Supplemental Information

Data sources

TimeUse+
Data collection year and location: June 2022 – February 2023 German-speaking Switzerland
Conducted by: Institute for Transport Planning and Systems, ETH Zurich, Switzerland
Sample demographic: Population aged 20 and older
Sample size: 1,302 individuals
Data collection method: GPS-based smartphone diary survey (four weeks) with background questionnaires (elaborated upon below)
Details: unpaid work includes unpaid household work, unpaid care work, and shopping **not** travel to unpaid work activities, as is the case for all other data sources; maintenance activities are somewhat overreported, as eating/cooking was included as a single activity (i.e. although eating is a maintenance activity and cooking is generally considered to be unpaid work). It follows that unpaid work is underreported in the data set, since cooking is not included.
Potential biases: underreporting of activities less than 10 minutes long and rounding of activities to 10 minutes; no further information when activity "other" was reported; activities eating and cooking reported as a single activity; splitting of activities at midnight (see below) rudimentary

Participation in TimeUse+ comprised three steps:

1. An initial online questionnaire (study information, consent, personal and household level socioeconomic characteristics, work preferences, and mobility tool ownership)
2. A four-week tracking period that involved downloading and using the TimeUse+ app (iOS and Android) which passively tracked participants. Participants were required to validate (correct) all locations visited and modes used, and actively log all activities and expenditures performed using preset lists provided within the app.
3. A second online questionnaires (long-term expenditures, a range of attitudinal questions and a personality inventory)

All TimeUse+ data and a field report to the study may be requested from the ETH Research Collection (https://www.research-collection.ethz.ch/handle/20.500.11850/634868).

All data preparation and analysis were performed in R (R Core Team, 2023). As far as data preparation is concerned, the following steps were taken for the TimeUse+ diary data:

1. Assigning weights to participants with the 2021 Swiss Mobility and Transport Microcensus (FSO & ARE, 2023) filtered for German-speaking Switzerland as the target population. Weighting was performed based on: age, gender, income, education level, mobility tool ownership, household size, and workload (if employed).
2. Splitting days at midnight and splitting activities proportionally between both days.
3. Public holidays were recoded as weekends. Weekdays participants took off from work could not be identified and thereby remained in the sample as weekdays.
4. Filtering out entire days if: time spent outside of Switzerland, implausible sleep duration.
5. Defining separate final data samples. The only difference is how time is allocated or categorized.

The final data sets for all analyses include 27,197 days from 1,302 participants. The TimeUse+ team was able to impute home locations (described in the field report), but not work locations. Hence, a limitation of this work lies in its inability to distinguish between working at one's workplace and working from a third location (e.g. a café).

Swiss Labour Force Survey (SLFS)
Data collection year and location: 2020, Switzerland
Conducted by: Swiss Federal Statistical Office
Sample demographic: Population aged 15 and older
Sample size: 120,000 interviews per year
Data collection method: Online questionnaire (with the option for a telephone interview) with stylized questions regarding background information and labor market participation indicators: employment situation, occupation, salary, etc.
Potential biases: Time use data collected via stylized questions have been found to be less reliable and valid than those collected using time use diaries (e.g., for logging working time; Otterbach and Sousa-Poza, 2010; Bonke, 2005).
Website for reference: https://www.bfs.admin.ch/bfs/en/home/statistics/work-income/surveys/slfs.assetdetail.22687497.html

German Time Use Survey (ZVE)
Data collection year and location: 2022-2023, Germany
Conducted by: German Federal Statistical Office (DESTATIS)
Sample demographic: Population aged 10 and older. Data used in Figure 1 filtered for population aged 18 and older.
Sample size: 15,000 households
Data collection method: Household survey (background questionnaire and 3-day diary), online or smartphone-based time use diary following HETUS (Eurostat, 2019) guidelines
Potential biases: Variable depending on whether a participant used the web-diary or smartphone diary. Any delay in recording activities is directly tied to recall bias. Activity durations susceptible to rounding errors, as they are reported in 10-minute intervals.
Website: https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Einkommen-Konsum-Lebensbedingungen/Zeitverwendung/Methoden/zeitverwendung.html

American Time Use Survey (ATUS)
Data collection year and location: 2022, United States of America
Conducted by: US Bureau of Labor Statistics
Sample demographic: Population aged 15 and older
Sample size:
Data collection method: Computer-assisted telephone interview (CATI) to detail a diary about the day prior to the interview, i.e. using the “yesterday method”. Susceptible to rounding, recall, and social desirability biases as one must think back to every activity done hours prior and appeal to the interviewer.
Website: https://www.bls.gov/opub/hom/atus/data.htm

As is always the case, the four data collection methods implemented by the four data sources considered each entail potential biases that influence their data. This is exactly why HETUS guidelines exist: to generate comparable data, at least within the EU. Future HETUS smartphone diaries are indeed expected to include GPS technology because of its highly accurate temporal and spatial resolution. However, GPS-based methods, such as TimeUse+, are susceptible to missing data due to loss in signal, a participant’s smartphone being shut off, and the like. Design choices that led to potential biases during the TimeUse+ project were implemented to increase the app’s usability or user experience. There are many challenges to be overcome until a GPS-based time use diary solution becomes fully viable. In the meantime, notwithstanding, it would be of great use for a Swiss federal agency to conduct a regular time use survey, either further exploring the opportunities of GPS and making data comparable to that collected with TimeUse+ or using a web or smartphone diary in line with HETUS guidelines.

Analytical framework

For Table 1, R package Hmisc (Harrell, 2023) was used to calculate means and standard deviations, while R package sjstats (Lüdecke, 2018b) was applied for the Mann-Whitney-U tests.

For the multinomial logistic regression estimated for Figure 1, clustered time investment in unpaid care and unpaid household work functioned as dependent variables where a low time investment represented an average daily unpaid work engagement of less than 5 minutes, medium between 5 and 40 minutes, and high more than 40 minutes. A multinomial logistic regression using clusters of time determined post hoc was deemed appropriate, as the original continuous time use data are highly skewed and include zeros, which violates assumptions for many regression types. An ordinal logistic regression was not applied due to a violation of the proportional odds assumption. Figure 1 presents how the predicted likelihood of different levels of engagement in unpaid work vary according gender and parenthood status, general household work and care work are categorically different. R package nnet (Venables & Ripley, 2002) was used to and R package ggeffects (Lüdecke, 2018a) was used to predict and plot the predicted probabilities.