneous activities, though. For instance, if a person is preparing food, looking after a child, and cleaning up at the same time, it is difficult to allocate the time on these three activities. In an "activity" approach the time may be counted three times, and in a budget approach two of the activities may be missing. To some extent this problem can be solved by recording primary as well as secondary activities in a time budget approach.

Time budget data are usually collected by time diaries. Alternative techniques, such as direct observation (by, for instance, video cameras) and beepers that go off by random intervals to signal the respondents to report current activities, were not considered to be superior to time diaries. Direct observations were rejected because of the costs involved, and the possibility of alteration of the respondents behaviour (Robinson, 1977 and 1985), and for privacy reasons. Beepers were assumed to be unsuitable for measuring outdoor activities (Robinson, 1985).

Given a time diary approach there were a number of alternatives to be considered regarding the coverage of population and time, classification and coding of activities, and design and administration of diaries. Content and coverage issues guided the choice of design, but we had to compromise between what was desirable and what was believed to be accomplishable. Concerns about large nonresponse rates were in many cases decisive. Rydenstam (1986) gives a comprehensive description of the alternatives considered and an evaluation of the pros and cons associated with different designs.

A time budget approach makes it possible to study a large number of various activities. The code used for classifying activities into categories in TBS is given in Appendix 1. This code refers to the classification of primary activities and contains 100 categories.

(Secondary activities were coded into ten categories only.) The structure of the code follows the concept, developed by Ås (1978), of four kinds of time;

1) Necessary time for sleep, meals, etc, (44-49 percent),
2) Contracted time for regular work (12-24 percent),
3) Committed time for housework, etc, (9-15 percent), and
4) Free time , the time left over (20-29 percent).

(The figures refer to results from time use studies conducted in ten industrialized countries and concern how the active population allocate the total time of a week (OECD, 1986)).

The TBS' code essentially coincides with those applied in time use surveys in other industrialized countries. There are some national differences, however. For instance, the 1965-66 Multinational Comparative Time-Budget Survey (Szalai et al, 1972) used ten categories for civic and collective participation activities, whereas the Swedish TBS used two only (not religious and religious, respectively). On the other hand, the Swedish TBS had more categories describing outdoor activities than the multinational survey (ten compared to three). It may also be noted that the most recent time use survey in the USSR (Belova and Dmitrichev, 1988) used eleven categories for classifying time spent on shopping and obtaining services compared to five in the multinational survey and the Swedish TBS.

The second aim of the survey, i.e., to produce some basic statistics, implied that the survey should be representative for a relevant population group and time span. It was regarded as most important to study the everyday-life among the active population. Therefore, it

was decided that the survey should cover all citizens aged 20-64 and the period November 1984 to May 1985, except for four weeks around Christmas and Easter. The rationale behind the choice of period, i.e., to exclude the summer, the early autumn and the weeks around the big holidays was that we expected large nonresponse rates during those periods. For the same reason it was decided that a person rather than a household approach would be used. (The Swedish annual surveys on living conditions had experienced great nonresponse problems associated with a household approach and had recently changed to a person approach.)

To obtain a representative sample according to both population and period, the persons and also the date or dates for which a selected person was to keep a diary had to be chosen by a probability sampling procedure. Kalton (1985) has shown that, considering costs, precision, and the possibility to measure the precision, a sample of two or more dates for each person would probably be most efficient. In spite of that, it was decided to select just one date for each person in the pilot survey. Again, it was feared that asking too much from the respondents would result in large nonresponse rates.

2.2 Design and administration of diaries

Among several alternative diary designs one was chosen that implied fixed time intervals (30 minute intervals between midnight and 5 am, and 10 minute intervals thereafter), and the activities written in words and then centrally coded. Regarding the administration of the diaries a mixed mode design, involving both interviewer administered and self administered diaries, was chosen.

An overall goal was to gather data as standardized as possible. In Norway and Finland fixed time interval diaries had been tested against open recording time diaries in pilot surveys, and the fixed interval method was found to be most advantageous (Lingsom, 1979 and

1980, and Niemi, 1983). For instance, in the Finnish survey it was found that the open method yielded large variation as to the quality of individual diaries. The Norwegian pilot survey also showed that the data editing and data processing were more complicated with the open method. A fixed interval approach measures the time less precisely than an open method does, at least theoretically, and is not suited for measuring activities of short duration. The advantages with this more standardized method were, however, judged to outweigh the disadvantages.

The choice not to use precoded activities was to some extent a consequence of the choice to use fixed time interval and self-reporting. A diary with both fixed intervals and precoded activities would be to ask too much from the respondents. This combination was used in the Danish time budget survey 1975 (Andersen, 1987), but in this survey the diary data were collected by means of telephone interviewing.

The diary was printed in a small handy format in an attractive light yellow colour. It contains nine openings, each with fifteen time interval rows for recording primary activity, secondary activity, and any other person present. The three last pages contain questions about particularities of the reported day (whether "typical" or not, whether the respondent was away from home that day, and whether the respondent was free from work or school that day, and, if so, for what reason), and questions concerning the diary keeping (when the respondent filled it in and if he/she had any problems with this task).

Regarding the administration of the diaries, most studies reported in the literature, for instance, the pretests for the multinational study 1965 (Szalai et al, 1972), suggest a "yesterday" interview. As a result of the pretests, the standard procedure for the multinational survey was an improved "yesterday" interview that

required two visits to each respondent. On the first visit an interviewer conducted a short interview and instructed the respondent how to use the forms for self-recording the next day. Two days later the interviewer would come back and conduct a "yesterday" interview based on the respondent's self-recording. The Swedish TBS was performed the other way around. Each respondent would keep a time diary during a randomly chosen day, and a few (if possible, four) days before that day an interviewer would visit the respondent and perform a "yesterday" interview as well as instruct the respondent how to fill in the diary. The same form of diary was used for both modes of collection.

The administration approach applied in the TBS required one visit only, and this would, of course, be much cheaper than the two visits approach applied in the multinational survey. In addition, we believed that self-reporting "today" would yield more accurate data than a recall "yesterday" interview, provided that the respondents had been properly instructed, and that the diaries were checked and completed by the interviewers. Thus, we believed that a face to face contact was needed, but hopefully just one. A second visit was replaced by a telephone contact. The main purpose of the interviewer's visit was to gather background data about the respondent and to instruct how to fill in the diary. We thought that the best way to instruct would be to actually fill in a real diary on the time use "yesterday". Besides the educational effect, we would thereby also obtain diary data for two days for each respondent. Although we expected that the quality of the self-reported data would be higher than the quality of the data from the "yesterday" interview, the latter might be good enough to be used to increase the precision of the estimates.

One of the crucial issues in the TBS was to get the respondent to report on the designated date and to get an interview a few (ideally

four) days before that date. Therefore, the interviewers were instructed to follow the schedule in Table 1.

Table 1. Schedule for the field work in the 1984/85 Swedish TBS

Day	Activity
-20	INT (the interviewer) receives material
-19 to -15	INT checks the SP's (selected person's) address and sends the advance letter
-14 to - 7	INT calls SP and they decide on a day for the interview
- 6 to - 1	INT visits SP, yesterday diary registration
0	SP keeps today diary, INT calls to remind
1	SP sends diary to INT
2 to 12	INT checks the diary (and calls SP for completion), and sends the diary to the central office

If the interviewer was not successful in getting an interview prior to the designated date, a delay of one or more weeks was accepted. The day of the week for the designated date must, however, not be changed. (This is in accordance with recommendations given by, for instance, Kalton, 1985.)

During the field work the interviewers should continuously report to the central office on the status of each case, i.e., the number of calls, the result of the calls, etc. To be able to judge whether the activities were reported in enough detail, the interviewers had been given a brief instruction on how the code was constructed. The coding was, however, conducted at the central office.

Though desirable, there was no independent verification of the coding operation due to the limited budget. There were, however, a dependent verification of the operation as well as various consistency checks of the codes. The code was hierarchical and the activities were denoted by figures according to this hierarchy. The coders were not familiar with the subject, however, and found it difficult to associate the combinations of figures with the verbal descriptions. Therefore, in a future survey, we consider to use abbreviations instead, and perhaps let the interviewers do the coding. (Automated coding is not likely to pay off for this kind of survey.)

2.3 Sampling design

The 1984/85 Swedish TBS is based on a two-stage sample of 2,080 persons aged 20-64. The primary sampling units (PSUs) consisted of about 200 uniquely defined interviewer areas of which 40 were selected with stratified probability proportional to estimated size (πpes) sampling with two PSUs per stratum. In the second stage a total of 52 persons were selected within each PSU through proportionate stratified sampling with strata defined by sex and age (three groups). Thus, the intention was to achieve a self-weighted sample and this goal was nearly fulfilled. For that reason we think it is justifiable that most of the results presented here are unweighted.

Two-stage sampling is not a standard method for surveys on individuals and households conducted at Statistics Sweden. One-stage sampling of persons from the Total Population Register (TPR) is the standard method applied. The reason for applying two-stage sampling for the TBS was an assumed advantage of using a limited number of interviewers. By this it would be easier and cheaper to give them adequate training and supervision. The choice of 40 interviewers, implying a total number of assignments of 52 persons each, would

yield a reasonably representative sample of interviewers and just right workload for each as well.

The survey should cover the period November 1984 to May 1985, excluding the four weeks around Christmas and Easter. That means 27 weeks or a total of 189 days. These days were randomly allotted to the selected persons in a stratified manner to assure representativeness according to the combinations of, on the one hand, demographic groups and interviewers, and on the other hand, days of the week and seasons. To each single day of the week, 297 persons (298 for Friday) were allotted and to each week 77 persons (78 for one week), which meant 4-18 persons for each single day of the period. Table 2 shows the outcome of the stratified selection of dates to selected persons.

Table 2. Number of selected diary dates by sex, age, month and day of the week in the 1984/85 Swedish TBS.

	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Total
ALL	297	297	297	297	298	297	297	2080
WOMEN	148	156	146	140	144	143	153	1030
20-34 years	46	45	44	50	49	48	49	331
35-49 years	57	55	54	50	50	52	57	375
50-64 years	45	56	48	40	45	43	47	324
MEN	149	141	151	157	154	154	144	1050
20-34 years	45	45	48	52	54	52	44	340
35-49 years	55	56	55	57	55	58	55	391
50-64 years	49	40	48	48	45	44	45	319
MONTHS								
Nov-Dec	92	90	90	91	85	83	85	616
Jan-Feb	85	82	89	91	82	99	88	616
March-Apr	63	69	73	58	67	60	73	463
May	57	56	45	57	64	55	51	385

It was not possible to achieve exactly uniform distributions according to all dimensions considered, i.e., to obtain that each day of the week was selected to exactly 1/7 of the persons belonging to each interviewer (area), and to exactly 1/7 of the persons in each demographic group, etc. Table 2 shows, however, that the outcome of the stratified sampling is quite good. The distribution of diary dates over interviewers is also nearly uniform due to the stratification. Of the 52 persons assigned to each interviewer, 6-9 were allotted to each single day of the week and 1-3 to each single week. Thus, the design is almost experimental when it comes to comparisons between different demographic groups, different days of the weeks, different seasons, and different interviewer areas. For each factor compared, the others are (almost) under control. No standardization is necessary.

2.4 Estimation

The second goal of the pilot survey was to provide some basic statistics. Estimates of the time use for the total population and time period investigated had to be produced. When calculating such estimates the response behaviour was assumed to be stochastic and constant within identifiable groups of individuals for which it was possible to estimate the response probabilities. By means of estimated response probabilities and the known selection probabilities, the "total inclusion probabilities" were estimated and used to compute modified Horvitz-Thompson estimates. Separate estimates were calculated for each day of the week and then averaged to yield estimates for the average weekday and average week, respectively. (Due to the small number of observations, no separate estimates were published for weekends.)

A few alternatives of forming homogeneous response behaviour groups were considered and tested. The final choice was twelve groups defined by sex, age (three groups) and marital status (two groups: married and unmarried). Although considered, it was decided that no adjustment should be done as for the large differences in response rates between interviewers (see Section 3.2). Only 52 persons were assigned to each interviewer and if we were to account for both the interviewer and some other factor, the resulting groups would be too small. Since the respondent's demographic characteristics were believed to have a greater effect than the interviewer on both response behaviour and time use, the demographic variables were chosen for estimating response probabilities. Later analyses have shown that the response rates differed over time and that we perhaps should have adjusted for this.

As mentioned, the "today" diary was the primary collection method. We expected that it would yield data of higher quality than the secondary "yesterday" diary method. Data from the latter would be

used only if they were found to be reasonably accurate. Separate estimates were calculated for each mode of collection and then compared. Since we did not find any substantial differences between these estimates (see Section 4), it was decided that the "yesterday" diary data should be used to increase the precision of the estimates. The final combined estimates were obtained by averaging the estimates based on respective type of diary. It is not to be expected that the use of the "yesterday" diary reports increases the precision very much, since the within-individual correlation between the two types of data are rather large for several activities. This will be further investigated.

It is not possible to get unbiased variance estimates that take the variation between days for a single individual into account, since only one cluster of two days is observed for each individual. To get rough variance estimates of the weighted population estimates, we have planned to use a modification of the ultimate cluster technique, i.e., estimate the variance between estimated PSU-totals within strata. The idea is to use both the "with replacement" pps-formula and the "without replacement" Yates-Grundy πps-formula to calculate bounds for the variances (see Wolter, 1985, pp 43-47), and perhaps also balanced repeated replication (Wolter, 1985). Appropriate Taylor approximations are of course needed for the "ultimate cluster" estimators, since the estimators are far from linear. So far, however, we have not been able to perform the calculations by means of PC-SAS. Other PC-software, such as PC-CARP (Statistical Laboratory, Iowa State University) or the new SUDAAN system (LaVange and Shah, 1988), are considered. The old SUDDAN system (Shah, 1981 and 1982) or Statistic Sweden's general purpose variance programmes for the mainframe are still other options.

Standard errors presented for unweighted results in this paper are calculated assuming simple random sampling.

3 NONRESPONSE

3.1 Factors causing nonresponse

There are many interrelated factors causing nonresponse in the TBS. The survey climate and the skill of the interviewers are general factors that affect most surveys, irrespective of their subject and design. There are also factors associated with respondent characteristics that seem to be general. For instance, some demographic groups are difficult to get to participate in any survey in Sweden (Lindström, 1983). In addition to general nonresponse generating factors, the TBS had special problems being a pilot survey, treating a sensitive matter, and requiring some efforts on the part of the respondents. Furthermore, the interviewers had to contact the respondent in time. When the designated date had passed, the record for that day was lost.

The privacy issue has become more and more important in Sweden and other Western European countries where the public debate about invasion of privacy in surveys has been going on since the 1970 censuses (Dalenius, 1988). Whether or not this debate originated from the average Swedish citizens, Swedes are now quite aware of this issue and often refuse to participate in surveys due to "privacy" reasons and the fear to be "registered". Since the early seventies the nonresponse rates, and especially refusals, have increased dramatically in Sweden . For instance, the nonresponse rates have increased from 2-3 percent (1970) to 11 percent (1987) in the Labour Force Survey (Lindström and Dean, 1986, Lundquist, 1988). In the 1988 Household Expenditure Survey the nonresponse rate would probably have exceeded 40 percent had not special measures been taken.

3.2 Interviewer performance

The privacy debate had a strong effect on the interviewers. They were not familiar with potential respondents being more willing to argue and question than ever before. Statistics Sweden undertook several actions to counteract the increase in nonresponse rates. Among these actions were special efforts to educate and train the interviewers so that they could better deal with reluctant respondents. The number of interviewers was also reduced from some 500 to about 200 at present, and the average number of hours worked per year has increased from about 400 to about 1100. By this the interviewers are likely to have adopted a more professional attitude towards their work, and it has become easier for the central staff to monitor the field work. In fact the nonresponse rates decreased somewhat in the late seventies and the early eighties. (Thereafter the nonresponse rates began to increase again to reach a very high level in 1986 during the so called Metropolitan debate (see Dalenius, 1988). This, however, happened after the TBS was carried out.)

In many surveys on individuals and households we have found that the response rates differ between interviewers much more than would be expected by chance. To some extent this is a consequence of the fact that the interviewers work in different geographical areas. For instance, people in large cities are generally much more reluctant to participate in surveys than people in rural areas. Lundström (1987) has investigated to what extent differences in nonresponse rates between different interviewer areas can be explained by differences in the demographic structure. His study is based on the Swedish Labour Force Surveys conducted in January through March 1986. Among ten potential predictors, three proved to explain the differences in nonresponse rates best, namely, percentage cohabiting, large cities/other areas, and percentage immigrants (the last two interacting). By means of these predictors, expected nonresponse

rates were calculated for each interviewer area and compared with the observed rates. It turned out that for some interviewer areas the differences between the expected rate and the observed rate were very large, up to 15-20 percentage points. Other factors than those accounted for in the prediction model must be sought. It is reasonable to believe that the interviewer's competence is one such factor.

For the 1984/85 TBS the differences in response rates between interviewers were larger than expected (Table 3). Apart from the fact that the interviewers worked in different areas with different survey climate, the other conditions were essentially equal according to the sampling plan. Each interviewer had an workload of exactly 52 sampled persons stratified by sex and age. Each interviewer should persuade one or two persons per week to participate in the survey, and the distribution of diary dates over days of the week and season was equal for all interviewers.

Table 3. Interviewer performance measured by number of completed "today" diaries and number of those kept on the selected date in the 1984/85 Swedish TBS. Number and percent of 52 allotted diaries

	Worst	Lower quartile	Median	Upper quartile	Best
Completed diaries	16(31%)	29(56%)	33(63%)	39(75%)	48(92%)
of which on selected date	5(10%)	18(35%)	24(46%)	31(60%)	44(85%)

Of the total allotment of 52 sampled persons, one interviewer could persuade just 16 persons to keep a diary and no more than five persons to keep it on the selected date, while another interviewer obtained 48 completed diaries of which 44 were kept on the selected date. It is not likely that these observed differences in response

rates are due to just chance or admitted differences in survey climate between areas. On the other hand we cannot say that some interviewers are throughout competent and others throughout incompetent. A comparison of 31 interviewers (or rather interviewer areas) contained in the study conducted by Lundström and also selected for the TBS, shows that the interviewers' performance in the two surveys were not completely consistent. Some interviewers with low response rates in the LFS had large response rates in the TBS and vice versa. (The product moment correlation is 17 percent and the rank correlation 24 percent only).

It appears that some interviewers are more successful in achieving high response rates in the LFS using telephone interviewing than in a face to face diary survey like the TBS (and vice versa). The question is, whether we could account for this when allocating sampled persons to the interviewers. We have not systematically investigated the interviewers' performances regarding the data quality. It may be that those interviewers who managed to achieve a high response rate did so at the expense of lower data quality. A simple measure of the data quality in diary surveys is the number of items recorded (i.e., purchases, activities etc). Using such a measure for TBS shows that for those interviewers who reached a high response rate, the number of activities reported was slightly greater than for those who reached a low response rate (see Table 4).

Table 4. Number of different activities reported by the interviewer's response rate, mode of diary administration and response dent's sex in the 1984/85 Swedish TBS. Women and men aged 20-64.

Mode of administration	Response rate % 31-63	65-92	Difference (s.e.)	Response rate % 31-63	65-92	Diference (s.e.)
	FEMALE RESPONDENTS			MALE RESPONDENTS		
Interviewer	27.5	29.8	-2.3 (0.6)	23.2	24.2	-1.1 (0.5)
Respondent	33.1	34.4	-1.4 (0.8)	26.9	27.0	-0.1 (0.6)

Assuming that interviewers with a low response rate would generate more sample bias than those with a high response rate, the results in Table 4 are quite surprising. It would be expected that those persons persuaded to participate by a "low response rate" interviewer (or rather within a "low response rate" area) are persons who have fewer objections to surveys and are most keen on doing a good job. Of course, persons who are less busy might be the easiest ones to get to participate in this kind of survey. In any case, the results do not indicate that interviewers reaching a high response rate are less careful when gathering and checking the diaries than those reaching a low response rate. (The differences in number of reported activities between the two modes of data collection are discussed in Section 4.)

We have not found any differences in the demographic structures of the respondents nor in the distributions over reported days of the week between the "low response rate" interviewers and the "high response rate" interviewers.

3.3 Person nonresponse and nonresponse adjustment

As previously mentioned there is a hard core, i.e., persons who are difficult to contact or who are reluctant to participate in any

survey, irrespective of its subject and design. In most Swedish surveys, the nonresponse rates are largest among the oldest and among those living alone. This was the case for TBS as well. Among those aged 50-64 and not married, no more than 45-46 percent of the sampled persons completed the "today" diary and less than 40 percent did it on the selected date (Table 5). Overall, the response rates are larger for married persons than for unmarried persons. This difference is more pronounced for men than for women, but on the whole women and men have the same response pattern. For both sexes, 47 percent completed the "today" diary on the selected day and a further 15-16 percent completed it one or more than one week later. Only 38 persons (2 percent) agreed to be interviewed but did not bother to fill in the "today" diary.

Table 5. Response behaviour by sex, age, and marital status in the 1984/85 Swedish TBS. Percent of total sample

Age	Today diary completed		Today diary nonresponse		Total	Base
marital status	on selected date	on later date	Interview conducted	No interview conducted		
			W O M E N			
20-34 years						
married	54	11	3	32	100	125
unmarried	44	19	0	37	100	206
35-49 years						
married	54	20	1	25	100	270
unmarried	46	19	3	32	100	105
50-64 years						
married	41	11	1	47	100	225
unmarried	39	7	2	52	100	99
			M E N			
20-34 years						
married	49	21	5	25	100	95
unmarried	43	19	2	36	100	255
35-49 years						
married	52	17	0	31	100	277
unmarried	38	11	3	48	100	114
50-64 years						
married	54	15	3	29	100	234
unmarried	34	11	2	53	100	85
All	47	16	2	36	100	
Number	975	327	38	740	2080	2080

Chi-Square=96.7 (df=33)

The differences in response behaviour are likely to be associated with differences in time use, i.e., the differences make the survey estimates biased. To reduce the bias an adjustment technique was used, based on estimation of response probabilities for groups defined by sex, age, and marital status (see Section 2.4 above). This adjustment does not reduce all the bias, since the stratification

variables are rather rough indicators of real living conditions. For instance, of those not married (in the relevant age groups) 30 percent are cohabiting (according to census' statistics).

To evaluate the effect of the nonresponse adjustment, estimates of average income (according to register information) were computed for the total sample and for the respondents. For the latter two weighting techniques were used; weighting that accounts for the sampling probabilities only, and weighting that in addition accounts for the (estimated) response probabilities. The results are shown in Table 6.

Table 6. Unweighted, weighted, and nonresponse adjusted estimates of average income by sex and age. The 1984/85 Swedish TBS. 1000 SEK

		Women			Men			Women	Men	All
		20-34	35-49	50-64	20-34	35-49	50-64			
Unweighted										
respondents	a	50	56	51	64	101	108	53	91	72
total sample	b	48	57	52	62	97	102	53	87	70
difference	a-b	1.6	-0.1	-0.8	1.8	3.5	5.7	0.5	3.4	2.2
(s.e.)		(1.1)	(1.2)	(1.9)	(1.2)	(1.9)	(2.9)	(0.8)	(1.3)	0.8
Weighted										
respondents:										
not adjusted	c	51	58	52	64	99	108	54	89	72
adjusted	d	51	58	52	64	98	106	54	88	71
total sample	e	49	58	53	62	97	102	53	86	70
difference	c-e	2.0	-0.4	-0.8	2.0	3.0	6.2	0.6	3.4	2.3
difference	d-e	2.0	0.1	-0.5	1.5	1.9	4.5	0.6	2.6	1.7
Base respondents		210	266	162	218	246	199	638	663	1301
Base sample		331	375	324	340	391	319	1030	1050	2080
Response rate %		63	71	50	64	63	62	62	63	63

Note: Of 1302 completed self administered diaries one was found not acceptable and deleted.

The estimates based on the respondents only are positively biased for men and for the youngest women. This is what would be expected considering, on the one hand the relation between response behaviour and marital status (shown in Table 5), and on the other hand the fact that married men have larger income than unmarried men. (For middle-aged women the opposite is true.) By adjusting for the differences in response rates between the different demographic groups the bias is only slightly reduced. The bias amounting to 6,200 SEK (6 percent) for men aged 50-64 is reduced to 4,500 SEK (4 percent) and for all men the bias is reduced from 3,400 SEK (4 percent) to 2,600 SEK (3 percent).

Regarding the bias of estimates of time use one can only speculate. The results presented in Table 6 indicate, however, that estimates of time spent on activities correlated with large income are afflicted with a positive bias and vice versa. It should be noted, though, that the Swedish TBS does not appear to be more affected by differential nonresponse than other surveys in Sweden and other countries. For instance, in the 1981 Canadian Time Use Pilot Study those with more extensive education were overrepresented as reported in Kinsley and O'Donell, 1983.

3.4 Time nonresponse

In addition to person nonresponse, a time budget survey is affected by time nonresponse, i.e., the observation is not obtained for the selected date. In some time use surveys this problem is "solved" by letting the interviewer or respondent report on a "convenient" day. Obviously, such an approach may introduce bias in the estimates, since the respondent may choose a day when he/she is not busy, a day he/she is not engaged in socially unacceptable activities, a day he/she thinks is "representative", etc. A designated day approach

aims at achieving a representative sample in the time dimension in addition to the representativeness in the person dimension. There is no guarantee that this representativeness is obtained, however, since the sampled person may choose not to participate at all, or at least not on the designated date.

In the TBS no more than 47 percent of the sampled persons consented to fill in the time diary on the designated date. Some further 16 percent postponed the diary keeping one or more than one week. Since it was not allowed to change the day of the week for the reported day, there is some resemblance with quota sampling regarding the representativeness in the time dimension. The interviewing was recommended to take place four days before the designated date, in order to achieve representativeness for the "yesterday" diaries as well. Deviations from this recommendation were rather frequent, though. Of those who completed the "today" diary, only 43 percent were interviewed four days before "today". The common pattern of the deviations from the recommendation is that weekends were avoided, which resulted in larger response rates for Fridays and Saturdays for the "yesterday" diary (see Figure 1 and Table 7).

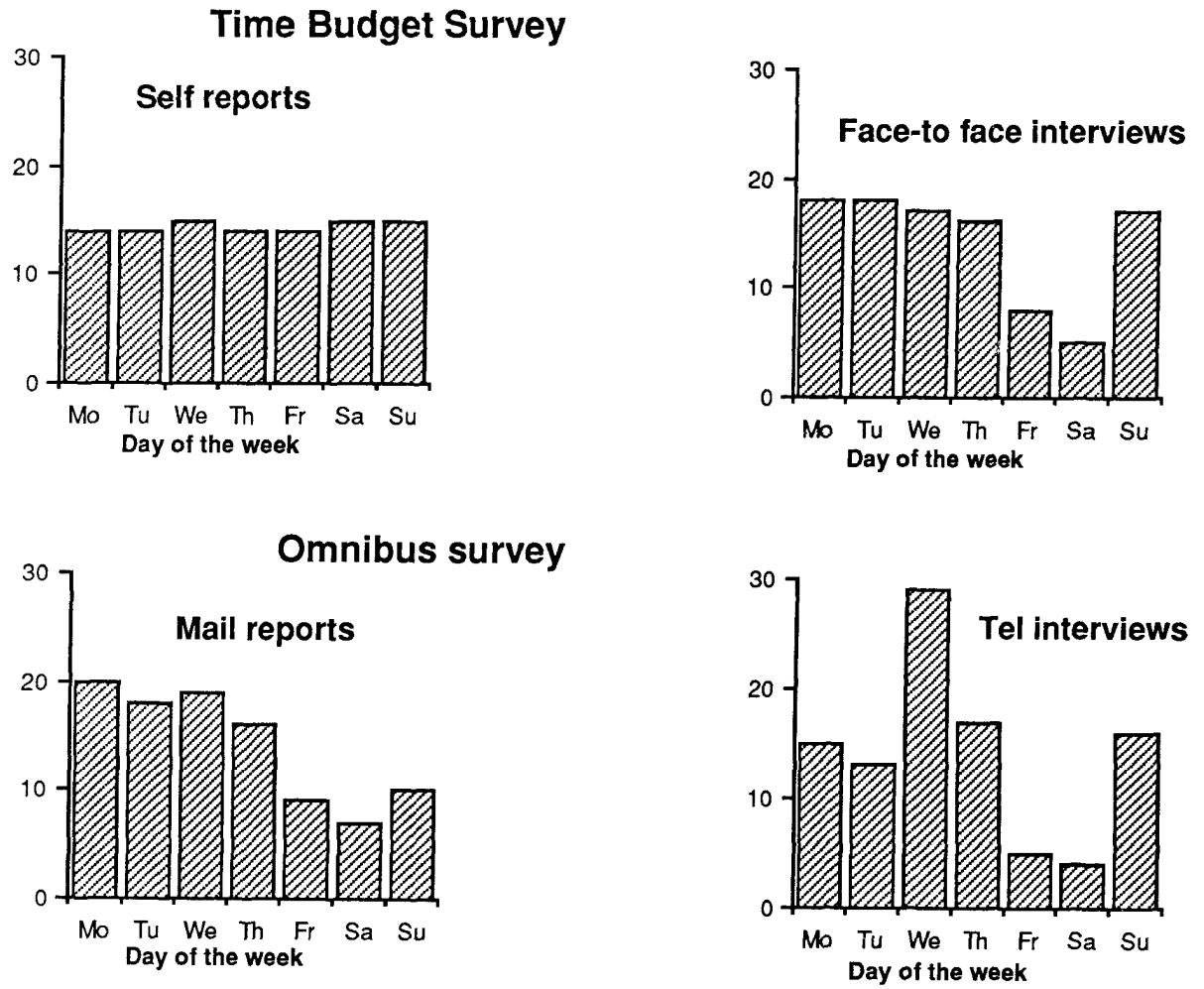

Figure 1. Distribution of time use reports by day of the week in the 1984/85 Swedish TBS and the 1982/83 Swedish mail omnibus survey, by mode of data collection. Women and men aged 20-64 and 16-74, respectively. Percent

Obviously, the interviewers and the respondents find weekends less convenient than weekdays for interviewing. This was also found in the previously mentioned mail omnibus survey carried out by Statistics Sweden in 1982/83 (see Figure 1). In this survey a subsample of the mail nonrespondents was followed-up by telephone interviewing to collect data about the time use "yesterday". As in the "yesterday"

part of the TBS, Fridays and Saturdays became underreported in the omnibus survey due to the fact that interviewers are reluctant to work on weekends. More surprising, however, is that Fridays, Saturdays, and Sundays were underreported in both the mail reports and the telephone reports of the omnibus survey. The respondents appear to find these days less suitable for diary reports. One explanation may be that the respondents do not think these days are representative for their time use. (The omnibus survey comprised 2,420 persons of which 1,648 or 68 percent responded by mail, and of those 397 subsampled 207 or 52 percent were interviewed.)

Table 7. Number of completed diaries by day of the week and mode of diary administration in the 1984/85 Swedish TBS. Women and men aged 20-64.

Mode of administration	Mon	Tue	Wed	Thu	Fri	Sat	Sun	All days
			W O M E N					
Interviewer	126	121	112	94	50	26	109	638
Respondent	89	92	90	85	90	95	97	638
			M E N					
Interviewer	111	114	109	111	59	44	116	664
Respondent	93	87	99	96	95	99	95	664

Table 7 shows that representativeness according to the day of the week was achieved for the "today" diary in the TBS. This means that there seems to be no correlation between the propensity to respond and designated day of the week. Furthermore, as Table 8 shows, there is no strong evidence that certain days of the week are more afflicted by postponements than others. Perhaps days in the middle of the week are less afflicted for the "today" diary and the weekends less afflicted for the "yesterday" diary. The differences are, however, within the 95 % confidence interval. On the whole, the

results in Tables 7 and 8 suggest that a designated date approach is needed in order to obtain representativeness regarding days of the week reported. The results also suggest that self-reporting supervised by an interviewer appears to be the most efficient way to stick to the selected day of the week.

Table 8. Percentage delayed diaries of those completed, by mode of diary administration in the 1984/85 Swedish TBS. Women and men aged 20-64. Percent

Delay	Mon	Tue	Wed	Thu	Fri	Sat	Sun	All	Number
				INTERVIEWER ADMINISTERED					
No delay	73	70	72	79	82	86	75	75	975
1 week delay	15	19	21	15	10	13	13	16	208
2-5 week delay	12	11	7	7	8	1	12	9	119
Total	100	100	100	100	100	100	100	100	
Base	237	235	221	205	109	70	225	1302	1302
				SELF ADMINISTERED					
No delay	71	74	82	78	76	70	72	75	975
1 week delay	23	16	8	13	11	20	21	16	208
2-5 week delay	6	10	10	9	13	10	7	9	119
Total	100	100	100	100	100	100	100	100	
Base	182	179	189	181	185	194	192	1302	1302

If we look at the relation between the response behaviour and season for the selected date, we find substantial and statistically significant differences, though. See Table 9. During the first months of the survey, 54 percent of the selected persons filled in the diary on the selected date compared to 33 percent during the last month. This is probably a seasonal effect. It was difficult to get in touch with people during the late spring because one holiday followed the other (Easter, the first of May, Ascension Day, and Whitsun).

Table 9. Percentage completed diaries and delays by selected season in the 1984/85 Swedish TBS. Women and men aged 20-64. Percent

Delay	NOV-DEC	JAN-FEB	MAR-APR	MAY	All
TOTAL	63	65	61	61	63
no delay	54	50	45	33	47
1 week delay	7	11	10	14	10
2-5 week delay	2	5	6	14	6
Base	616	616	463	385	208

Figure 2 shows in more detail how the response pattern varies over the weeks. The lower area shows the number of diaries selected to a specific week and also completed during that week. The area between the lower curve and the dotted line (77) represents the time nonresponse. The single line represents the "delays from specific the week", i.e., diaries selected to that week but filled in later.

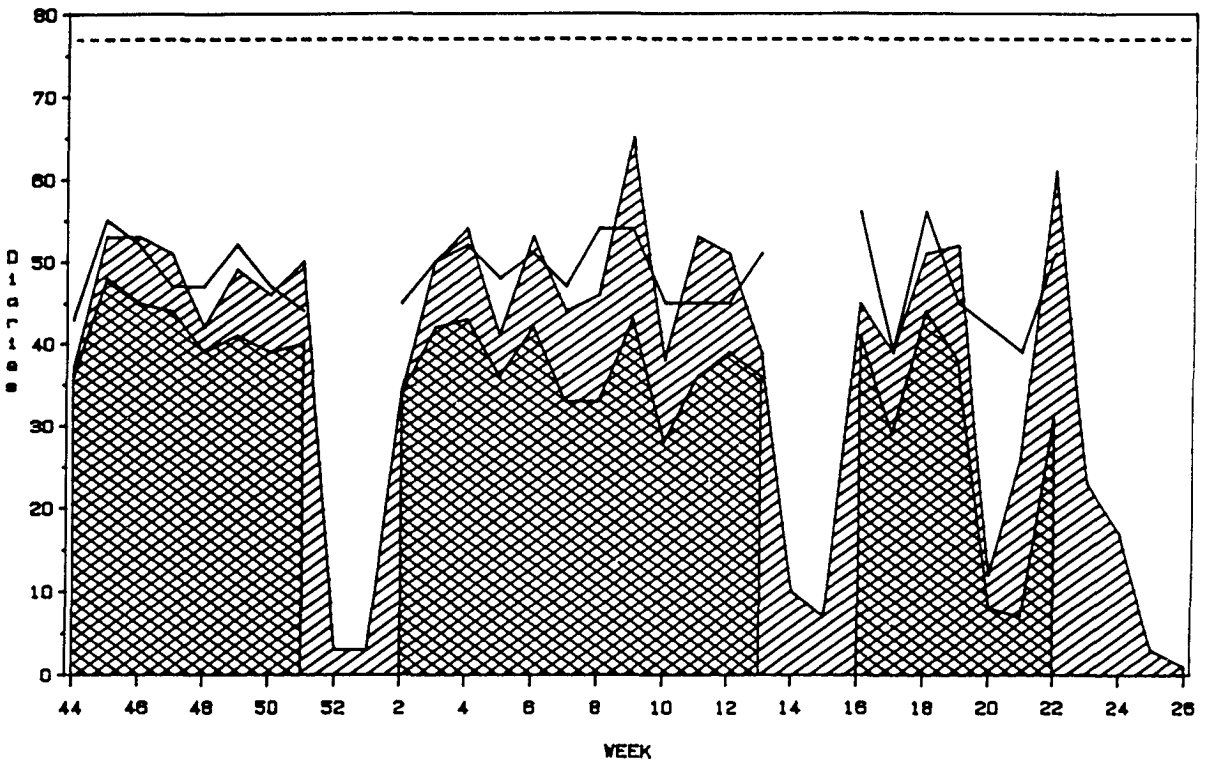

Figure 2. Number of completed diaries in the 1984/85 Swedish TBS, by week.
Note that the weeks around Christmas and Easter (no. 52-1 and 14-15) were excluded from the selection of diary dates.

The segment between the two filled curves in Figure 2 represents the "delays to the specific week", i.e., diaries completed during that week though selected to an earlier week. These diaries may be regarded as non-random substitutes for those delayed from the specific week (the single line). It seems reasonable to use these substitutes in the estimates. Those who postpone the diary keeping are expected to differ from those who fill in the diary on the selected date, and would therefore generate bias if not used. We

have no strong empirical evidence, however, that those who postpone differ from the other respondents. Table 10 shows that the differences between the two groups regarding employment status and whether they have children living at home are rather small and not statistically significant. Perhaps full-time working women are more inclined to postpone the diary-keeping than other women. Furthermore, we have not found any substantial differences in the diary reports between those who postpone versus the other respondents, at least not regarding time spent on aggregated groups of activities. This will be further investigated, though.

Table 10. Comparison between respondents who filled in the diary on selected date versus those who postponed the diary keeping regarding employment status and children aged *0-16 living at home. The Swedish 1984/85 Time Budget* Survey. Women and men aged 20-64. Percent

Diary kept	NOT EMPLOYED			PART-TIME WORK			FULL-TIME WORK			TOTAL	Base
	Total	Children		Total	Children		Total	Children			
		Yes	No		Yes	No		Yes	No		
					W O M E N						
on selected date	19	13	6	41	16	25	40	21	19	100	481
later	17	13	4	36	15	21	47	26	20	100	157
					M E N						
on selected date	11	9	1	4	2	2	85	44	41	100	494
later	8	8	0	5	4	1	87	44	44	100	170

The problem with postponements is that they are probably associated with the respondent's time use during the selected day. Possible causes of postponements (and total nonresponse) are that the

respondent during the selected date is busy, is travelling, is ill in bed, etc. All these factors have an effect on the time use. The effect of such factors is that "typical" days become overrepresented. Apparently, however, these factors do not seem to have caused all the nonresponse due to "atypical" days. Table 11 shows that quite a large percentage of the respondents said that the reported day was rather "atypical" for that day of the week or that they were away on a travel that day.

Table 11. Percentage of respondents saying the reported day was rather atypical for that day of the week or that they were travelling that day, by weekdays and weekends, and by mode of diary administration. The 1984/85 Swedish TBS. Women and men aged 20-64.

Mode of collection diary kept	WEEKDAYS			WEEKENDS		
	WOMEN	MEN	ALL	WOMEN	MEN	ALL
			RATHER ATYPICAL DAY %			
Interviewer	36	29	32	39	34	36
Respondent	24	19	21	26	33	30
on selected date	25	16	20	27	34	30
delayed	20	29	25	25	31	28
			TRAVELLING THAT DAY %			
Interviewer	10	13	12	16	16	16
Respondent	12	18	15	22	16	19
on selected date	12	16	14	20	15	18
delayed	11	24	19	27	18	23
Bases:						
Interviewer	512	521	1033	143	164	347
Respondent	446	470	916	192	194	386
on selected date	349	351	700	132	143	275
delayed	97	119	216	60	51	111

The differences between the two modes of collection, and between those who filled in the diary on the selected date versus those who did not, are in general rather small. The differences in the percentages saying that the day was "rather atypical" between the two modes of diary administration are significant on the 5 percent level, though. We believe that these differences are pure mode effects rather than sample bias caused by time nonresponse. Time use is a rather private matter and by saying that the day was not typical the respondent has not exposed too much of his/her lifestyle. (When the respondent filled in the self administered diary he/she was not to meet the interviewer again.)

The possible effects of the time nonresponse cannot be assessed due to lack of information. In a future survey we will instruct the interviewers to record the reasons for postponements. Perhaps there is no strong association between nonresponse and time use during the selected day, but rather a question of time needed to get in touch and for persuasion.

4 COMPARISON BETWEEN THE TWO MODES OF DATA COLLECTION

There are several differences between the modes of data collection that should produce differences in the response patterns. First, the "yesterday" data were collected from an unaccustomed respondent not previously confronted with a time diary, whereas the "today" data were reported by a "trained" respondent. Second, the "yesterday" data were gathered retrospectively and likely to be afflicted by recall bias. Third, the "yesterday" data were collected in an interview situation that may cause some interviewer related bias and overreporting of socially desirable behaviour. This third factor is not eliminated completely for the self administered diary, since the interviewers instructed the respondents how to fill in the diary and also checked it. On the whole, however, these factors are all likely

to result in higher quality of the "today" data compared to the "yesterday" data.

Without any true records of the respondents' time use it is not possible to measure the errors in any of the two types of diaries. We can, however, compare the response patterns and, if they are essentially equal, establish that the two modes of collection yield data of about the same quality. If the patterns differ it is often possible to judge which of the modes are superior, at least regarding certain aspects of quality. For instance, for diary surveys the number of items reported is a quality measure that most researchers find relevant. It is not believed that respondents invent and report nonexisting items (or change of activity as in time diary surveys). The diaries based on self-reporting in the course of the day are expected to yield a greater number of reported activities compared to the "yesterday" recall diaries. In the so called 1973 "Jackson study" the respondents reported 33.3 primary activities in the self-reporting diaries compared to 31.4 for the yesterday recall diaries; and in the 1965-66 American Time Use Survey the experiment group reported 27.0 activities in their "tomorrow" diaries (based on self-reporting in the course of the day) compared to 25.0 activities in their yesterday recall diaries (Robinson, 1985). The Swedish TBS showed even larger differences; 30 compared to 24 activities (Table 12).

Table 12. Comparison between the number of activities reported in the interviewer administered versus the self administered diaries in 1984/85 Swedish TBS. Women and men aged 20-64.

Mode of administration	Number of activities			Average number of activities					
	Lower quartile	Median	Upper quartile	ALL mean	s.e.	WOMEN mean	s.e.	MEN mean	s.e
Interviewer	21	25	30	26	(0.2)	29	(0.3)	24	(0.3)
Respondent	24	29	36	30	(0.3)	34	(0.4)	27	(0.3)
Difference	-3	-4	-6	-4	(0.3)	-5	(0.3)	-3	(0.3)

The quartile values in Table 12 show that 50 percent of the respondents reported between 21 and 30 activities in the yesterday diaries and 50 percent reported between 24 and 36 activities in the today diaries. Furthermore, the differences in average number of reported activities are larger for women than for men, and women reported more activities than men, irrespective of mode. The latter is probably a combined effect of two factors; Women change between activities more frequently than men, and women are in general more careful in making notes. The aggregate estimates of time use are, however, very similar for the two modes of data collection. This is also consistent with results presented by Robinson (1985). See Table 13 that compares results from two American surveys with the TBS' results regarding aggregate time estimates.

Table 13. Comparison between aggregate time estimates for activities reported by "fresh" respondents (for "yesterday") versus those reported after an initial interview (for "tomorrow" or "today"). Percent of total time (24 hours)

Activity category	USA 1965-66 National Sample +Jackson Sample All aged 18-64		USA 1973 Jackson Sample Women		SWEDEN 1984-85 TBS All aged 20-64	
	Yesterday	Tomorrow	Yesterday	Tomorrow	Yesterday	Today
Work-Related	- 18.6	18.9	- 8.2	10.1	+ 20.0	19.6
Housework	- 9.7	10.3	+ 13.5	13.4	- 9.7	10.1
Child care	+ 3.0	2.3	+ 4.0	3.8	- 2.0	2.2
Shopping	- 3.6	3.8	- 2.3	3.9	- 3.3	3.4
3.3 3.4						
Personal care	+ 44.1	43.4	- 44.0	44.2	- 41.8	42.1
Adult Education	+ 1.2	0.9	- 0.7	0.9	+ 1.5	1.3
Organizations	- 1.3	1.4	+ 2.9	1.4	- 0.6	0.7
Social Entertainment	5.6	5.6	+ 6.1	4.3	+ 5.3	4.9
Active Leisure	+ 2.6	2.1	- 3.0	3.6	- 2.7	3.1
Passive Leisure	- 9.9	11.2	+ 15.1	14.7	- 9.4	9.5
Other free time	..	..	..	..	+ 1.8	1.3
Travels, free time	..	..	..	..	1.5	1.5
Others	0.4	0.1			0.4	0.4
Total	100	100	100	100	100	100
Bases	292	2024	96	96	1301	1301

Source: Robinson (1977 and 1985)
Note: Travels are classified differently in the American surveys and TBS

The sum of the absolute values of differences between the two types of diaries is, as would be expected, largest for the small Jackson Study, and smallest for the relative large TBS. It is difficult to see any common pattern in the three surveys. For just one activity group the differences have the same sign; in all three surveys the yesterday diary appears to underestimate the time spent on shopping. What is most striking is how similar the distributions are over time and between countries. There are very small differences between the 1965-66 US survey and the 1984-85 Swedish TBS that refer to both sexes. (The differences regarding "child care" are probably explained by the 1965-66 baby boom.)

Figure 3 (based on the results in Table A1 in Appendix 2) also shows that the TBS' differences in aggregate time estimates between the two modes of data collection are small. Moreover, the differences for some activity groups have opposite signs for women and men. The interviewer administered yesterday diary seems to overestimate the time spent on market work for women (+ 15 minutes) but underestimate that time for men (-6 minutes), whereas the opposite seems to be true for time spent on "free activities" (-4 minutes compared to +10 minutes).

The time estimates shown in Figure 3 weighted (see Section 2.4). Therefore, the differences cannot be explained by the differences in distributions over days of the week. The differences may, however, be explained by chance. It should also be noted that the collection technique implies that the differences cannot be too large. For both modes of data collection the total amount of time is 1440 minutes, and a large part of this time is spent on personal needs (sleep, meals, etc), activities that are not likely to be forgotten, irrespective of how the diary is administrated.

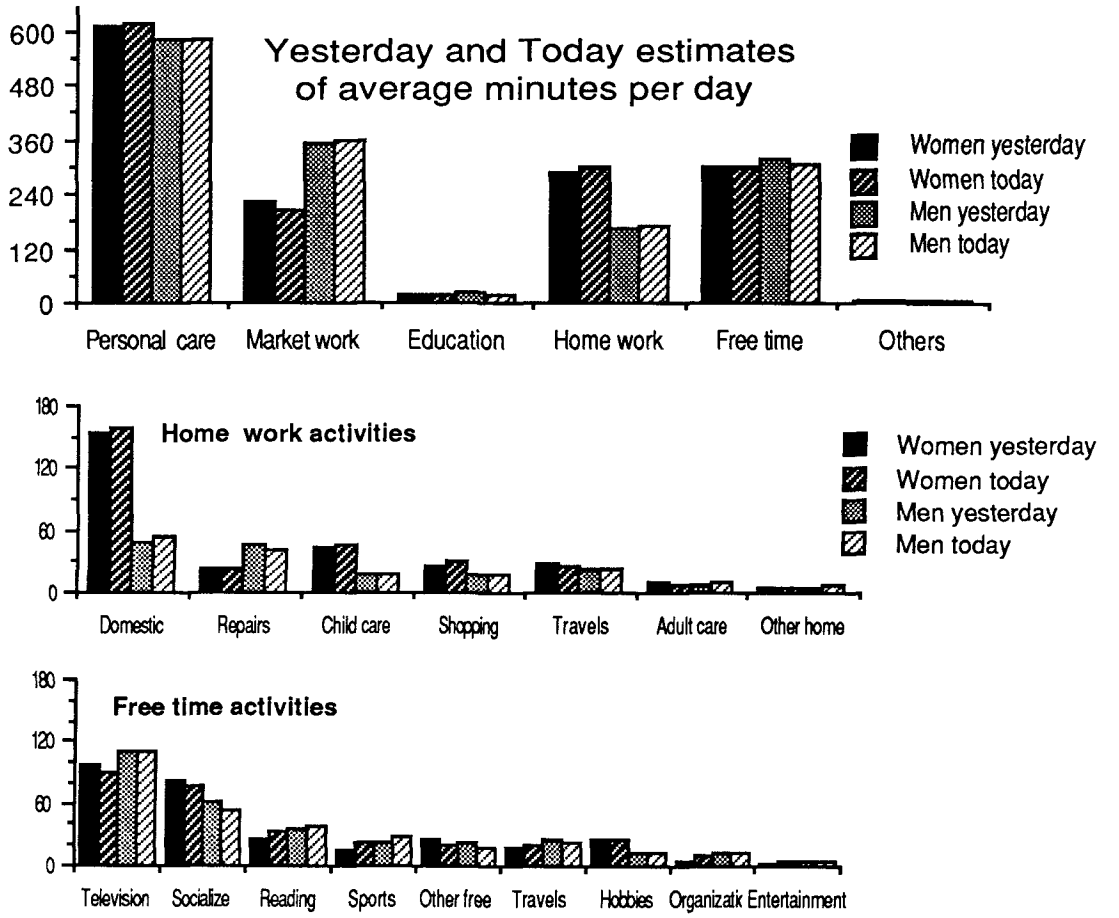

Figure 3. Comparison between aggregated time estimates based on yesterday and today diary reports for all days of the week. The 1984/85 Swedish TBS. Women and men aged 20-64. Average minutes per day for all.
(The figures are given in Table A1 in Appendix 2.)

The fact that fewer activities are recorded in the interviewer administered diaries than in the self administered diaries, suggests that the former also record fewer different activities (according to the code used), and, as a consequence, underreport the number of

that the former also record fewer different activities (according to the code used), and, as a consequence, underreport the number of participants in different activities. If so, the average duration for participants would be larger in the interviewer administered diaries, since the mean time averaged over all persons is about the same for the two modes of administration. The results in Table A2 (Appendix 3) that refers to weekdays and are depicted in Figure 4, confirm this hypothesis. For most activities the interviewer administered diaries report a lower percentage of participants than the self administered diaries. It is also more common that the average duration for participants are larger for the interviewer administered diaries versus the self administered diaries. The exceptions from this general pattern (for instance participating women's time spent on child care, sports, and organizations, and participating men's time spent on market work, adult care, and organizations) are within the 95 percent confidence intervals.

Table 14 shows the estimated differences between the yesterday and today time diary estimates, and the standard errors of these differences. Since the standard errors in most cases are very large, it is difficult to draw any firm conclusions.

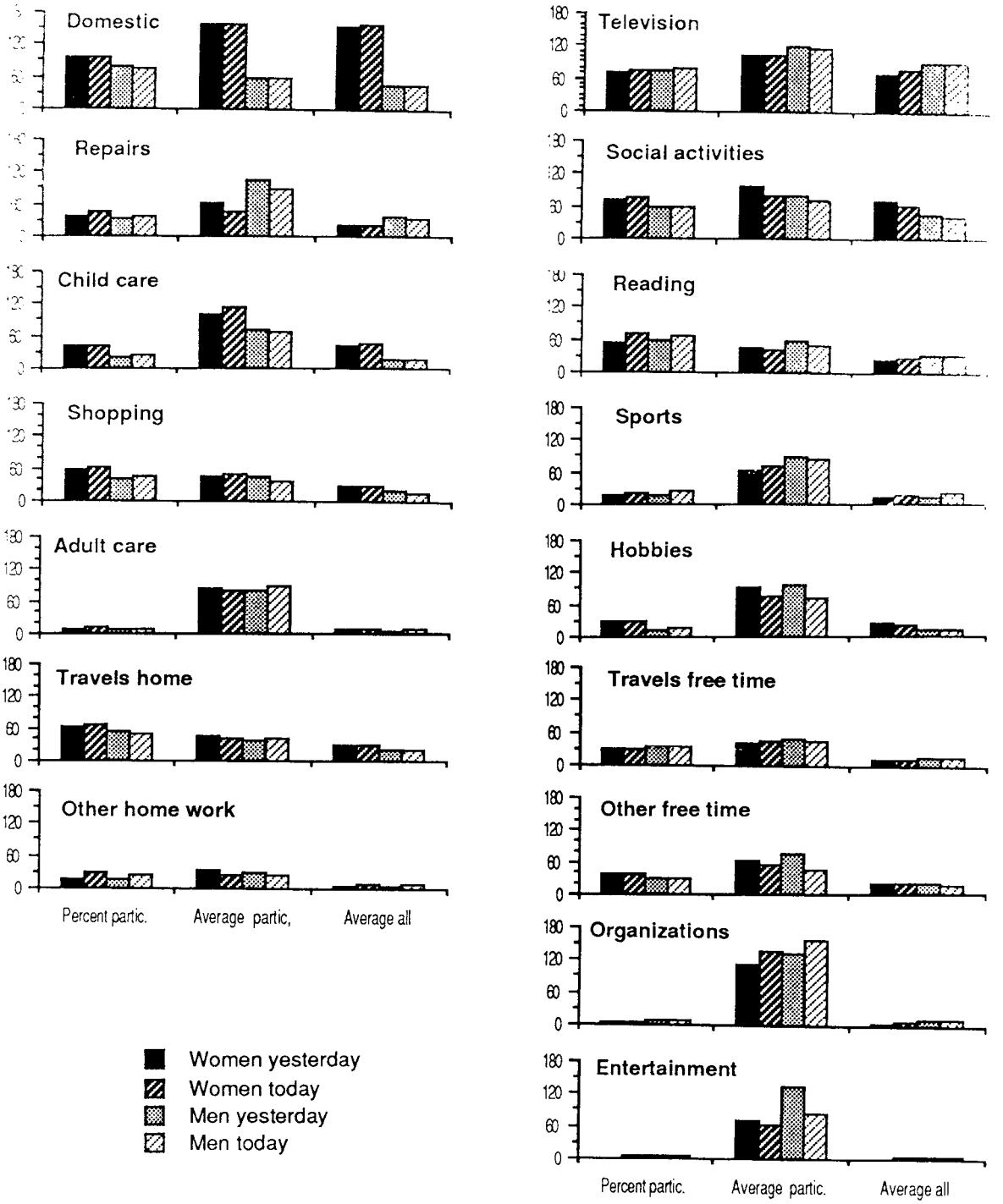

Figure 4. Comparison between weekday yesterday estimates and weekday today estimates of percentage participants, average time spent by participants, and average time spent by all for home work activity groups and free time activity groups in the 1984/85 Swedish TBS. Women and men aged 20-64. Percent and minutes per day

Table 14.Differences between weekday "yesterday" estimates (Y) and weekday "today" (T) estimates of average time spent by all, percent participants, and average time spent by participants. The 1984/85 Swedish TBS. Women and men aged 20-64. Minutes per day and percent

	W O M E N			M E N		
	Average all Minutes	Percent partic. %	Average partic. Minutes	Average all Minutes	Percent partic. %	Average partic Minutes
	D I F F E R E N C E S Y-T (s.e)					
Market work:						
work, etc	10 (12)	2 (2)	5 (10)	-12 (12)	- 1 (2)	- 8 (8)
travels	1 (2)	1 (3)	1 (3)	2 (2)	- 1 (2)	3 (2)
Home work:						
domestic	- 3 (7)	- 1 (1)	- 1 (7)	- 0 (3)	1 (2)	- 1 (4)
repairs	3 (3)	- 8 (3)*	18 (6)*	4 (4)	- 3 (3)	19 (10)*
child care	- 6 (4)	- 2 (2)	-10 (8)	- 0 (2)	- 3 (2)	7 (7)
adult care	- 2 (2)	- 3 (2)	7 (16)	- 1 (3)	- 1 (1)	- 9 (34)
purchases	- 2 (3)	- 3 (3)	- 1 (4)	2 (2)	- 2 (3)	7 (5)
others	- 2 (2)	-13 (3)*	8 (8)	- 2 (1)*	- 9 (2)*	2 (4
travels	2 (2)	- 2 (3)	5 (3)	0 (2)	2 (3)	- 1 (3)
Personal needs:						
sleep, meals, ..	- 3 (7)	- 0 (0)	- 1 (7)	- 6 (6)	- 0 (0)	- 4 (6)
travels	0 (0)	- 0 (1)	4 (3)	0 (0)*	1 (1)	6 (3)*
Education:						
education, etc	2 (3)	- 2 (2)	43 (22)	2 (4)	- 1 (2)	26 (30)
travels	0 (0)	1 (1)	- 4 (5)	1 (1)	2 (1)	0 (15)
Free time:						
sports, etc	- 4 (2)*	- 4 (2)	-10 (7)	- 7 (3)*	- 9 (2)*	3 (11)
organizations	- 2 (2)	- 1 (1)	-23 (20)	- 2 (3)	0 (2)	-29 (21)
entertainment	- 1 (1)	- 2 (1)	10 (22)	2 (2)	- 0 (1)	52 (20)*
social activities	8 (5)	- 5 (3)	17 (6)*	7 (4)	1 (3)	11 (6)
television, radio	- 6 (4)	- 5 (3)	- 1 (5)	- 2 (5)	- 4 (3)	5 (5)
reading	- 4 (2)*	-18 (3)*	7 (3)*	2 (3)	-10 (3)*	11 (4)*
hobbies	4 (3)	- 1 (3)	17 (8)*	- 1 (2)	- 5 (2)*	26 (14)
others	2 (2)	- 3 (3)	10 (6)	8 (2)*	- 0 (3)	26 (6)*
travels	- 1 (2)	1 (3)	- 6 (6)	2 (3)	1 (3)	5 (9)
Other activities:	3 (4)	- 5 (1)*	184 (128)	1 (4)	- 9 (2)*	87 (71)
Bases: Yesterday/today/both		503/446/321			504/469/326	

Note: The estimates refer to weekdays and are unweighted. The figures within the parenthesis are the standard errors of estimated differences. The "*"indicates that the difference is significant on the five percent level.

The differences in the percentage of participants are statistically significant on the 5 percent level for five activity subgroups. The interviewer administered diaries seem to underreport the number of participants in "other home work" and reading (significant for both sexes), repairs (significant for women), and sports and hobbies (significant for men). The differences are also significant for "other activities", but this may be explained by the fact that this category contains "keeping the time diary", an activity that was not relevant for the yesterday diary. In all cases but one (sports for women), these "significant" underreports of the number of participants are followed by overreports of the time the participants spent on the activity in question. That explains the small differences in the averages for all respondents.

5 CONCLUSIONS

The two modes of data collection used in the 1984/85 TBS appear to yield data of acceptable quality. As expected the self administered diaries provided more detailed reports than the interviewer administered recall diaries (30 compared to 26 activities recorded). The estimates of time spent on different groups of activities were similar for the two modes of data collection, as averaged over all respondents. The interviewer administered diaries seem, however, to underestimate the percentages of participants in different activities and overestimate the time spent among the participants. Therefore, for more detailed analysis of how people spend their time, the approach with self administered diaries seems superior. We believe, however, that the respondent must be personally instructed by an interviewer how to fill in the diary, and that the training with a real diary is very useful. Mail collection or telephone interviewing are not likely to yield time diary data of acceptable quality. First, it would be very difficult to obtain acceptable response rates with

data collection by mail. Second, with mail collection as well as telephone interviewing it seems difficult to obtain representativeness according to the days of the week covered; Fridays and weekends become underrepresented. Third, with mail collection and telephone interviewing it is not possible to give verbal instructions with visual aids and actually train the respondents.

The nonresponse rate in TBS was large. Only 64 percent did fill in a diary and no more than 47 percent did so on the selected date. The nonresponse rates differed greatly between interviewers. It seems that there is a "mode preference" among the interviewers; some of those with large response rates in the TBS had low response rates in the LFS (based on telephone interviewing), and vice versa. In a full-scale TBS it should therefore be considered to choose those interviewers who perform well in diary surveys.

As in other Swedish surveys the nonresponse rates were largest among the oldest, and among those living alone (as measured by marital status). Register information about sex, age, and marital status was used for nonresponse adjustment of the estimates. Comparisons between, on the one hand, unadjusted and adjusted estimates of respondent income, and on the other hand, corresponding estimates based on the full sample, showed that the adjustment technique reduced the nonresponse bias just slightly for this variable.

Four weeks around Christmas and Easter were excluded in the TBS. This seems to be wise. The nonresponse rates were very large for some weeks around the short holidays in late spring, and had probably been even worse for the weeks around the big holidays. For a future survey it should be seriously considered to exclude late spring and summer, periods during which it is difficult to obtain acceptable response rates, especially for diary surveys. If the users of time use statistics are most interested in the everyday time use, it seems

wise to focus on that and refrain from collecting data of questionable quality during holidays.

We have no useful information that can be used to assess the effects of time nonresponse, i.e., that some of the respondents filled in their diaries on a later date than the selected one. Full-time working women seemed more inclined to postpone the diary keeping than other women. No large differences in economic-demographic structure or in time spent on aggregated activity groups between those who filled in the diary on the selected date and those who postponed the diary keeping could be detected. In a future survey we plan to instruct the interviewers to record the reasons for postponements, so we can judge whether there is any connection between postponements and time use during the selected date. In any case, we believe that postponements must be accepted for several reasons. First, a "now or never" approach would probably have an demoralizing effect on the interviewers who are trained to try to persuade a potential respondent. Second, a reluctant respondent may as well keep the diary on the selected day if he/she understands that the interviewer will keep on asking. Third, those who are inclined to postpone (or refuse totally) may have a different time use pattern than others. For instance, they may be more busy. Using time data for another day than the selected one would then reduce the nonresponse bias. Although desirable, we have not yet used the time diary data to investigate in detail if those who postpone have a different time use pattern. (On aggregated levels we have not found any substantial differences.)

Due to feared nonresponse problems the 1984/85 TBS was based on a person approach and only one diary date (or rather a pair of dates) was designated to each respondent. When producing and analyzing the statistics on time use, we missed, however, the opportunities to study the time use for couples and the opportunities to estimate the precision of estimates properly. Therefore, we might try a household

approach with two diary dates in a future survey, at least for a subsample.

Regarding the data processing in a future survey we consider to use abbreviated codes and perhaps let the interviewers do the coding.

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Activity Code in the 1984/85 Swedish Time Budget Survey

1 FÖRVÄRVSARBETE	GAINFUL EMPLOYMENT
11 Förvärvsarbete	Gainful employment
. Ordinarie arbete i huvudyrke	. Regular work
. Övertidsarbete i huvudyrke	. Overtime
. Bisyssla, extraknäck	. Second job
. Måltider i samband med arbete	. Meals at work
. Annan tid på arbetsplatsen	. Other time at workplace
12 Arbetsresor	Journey to/from work
. Arbetsresor	. Journey to/from work
2 HEMARBETE	HOUSEHOLD WORK
21 Hushållsarbete	Domestic work
. Matlagning	. Food preparation, setting of table
. Brödbakning	. Baking bread
. Saftning, konservering	. Food preservation
. Diskning, avdukning	. Dish washing, cleaning table
. Städning av bostaden	. House cleaning
. Tvätt, strykning	. Laundry, ironing
. Vård, tillverkning av kläder	. Making and maintaining clothes
. Eldning, vedhuggning	. Heating, wood chopping
22 Underhållsarbete	Home repair
. Skötsel av tomt och trädgård	. Gardening
. Rastning av hund	. Walking the dog
. Annan skötsel av sällskapsdjur	. Other animal care
. Byggarbetet, reparation av gostad	. Construction, home repairs
. Reparation, underhåll av fordon	. Vehicle repair and maintenance
. Reparation, underhåll av annat	. Other repair and maintenance
23 Omsorg av barn	Child-care
. Tillsyn och hjälp av barn	. Care of children
. Hjälp med läxläsning	. Help with homework
. Lek med barn	. Playing with children
. Samtal med barn	. Talking with children
. Högläsning för barn	. Reading aloud to children
. Föräldramöten m m	. Parent meeting
. Närvaro vid barns aktiviteter	. Activities together with children
. Annan omsorg om barn	. Other child care
24 Omsorg om vuxna	Adult care
. Hjälp till vuxna i eget hushåll	. Help to adults within own household
25 Inköp av varor och tjänster	Purchasing of goods and service
. Inköp av dagligvaror	. Purchasing grocery
. Inköp av andra varor	. Purchasing other goods
. Medicinsk behandling utom hemmet	. Medical care outside

	the home
. Ärenden på offentliga inrättningar	. Dealing with public agencies
. Övriga ärenden	. Other errands
26 Annat hemarbete	Other house work
. Annat hemarbete	. Other house work
27 Resor i samband med hemarbete	Journeys, household work
. Resor i samband med hemarbete	. Journeys, household work
3 PERSONLIGA BEHOV	PERSONAL NEEDS
31 Personliga behov	Personal needs
. Nattsömn	. Night-time sleep
. Middagslur	. Nap
. Sängliggande på grund av sjukdom	. Ill in bed
. Personlig hygien, av- och påklädning	. Personal hygiene, dressing
. Bastu, solarium	. Sauna, solarium
. Måltider	. Meals
. Kaffedrickning, förfriskningar	. Coffee-breaks, refreshments
. Andra personliga behov	. Other personal needs
32 Resor i samband med personliga behov	Journeys, personal needs
. Resor i samband med personliga behov	. Journeys, personal needs
4 STUDIER	EDUCATION
41 Studier	Education
. Målinriktade studier, lektioner	. Class attendance
. Målinriktade studier, hemarbete	. Homework
. Studiecirklar och liknande	. Study circles
. Läsning av facklitteratur	. Reading non-fiction
42 Resor i samband med studier	Journeys, education
. Resor i samband med studier	. Journeys, education
5 FRI TID	FREE TIME
51 Idrotts- och friluftsliv	Sports, outdoor activities
. Promenader, vandring	. Walks
. Svamp-, bärplockning	. Mushroom, berry gathering
. Jakt, fiske	. Fishing, hunting
. Idrott, motion ute	. Sports, outdoors
. Idrott, motion, inne	. Sports, indoors
. Cykelturer	. Bicycling tours
. Båtturer	. Bout tour
. Sola, bada	. Sunning, bathing
. Bilutflykter	. Car tour
. Annat idrotts- och friluftsliv	. Other outdoor life
52 Föreningsverksamhet	Union, organization
. Föreningsverksamhet (ej religiös)	. Non-religious
. Religiös verksamhet	. Religious
53 Underhållning och kultur	Entertainment, cultural activities

. Åskådare vid idrottsevenemang	. Spectator sport events
. Biobesök	. Cinema
. Teater, konsert, utställningar	. Theatre, concert, museum
. Bibliotekbesök	. Visiting the library
. Annan underhållning	. Other entertainment
54 Social samvaro	Social life
. Fest, kalas	. Party
. Besök hos släkt och vänner	. Visiting friends, relatives
. Besök av släkt och vänner	. Receiving visits
. Samtal	. Conversation in person
. Telefonsamtal	. Conversation by telephone
. Besök på restaurang, kafé, bar	. Restaurant, bar, cafe
. Dans, diskotek	. Dancing, discotheque
. Spel, sällskapslekar	. Games
. Andra sociala sammankomster	. Other social events
55 Radio och TV	Radio, television
. TV-, videotittande	. Watching TV, VCR
. Radiolyssnande	. Listening to radio
56 Läsning	Reading
. Dagstidningsläsning	. Newspapers
. Veckotidningsläsning	. Weekly magazines
. Bokläsning	. Books (fiction)
. Övrig läsning	. Other reading
57 Hobbies	Hobbies
. Stickning	. Knitting
. Träslöjd	. Woodwork
. Annat handarbete	. Other needlework
. Tekniska hobbies, samling	. Technical hobbies, collection
. Spel, lek ensam	. Playing games on own
. Penningspel	. Hazard games
. Lyssna på grammofon, bandspelare	. Listening to records, tape recorder
. Musikutövning	. Making music
. Andra konstnärliga hobbies	. Other artistic creations
. Korrespondens	. Writing letters
. Andra hobbies	. Other hobbies
58 Annan fri tid	Other free time
. Vila, meditera, göra ingenting	. Relaxing, thinking, doing nothing
. Ospecificerad fri tid	. Unspecified free time
59 Resor i samband med fri tid	Journeys, free time
. Resor i samband med fri tid	. Journeys, free time
6 ÖVRIGT	OTHER
60 Övrigt, okodbart	Other, unclassified activity
. Förde tidsdagbok	. Keeping the time diary
. Ospecificerade resor	. Unspecified journeys
. Ej uppgiven eller okodbar aktivitet	. Missing, not classified activity

APPENDIX 2

Table A1. Comparison between aggregate time estimates based on interviewer administered diary reports for "yesterday" versus self administered diary reports for "today", by sex in the 1984/85 Swedish TBS. Women and men aged20-64. Minutes per day

	W O M E N			M E N		
	Yesterday	Today	difference	Yesterday	Today	difference
Market work	221	206	15	351	356	- 6
work, etc	203	189	14	324	330	- 6
travels	18	17	1	27	26	1
Home work	288	296	- 8	166	171	- 4
domestic	155	159	- 4	50	55	- 4
repairs	22	23	- 1	45	42	3
child care	43	45	- 2	17	17	- 1
adult care	9	8	1	8	9	- 1
purchases	27	30	- 3	19	19	0
others	5	6	- 1	5	7	- 2
travels	28	26	2	23	22	1
Personal needs	611	615	- 4	578	582	- 4
sleep, meals, etc	610	614	- 4	577	581	- 4
travels	0	0	- 0	1	1	0
Education	18	19	- 1	23	19	4
education, etc	16	17	- 1	21	18	4
travels	1	2	- 0	2	1	1
Free time	298	301	- 4	315	305	10
sports, etc	15	23	- 8	24	28	- 4
organizations	5	9	- 4	12	13	- 1
entertainment	2	4	- 2	6	5	1
social activities	82	77	5	63	55	8
radio, television	98	91	6	110	111	- 1
reading	26	33	- 7	37	38	- 1
hobbies	26	25	1	12	14	- 2
others	26	20	6	24	18	6
travels	19	20	- 1	25	22	3
Others	5	3	2	7	7	-1
TOTAL	1440	1440	0	1440	1440	0
Bases	638	638		663	663	

Note: The estimates refer to all days of the week and are are weighted, see Section 2.4.5.

APPENDIX 3

Table A2. Comparison between weekday "yesterday" estimates (Y) and weekday "today" (T) estimates of average time spent by all, percent participants, and average time spent by participants. The 1984/85 Swedish TBS. Women and men aged 20-64. Minutes per day and percent

	WOMEN						MEN					
	Average all Minutes		Percent partic. %		Average partic. Minutes		Average all Minutes		Percent partic. %		Average partic. Minutes	
	Y	T	Y	T	Y	T	Y	T	Y	T	Y	T
Market work:												
work, etc	266	256	61	59	439	434	426	439	78	80	544	551
travels	23	22	53	52	44	43	37	34	73	74	50	47
Home work:												
domestic	155	158	97	98	159	161	45	45	78	77	57	58
repairs	23	20	37	45	62	44	37	33	35	38	105	86
child care	41	48	41	42	102	112	16	17	22	25	73	66
adult care	7	9	8	11	85	78	6	7	7	8	79	89
purchases	28	30	59	63	47	49	19	17	43	45	45	38
others	5	7	17	29	32	24	5	7	17	26	28	26
travels	30	28	64	66	47	42	21	21	54	51	39	40
Personal needs:												
sleep, meals, ...	583	586	100	100	585	586	543	549	100	100	545	549
travels	1	1	3	3	20	16	1	0	4	3	21	15
Education:												
education, etc	20	19	11	13	191	148	20	18	12	13	168	141
travels	2	2	6	5	33	38	3	2	5	3	58	58
Free time:												
sports, etc	11	15	17	21	61	71	14	21	16	25	87	84
organizations	6	8	5	6	114	137	11	12	8	8	133	161
entertainment	2	3	2	4	73	63	5	3	4	4	133	82
social activities	70	62	72	76	98	81	48	40	59	58	81	70
television, radio	73	79	71	76	103	104	92	93	76	80	122	116
reading	26	30	53	72	48	42	35	34	59	69	60	49
hobbies	25	21	28	29	91	74	11	12	12	17	97	71
others	22	20	36	38	63	53	23	15	31	31	74	48
travels	13	14	31	29	42	47	17	15	35	34	49	44
Others activities:	7	4	3	8	228	44	7	6	6	15	127	39
Bases: Yesterday/today/both	503/446/321						504/469/326					

Note: The estimates refer to weekdays and are unweighted. The differences and their estimated standard errors are given in Table 14.

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