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Work from Home and Time Allocation

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Abstract

This paper investigates the impact of remote work (work from home, WFH) on time use for work, housework, leisure, and sleep in daily life. We use time-use survey data for Japan. We find that WFH tends to reduce working hours. By WFH, females tend to spend more time on housework, while males tend to devote more time to leisure. However, WFH involves heterogeneous impacts on time reallocation among different groups. For instance, for single males or long hours workers, there is no substantial impact of WFH on time allocation, whereas single females tend to allocate less time to work and more time to leisure than married females (e.g., relaxing in the afternoon and watching TV late at night). However, WFH allows married females, as well as males with a child, to increase childcare hours, thereby allowing males to devote more time to childcare.

Keywords: Work from Home, time use, working hours, housework hours, single, childcare

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1 Introduction

Work from home (WFH) has drawn considerable attention since the onset of the global COVID-19 pandemic in February 2020 (e.g., Alipour et al., 2020; Eurofound, 2020). Originally, WFH was thought to improve work–life balance through more flexible use of time and the workplace (Gajendran and Harrison, 2007; Dutcher, 2012; Bloom et al., 2015; Giménez-Nadal et al., 2019). This could be particularly helpful to women raising children and people caring for the elderly. However, WFH sometimes faces the difficulties of maintaining work performance and optimal time allocation between work and family, because WFH prevents spatial separation of the workplace and housework. Furthermore, many workers are not permitted to WFH because of their occupational characteristics and/or employment regulations (Dingel and Neiman, 2020). Thus, not being allowed to WFH may restrict their optimal time allocation. A central issue is whether WFH can promote time flexibility and improved time allocation. Using Japanese time-use survey data, this paper investigates who uses WFH and to what extent WFH changes time allocation among work, leisure, household chores, and sleep. The data provide information on individuals' time use, in the form of time diaries, 24 hours a day.

Japan is an interesting case study of time allocation in the context of WFH, because some employees are typically overworked with a poor work–life balance, resulting in deteriorating health, life satisfaction, and happiness, and sometimes causing mental illness and death (Kuroda, 2010; Ono, 2018). Despite a reduction in total working hours in Japan in recent decades, working hours for regular male employees have increased steadily in the 2000s because of a shortage of workers associated with the aging population (Genda et al., 2015; Takami, 2019). The distribution of the female employment rate by age has long been M-shaped (Houseman and Osawa, 1998). For many women, after they get married and become pregnant, they leave their job to spend time on childcare. Married females who return to the labor force after childcare tend to find themselves in lower status positions, for example, part-time jobs.

Importantly, Japan strongly remains traditional gender roles, where men work and women do housework. As a result, Japan ranks worst among G7 countries in the gender gap rankings. Japan ranks 116th among 146 countries in 2022. Recently, women is increasingly joining the labor force. However, wives spend around seven times as much time doing housework as their husbands according to the National Survey on Household Change, conducted in 2019 by the National

Institute of Population and Social Security Research, Japan.

Consequently, the notion of WFH has drawn attention in Japan (MLIT, 2016). As WFH increases the flexibility of working hours and location and allows more time for household chores and childcare, WFH is viewed as a means of increasing female labor force participation and productivity. In addition, WFH is expected to increase work–life balance, thereby boosting happiness and life satisfaction. The Japanese government has also promoted WFH to companies for improving work–life balance and worker productivity (MIAC, 2021). Nevertheless, WFH is not prevalent in Japan even following the spread of COVID-19 (Okubo, 2022). Therefore, it is worth investigating WFH in Japan in terms of time use. Whereas some previous studies have examined workers' time-use data for the US, we use similar data for Japan.

In general, WFH would largely change time allocation and work hours. Since WFH does not involve commuting, commute time will be saved. Furthermore, WFH might reduce working hours per se, because of avoiding unnecessary meetings and communication and raising working performance. Spare time by WFH will devote to time for leisure and housework.

In this paper, we obtain several results. First, females, the better educated, and office workers tend to WFH. Second, WFH tends to reduce the number of working hours. Females tend to devote more time to housework, whereas males tend to devote more time to housework and leisure. But long hours workers tend to have much smaller impact of WFH. Third, WFH has heterogeneous impacts on time reallocation among groups. For instance, there are no substantial differences among single males in time allocation between office work and remote work. By contrast, WFH allows single females to devote less time to housework and more time to leisure than married females, in particular, to relaxing in the late afternoon and watching TV at night. However, both married females and males with small children (under 10 years of age) devote significantly more hours to childcare through WFH. In this sense, WFH is beneficial for childcare by males.

The remainder of the paper is structured as follows. Section 2 reviews the literature and Section 3 describes the data and some stylized facts. Section 4 examines how individual traits are correlated with WFH. In Sections 5 and 6, we present some estimation results, and Section 7 shows the distributions of time-use data. Section 8 provides concluding remarks.

2 Literature Review

WFH has attracted considerable attention as a means of improving work styles and quality of life in the digitalized society. Although the mechanisms have not been fully investigated, WFH is regarded as a means of increasing work efficiency by reducing commuting time (Helminen and Ristimäki, 2007; Haddad et al., 2009), increasing the flexibility of work hours (Coenen and Kok, 2014), and giving workers more time for daily activities (Tremblay, 2002; Baines and Gelde, 2003; Wheatley, 2012; Kazekami, 2020).

Since the spread of COVID-19 in 2020, WFH has been promoted primarily as a countermeasure against infection. Many countries have seen drastic increases in WFH. In the US, WFH increased from 8% in February 2020 to 35% in May 2020 (Bick et al., 2020). In Europe, 37% of workers began working remotely (Eurofound, 2020), including 20–50% of teleworkers (Alipour et al., 2020). In Japan, WFH increased from 6% in January 2020 to 17% in June 2020 (Okubo, 2020).[1] Studies on WFH have reached several conclusions, for example, WFH tends to be used by higher-income workers (Mongey et al., 2020; Sostero et al., 2020) and younger workers (Adams-Prassl et al., 2020) and reduces working performance (Okubo et al. 2021). It has also been found that WFH is suitable for specific occupations. Dingel and Neiman (2020) identified the occupations that can be performed entirely at home and estimated how much of the population could possibly work from home using job characteristic information on O*NET and US Bureau of Labor Statistics data.[2] Subsequently, the association of WFH with personal traits, as well as occupational characteristics, has been investigated by a number of studies (e.g., Boeri et al. 2020).

However, despite WFH having the crucial benefit of flexibility in time use, it is still unclear how WFH affects time-use patterns in daily life. Some US studies have used time-use survey data,[3] although most of these employ the 2004 Current Population Survey Work Schedules and Work at Home (CPS-WS) Supplement and the 2004–2005 American Time Use (ATU) or the 2017–2018 ATU Survey Leave and Job Flexibilities (ATUS-LV) module. Giménez-Nadal et al. (2019) and Pabilonia and Vernon (2022) showed that WFH allows workers to

[1] Gottlieb et al. (2021) report that the share of workers who work from home in urban areas is 20% in poor countries and 40% in rich countries.
[2] It was found that 37% of US workers could possibly perform their jobs entirely at home.
[3] Apart from WFH, many studies have used time-use survey data to investigate working hours in the US (e.g., Aguiar and Hurst, 2007).

reduce grooming and commuting times, and they can therefore devote more time to leisure, housekeeping, and family time.[4] Wight and Raley (2009) found that females tend to reduce working hours by WFH, and parenthood is positively associated with WFH in the sense of devoting more time to childcare. However, WFH also involves costs. Genadek and Hill (2017) noted that female remote workers tend to spend more time on childcare than office workers, while remote working causes conflicts with other family members regarding home work roles. Eldridge and Pabilonia (2010) found that only 8% of workers work remotely, but 5% of this 8% is to finish and catch up on their work at home for a short time. By contrast, Golden (2008) asserts that teleworking is associated with longer working hours. Most studies on WFH and time allocation investigate whether WFH can increase family time without reducing work performance and whether WFH involves a wage premium or not.

All of these studies cited use US data, and very few have examined the relationship between WFH and time allocation in other countries (Natti et al., 2011, for Finland; Callister and Dizon, 2001, for New Zealand; Powell and Craig, 2015 for Australia). Our paper addresses this gap. Furthermore, our focus is specifically on time use, that is, on (i) who uses WFH, (ii) who experiences reduced working hours when working from home, (iii) how this saved time is allocated, and (iv) how WFH changes time use for males and females, and for people who are single, married without children, and married with children.

We use unique Japanese time-use data to investigate the correlation between time use and WFH. A small number of studies have used Japanese time-use data. For instance, the long-term care insurance system, commenced in 2000, contributed to females devoting less time to family caregiving (Kan and Kajitani, 2014). Kuroda (2010) studied trends in average working and leisure hours over three decades. Mizunoya (2019) and Kagawa (2019) investigated the hours of the day when work occurred, while Ito (2019) and Ishida (2019) investigated time allocation for hobbies and leisure across generations and various family structures and social statuses.[5] Although all of these studies examined time use, none of them considered time use and WFH in Japan.

[4] Giménez-Nadal et al. (2019) found that remote workers devote fewer hours to work than office workers and 60% of remote workers work regular working hours, whereas 80% of commuters do so.

[5] Mizunoya (2017) proposed an augmented definition of time on childcare.

3 Data and Stylized Facts

3.1 Data and Definitions

Our paper uses nationwide large-scale survey data for Japan, the Survey on Time Use and Leisure Activities, conducted by the Ministry of Internal Affairs and Telecommunications, in October 2016.[6] The survey attempts to ascertain the Japanese people's daily activities and time allocations over 24-hour periods. The survey uses a two-stage stratified random sample, comprising around 176,000 Japanese people who were at least 10 years of age on October 20, 2016. The survey uses a time diary of 15-minute intervals over a two-day period,[7] between October 15 and 23. The sample is split into eight groups randomly, and then two days are assigned for each group.

In the survey, respondents are first asked about their primary activities of the day: leisure/vacation travel, event/ceremonial occasions, business trips/job training, WFH, recuperation, holiday, parental leave, nursing care leave, workday, and other activities (respondents may choose multiple answers). Importantly, the survey defines WFH as completing tasks at home with their company's permission.[8] We note that overtime work at home and miscellaneous short-time work at home (checking e-mails) are not included in the WFH definition. Next, the survey requires the completion of a time diary using the pre-code method. The respondents were asked in record in detail how they spend their time for every 15-minute period over a two-day period. Activities are coded in detailed categories as follows: sleeping, personal care (dressing), meals, commuting to and from office or school, working and doing tasks, schoolwork, housekeeping/household chores, nursing care for the aged, childcare, shopping, moving (excluding commuting), watching TV/listening to the radio/reading magazines or newspapers, rest and relaxation, study and job training (excluding schoolwork), hobbies/amusements, sports, volunteer/social activities, social life (e.g., meeting friends and talking with neighbors), medical treatment, and other

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[6] https://www.stat.go.jp/data/shakai/2016/gaiyou.html

The survey is conducted every five years. The sample differs across surveys and thus the data are not a panel.

[7] Kuroda (2010) compared the time-use survey with the Labour Force Survey, the Monthly Labour Survey, and other surveys and found no significant sample bias in the time-use data. A potential problem is that time-use surveys sometimes involve downward bias in working hours because busy people are sometimes unable to correctly record their activities every 15 minutes. However, Kuroda (2010) found no such bias in the Japanese time-use survey.

[8] https://www.soumu.go.jp/main_content/000716747.pdf

(miscellaneous). In this study, these activities were grouped into five categories.

1) Working hours, defined as doing tasks (i.e. market work).
2) Housework hours, defined as doing household chores, nursing care for the elderly, childcare, and shopping (i.e. nonmarket work).
3) Leisure time, defined as watching TV/listening radio/reading magazines or newspapers, rest and relaxation, study and training (excluding schoolwork), hobbies/amusements, sports, volunteer/social activities, social life (meeting friends).
4) Sleeping hours, defined as sleep.
5) Other time, defined as all other categories.

The survey also asks individuals about their basic characteristics: gender, income, job status, firm size of workplace, occupation, work style (full-time or part-time), number of children under the age of 10 years, number of family members, marriage status, nursing elderly parents (if they live with aged), and the use of childcare services, such as kindergarten and babysitters (if they have a child). See Appendix Table 1 for the basic statistics and definitions.

We note that our survey was conducted on specific days in the period October 15–23, 2016. Hence, even if workers sometimes work from home, but did not on the survey day, they were counted as office workers. A drawback of our survey is that we did not ask about the frequency of remote work. Regardless of regular or occasional remote working, we can identify WFH by using the information from the primary activity question and time diaries.

3.2 Stylized Facts

Table 1 reports the number of samples. The total number of respondents is 176,285, with 101,717 of these working in specific jobs, including part-time work by housewives/househusbands and student workers. In the sample, 100,426 respondents are working, which excludes those on parental, nursing care, or sick leave. Decomposing our sample, there are 54,396 males and 46,030 females. Of the 100,426 workers, 76,581 worked at least one day during the two consecutive survey days, and this comprises our main sample.[9] Thus, nonworking people

[9] Of the respondents, 1,291 took parental leave, nursing leave, or sick leave. Out of 1,291, 13 respondents worked from home because they were on leave for childcare, nursing elderly parents, or illness, and they were already excluded from the sample of 76,581 respondents.

and on-leave employees are not included in our sample (e.g., unemployed people, students, housewives/househusbands, and pensioners). Working people who were on holiday during the survey period were also excluded. Of the 76,581 respondents, 450 worked from home on at least one of the two survey days (Table 2). This represents 0.6% of the sample. Thus other than 450 remote workers commuted to their office to work. The WFH rate is low, but this reflects the rigorous definition of WFH used in the survey. As noted, our definition of WFH is limited to working from home for an entire day as permitted by the employer, and thus our paper excludes working at home on e-mails and telephone calls, which is not a negligible factor (Eldridge and Pabilonia, 2010; Kazekami, 2020).

Japan had one of the lowest WFH rates in the world prior to the COVID-19 pandemic. The WFH rate in our sample is consistent with those in the MLIT Telework Survey (MLIT, 2016) and Kazekami (2020). According to MLIT (2016), only 3.5% of all employees teleworked more than once a week, 82.7% of teleworkers checked e-mails and searched websites, and 73.9% listed creating documents as their main task.[10] Using data from the Japanese Panel Study of Employment Dynamics, conducted by the Recruit Works Institute, Kazekami (2020) found that 2.4% of male workers and 1.64% of female workers were involved in WFH in 2017, but most of them (>95%) were simply working overtime from home when they could finish their tasks at their office. As our definition of WFH excludes such short-time work and overtime work at home, our data are fairly consistent with other data for Japan and previous studies (Kazekami, 2020).

Next, decomposing by gender, of the 450 WFH workers, 203 are male and 247 are female (Table 2); thus females are slightly more likely to WFH. Figure 1 shows the prevalence of WFH by occupation. A large number of WFH employees are clerical office workers (46 workers, representing 11% of all WFH employees), writers/authors/designers (37 workers, 8%), and accounting office workers (28 workers, 6%). These occupations are suited to remote work, which is consistent with the results of previous studies (e.g., Dingel and Neiman, 2020).

[10] We compared our data with those from other national surveys as a reference. According to the MLIT survey, 6.1% of employees undertook telework from home in Japan in 2016, with 3.5% of employees conducting telework more than once per week. The MLIT survey asked about the duration and nature of telework tasks. Of all teleworkers, 82.7% worked remotely on e-mails and searching websites as their main tasks, 73.9% created documents, 11% participated in teleconferences and telemeetings. On average, 2.9 hours were spent on telework. This included overtime work at home and WFH while on vacation. By contrast, our definition of remote work is more stringent, namely working from home for an entire day, as permitted by their employer.

3.3 Overview of Time-use Patterns

As mentioned above, our main interest is all employees who are working during the survey period (i.e., workday). Table 3 reports different time-use patterns between remote (WFH) and office workers. Here, we define remote workers as employees that WFH and office workers as employees commuting to and working in their workplace. Table 3 shows the simple averages of time use on workdays (in hours). The average number of working hours (excluding commuting, meals, and breaks) is 7.88 hours for office workers and 6.05 hours for remote workers. Hence, WFH reduces working hours by 1.83 hours on average. The difference in working hours is statistically significant. The average number of housework hours is 1.26 hours for office workers and 2.51 hours for remote workers, indicating that remote workers spent 1.26 hours more on housework than office workers.

Table 3 (middle and bottom panels) shows that females that WFH reduced their working hours by 1.54 hours on average, yet increased housework hours by 1.5 hours. For office workers, average working hours were 8.58 hours for males and 7.05 hours for females, with only 0.37 hours being spent on housework by males and 2.39 hours by females. Time for leisure is slightly longer for males (3.67 hours) than for females (3.22 hours). Female office workers spent more time on housework than male office workers, whereas males devoted more time to leisure.

We turn to remote workers. By using WFH, working time was reduced by 1.88 hours for males and 1.54 hours for females, while time on housework increased by 0.5 hours for males and 1.5 hours for females. Furthermore, leisure time increased by 1.18 hours for males and 0.37 hours for females. Therefore, WFH allowed males to reduce their working time by more hours and devote more hours to leisure than females.

4 Who Works from Home?

Next, we examine who is most likely to adopt WFH. According to the literature, individual traits and occupations affect the use of WFH. We use data for the first survey day of the two consecutive days.[11] The following equation is estimated by logit estimation:

$$Prob(WFH_i) = \Phi(\alpha X_i + \beta Y_i + \delta F_i + Occu_{O(i)} + Pref_{r(i)} + Date_{d(i)} + \varepsilon_i), \quad (1)$$

[11] Even if we use the second survey day, main results remain the same.

where WFH is a dummy variable for WFH for worker *i*. If he/she works from home, the dummy variable equals one, and zero otherwise. *X* denotes a set of basic traits: gender, "*Female*" (female = 2, male = 1); age, "*Age*," (log of age); annual income in 2016, "*Income"* (log of annual income, scaled by 500,000 yen); university degree, *"Univ"* (dummy for a university degree); and marriage status, "*Single"* (dummy for unmarried persons). Y denotes a set of workplace traits: firm size, "*Firm_size*" (nine size categories)[12]; regular worker dummy, "*Regular*" (dummy for regular worker); and flextime dummy, "*Flex*" (dummy for flexible working hours). Then, *F* denotes a set of family traits: the number of family members living together, that is, the number of people above age 10 years ("*Num_Adult*"); and the number of children under age 10 years ("*Num_Child*"); and alternatively used as a dummy for having a child ("*Child*"). Then, we use a dummy for caring for the aged at home ("*Nursing*"), a dummy for not using any childcare services such as kindergarten even if needed ("*Non_Childcare*"), and a dummy for nobody available to provide childcare even if needed (e.g., no grandparents, neighbors, or babysitters) ("*Non_Helper*"). Some fixed effects are added. *Occu* is the occupation fixed effect, *Pref* is the residential prefectural fixed effect[13], *Date* is the survey date fixed effect, and ε is the error term clustered by household. As noted, the survey date is assigned as specific days for each of the eight groups.

Columns 1–3 in Table 4 present the results. In terms of personal traits, *Female*, *Age*, and *Univ* are all significantly positive, while Single is significantly negative. Thus, females, the aged, the better educated, and married people are more likely to engage in WFH. Regarding workplace traits, *Firm_Size* is significantly negative, while *Regular* and *Flex* are significantly positive. Regular workers under flexible working systems who are employed by smaller companies tend to engage in WFH. All results are similar to previous studies except for the firm size variable; that is, workers at smaller establishments are more likely to WFH than those at larger ones. This outcome is in sharp contrast to the current research on WFH following the spread of COVID-19, where more WFH is reported in larger companies. This is because the shock of COVID-19 has led to more investment on digitalization in larger companies (Okubo, 2022). Next, we discuss the set of

[12] *Firm_Size* is categorized as 1–4, 5–9, 10–29, 30–99, 100–299, 300–999, 1,000–4,999 employees, more than 5,000 employees, and public offices.
[13] There are 47 prefectures in Japan.

family variables *F*. Variables for family structure, *Child and Num_Child* are positive but not significant and *Num_Adult* is negative but not significant. Likewise, *Nursing*, *Non_Childcare*, and *Non_Helper* are all positive but not significant. Family variables are not associated with WFH. As a robustness check, column 4 of Table 4 reports the results only for workers who are married and have small children. However, not all family variables are significant. Thus, nursing elderly parents or having children without childcare services are not correlated with WFH.

5 Different Time Allocation between WFH and office workers

5.1 Average Treatment Effects by Propensity Score Matching

This section investigates time use in greater detail. A simple analysis of remote WFH and office workers in Section 3 would be biased. Hence, to address this potential problem, we employ the propensity score matching as in Rosenbaum and Rubin (1983). The probability of treatment, defined as the propensity score ($0<p<1$) given the observables, is specified as $p(Z) \equiv p(WFH = 1|Z)$. The propensity score is estimated by logit regression on WFH using all above-mentioned variables $Z \in (X, Y, F, Occu, Pref, Date)$, such as individual variables, job traits, family traits, occupation, prefecture, and survey date dummies. In the next stage, we compare remote workers with office workers for each time category using the PSM technique. To match the sample, we use caliper matching, where the caliper (δ) is set as 0.2 times the standard deviation (Austin, 2011) and involve one-to-one matching with replacement with common support.[14] For a pre-specified δ, treated individual (remote workers, WFH) *i* is matched to the non-treated individual (office workers) *j* such that $\delta > |p_i - p_j| = \min_{k \in \{WFH\}} |p_i - p_j|$. We note that if none of the non-treated units are within δ from treated individual *i*, then the individual remains unmatched. The expected difference of time allocation, T, (working, housework, leisure, and sleep) between matched pairs is given by $E\big(T\big|WFH = 1, p(Z)\big) - E\big(T\big|WFH = 0, p(Z)\big) = E(T^1 - T^0|p(Z))$. The average treatment effect gives $ATT = E(T^1 - T^0)$. To check whether a pair of sample has similar individual characteristics, *Z*, we use a balance test. The test checks whether independent variables used in the above-mentioned logit

[14] In our regression, common support is imposed on the treated units. Because of the common support, the treated units whose propensity score is higher than the largest propensity score in the non-treated group can remain unmatched.

regression to derive propensity score are significantly different, on average, between treated and non-treated groups. After matching the pair, when the gaps in almost all the average variables between two groups are insignificant in a t-statistic, we succeed in pair matching identical characteristics. Appendix Figure 1 shows the quality of matching by distributions of propensity score. The distributions of treated and non-treated groups overlap after matching based on the propensity score. The overlap confirms the validity of common support.

Table 5 reports the results of the analysis of the difference between remote and office workers of four main time-use categories (i.e., work, housework, leisure, and sleep; see Section 2). As shown in the upper panel of column 1 of Table 5 (“1. All”), remote workers (“WFH” in the table) work 1.21 fewer hours than office workers (“Office” in the table). Note that the number of working hours for office workers does not include commuting time. Remote workers tend to spend more hours on housework (0.85 hours), leisure (0.47 hours), and sleep (0.19 hours) than office workers. All gaps are statistically significant.

Gender differences are conspicuous in time allocation under WFH. As shown in the middle panel of column 1 of Table 5, males worked 1.88 fewer hours under WFH and devoted more hours to housework (0.3 hours more) as well as leisure (1.07 hours more). All of them are significant. However, females (the lower panel) worked 1.08 fewer hours, and spent more time on housework (1.24 hours more) and leisure (0.4 hours more) under WFH. In sum, WFH reduces working hours, with males allocating the spare time to housework and leisure, whereas females allocate almost all of it to housework.

Marriage status and family environment also influence time use in different ways. We now decompose our sample according to respondents’ status as single, married without children, and married with children. Column 2 of Table 5 (“2. Single”) reports the results for single males and females. There is no significant difference in time use for single males between remote (WFH) and office workers, whereas for female singles there is a significant difference. Compared with office workers, single female remote workers work 1.87 fewer hours, but increase housework by 1.15 hours and leisure by 2.31 hours, on average, indicating that the increase in leisure hours is double that for housework hours.

Column 3 of Table 5 (“3. Married without small children”) illustrates some different features for respondents who are married without small children. Compared with office workers, male remote workers work 0.92 fewer hours, but

there is no difference between these groups in terms of housework hours. Instead, male remote workers increase their leisure time by 0.62 hours and sleeping time by 0.34 hours. This indicates that males without children do not increase time spent on housework, but instead devote more time to leisure and sleep under WFH. By contrast, female remote workers spend 1.06 fewer hours on work compared with female office workers, and 1.05 more hours on housework.

Finally, workers who are married with small children also show substantial differences from the other groups (column 4, Married with small children). Under WFH, male workers reduced their working hours by 1.64 hours, and increased housework by 0.91 hours and leisure by 1.1 hours. The difference between “WFH” and “Office” in housework hours is now significant, although the groups of single males and married males with no children did not see any significant differences at all. Thus, we conclude that WFH has significantly positive impacts on male housework hours. By contrast, female workers engaged in WFH reduced their working time by 1.51 hours and increased housekeeping by 1.51 hours. This result is similar to that for females without children. In column 5 of Table 5, another decomposition of household hours is between household chores and childcare. Under WFH, males increased the time spent on household chores by 0.29 hours and on childcare by 0.59 hours. Females also allocated an additional 0.73 hours to household chores and 0.56 hours to childcare. Thus, the increase in hours devoted to childcare under WFH is almost identical for males and females.

In sum, WFH significantly reduced working hours regardless of family structure, except for single males. WFH had no significant impact on the time allocation of single males. By contrast, single female remote workers reduced their working hours under WFH and increased the time spent on housework and leisure. In particular, they increased the time devoted to leisure by twice as much as the increased time spent on housework. For married respondents without children, male workers engaged in WFH allocated the additional time to leisure and sleep, while females devoted it to housework. Although the group of singles and married without children is not significant in housework, male with children is significantly positive. They spent the additional time not only on leisure but also on housework. Married female remote workers allocated more hours to housekeeping and reduced their working hours under WFH, in particular those with children. WFH increased the time devoted to childcare for both males and females.

5.2 Quantile Treatment Effects

Time allocations are various across workers. For example, some specific workers (e.g. IT engineers) usually work for long hours due to heavy workload. WFH would not allow them to reduce workload or could devote more time for working. For such long hours workers, WFH might not influence working hours. Hence, it would be worthwhile to investigate quantile treatment effects of WFH (Fröolich and Melly, 2010). Table 6 reports the results on working, housework, and leisure hours for males and females, and for people who are single, married without small children, and married with small children. In working hours (the upper panel), male and female workers are significantly negative in all quantiles. The impact of WFH by males dampens in working hours. That is, WFH by long hours male workers tends to shorten less (1.25 hours less) and WFH by short hours males reduces more (2.75 hours less). In the second column of the upper panel (“2. Single”), in parallel to the previous result, single male workers have no significant impact of WFH in all quantiles. Single females working long hours are not significant, while those working shorter are significantly shorter by WFH (3.75 hours less). Male and female married workers with small children (column 4) are significantly negative in all quantiles, while those without children (column 3) tend to be significantly negative and larger in lower quantiles. Overall, the impact of WFH on reducing working hours becomes weaker for long hours workers.

Next, the middle panel reports housework hours. Most male workers do not devote hours to housework, but male workers with some housework hours tend to devote more by WFH. Females tend to be significantly positive. Female workers with longer housework hours tend to increase housework by WFH. Finally, the bottom panel reports leisure hours. Male workers with longer leisure hours tend to devote more by WFH (1.75 hours more). Single female workers (Column 2) are significantly positive in all quantiles with larger coefficients than all other groups (1.5 to 2 hours more).

6 To What Extent does WFH Change Time Allocation?

We measure the impact of WFH on working, housework, and leisure hours. Using all sample, we estimate a WFH dummy in the OLS estimations. In detail, we regress the same set of independent variables as equation (1) on time use, i.e. work, leisure, housework, and sleep:

$$Time_i = \beta WFH_i + \alpha X_i + \gamma Y_i + \delta F_i + Occu_{O(i)} + Pref_{r(i)} + Date_{d(i)} + \varepsilon_i, \quad (2)$$

where *WFH* is a dummy for WFH. As defined above (equation (1)), *X, Y, and F* denote a set of basic, workplace, and family traits, respectively. However, the OLS estimates of WFH would be biased because unobserved heterogeneity in workers and firms is correlated with both time allocation and WFH. Poor public childcare services for workers with small children and high bargaining powers by high skilled workers in large companies might be more likely to give permission to WFH and thus simultaneously affect their time use. Thus, the coefficients of the WFH dummy would combine the impact of WFH on time with such other impacts. This leads to overestimate or underestimate the true impact of WFH on time. To deal with this unobserved heterogeneity, we estimate bounds on the coefficients of WFH following Altonji et al.(2005). We employ the methodology of Oster (2019). Oster beta, β^* is calculated as $\beta^* = \tilde{\beta} - \delta(\beta - \tilde{\beta})\left(\frac{R_{max}-\tilde{R}}{\tilde{R}-R}\right)$. We note that $\tilde{\beta}$ and $\tilde{R}$ are coefficient of WFH and R-squared when using all controls, while β and R are coefficient and R-squared without any controls. Following Oster (2019), we assume δ =1 and $R_{max} = 1.3\tilde{R}$. If the range between OLS estimates and Oster's beta includes zero, the OLS estimates are not robust to omitted variable bias. Table 7 reports only OLS coefficient of WFH in each estimation (work, housework, leisure, and sleep), omitting to report all other coefficients. It also reports Oster beta values. In the first column, male workers reduce working hours by 1 to 1.2 hours, while female workers do by 1 to 1.12 hours. On the other hand, male workers increase housework hours by 0.36 to 0.39 hours, leisure hours by 0.64 to 0.72 hours, and sleep hours by 0.43 to 0.44 hours, while female workers increase housework from 1.15 to 1.26 hours. In the second column, while single male workers see no significant outcomes, single female workers significantly increase housework by 1.12 to 1.25 hours and leisure by 1.44 to 1.45 hours. Married workers without small children see some different impact of WFH between genders. In the third column, while married male workers without small children tend to reduce working hours by 1.2 to 1.4 hours, while female tends to reduce working hours only by 0.74 to 0.76 hours. Instead, male workers increase leisure hours by 0.97 to 1.06 hours and sleep hours by 0.32 to 0.33 hours, although female workers are not significant. Married workers with small child see some different outcomes. Then both male and female reduce almost the same number of working hours (1.6 to 1.8 hours). On the other hand,

while male increases housework by 0.77 to 0.81, female does by 1.88 to 2.05 hours. In decomposition of housework, male (female) increases childcare hours by 0.59 to 0.62 (0.71 to 0.72) hours. Compared with other groups, the impacts of WFH in married workers with small children are similar between male and female. All of these results are consistent with our previous results. For all statistically significant coefficients, the Oster bounds do not include zero. This means that our results on WFH impact are robust to bias from unobservables.

7 Time-use Schedule and WFH

7.1 Work, Housework, and Leisure Schedule

In addition to our estimation results, we consider a plot of the frequency of workers in each time-use category at 15-minute intervals for a 24-hour period. The sample is all workers who worked on the survey day. Figure 2-1 displays the frequency distribution of those engaged in work at 15-minute intervals by gender for office workers and remote workers (“WFH_Male”, “WFH_Female”, “Office_Male”, and “Office_Female”). Note that work hours by office workers do not include commuting hours.

Overall, all groups have similar distributions in work hours. The majority of workers in all four groups worked during the conventional working hours (i.e., 09:00–17:00) including a one-hour lunch break (12:00–13:00). Compared with office workers (“Office_Male” and “Office_Female”), the distributions of remote workers (“WFH_Male”, and “WFH_Female”) are less dispersed and have lower peaks. Overall, working hours for remote workers are shorter than for office workers, and Figure 2-1 shows that the distributions of remote workers are clearly dominated by those of office workers. The tails of the distributions are much shorter for remote workers, which implies that many remote workers commence work later in the morning and finish earlier in the afternoon than office workers. The peaks of the distributions are lower for remote workers, which indicates that many remote workers tend to allocate time during the day to nonworking activities such as household chores. In particular, the distributions of female remote workers have similar shape but smaller distribution. This indicates that female remote workers tend to work shorter hours and devote more time to nonwork activities than the other three groups. However, the distributions of male office workers dominate those of the other groups; the right tail is much longer, and male office workers tend to work conventional working hours, as well as overtime.

Figure 2-2 shows the distribution of time spent on housework, and indicates a substantial difference between genders. Females have two peaks, namely early morning and late afternoon. Female office workers (“Office_Female”) tend to do housework early in the morning before commuting at the peak time of 06:30. The distribution declines drastically after this peak. By contrast, remote female workers (“WFH_Female”) have higher peaks and longer right tails in the morning. Remote female workers tend to do more housework in the morning. Their peak is later than for office female workers, at around 08:00. In the evening, both remote and office female workers have similar shaped distributions. More remote workers do housework than office workers from 17:00 to 18:00 and then do more housework until late at night. The frequency distributions of male workers are much lower than those of females. A relatively low number of male office workers and remote workers do a small amount of housework, with male office workers doing almost none, and male remote workers doing some housework in the middle of the day.

Figure 2-3 plots the distributions for leisure time. Males tend to spend time on leisure from 19:00 to 22:00. In particular, male remote workers differ from the other groups. Many male remote workers tend to spend more time on leisure from 17:00 to 21:00 than the other groups. Furthermore, there are three small peaks at 08:00–09:00, 13:00–14:00, and around 17:00, which indicates that some male remote workers devote time to leisure in the middle of day. By contrast, male office workers have the same frequencies as female office workers, no leisure until 17:00 (except a small peak in lunch time), that is, the core working hours. No office workers devote time to leisure during the day regardless of gender.

Appendix Figure 2 provides detailed information about the time-use categories. The distribution of household chores (subcategory in housework) looks similar to that of household work. Most household work involves completing household chores. Then, watching TV, listening to the radio, or reading magazines and newspapers, as well as rest and relax are major categories in leisure. Leisure at night for male remote workers mainly involves watching TV, listening to the radio, or reading magazines and newspapers. Office workers tend to take rest from 12:30 to 13:30, while remote workers tend to take more relaxation in the middle of day (afternoon). Female remote workers are more likely to take rest in the late afternoon.

Finally, Figure 2-4 shows data for sleep patterns, and indicates that all four groups have similar shaped distributions. Male office and remote workers tend to

go to bed earlier than female office and remote workers. In the morning, male and female office workers wake earlier than remote workers.

7.2 Single Workers

Next, we focus on single workers. Figure 3-1 plots the distribution of working hours. Single male and female office workers (“Office_male” and “Office_female”) have similar distributions, with the distributions of male singles being almost identical between remote and office workers (“WFH_male” and “Office_male”). This indicates that WFH does not crucially affect the time-use schedules of male singles. However, the distribution of female remote workers differs from that of female office workers with a much smaller peak in working hours, in particular for remote workers in the morning. This indicates that female remote workers work much less in the morning than the other groups. Figure 3-2 plots housework hours. Compared with Figure 2-2 for the total sample, the distribution of single female office workers is much lower (0.05-0.1 at peak) than for all female office workers (0.4 at peak) and close to that of males (0.05 at peak). Female remote workers tend to spend much less time on housework (0.2-0.3 at peaks). Figure 3-3 plots leisure hours. The distribution for male singles is similar to that for the total sample (Figure 2-3). However, unlike the total sample, Figure 3-3 shows that single female remote workers devote much more time to leisure, particularly in the late morning and late evening. To analyze the behavior of single female remote workers more closely, Appendix Figure 3 shows the detailed categories, with the upper panel giving the distributions of watching TV/listening to the radio/reading magazines or newspapers and the lower panel those of rest/relaxation. Single female remote workers devote much more time to TV/Radio/Magazines in the late evening than do males. Rest/relaxation has higher frequencies of time use for single female remote workers from 14:00 to 18:00. These time-use patterns are specific to single female remote workers.

7.3 Married Workers with Small Children

We now focus on workers with small children, and Figure 4-1 shows working hours. Overall, the distributions look similar to those distributions of all workers (Figure 2-1). However, the peaks for female remote workers are lower than for female office workers. Moreover, the peaks in the afternoon for female remote and office workers are much lower than those for males. Female remote workers have a lower peak in the afternoon than female office workers, and female remote

workers experience a large decline after 16:00 and office workers after 17:00. The distributions of male office workers are similar to those of all male workers (Figure 2-1) with many working after 17:00. The decline in frequency after 17:00 is gradual. By contrast, male remote workers tend to stop working after 17:00, after which the decline is sharp. WFH allows males to finish work earlier and thereby prevent overwork.

More female remote workers devote time to housework than female office workers. Figure 4-2 shows that the peaks in housework hours for female remote workers are higher (by 0.5–0.6) than for female office workers (by ~0.4). Parallel to finishing work earlier than office workers, housework increases after 16:00 for female remote workers and after 17:00 for female office workers. While the distributions of male office workers are similar to the full sample (Figure 2-2), that is, low frequency of household work, male remote workers see two peaks around 19:00–21:00 with higher frequencies (by 0.2) than in the total sample (by 0.05–0.1). This indicates that some male remote workers with small children tend to help their wives with household work.

Figure 4-3 shows that the distribution of leisure hours for married workers with a child is similar to that for all workers (Figure 2-3). Overall, while there is no substantial difference between female office workers and remote workers, there is some difference for males in that remote male workers tend to spend more time on leisure at night than male office workers, which is similar to the full sample (Figure 2-3).

Both female and male remote workers tend to spend more time on housework if they have small children. Appendix Figure 4 presents two subcategories of housework, namely household chores and childcare. Overall, less time is devoted to childcare than household chores, but childcare is undertaken periodically as revealed by the lower frequency (vertical axis) but numerous humps. For childcare hours, remote workers have higher frequencies than office workers over the entire day. Importantly, both female and male remote workers tend to devote more time to childcare, with higher peaks from 07:00 to 08:00 and from 16:00 to 19:00, as well as from 20:00 to 22:00. This is in a sharp contrast to office workers. For female office workers, there are only two peaks, from 07:00 to 08:00 and 19:00 to 22:00, which are almost identical to those for childcare for male remote workers. This indicates that WFH may allow more time to be devoted to childcare, particularly for males.

8 Conclusion

WFH is thought to improve work–life balance through more flexibility in time use. It is well known that Japanese workers have extremely poor work–life balance and low female participation in labor markets among developed countries. This paper investigated the impact of WFH on time allocation in Japan, using Japanese time-use survey data. We obtained three main results.

First, females, the better educated, and office workers tend to WFH. Second, WFH tends to reduce the number of working hours. Instead, females tend to devote more time to housework, while males tend to devote more time to housework and leisure. Third, WFH has heterogeneous impacts on time reallocation among groups. For instance, there are no substantial differences in time allocation by single males between office work and remote work. WFH allows single females to devote more time to leisure, in particular to watching TV around midnight and to relaxation in the late afternoon. However, married females and males with small children significantly increased the time they devoted to childcare through WFH; importantly, WFH allows males to devote more time to childcare.

Some limitations should be mentioned. First, the survey was conducted prior to the COVID-19 pandemic and thus WFH was not prevalent at that time. Future research should use more recent survey data. Second, our time-use survey does not ask the frequency of WFH. Thus, we cannot distinguish between occasional and home-based remote workers. The new survey conducted in late 2021 (as of August 2022 the data remain unavailable) addresses this question and should overcome this limitation. Third, we cannot identify correlation between WFH and life satisfaction (or happiness) due to data unavailability. Such variables would allow us to explore these issues.

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Table 1: Number of Sample

	Num
All respondents	**176,285**
Workers	101,717
Workers (excl. on-leave)	100,426
Workers on workday (excl. on-leave)	76,581
Male workers on workday (excl. on-leave)	42,839
Female workers on workday (excl. on-leave)	33,742
Workers on workday at survey day 1 (excl. on-leave)	63,853
Male workers on workday at survey day 1 (excl. on-leave)	36,463
Female workers on workday at survey day 1 (excl. on-leave)	27,390

Table 2: Number of Work from Home

	WFH	All workers (workday)
Male	203	42839
Female	247	33742
Total	450	76581

Table 3: WFH and Average Time Allocation (unit: hour)

All		WFH	Office	Difference	T-stat	
	Work	6.05	7.88	-1.83	-14.17	***
	Housework	2.52	1.26	1.26	15.40	***
	Leisure	4.16	3.49	0.67	6.54	***
	Sleep	7.38	7.21	0.17	2.62	**
Male		WFH	Office	Difference	T-stat	
	Work	6.70	8.58	-1.88	-9.62	***
	Housework	0.86	0.37	0.50	8.35	***
	Leisure	4.85	3.67	1.18	7.25	***
	Sleep	7.73	7.33	0.41	4.09	***
Female		WFH	Office	Difference	T-stat	
	Work	5.50	7.05	-1.54	-9.75	***
	Housework	3.89	2.39	1.50	11.69	***
	Leisure	3.59	3.22	0.37	2.98	***
	Sleep	7.09	7.05	0.04	0.50	

*** p<0.01, ** p<0.05, * p<0.10

Table 4: Who Works from Home

Dependent variable: WFH

	1		2		3		4	
Female	0.713991	4.58 ***	0.725262	4.64 ***	0.732364	4.67 ***	1.101692	3.15 ***
Age	0.63363	2.36 **	0.692633	2.39 **	0.693407	2.39 **	0.935945	1.68 *
Income	-0.02457	-0.52	-0.02471	-0.52	-0.024	-0.51	-0.06151	-0.6
Univ	0.465801	3.25 ***	0.462487	3.23 ***	0.457644	3.21 ***	0.617159	1.89 *
Single	-0.61496	-2.56 ***	-0.45603	-2.05 **	-0.45098	-2.03 **		
Flex	0.399768	2.18 **	0.395554	2.16 **	0.394171	2.15 **	0.182951	0.47
Regular	0.309172	1.9 *	0.311896	1.9 *	0.312928	1.91 *	0.034593	0.1
Emp Size	-0.15898	-4.54 ***	-0.15916	-4.54 ***	-0.15876	-4.53 ***	-0.15023	-2.08 **
Child	0.170537	0.74						
Num_Child			0.134089	1.3	0.061258	0.39	0.153896	0.62
Num_Adult			-0.04874	-0.91	-0.05277	-0.98	-0.08995	-0.69
Nursing					0.035739	0.17	0.312618	0.6
Non_Childcare					0.301502	1.03	0.312257	1.01
Non_Helper					-0.06038	-0.22	0.047209	0.15
Sample	All		All		All		Married with Children	
Num Obs	58,607		58,607		58,607		6,057	
log likelihood	-1636.34		-1635.18		-1634.56		-255.188	

*** p<0.01, ** p<0.05, * p<0.10

Table 5: Average Treatment Effects of WFH (unit: hour)

1. All

Total					
	WFH	Office	Differenc	T-stat	
Work	6.06	7.27	-1.21	-6.18	***
Housework	2.51	1.66	0.85	5.79	***
Leisure	4.16	3.69	0.47	2.97	***
Sleep	7.38	7.19	0.19	2.06	**

	2. Single					**3. Married without small children**					**4. Married with small children**				
Male	**Male**					**Male**					**Male**				
	WFH	Office	Difference	T-stat		WFH	Office	Differenc	T-stat		WFH	Office	Differen	T-stat	
Work	8.09	8.72	-0.64	-0.97		6.67	7.58	-0.92	-2.72	**	7.04	8.68	-1.64	-2.00	**
Housework	0.70	0.35	0.35	1.33		0.72	0.57	0.15	1.33		1.54	0.63	0.91	2.16	**
Leisure	4.47	4.20	0.27	0.41		5.06	4.44	0.62	2.18	**	3.85	2.75	1.10	1.96	**
Sleep	7.75	7.50	0.25	0.68		7.71	7.37	0.34	2.31	**	7.79	7.82	-0.03	-0.06	
Female	**Female**					**Female**					**Female**				
	WFH	Office	Difference	T-stat		WFH	Office	Differenc	T-stat		WFH	Office	Differen	T-stat	
Work	5.59	7.46	-1.87	-2.28	**	5.67	6.73	-1.06	-3.85	***	4.77	6.27	-1.51	-2.59	**
Housework	1.96	0.80	1.15	2.26	**	3.48	2.43	1.05	4.96	***	5.66	4.15	1.52	2.68	***
Leisure	5.29	2.97	2.31	3.62	***	3.80	3.51	0.29	1.41		2.59	2.30	0.30	0.73	
Sleep	7.25	7.33	-0.08	-0.20		7.07	7.01	0.06	0.50		7.16	7.24	-0.08	-0.31	

*** p<0.01, ** p<0.05, * p<0.10

5. Married with small children (detail categories of housework)

Male					
	WFH	Office	Differenc	T-stat	
Household chore	0.44	0.15	0.29	1.69	*
Childcare	0.83	0.24	0.59	2.45	**
Female					
	WFH	Office	Differenc	T-stat	
Household chore	3.57	2.84	0.73	1.61	
Childcare	1.46	0.90	0.56	1.67	*

*** p<0.01, ** p<0.05, * p<0.10

Table 6: Quantile Treatment Effects (unit: hour)

Work	1. All			2. Single			3. Married without small children			4. Married with small children		
	Male			Male			Male			Male		
	25%	50%	75%	25%	50%	75%	25%	50%	75%	25%	50%	75%
Coeff	-2.75	-2.25	-1.25	-1.25	0.25	0	-2.75	-2.75	-1.25	-2.5	-1.5	-2.25
z	-5.71 ***	-4.4 ***	-3.51 ***	-0.98	0.43	0	-6.29 ***	-7.16 ***	-1.71 *	-2.64 ***	-1.71 *	-3.53 ***
	Female			Female			Female			Female		
	25%	50%	75%	25%	50%	75%	25%	50%	75%	25%	50%	75%
Coeff	-2	-2.25	-1	-3.75	-3.25	-1.75	-1.25	-1	-0.5	-3	-3.25	-2.75
z	-6.48 ***	-7.29 ***	-4.03 ***	-3.49 ***	-3.85 ***	-1.23	-3.38 ***	-1.43	-1.87 *	-4.99 ***	-3.44 ***	-2.73 **

*** p<0.01, ** p<0.05, * p<0.10

Housework	1. All			2. Single			3. Married without small children			4. Married with small children		
	Male			Male			Male			Male		
	25%	50%	75%	25%	50%	75%	25%	50%	75%	25%	50%	75%
Coeff	0	0	0.75	0	0	0.5	0	0	1	0	1	2
z	0	0	6.43 ***	0	0	3.27 ***	0	0	6.93 ***	0	1.77	3.71 ***
	Female			Female			Female			Female		
	25%	50%	75%	25%	50%	75%	25%	50%	75%	25%	50%	75%
Coeff	1.25	2	2	0	2	2	0.25	1	1	2.75	2.75	3
z	3.99 ***	7.99 ***	7.15 ***	0	3.37 ***	3.82 ***	0.91	3.72 ***	3.63 ***	5.01 ***	4.27 ***	4.69 ***

*** p<0.01, ** p<0.05, * p<0.10

Leisure	1. All			2. Single			3. Married without small children			4. Married with small children		
	Male			Male			Male			Male		
	25%	50%	75%	25%	50%	75%	25%	50%	75%	25%	50%	75%
Coeff	0.5	1	1.75	-2	-0.5	1.75	1	1.75	1.75	0.75	0.75	1
z	1.6	2.27 **	4.7 ***	-4.35 ***	-0.53	1.4	2.81 ***	3.14 ***	4.76 ***	2.4 **	1.05	2.17 **
	Female			Female			Female			Female		
	25%	50%	75%	25%	50%	75%	25%	50%	75%	25%	50%	75%
Coeff	0.75	0.75	1	1.75	2	1.5	0.25	0.5	0.25	0.5	0.5	1
z	2.4 **	1.05	2.17 **	1.68 *	4.08 ***	3 ***	1.14	2.75 ***	0.88	1.34	1.16	1.45

*** p<0.01, ** p<0.05, * p<0.10

Table 7: Estimations on impact of WFH

NB: Reported coefficients of WFH dummy only

1. All				**2. Single**			**3. Married without small children**			**4. Married with small children**		
Male				**Male**			**Male**			**Male**		
Dependent var	Coeff	t	Oster beta	Coeff	t	Oster beta	Coeff	t	Oster beta	Coeff	t	Oster beta
Work	-1.19999	-4.3 ***	-1.06012	0.477305	0.7	0.60373	-1.41622	-4.18 ***	-1.26125	-1.86765	-3.49 ***	-1.67672
Housework	0.395755	3.31 ***	0.36651	0.195012	0.7	0.16937	0.329584	2.54 **	0.30354	0.818763	2.28 **	0.7739
Leisure	0.721949	2.76 ***	0.64734	-0.43507	-0.63	-0.55703	1.064397	3.29 ***	0.97759	0.65105	1.39	0.62327
Sleep	0.440119	3.33 ***	0.43402	1.923917	1.48	0.47385	0.32722	2.26 **	0.31567	0.794511	2.1 **	0.80804
Female				**Female**			**Female**			**Female**		
	Coeff	t	Oster beta	Coeff	t	Oster beta	Coeff	t	Oster beta	Coeff	t	Oster beta
Work	-1.12032	-4.67 ***	-1.00988	-1.53432	-1.55	-1.32476	-0.75992	-2.68 ***	-0.73846	-1.8862	-3.9 ***	-1.63534
Housework	1.263505	6.14 ***	1.151	1.252215	1.98 **	1.12367	0.859527	3.9 ***	0.84835	2.057679	4.1 ***	1.88097
Leisure	0.17591	1.1	0.17819	1.446141	2.07 **	1.45242	0.343975	0.47	0.35813	0.181364	0.55	0.12334
Sleep	0.016707	0.15	0.01915	-0.27294	-0.44	-0.22807	0.085131	0.67	0.07559	-0.04543	-0.2	-0.04344

*** p<0.01, ** p<0.05, * p<0.10

5. Married with small children (detail categories of housework)

Male			
	Coeff	t	Oster beta
Household chore	0.037099	0.36	0.01759
Childcare	0.615	2.45 **	0.59488
Female			
	Coeff	t	Oster beta
Household chore	0.962849	2.32 **	0.82729
Childcare	0.720471	2.07 **	0.71201

*** p<0.01, ** p<0.05, * p<0.10

Appendix Table: Basic Statistics

Var names	Num	mean	sd	min	max	Definitions
WFH	63853	0.004698	0.068383	0	1	WFH dummy (Work from Home=1)
Child	63853	0.199552	0.399667	0	1	Dummy for children
Num_Child	63853	0.271702	0.655181	0	6	Num children under 10 years of age
Num_Adult	63853	2.969774	1.309445	1	14	Num family member above 10 years of age
Regular	63853	0.549136	0.497584	0	1	Dummy for regular employees
Flex	63853	0.088124	0.283478	0	1	Dummy for flextime working
Emp_Size	62522	4.081091	2.483563	1	9	Size of companies (categorical variable)
Univ	63853	0.316446	0.465093	0	1	Dummy for university degree
Income	63041	5.285318	1.194521	0	7.467	Income of respondents (ln)
Female	63853	1.428954	0.494931	1	2	Female variable (female=2, male=1)
Age	63853	3.844322	0.344918	2.71	4.595	Age of respondents (ln)
Nursing	63853	0.068329	0.252311	0	1	Dummy for nursing the elderly
Non_Childca	63853	0.095281	0.293606	0	1	Dummy for non-access to kindergartens even if needed
Non_helper	63853	0.113808	0.317581	0	1	Dummy for no helpers for childcare even if needed

NB: The sample is only day 1

Figure 1: number of WFH by occupations

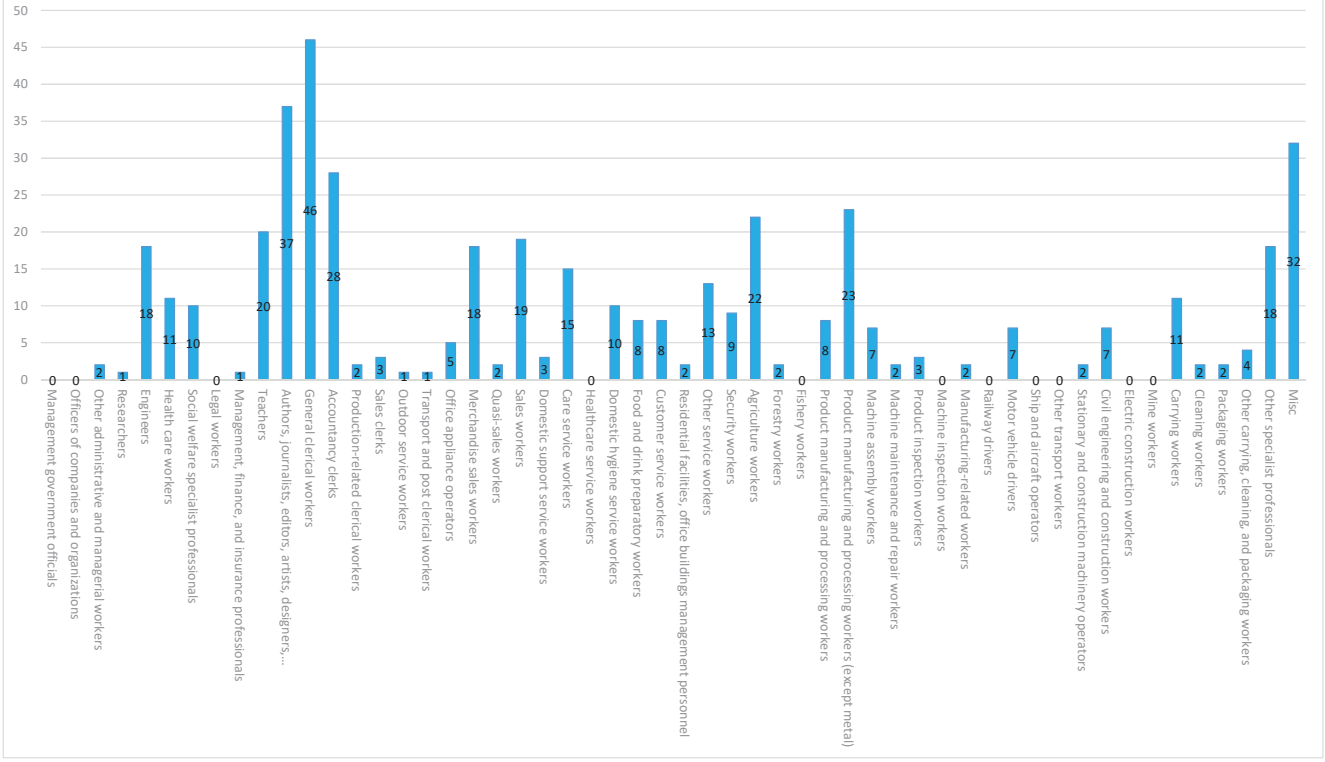


Figure2: Time-use Schedule (All sample)

Figure 2-1: Work (All sample)

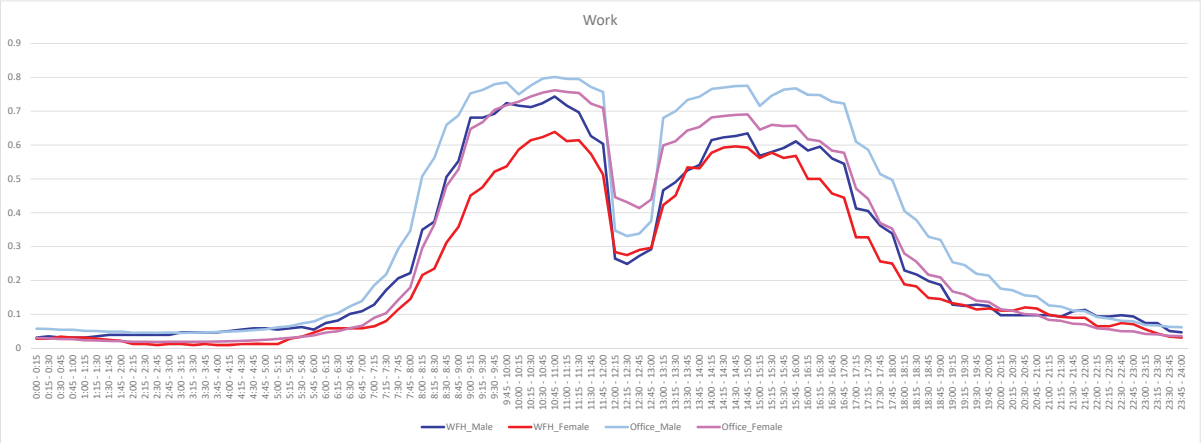


Figure 2-2: Housework (All)

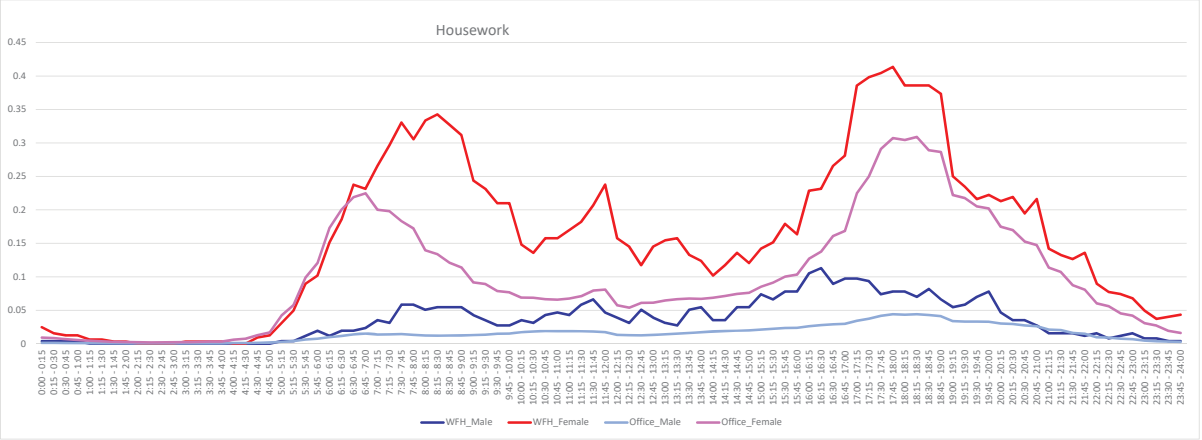


Figure 2-3: Leisure (All)

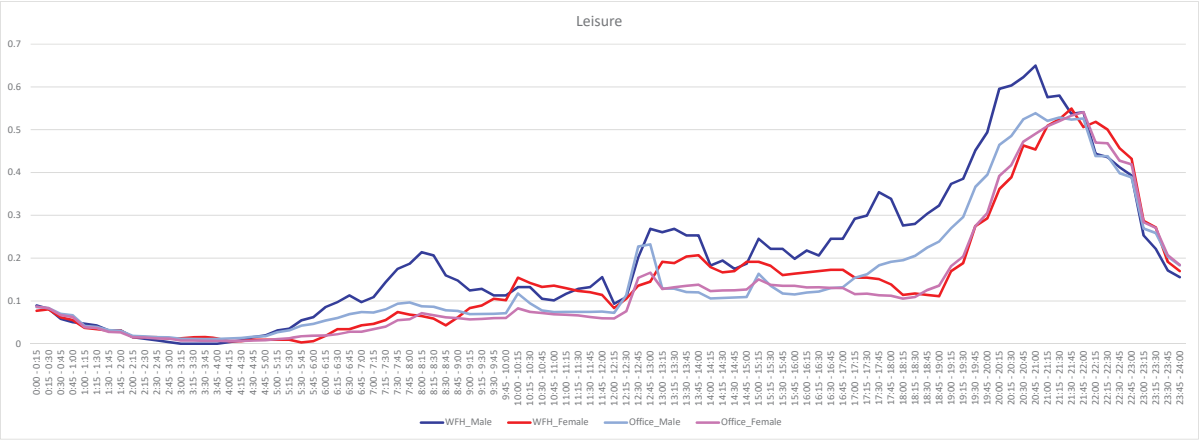


Figure 2-4: Sleep (All)

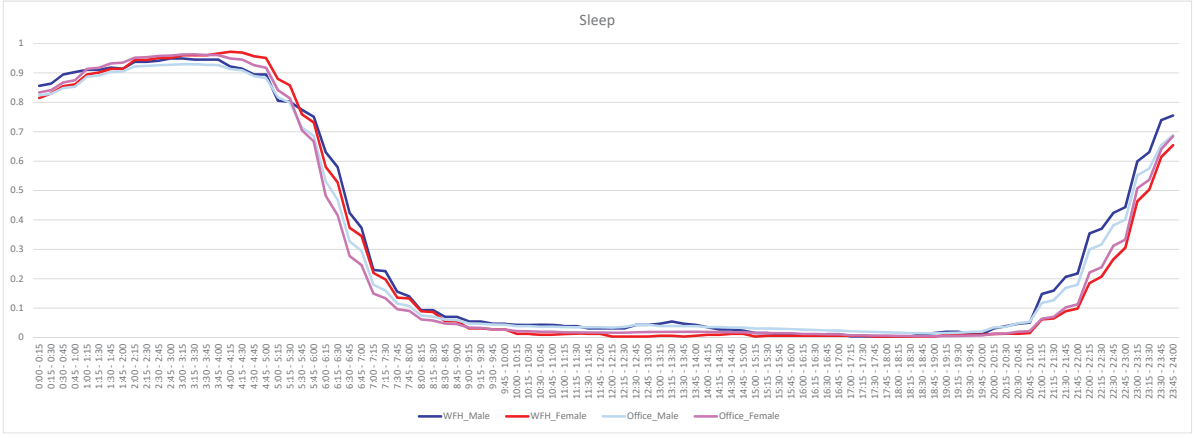


Figure3: Time-use Schedule (Single)

Figure 3-1: Work hours (Single)

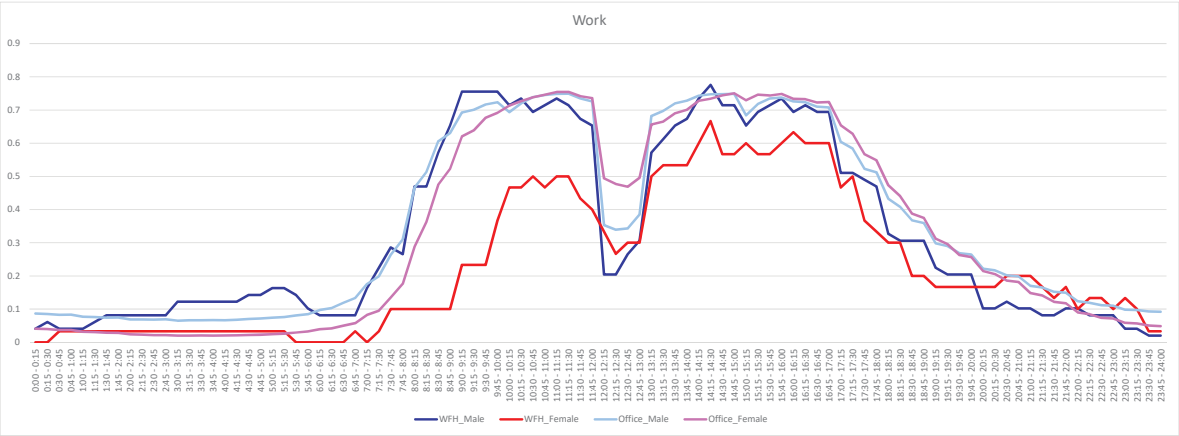


Figure 3-2: Housework hours (Single)

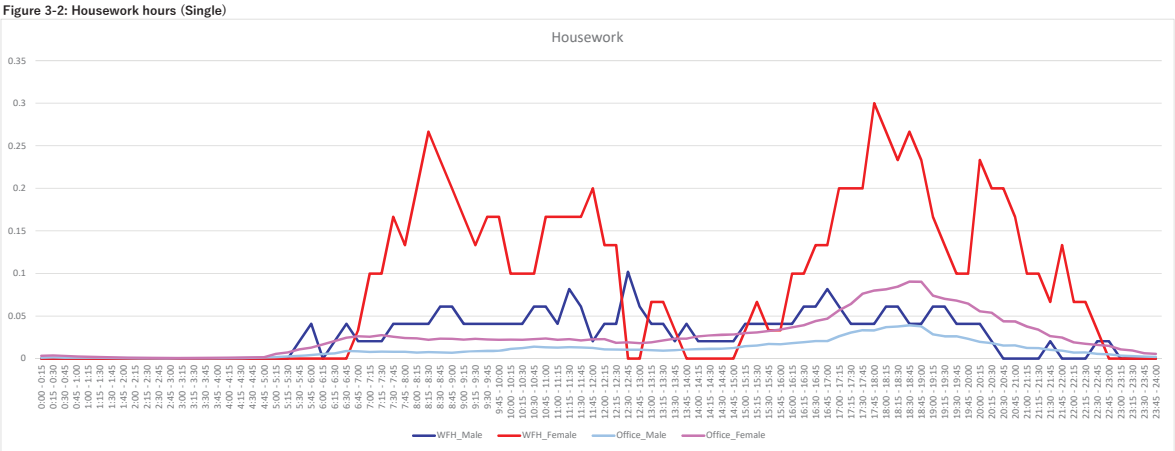


Figure 3-3: Leisure time (Single)

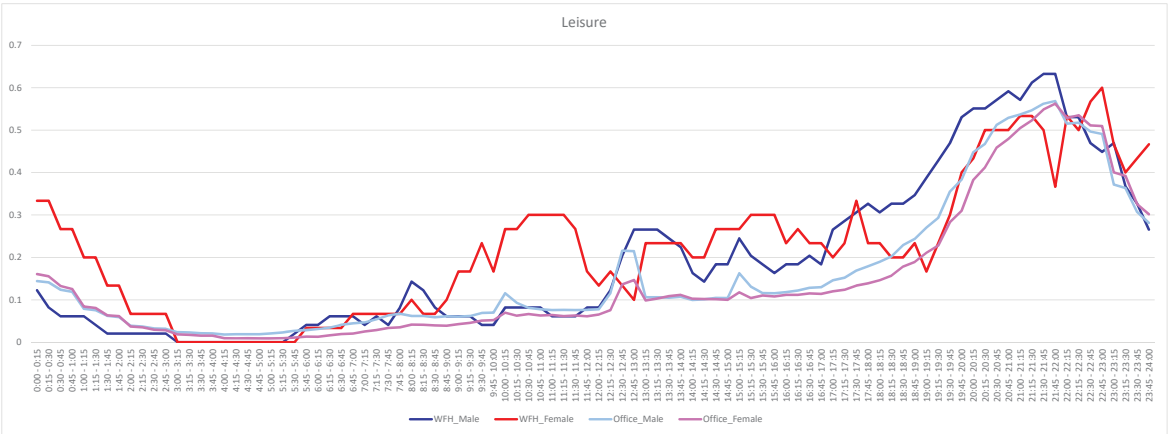


Figure 3-4: Sleep time (Single)

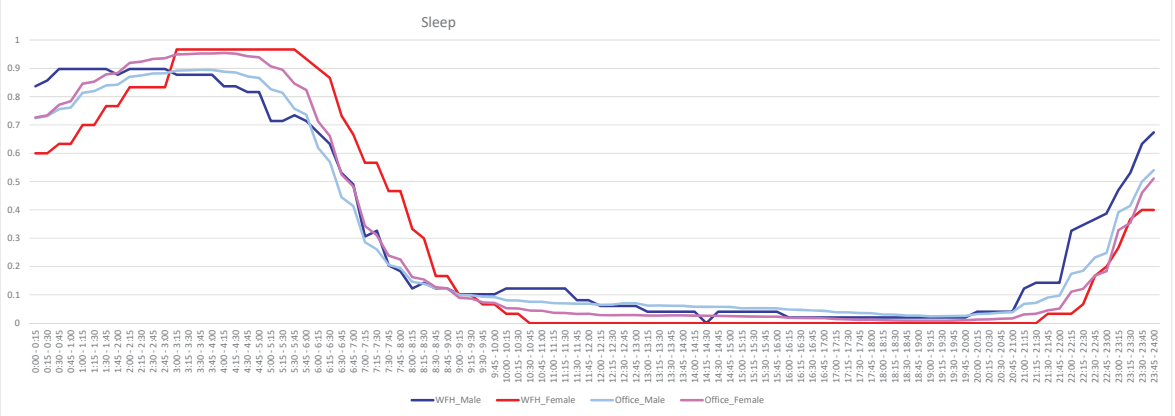


Figure4: Time-use Schedule (Married with children)

Figure 4-1: Work hours (Married with children)

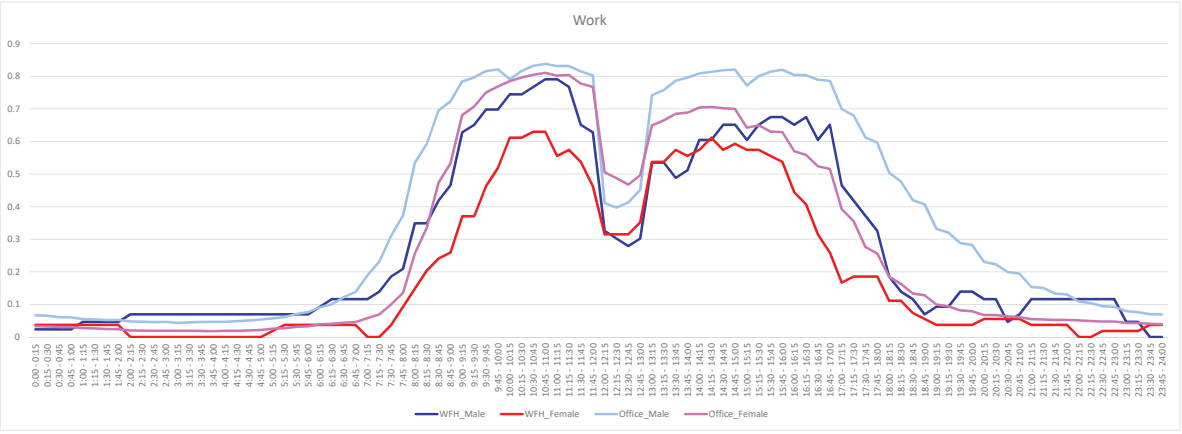


Figure 4-2: Housework hours (Married with children)

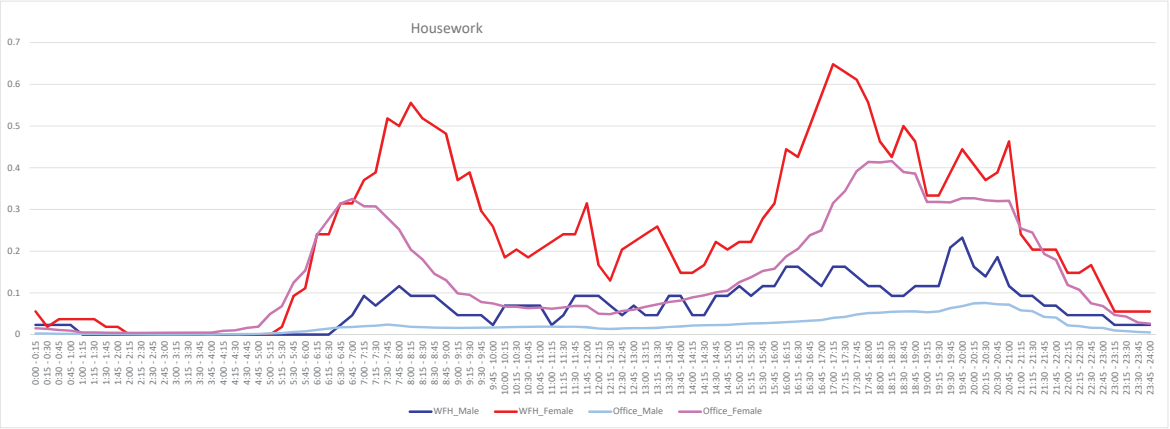


Figure 4-3: Leisure time (Married with children)

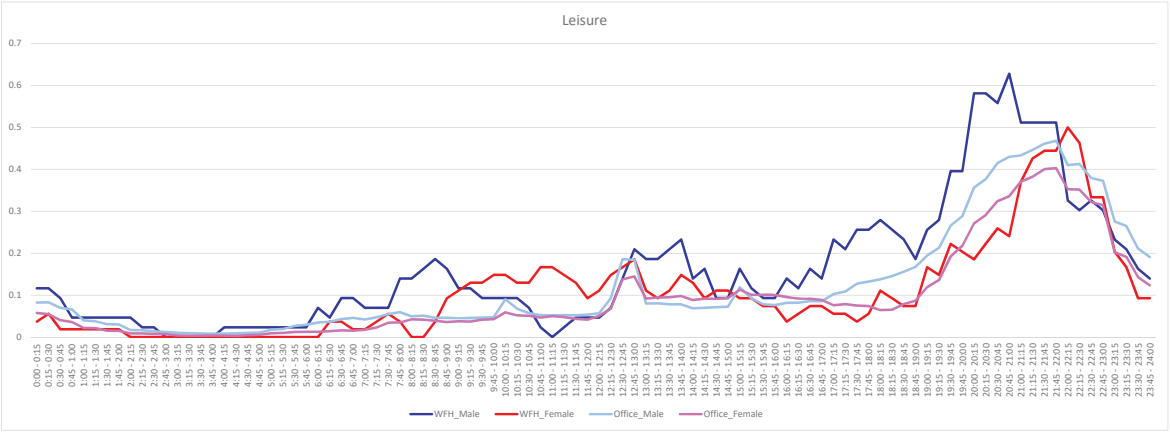
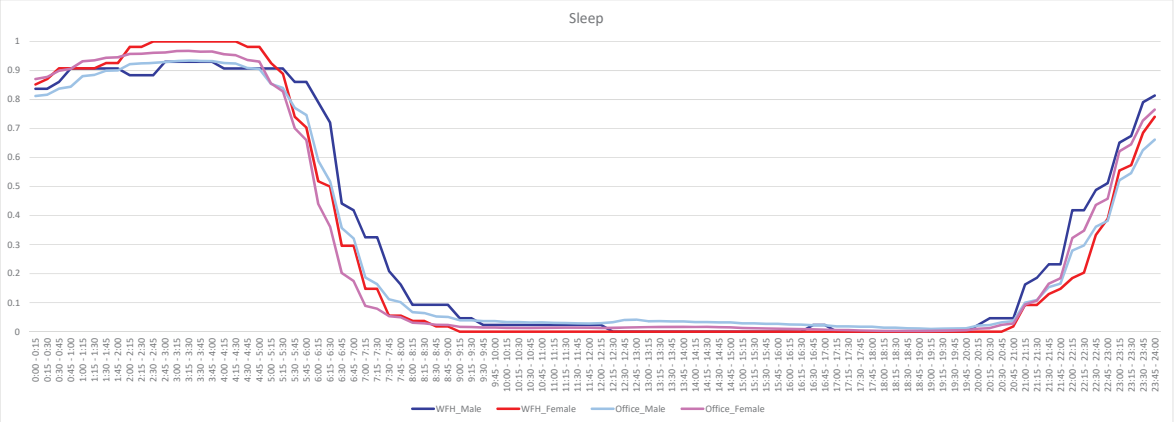
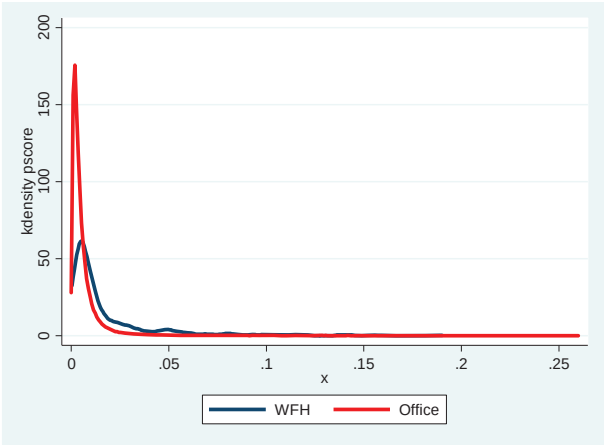


Figure 4-4: Sleep time (Married with children)

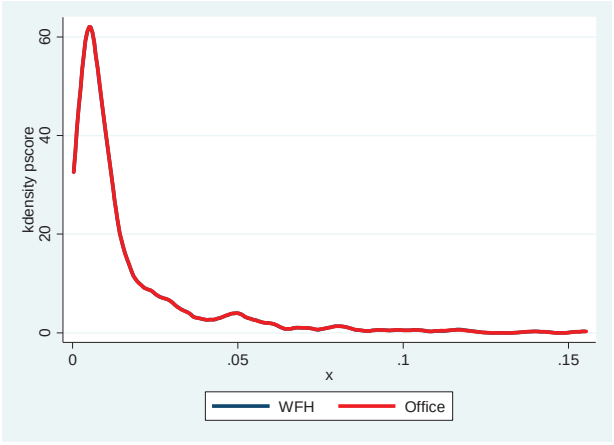


Appendix Figure 1: Quality of matching

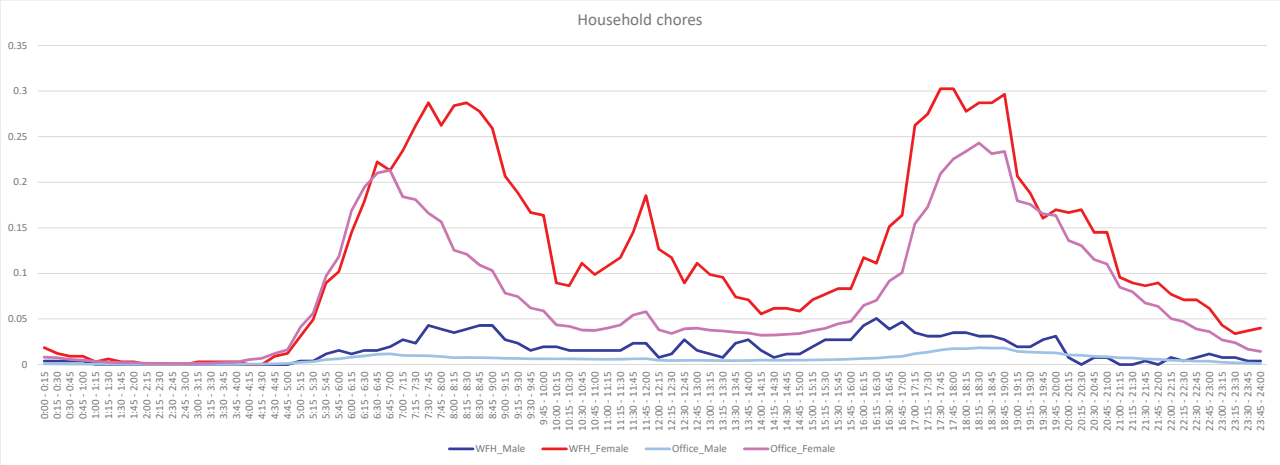
Before matching

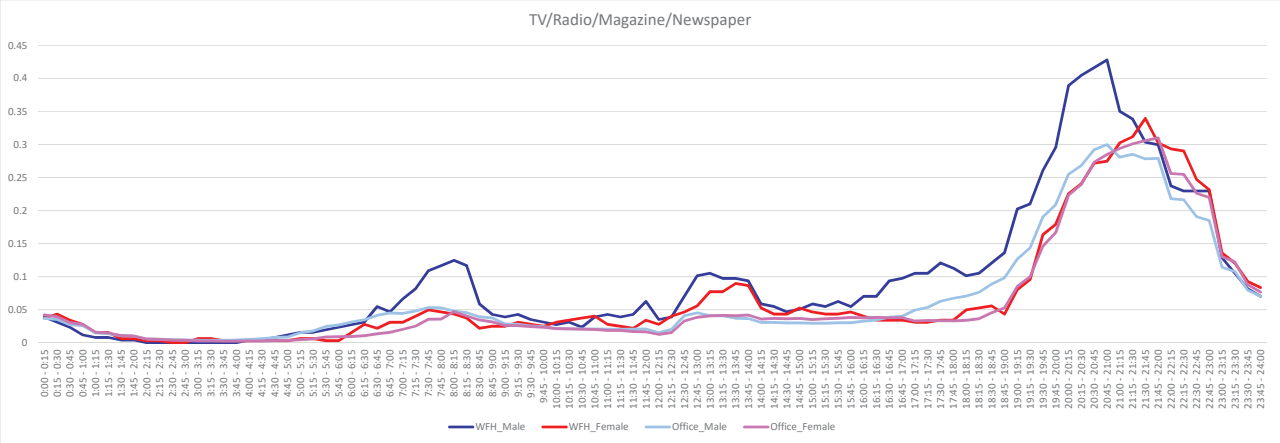


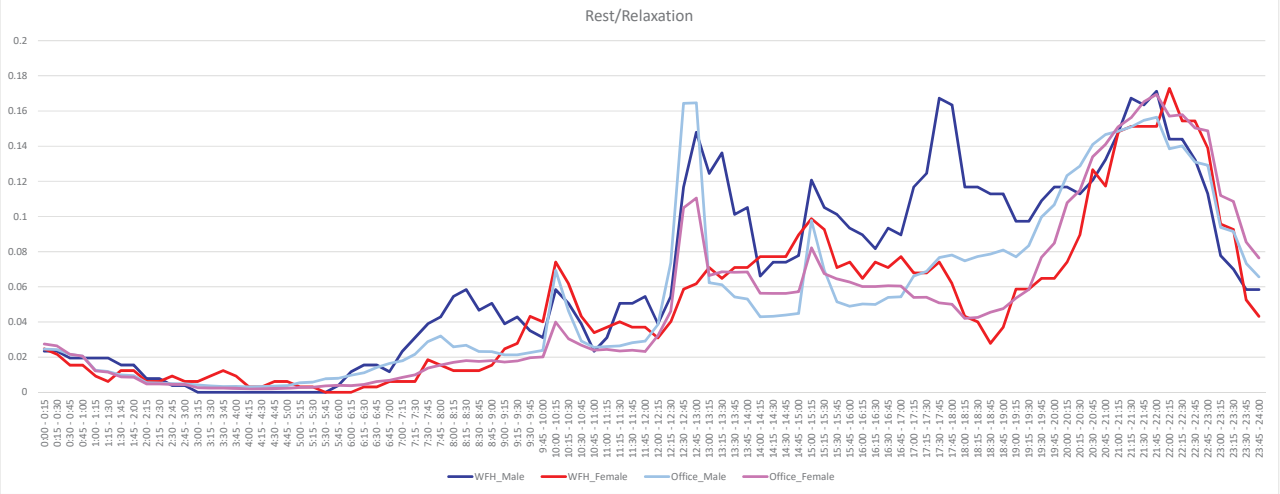
After matching



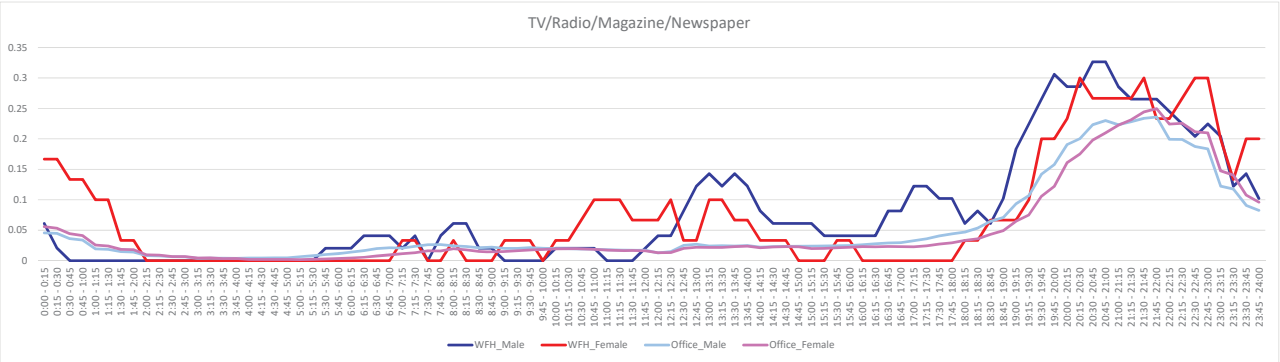
Appendix Figure 2: Subcategories of Leisure: Household chores, TV/Radio/Magazine/Newspaper, and Rest/Relaxation (total)

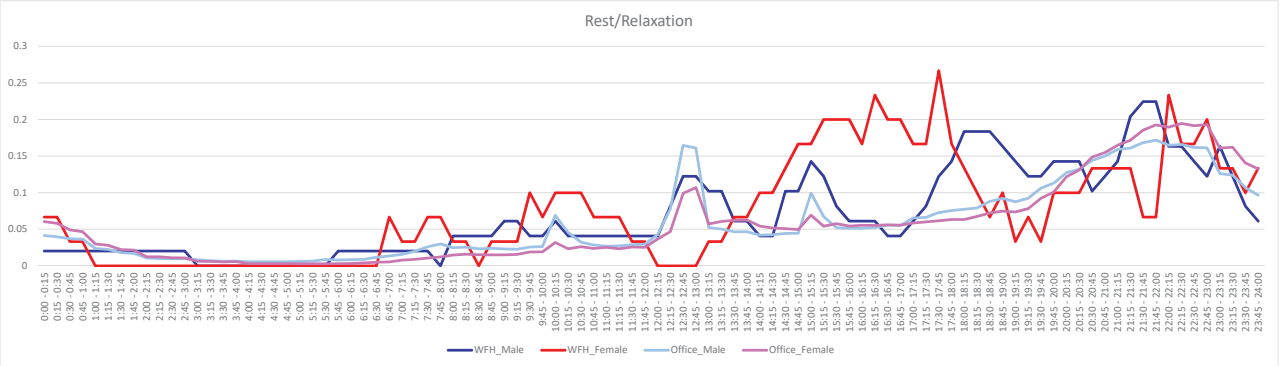






Appendix Figure 3: Some subcategories of Leisure: TV/Radio/Magazine/Newspaper and Rest/Relaxation for Single





Appendix Figure 4: Some subcategories of Housework: Childcare and Household chores for married with child