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Effects of Fathers' Nonstandard Work Schedules on Childcare Time

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Sep 3, 2022

Abstract

This study used Japanese time use data to analyze the effect of fathers' nonstandard work schedules on childcare time. The results indicated that weekday evening and weekend work reduce fathers' childcare time and increase that of mothers. In addition, the marginal effect found through multivariate analysis revealed that mothers do not fully compensate for the reduction in fathers' childcare time, leading to the possibility that the total childcare time is shortened. However, the results of the weekday/weekend integrated data analysis showed that fathers (especially white-collar fathers) working weekday evenings reduce the gap with other fathers through weekend childcare.

Keywords: Nonstandard Working Schedules · Childcare time · Time use · Japanese Time-Use Survey
JEL Classification: J13 · J22

1 Introduction

In many developed countries, the time parents dedicate to childcare is increasing. The context for this development is the expansion of income inequality that started in 1980. Much of this trend, especially in the 80's, is attributed to the growth in educational returns.[1] That is, children's future economic success is understood as a result of their education. Parents, therefore, have come to invest significantly in childcare, spending not only money but also their own time to achieving high-quality education.[2]

We all have limited time. Given that work hours generally cannot be reduced, an increase in the childcare time may lead to issues such as reduced sleep or compromised health because of the constant stress of limited time. However, while work hours have not reduced dramatically, the expansion of the 24/7 economy has led to an increase in the percentage of workers with nonstandard work schedules (NSWS). NSWS is an alternative to the standard work schedule of 9 a.m. to 5 p.m. on weekdays, which may entail working in the evening, at night, or in the early morning on weekdays and even on the weekends.[3] Work schedules of this kind have become more prevalent in developed countries because of the globalized economy and the growth of the service industry and the rise of information technology (Presser 2003). How has NSWS affected the parenting time? This study uses the data from Japanese time use survey to analyze these effects.

In this context, a broader societal concern is reflected: the varying rates of increase in parents' childcare time based on social class. The time dedicated to childcare in higher-earning households has increased more sharply than in families of lower social class. While this may be because of differences between classes in the awareness of the effects of educational investment on children, it is also possible that lower-social-class households face greater financial and, therefore, temporal restrictions. Affluent households are financially able to outsource other types of housework, thus guaranteeing more time for parents to spend on childcare. In contrast, in poorer households, parents often hold multiple jobs to supplement lower incomes, resulting in scarce time for childcare.[4]

This study aims to clarify (with attention to differences in social class) whether fathers' NSWS in nuclear family households with children under the age of 6 years affect the time dedicated to childcare and, if so, in what way and to what extent.[5] Here, "nuclear family household" refers to

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[1] Doepke and Zilibotti (2019) p.68.
[2] Unlike housework, parenting tend to be considered difficult to substitute with market goods; thus, it has been found that parents' childcare time does not decrease as income increases. As described in further detail below, the time parents dedicate to childcare is proportional to children's outcomes and is, thus, highly significant as an investment.
[3] Rotating hours and split shifts are also included.
[4] Doepke and Zilibotti (2019) p.127.
[5] Mothers with children under the age of 6 years are not addressed here because of their low rate of NSWS workers (1%–2% work on nonstandard schedules before 8 a.m. or after 6:30 p.m. on weekdays). However, up to 10% of mothers are employed during some weekend daytime periods. This remains to be

households composed of a husband, wife, and child(ren). The study is limited to nuclear family households for two reasons. First, nuclear families in Japan are typical of households with children, making up three out of four families. Second, this study also aims to examine the effect of fathers' childcare time on mothers' childcare time; therefore, households that include cohabiting grandparents and single-parent households were excluded.[6]

２．Literature review

2.1 Parents' childcare time and children's outcomes

Parallel to the heightened expectations of childcare in developed countries, the time parents dedicate to childcare is on the increase. According to Dotti Sani and Treas (2016), who compared 11 western countries (1965–2012), childcare time has increased for both fathers and mothers in every country except France.[7] This increase in the time dedicated to childcare is considered a result of changing family behavior more than demographic factors (Sandberg and Hofferth 2001).

If this is the case, it is worth understanding why parents' childcare behavior has changed. According to Doepke and Zilibotti (2019), parents' childcare-related behavior has a direct effect on children's success (e.g., cognitive and noncognitive capacities and future income). They categorize parents' child-raising styles into four—authoritative, authoritarian, permissive, and neglectful. The study shows that the first two types—specifically, the authoritative style—improve children's grades and future incomes. In recent years, "helicopter parenting" (i.e., monitoring of children by parents performing authoritative childcare) has increased in developed countries because this parenting practice has been found to produce higher future returns as income inequality expands in society. This explanation is considered convincing: in societies with high internal rates of return on education, more intensive parenting (authoritarian, authoritative, or a blend of the two) is increasingly becoming the norm. Additionally, highly educated parents are more interested in intensive parenting, dedicating more time to childcare and selecting childcare activities that are better suited to their children's developmental needs (Craig 2006, Guryan et al. 2008, Cha and Song 2017). This point lends itself to the following interpretation: in the authoritative childcare model, while parents' child-raising knowledge and financial resources are important, parents with higher levels of education have greater access to these resources and expect higher returns, thus leading them to develop greater interest in intensive childcare.

Income and leisure model in economics expects that higher opportunity costs of domestic chores lead to reduced housework and childcare time; however, parents with higher educational backgrounds (therefore higher income) actually invest more time in childcare (Craig 2016, Cha and

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addressed in future studies.

[6] Some previous studies who analyzed childcare time, likewise limited their study to nuclear families (Hook and Wolfe 2013, Gracia and Kalmijn 2016).

[7] In France, mothers' childcare time was found to be decreasing.

Song 2017). This suggests that childcare differs from housework. The first difference is that parents' childcare duties cannot be entirely replaced with market goods, a view especially held by highly educated parents (Dotti Sani and Treas 2016). The second difference is that childcare is not simply a domestic chore to be performed; it also involves an investment in children and their outcomes. As Becker's (1981) Rotten Kid Theorem shows, parents are altruistic toward their children and are willing to sacrifice their own opportunity costs to work toward educational investment for their children (i.e., childcare).

Thus, as parents' childcare time has come to have positive effects on children's outcomes, their time dedicated to childcare continues to increase. How, then, is parents' childcare affected by NSWS?

2.2 Effects of parents' non-standard work schedules on childcare time

This section presents an analysis of the relationship between parents' nonstandard work schedules (NSWS) and childcare time. Extensive research has been conducted on this topic, mainly in the U.S. As highlighted by several other studies, atypical work schedules have a mixed impact on parenting time; however, a more careful examination reveals that the situation differs depending on the type of NSWS. Only a few studies assert that working night shifts negatively affects parenting time, despite the fact that results on the impact of working during the evenings on weekdays are divided. These studies are discussed in detail below.

Regarding the impact of evening employment, studies have shown divergent results. Some studies demonstrate that working in the evening reduces parenting time (Nock and Kingston 1998, Lesnard 2008, Rapoport and Le Bourdais 2008, Gutierrez-Domènech 2010), whereas others provide an opposing view (Wight, Raley, and Bianchi 2008, Hook and Wolfe 2013).

Nock and Kingston (1998) analyzed a subsample from the Study of Time Use 1981 in the U.S. and deduced that a "father's evening work is associated with an especially huge loss of time with the children." Lesnard (2008), who used French Time Use Study (TUS) for its analysis, argues that working during evening decreases family time, such as the time spent with one's spouse and children. In a careful and detailed analysis using the Canadian TUS, Rapoport and Le Bourdais (2008) also discovered that working in the evening has a negative impact on the total parenting time, leisure, and social activities, especially in two-parent households. Gutierrez-Domènech (2010) conducted an analysis using the Spanish TUS. The author deduced that completing work before 6:00 p.m. was associated with more time for childcare (although the paper does not focus on the effects of atypical work schedule). In other words, evening work can be associated with shorter time for childcare.

Alternatively, the following studies deduced that evening employment increases parenting time. The estimates made by Wight, Raley, and Bianchi (2008), who used the U.S. TUS, concluded that fathers who work evenings (and/or late nights and early mornings) spend more time with their

children than those who work normal hours. Using the TUS for four nations (the U.S., Germany, Norway, and the U.K.), Hook and Wolfe (2013) estimated that in the U.S., fathers who work evening shifts spend more time with their children, regardless of the mother's employment status. The study also shows similar results for the U.K. and Germany, under the condition that mothers are employed. Weinshenker (2016) used the U.S. data (from the Early Child Longitudinal Study, Birth Cohort) to conclude that fathers are more likely to care for their children in the absence of mothers in families where either parent is employed with some form of NSWS.

Other studies have not been able to confirm that evening employment has a positive effect, as they have not been able to generate statistically significant results. According to the estimates of Genadek and Hill (2017), which combined the U.S. TUS and CPS2015 to create a dataset for estimation, the evening work coefficient in the data is negative but not significant when controlled for other factors. Gracia and Kalmijn (2016), who used the Spanish TUS 2003 to make extrapolations, deduced that evening employment has a negative impact on family time but not on parent–child time[8]. Zilanawala and McMunn (2022) used data from the U.K. Millennium Cohort Study to deduce that the negative effect of evening work disappears when mothers' employment status is controlled.

This discrepancy in findings about the effects of evening employment can be attributed, in part, to the fact that each study defines evening employment differently and uses different types of variables. Wight, Raley, and Bianchi (2008) and Hook and Wolfe (2013) found a positive effect for evening work. They defined evening work as employment in which the majority of work hours are between 4:00 p.m. and midnight (using a dummy variable for applicable or not applicable). Conversely, in Nock and Kingston (1998), who found a negative effect, work hours were from 6:00 p.m. to midnight (in a continuous variable); in Rapoport and Le Bourdais (2008), work hours were from 6:00 p.m. to 10:00 p.m. (in a continuous variable); and in Gutierrez-Domènech (2010), the evening variable was whether the parent was working after 6:00 p.m. (a dummy variable). Additionally, Genadek and Hill (2017) used a dummy variable for whether the workday ended after 6:00 p.m., and Gracia and Kalmijn (2016) used a dummy variable for whether the parent worked for at least 3 hours between 6:00 p.m. and midnight as the evening variable. Besides differences in the definition of evening work, simple comparisons are difficult owing to analysis of age differences among the youngest children in families and whether weekends are included in the scope of the study.

Another reason for different assessments of evening work is that the types of workers who work evenings and their occupations may differ by country. Studies that found no negative effects for evening work include statements that night and evening schedules are shorter than normal schedules (Standard Work Schedule) (Wight, Raley, and Bianchi 2008) and "evening schedules may create the capacity to be involved before or after school, but possibly at the cost of missing family activities

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[8] Family time refers to the time that both parents and children spend together, whereas parent–child time refers to the time either parent spends with their children.

during the evening" (Zilanawala and McMunn 2022). These studies also suggest that evening workers are typically shift workers, who spend longer time at home during the day compared with standard shift workers. In Japan, however, evening work is mainly performed by white- or gray-collar workers working overtime (see section 5 and Fig.1a). They are not at home during the day because they are at work since morning. Therefore, unlike shift workers, they cannot compensate during the day for what they cannot do at evening. Owing to these differences, a full-scale comparison of the impact of evening employment would require exploring occupations and work schedules as well; however, it is outside the purview of this paper and will be saved for a future study.

Results on late night and early morning work hours are not as divided as those on evening work. Some studies have found positive effects for night work (Wight, Raley, and Bianchi 2008, Zilanawala and McMunn 2022); however, most have not found any significant effect.

Based on previous research, this study is considered significant in two aspects. The first is that while there are very few studies on this topic conducted in Asia, this study provides the results of an analysis that uses national representative data for Japan. The second is that this study examines the relationship between weekdays and weekends, which were not sufficiently explored by prior studies. In other words, it is conceivable that parents who work weekday evenings and thus do not have sufficient time for childcare might be able to make up for this lost time on weekends; however, this aspect remains largely unexamined. Section 8 of this paper addresses the abovementioned issue.

3．Theoretical discussion on childcare time
3.1 Determinants in parents' childcare time
There are four major approaches to explain fathers' childcare time.

The first is the *economic approach (utility maximization theory).* The theory suggests that the higher wives' incomes, the more time husbands dedicate to housework and childcare. This is based on the economic theory that households decide the time allocation (i.e., market labor time, housework and childcare time, and leisure time), maximizing their utility under the budget constraint (Becker 1965, Solberg and Wong 1992). According to this theory, husbands' and wives' housework and childcare time is entirely determined by their respective wages as a corollary of internal solutions. If so, men's childcare time should increase as their relative income decreases.

The following three approaches were proposed mainly by sociologists.

The *time availability theory* (Coverman 1985) proposes that parents participate in housework and childcare based on their own work time and that of their spouse. Therefore, more time working results in less time for housework and childcare.

Domestic labor demand is the third approach, which posits that when the youngest child is small or there are many children in the household, the required housework and childcare increase; thus,

family members' time dedicated to housework and childcare also increases.

Here, we must note that the second and third theories are interrelated. Specifically, in households where childcare time is available but demand is low, the husband's childcare time is likely to be less. Conversely, in households where childcare demand is high but the time available is low, the time dedicated to childcare time will be less (Coverman 1985).

The fourth approach is the *ideology hypothesis* (Paloma and Garland 1972), which states that husbands with a strong sense of the gendered division of labor are less likely to do housework or engage in childcare. Similar theories exist in economics, such as "Identity economics" (Akerlof and Kranton 2000). According to this theory, the utility of an individual *i* depends not only on their own behavior but also on that of others and on their identity. If the behavior of the self and others is inconsistent with the norms held by individual *i*, their utility will decrease. Therefore, individual *i* attempts to behave in accordance with the prevailing norms to recover their utility. Based on this theory, we can draw the following conclusion about husbands' childcare time. Husbands with strong "childcare is women's work" norms will not attempt to increase their childcare time even when their relative income is low. Similarly, wives with the same norms will not try to reduce their childcare time.

3.2 Effects of non-standard work schedules on childcare time

First, let us consider the issue in light of economic theory. In the work–leisure model, each household determines it's time allocation (i.e., market labor time, household/childcare time, and leisure time) maximizing utility under the budget constraint. If housework/childcare time is thus determined, the problem that arises is childcare time. Housework can, in relative terms, be performed at any time within the 24 hours of the day, but almost all childcare is provided during children's waking hours. In other words, carers are assumed to be at home while children are awake. Among employees with NSWS arrangements, evening shifts, in particular, are thought to reduce the time available for childcare because carers cannot be at home in the evening when their children are awake. Night shifts, however, should have less of an impact, as children are already asleep. Likewise, early morning shifts are also considered as resulting in reduced childcare time, as children are awake, although to a lesser extent as less total time is affected.

Let us consider the above along with the concept of *time availability theory* presented by sociologists, which is defined in this specific context as the time available while children are awake. In this case, compared to late-night or early-morning shifts, evening shifts result in less available time; thus, the theory more closely reflects reality.

The analysis in the following section is divided into evening NSWS, when children are awake (7–

11 p.m.), and late-night NSWS, when children are usually asleep (11 p.m. to 8 a.m.).[9]

4．Analytical strategy

Here, the analytical strategy for the following sections is described. Before that, let's take a look the employment rates of fathers by time slot to see who work on standard work schedules (SWS) and NSWS (see Fig. 1a and Fig. 1b). We observe the data by fathers' occupations to account for class differences. Occupations are used to represent social classes because the characteristics of standard work schedules usually differ by occupation. White-collar workers are unlikely to work late at night or early in the morning on weekdays, but overtime after 6 p.m. is not uncommon. As shown in Fig. 1a, one in three fathers was working up till 8 p.m. A high percentage of grey-collar workers also work in the evening (the highest of the three classes, with 40% working at 8 p.m.). In contrast, although relatively few blue-collar workers work in the evening, many work at night and, particularly, in the early morning (with 10% at work as of 6 a.m.). On weekends, relatively few white-collar workers work, whereas a relatively high percentage of grey-collar workers work (in particular during the daytime and evening) (see Fig.1b). Blue-collar workers are likely to be at work from early morning through early evening. In summary, the rate of NSWS is high for white-collar workers on weekday evenings, for grey-collar workers on weekday evenings and weekends, and for blue-collar workers on weekday nights and early mornings and weekends.

After the introduction of data in the next section (section 5), the descriptive analysis was conducted in Section 6, which observes the differences in fathers' childcare time, mothers' childcare time, both parents' childcare time,[10] and total childcare time between fathers working standard schedules and fathers on NSWS, divided by occupation (by collar color[11]). In section 7, multivariate analysis was employed to estimate the effect of fathers' NSWS on childcare time controlling the other variables that could affect the time dedicated to childcare. Here, the analysis considers differences not only in fathers' occupations but parental educational backgrounds. Finally, to consider the time dedicated to childcare over the entire week, we conducted the analysis of the effect of weekday NSWS on childcare over the entire week in section 8, creating a dataset of respondents covering two consecutive investigated days—either a weekday or weekend (Friday/Saturday) or weekend and weekday (Sunday/Monday)[12].

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[9] NSWS is often defined as work outside the hours of 9 a.m. to 6 p.m. on weekdays; here, allowing for the possibility that respondents happen to arrive at work an hour later on the day investigated, it is defined as work outside the hours of 8 a.m. to 7 p.m. on weekdays, with an hour's margin.

[10] Time when both parents reported being engaged in childcare is considered both parents' childcare time. However, in the case of multiple children, each parent may be caring for a different child; thus, this definition is not entirely accurate.

[11] For collar color types, see the appendix.

[12] The survey was conducted over two consecutive days. See the next section for the details.

5．Data

This analysis used data from the 2016 Survey on Time Use and Leisure Activities. This survey used the stratified two-stage sampling method to target about 200,000 household members aged 10 years and older from about 88,000 randomly selected households, investigating the use of time during a typical day of ordinary life. The survey also provides demographic information other than time use, including age, occupation, and family composition. The survey was conducted over two consecutive days, specified for each surveyed region out of the nine days between October 15 and October 23, 2016. The respondents used the pre-coded method, selecting from 20 behavior types provided in advance for each 15-minute period, and the after-coded method of specifically describing their behavior. This paper's analysis uses the pre-coded results, which have a larger sample size, to ensure accuracy. With regard to the time dedicated to childcare, the periods for which "childcare" was selected have been multiplied by 15 minutes.[13]

Because the paper topic is childcare time, the respondents were limited to households composed of couples and child(ren) with at least one child under the age of 6 years.[14] Further, the data was divided into male and female respondents who were matched via family IDs to create a dataset providing information on fathers and mothers within the same household. The number of observations after data cleaning was 3,344 for weekday dataset and 5,543 for weekend dataset. The descriptive statistics are presented in Table 1.

6．Descriptive analysis

Fig.2 shows the time fathers dedicate to childcare for children under the age of 6 years (Fig.2a: weekdays,[15] Fig.2b: weekends). The three leftmost bars for weekdays indicate the average childcare time dedicated by fathers with standard work schedules (SWS), the middle three represent fathers with evening work schedules (NSWS1923)[16], and the rightmost those with late-night/early-morning work (NSWS2308).[17] [18] Each shows the average childcare time and 95% confidence interval by fathers' occupations (i.e., white-collar, grey-collar, and blue-collar). Fig 2b shows weekend childcare time, with averages for fathers not working on the left and those working on the right.

First, the following two characteristics can be observed from weekday childcare times (Fig 2a).
(1) In each social class (collar color), SWS fathers dedicated the most time to childcare, followed by

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[13] When two or more behaviors were listed within 15 minutes, the longer one was selected, leading to the possibility of error within the behavior time (i.e., over- or underestimation).

[14] Because the respondents included children aged 10 years and above, they were omitted to leave only fathers and mothers of children under the age of 6 years.

[15] To view differences by work period, those who were not working on the survey day have been omitted.

[16] Average childcare time for fathers working at least 15 minutes between 7 and 11 p.m.

[17] Average childcare time for fathers working at least 15 minutes between 11 p.m. and 8 a.m. the next day.

[18] The total 13% included those belonging to both NSWS1923 and NSWS2308.

fathers with late-night/early-morning work schedules (NSWS2308). Fathers who worked in the evening (NSWS1923) spent the least amount of time on childcare.

(2) In all time periods, the white-collar fathers dedicated the most time to childcare. However, the difference was not particularly marked in the case of the NSWS fathers.

Next, the following points can be observed in the weekend childcare times (Fig 2b).

(3) Fathers working on weekends had spent less time on childcare than those who did not. By percentage, the difference was notable for grey- and blue-collar fathers.

(4) Regardless of whether they worked on weekends or not, the time white-collar fathers dedicated to childcare was longer than that of the other collar colors, suggesting the possibility that white-collar fathers used weekends to engage in childcare to make up for not being available during the weekday because of overtime work.

As shown in Figure 2, fathers' NSWS shorten the time they spend on childcare. We used weekday data to consider how this affects mothers' solo childcare time, both parents' childcare time, and total childcare time. Figure 3 uses the same grouping as Figure 2a to show the accumulated childcare time for (from bottom) (1) fathers' solo childcare time, (2) mothers' solo childcare time, and (3) both parents' childcare time (Figure 3). The height of each bar represents the total of both parents' childcare time.[19] Figure 3 depicts the following points:

(1) In households with white-collar fathers, regardless of their work schedules, fathers dedicated a significant amount of time to childcare (a total of roughly 255 minutes). However, in households with NSWS fathers, the time fathers spent on solo childcare and the time both parents dedicated to childcare were less compared to their SWS counterparts, in response to which mothers' solo childcare time was 40 minutes longer. It is believed that mothers compensate for the insufficient time fathers with NSWS schedules spend on childcare.

(2) In households with grey-collar fathers, while the total childcare time was similar to that of white-collar households, in NSWS households it was closer to the relatively shorter time of blue-collar households. In particular, it was shorter with late-night/early-morning work. Unlike in white-collar households, in this situation, mothers were not found to be compensating for the insufficient time spent by NSWS fathers on childcare. Grey-collar work was originally a category created to reflect the expansion of the service industry to account for the increase in occupations that could not be categorized as either white-collar or blue-collar; it covers a spectrum including jobs more white-collar-oriented and others that are more blue-collar-oriented. To deal with this ambiguity, the multivariate analysis discussed in the next section controls educational background in addition to collar color.

(3) In households with blue-collar fathers, regardless of their work schedules, less total time was

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[19] The values in Figure 2a are equal to the sums of those in Figure 3 for fathers' solo childcare time and both parents' childcare time.

dedicated to childcare time (about 200 minutes). In households where fathers worked evening NSWS schedules, the time spent on childcare was slightly less than otherwise (little difference was found in late-night/early-morning work). However, as mothers' solo childcare time was longer, the total childcare time was just slightly longer.

The descriptive analysis above shows that while the difference in total childcare time by social class is significant, there is little difference as a result of whether fathers work NSWS. Elsewhere, fathers' NSWS (in particular evening work) reduces the time they dedicate individually to childcare and the time that both parents spend on childcare; mothers' may compensate for this insufficiency by increasing their solo childcare time. That is, fathers' NSWS does not change the total childcare time but leads to heavier childcare burdens on mothers.[20] This effect is particularly significant in white-collar households, which dedicate more time to childcare in any case. However, as noted above, fathers may be compensating for insufficient time on childcare during the weekday with more time during the weekends; this is discussed in section 8.

7．Multivariate analysis

7.1 Estimation model

This section pertains to multivariate analysis that uses as many variables as possible that can be considered to affect parents' childcare time. While it is unclear from the descriptive statistics observed in the previous section, the dataset also contains large quantities of data in which childcare time is zero.[21] Of 3,344 observations in the weekday dataset, there are 2,415 fathers (72%) and 677 mothers (20%) whose childcare time is zero. Likewise, 61% of fathers and 26% of mothers don't spend any their time on childcare in the weekend.　In this case, estimation using Ordinary Least Squares regression would underestimate the true slope. This issue is resolved by estimating childcare time via the Tobit model.

Rapoport and Le Bourdais (2008), introduced above, used a switching regression model to control the selection bias that arises because of including unemployed people in the dataset; however, the dataset used here contains only fathers whose main activity was employment.[22] Therefore, there is no bias engendered by the inclusion of unemployed people. However, data for people who were not working on the day of the survey (that is, whose work time is zero) is 6.8%, which may result from people who happened to be taking a paid holiday on the survey day or those who had certain

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[20] Weekend graphs are omitted because their trends are essentially the same as those of weekdays. In short, when fathers work on weekends, the total childcare time does not change significantly, but mothers' solo childcare time increases.

[21] Because of the nature of the survey, activities of less than 1/2 of 15 minutes are considered 0; thus, the "0 minutes" in the data actually represent "<7.5 minutes."

[22] Fathers whose main activity was not work had been observed to a small extent (0.4%), which were excluded from the dataset for the analysis.

weekdays off work.[23] Some people may have selected jobs that enabled them to have weekdays off work out of preference. However, as confirmed in Figure 3, given that fathers' childcare time is extremely short, it is considered that almost none of them chose jobs with weekday holidays in order to ensure time for childcare. Here, the estimation includes people whose work time on the survey day was zero. To be on the safe side, an estimation was also conducted omitting this data in order to check whether the results would differ significantly.

The estimation uses the left-censored Tobit model, as shown below. The explained variable is one day's childcare time, shown in minutes. Fathers' and mothers' childcare times are estimated separately.

$$y_i = \begin{cases} y_i^* = \beta x_i + u_i & \text{when } y_i^* > 0 \\ 0 & \text{when } y_i^* \leq 0 \end{cases}$$

$$u_i \sim IN(0, \sigma^2)$$

The explanatory variables are described below.

First, two variables were created for the main variable of NSWS: evening work times of 7–11 pm, with high response rates among white- and grey-collar workers (NSWS1923), and late-night and early-morning work times spanning from 11 pm to 8 am, with high response rates among blue-collar workers (NSWS2308).

Following this is an explanation of the variables based on the four theories introduced in section 3.1.

The variable based on the *economic approach* is the income gap between husbands and wives. Specifically, by dividing mothers' income by couples' total income, a variable for the mothers' income percentage was created. "Income" here refers to income from employment.

Next, the variables based on *time availability* include fathers' work time (excluding NSWS work time), commuting time, and housework time, including mothers' work time, commuting time, and housework time.

Variables based on *domestic labor demand* included age of the youngest child and number of children under six. It is thought that the younger the youngest child is and the greater the number of children under six, the higher the demand for domestic labor. Further, the estimation of fathers' childcare time is made using the mothers' childcare time, and vice versa. This is because the demand for domestic labor for one partner is affected by the childcare time of the other. For example, when the mother is a housewife handling much of the housework and childcare, the father's domestic labor

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[23] Jobs with weekdays off tend to be in the service industry, such as restaurants, bars, hotels, retail, healthcare, and welfare. Therefore, many of the respondents who were not working on the survey day are suspected to be grey-collar workers.

demands are lower even if there are children under six.

Variables related to the *ideology hypothesis* include fathers' employment (grey collar and blue collar, with white collar as a reference) and fathers' and mothers' educational background (college graduate as dummy)[24].

The remaining variables are as presented below.

As noted in section 2.1, childcare time has been increasing in recent years, a trend particularly notable among highly educated parents. As the effect of parents' educational background on childcare time is stronger when both parents are highly educated (the cross-couple effect), confounding variables with a college graduate father and mother as dummies were created to examine what, if any, effect these variables have.

Because children's enrollment in childcare centers, as well as childcare support from grandparents or babysitters, may reduce parents' childcare time, other variables included the youngest child's childcare center time and the presence of everyday childcare support from parents, friends, or babysitters.

7.2 Estimation results

Table 2 shows the estimation results for weekday childcare time. Three models were estimated, with different social class variables (occupation and educational background): model (1) includes only the occupation dummy, model (2) only the educational background dummy, and model (3) includes both.

First, regarding fathers' NSWS work time, both evening (NSWS1923) and late-night/early-morning (NSWS2308) work significantly reduced fathers' childcare time. However, when we examine the marginal effect, we see that the effect of evening work far exceeded that of late-night/early-morning work (from −0.645 to −0.652 vs. from −0.081 to −0.099, respectively). Elsewhere, fathers' non-NSWS work time similarly significantly reduced their childcare time. The marginal effect was −0.289. These results are consistent with some previous researches showing that evening NSWS reduces childcare time, while the negative effects of late-night/early-morning NSWS were found to be insignificant.

Regarding the effects of fathers' NSWS on mothers' childcare time, only evening NSWS increased mothers' childcare time significantly, but with a relatively low marginal effect.

Other results are as presented below.

Higher mothers' income percentages significantly increased fathers' childcare time and reduced that of mothers; these results are in accordance with the *economic approach*. Interestingly, the scales of the increase and decrease were roughly equivalent (from 0.496 to 0.567 and from −0.440 to

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[24] Yamaguchi (2000) compared awareness of gendered division of labor in the US and Japan, showing that it is related in both countries to educational and occupational status.

−0.483, respectively).

Regarding the effects of the *time availability* variables, there were commonalities and differences between fathers and mothers. A reduction in childcare time owing to work and commuting time was common. The difference was that while fathers' housework and childcare time had a positive effect, mothers' exhibited a negative effect. This should hardly be a surprise; because mothers handle most of the housework and childcare, time restrictions mean that increased housework must imply reduced childcare, while for fathers, whose time for both is short, there are no such restrictions, and fathers who do housework are also likely to engage in childcare.

Regarding *domestic labor demands*, childcare time was sharply reduced for both parents as the youngest child's age increased. The number of children under six had a positive coefficient for the mother alone, which was not significant. Although partners' childcare time was believed to likely reduce domestic labor demands for the other partner, the opposite results appeared: for both parents, childcare time and partner's childcare time had a positive relation. Mothers' and fathers' childcare apparently complement rather than substitute one another.

As for the effects of fathers' occupation and both parents' educational background, based on the *Ideology hypothesis*, the results of model (2) found that compared to white-collar fathers, grey- and blue-collar fathers had shorter childcare times. Model (3) found that the occupational difference was significant even when controlling for educational background. In blue-collar households, mothers' childcare time was also short. In model (1) (including only the educational background dummy), however, college graduate fathers significantly increased mothers' childcare time and vice versa. Nonetheless, when controlled for occupation in model (3), the difference was not particularly significant. Moreover, the cross-couple effect was not confirmed. Based on the aforementioned details, the results indicate that childcare time is affected more by occupation than educational background.

Regarding the youngest child's childcare center enrollment, different effects were found for fathers and mothers. Although it had no relation with fathers' childcare time, mothers' childcare time was precisely inversely proportionate to the youngest child's time spent at a childcare center. This finding indicates that the existence of childcare centers and similar facilities mainly acts as a substitute for childcare by mothers bearing majority of the burden.

Regarding everyday childcare support, only friends showed a significant effect. For both parents, childcare time was longer for those with friends' support than for those without. This suggests that rather than being supported by friends during absences, families are spending more time interacting altogether.

Finally, to confirm whether a bias was created by the inclusion of data for which the survey day was a day on which respondents were not at work, estimation was conducted with the data for zero

hours of work excluded from the dataset[25]; comparison with Table 2 essentially found the same results. Therefore, the interpretation of the aforementioned Table 1 is valid. However, there was only one point of difference: the scale of the gray-collar coefficient (negative) of fathers' childcare time was larger, equivalent to that of the blue-collar group. This may mean that the coefficient in Table 2 was assumed to be larger because of the inclusion of gray-collar fathers who were not working on the survey day.

Table 3 presents the results of a similar estimation of childcare time with the weekend dataset. Because weekend work is all considered NSWS, fathers' work time was not divided by period as on weekdays; rather, fathers' total work time was used as an explanatory variable. The other variables were the same as in the weekday estimation.

First, let us consider the effect of weekend work on time devoted to childcare. Fathers' work time significantly reduced their childcare time (dy/dx = −0.440) while significantly increasing mothers' childcare time (dy/dx = 0.181). A simple calculation suggests that one hour of weekend work reduced fathers' childcare time by approximately 26 minutes and increased mothers' childcare time by approximately 11 minutes. Mothers' weekend work had the same effect, reducing their childcare time (dy/dx = −0.373) and increasing that of fathers' (dy/dx = 0.251).

In addition, common points with weekdays included the complementary relationship of fathers' and mothers' childcare time, lower youngest child ages were associated with a significant increase in childcare time, and shorter childcare time on the part of gray- and blue-collar fathers compared with white-collar fathers. A notable difference from weekdays related to both parents' educational backgrounds. Pronounced results were confirmed based on this variable on weekends but not in the weekday estimation. College graduate fathers' childcare time was approximately 32 minutes longer than that of their non-graduate counterparts. In households with college graduate mothers, the childcare time was approximately 50 minutes longer for mothers and 38 minutes longer for fathers. However, the cross-couple effect could not be confirmed. In Japan, the cross-couple effect appears to be less important than whether the mother is a college graduate.

Based on the aforementioned results of the weekday and weekend childcare time, it is possible that with regard to fathers' NSWS, weekday evening and weekend work sharply reduce their childcare time, and while mothers pick up the slack, the reduced time is not 100% compensated for, thereby reducing total childcare time. Weekday evenings and weekends are both times when children are at home for extended periods; therefore, the effect of NSWS is pronounced.

８．Relation between weekends and weekdays

The analysis so far has confirmed that weekday evening NSWS, in particular, reduces fathers' childcare time. However, as noted above, fathers may be compensating for the weekday shortfall on

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[25] The estimation results are available from the author on request.

weekends. To analyze the weekday–weekend relation, a dataset of households on which the survey days covered weekdays and weekends was created (the weekday/weekend integrated dataset). Although the number of observations was a relatively small, 1,010, the use of this dataset enabled assessment of childcare time throughout the week and confirmation as to whether fathers were compensating on weekends.

Table 4 reports fathers' average childcare time divided into weekdays and weekends by work schedule. The work schedule periods were the same as in Section 6, with SWS as the typical work schedule, NSWS1923 for evening nonstandard work hours, and NSWS2308 for late-night and early-morning nonstandard work hours. First, it reveals that fathers working standard weekday schedules had longer childcare time on weekends as well as weekdays. However, the large differences visible on weekdays were not present on weekends. The fathers working NSWS on weekdays almost all provided 60 minutes or more of childcare on weekends. Comparing weekdays and weekends (Table 4 last line), the ratio was approximately two–three times greater for the latter, but for white-collar fathers working weekday evening NSWS, it was 6.2 times greater. The rate was not as high for the other collar colors but trended somewhat higher compared to weekdays. Furthermore, fathers working weekday late nights/early mornings had a higher rate than those with standard work schedules. Thus, fathers working weekday NSWS (especially white-collar fathers) were confirmed to engage in somewhat more childcare on weekends than on weekdays. However, since the weekend is two days to five weekdays, the longest total childcare time remains that of fathers working standard schedules.

Table 5 shows the results of a multivariate analysis along the same lines as in Section 7 using the weekday/weekend integrated dataset. However, Model (1) uses fathers' weekday childcare time and Model (2) uses the weekly average childcare time[26] as the explained variable. Owing to space limitations, only the variables relating to fathers' work time are presented, but the results of the other explanatory variables are essentially the same as the weekday childcare time estimation in Section 7. The weekday results of Table 5 are similar to Table 2, with fathers' evening work time reducing childcare time the most. However, the full week childcare time estimation results demonstrate that the marginal effect is reduced throughout because fathers engage in more childcare on weekends. Notably, the difference in marginal effect owing to work periods on weekdays is reduced when looking at the week overall. This is due to the largest change in marginal effect on the part of the fathers' working evenings.

Based on the aforementioned analysis, fathers working weekday evening NSWS reduce the gap in childcare time with other fathers by performing more childcare on weekends than on weekdays. However, their childcare time remains short compared to those working other schedules.

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[26] Weekly average time is calculated by (weekday childcare time x 5 + weekend childcare time x 2)/7.

９．**Conclusion**

This study used Japanese time use data to analyze the effect of fathers' nonstandard work schedules on childcare time. The results indicated that weekday evening and weekend work reduce fathers' childcare time and increase that of mothers. In addition, the marginal effect found through multivariate analysis revealed that mothers do not fully compensate for the reduction in fathers' childcare time, leading to the possibility that the total childcare time is shortened. However, the results of the weekday/weekend integrated data analysis showed that fathers (especially white-collar fathers) working weekday evenings reduce the gap with other fathers through weekend childcare.

As shown in Figure 3, the childcare burden in Japan is severely skewed toward mothers, and the stress that mothers experience as a result of solo childcare has become a social issue. In this context, fathers' increased commitment to childcare is hoped to mitigate mothers' work-life conflicts and stress. Fathers' nonstandard work schedules, which increase mothers' childcare burdens, run counter to these expectations. When reconsidering fathers' work styles, the necessary perspectives include not only the reduction of work time but also attention to the time periods, which ensure that time is spent with children.

This study contributes in the form of ascertaining the relationship between fathers' work time periods and childcare time in Japan but remains insufficient; because its data is cross-sectional, there was no control for unobserved individual heterogeneity and no insight on changes over time. Analysis using panel data is required to address these concerns. Moreover, analysis of the time that parents spend with children is required (in this case, the fathers' activities are not necessarily childcare) because it has been found that time spent with parents has a positive effect on children's outcomes. While the task is complex, this analysis can be conducted with the data used in this study.

Figures and Tables

Fig. 1 Employment rates by time slot of fathers with children under 6 years old.

1a. Weekdays
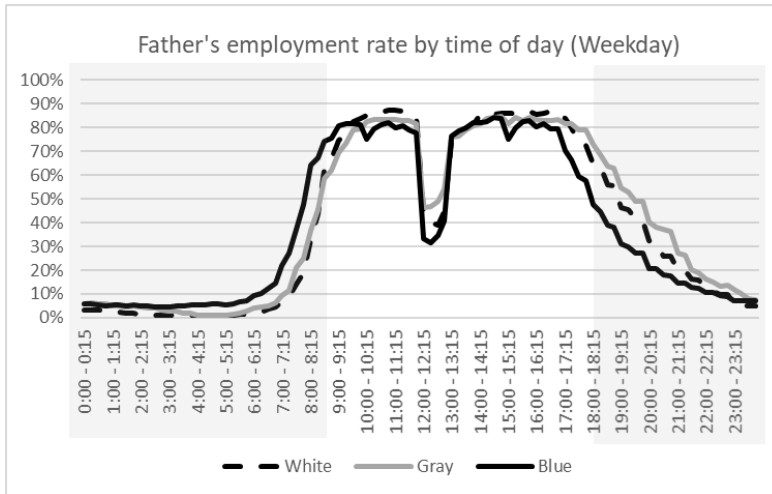
1b. Weekends
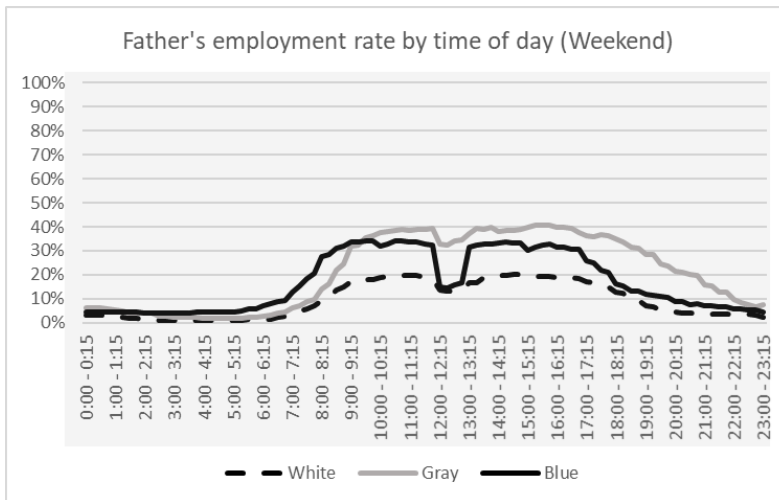
Source: Created by the author based on the Survey on Time Use and Leisure Activities 2016

Fig. 2 Fathers' childcare time (minutes per day) *

2a. Weekdays
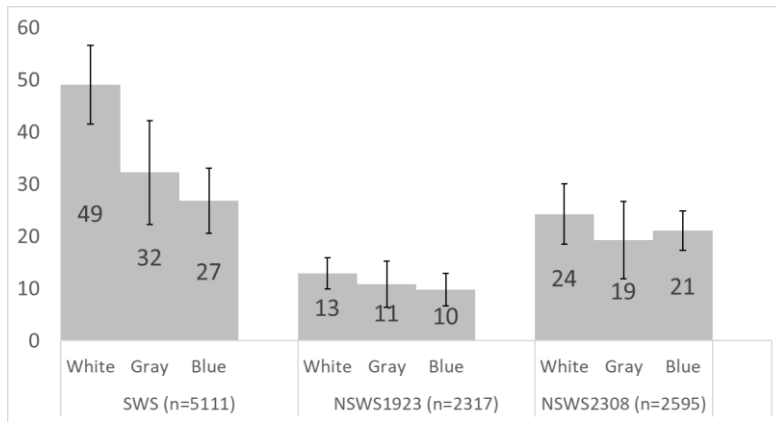
2b. Weekends
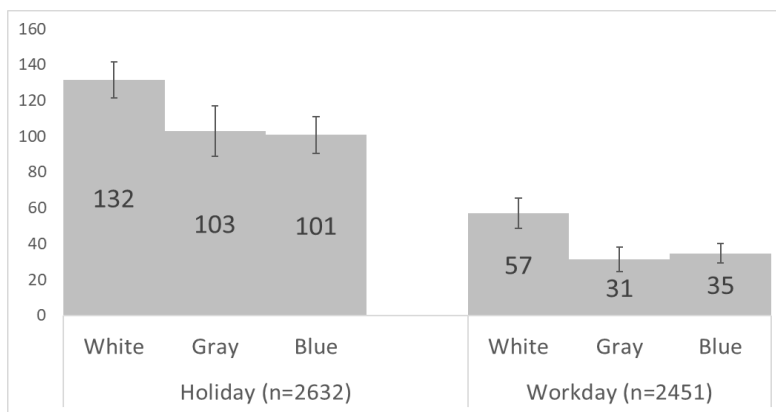
*Error bar shows 95% confidence intervals.

Source: Created by the author based on the Survey on Time Use and Leisure Activities 2016.

Figure 3 Breakdown of childcare times on weekdays (minutes per day).

Source: Created by the author based on the Survey on Time Use and Leisure Activities 2016.

Table 1 Descriptive statistics

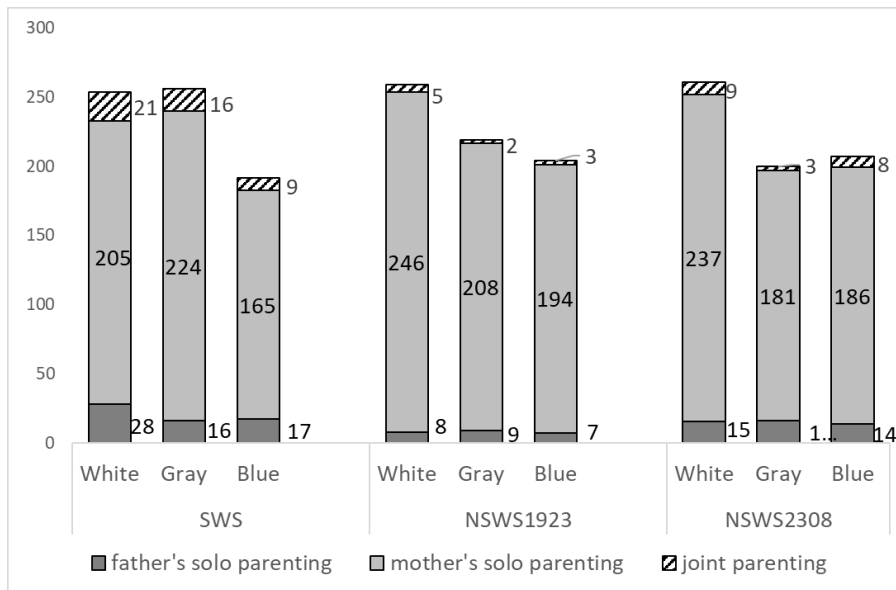|	Weekdays（n=3344)				Weekends (n=5543)			
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Explained Variables								
Fathers' childcare time	29.59	69.42	0	735	78.86	144.77	0	975
Mothers' childcare time	210.35	205.28	0	1095	195.14	203.40	0	1110
Explanatory Variables								
NSWS1823（Evening)	50.63	74.73	0	240				
NSWS2308（Late night and early morning)	37.35	81.03	0	540				
NSWS　　(Weekends)					224.22	296.87	0	1275
Mothers' income percentage	17.26	19.09	0	100	17.85	19.46	0	100
Fathers' work time (Standard Schedule)	480.03	185.76	0	660				
Fathers' commuting time	65.06	57.38	0	375	23.70	44.81	0	390
Fathers' housework time	13.52	42.35	0	480	23.35	59.28	0	840
Mothers' work time	176.39	222.31	0	1020	46.46	137.37	0	840
Mothers' commuting time	25.63	40.55	0	300	6.48	22.86	0	300
Mothers' housework time	193.38	132.46	0	825	175.76	136.20	0	990
Age of youngest child	2.29	1.66	0	5	2.25	1.67	0	5
Number of children under 6	1.34	0.55	1	4	1.34	0.53	1	4
Fathers' occupation								
White-collar	0.34	0.47	0	1	0.34	0.47	0	1
Gray-collar	0.19	0.39	0	1	0.20	0.40	0	1
Blue-collar	0.39	0.49	0	1	0.38	0.48	0	1
College graduate father	0.43	0.50	0	1	0.42	0.49	0	1
College graduate mother	0.28	0.45	0	1	0.28	0.45	0	1
Both parents college graduate	0.21	0.41	0	1	0.21	0.41	0	1
Youngest child's childcare center status								
Not enrolled	0.42	0.49	0	1	0.41	0.49	0	1
4 hours or less	0.01	0.12	0	1	0.02	0.13	0	1
5 to 7 hours	0.26	0.44	0	1	0.26	0.44	0	1
8 to 10 hours	0.30	0.46	0	1	0.30	0.46	0	1
11 hours or more	0.01	0.11	0	1	0.01	0.12	0	1
Everyday childcare support for youngest child								
Grandparents	0.41	0.49	0	1	0.42	0.49	0	1
Friends	0.01	0.11	0	1	0.01	0.11	0	1
Babysitters	0.00	0.07	0	1	0.01	0.09	0	1

Table 2 Results of the childcare time estimation (weekdays)

	(1)				(2)				(3)			
	Fathers' childcare time		Mothers' childcare time		Fathers' childcare time		Mothers' childcare time		Fathers' childcare time		Mothers' childcare time	
	dy/dx	Std. Err.	dy/dx	Std. Err.	dy/dx	Std. Err.	dy/dx	Std. Err.	dy/dx	Std. Err.	dy/dx	Std. Err.
NSWS1823 (Evening)	-0.645	0.056 ***	0.117	0.042 ***	-0.651	0.056 ***	0.100	0.042 *	-0.652	0.056 ***	0.096	0.042 *
NSWS2308 (Late night and early morning)	-0.099	0.043 *	0.009	0.040	-0.085	0.043 *	0.018	0.040	-0.081	0.043 *	0.025	0.040
Mothers' income percentage	0.507	0.220 *	-0.442	0.214 *	0.567	0.219 ***	-0.440	0.213 *	0.496	0.220 *	-0.483	0.214 *
Fathers' work time (Standard Schedule)	-0.289	0.018 ***	0.161	0.019 ***	-0.289	0.018 ***	0.165	0.019 ***	-0.289	0.018 ***	0.160	0.019 ***
Fathers' commuting time	-0.173	0.062 ***	0.247	0.054 ***	-0.180	0.062 ***	0.246	0.054 ***	-0.179	0.062 ***	0.240	0.054 ***
Fathers' housework time	0.297	0.069 ***	0.064	0.077	0.292	0.069 ***	0.064	0.077	0.281	0.069 ***	0.047	0.077
Fathers' childcare time			0.394	0.048 ***			0.392	0.048 ***			0.383	0.048 ***
Mothers' work time	0.080	0.026 ***	-0.374	0.024 ***	0.074	0.026 ***	-0.378	0.024 ***	0.077	0.026 ***	-0.372	0.024 ***
Mothers' commuting time	0.080	0.105	-0.389	0.098 ***	0.097	0.105	-0.368	0.097 ***	0.083	0.105	-0.385	0.097 ***
Mothers' housework time	0.064	0.030 *	-0.449	0.026 ***	0.058	0.030 *	-0.450	0.026 ***	0.060	0.030 *	-0.449	0.026 ***
Mothers' childcare time	0.175	0.022 ***			0.174	0.022 ***			0.171	0.022 ***		
Age of youngest child	-22.311	2.994 ***	-36.648	2.651 ***	-22.739	2.999 ***	-37.226	2.652 ***	-22.714	2.995 ***	-37.075	2.649 ***
Number of children under 6	-1.082	6.144	6.997	5.805	-0.988	6.142	6.351	5.803	-0.820	6.135	6.866	5.795
Fathers' occupation (ref. White-collar)												
Gray-collar					-23.020	9.356 **	-0.726	8.290	-20.222	9.410 *	3.288	8.346
Blue-collar					-31.449	7.409 ***	-33.929	6.835 ***	-27.481	7.984 ***	-24.109	7.393 ***
College graduate father	7.142	8.651	24.036	7.723 ***					-0.712	9.037	14.983	8.095 †
College graduate mother	22.740	12.644 †	19.928	12.014					20.085	12.646	18.197	12.003
Both parents college graduate	-0.892	15.960	-2.696	14.958					-0.967	15.949	-1.386	14.935
Youngest child's childcare center status (ref. Not enrolled)												
4 hours or less	-5.095	28.528	-24.314	25.556	-6.023	28.597	-23.778	25.524	-6.487	28.511	-24.585	25.493
5 to 7 hours	-2.085	11.844	-70.780	10.268 ***	-3.961	11.834	-73.260	10.251 ***	-2.685	11.826	-71.420	10.249 ***
8 to 10 hours	18.259	12.699	-95.215	11.540 ***	16.323	12.671	-97.612	11.516 ***	17.663	12.674	-95.251	11.516 ***
11 hours or more	40.092	28.646	-109.601	29.962 ***	40.383	28.654	-107.533	29.915 ***	39.592	28.612	-109.007	29.884 ***
Everyday childcare support for youngest child												
Grandparents	2.456	6.799	-2.157	6.294	2.457	6.788	-3.210	6.277	3.231	6.795	-1.678	6.283
Friends	57.223	26.018 *	64.907	25.780 **	52.240	26.062 *	65.216	25.780 **	55.531	26.028 **	67.893	25.763 ***
Babysitters	7.613	43.547	-16.557	46.169	8.545	43.552	-13.179	46.151	4.124	43.582	-16.751	46.109

***, **, *, and † indicate statistical significance at levels of 0.1%, 1%, 5%, and 10%, respectively.

Table 3: Results of the childcare time estimation (weekends)

	Fathers' childcare time		Mothers' childcare time	
	dy/dx	Std. Err.	dy/dx	Std. Err.
Mothers' income percentage	0.456	0.259 †	-0.001	0.201
Fathers' work time	-0.440	0.020 ***	0.181	0.013 ***
Fathers' commuting time	-0.193	0.121	0.263	0.079 ***
Fathers' housework time	0.155	0.064 *	0.090	0.053 †
Fathers' childcare time			0.359	0.022 ***
Mothers' work time	0.251	0.039 ***	-0.373	0.031 ***
Mothers' commuting time	0.582	0.210 ***	-0.272	0.169
Mothers' housework time	0.189	0.032 ***	-0.278	0.024 ***
Mothers' childcare time	0.358	0.023 ***		
Age of youngest child	-22.311	3.499 ***	-46.730	2.595 ***
Number of children under 6	22.348	7.697 ***	-1.921	5.961
Fathers' occupation (ref. White-collar)				
Gray-collar	-37.385	11.387 ***	2.721	8.517
Blue-collar	-32.425	9.818 ***	1.230	7.477
College graduate father	32.140	10.890 ***	10.753	8.280
College graduate mother	38.294	15.492 **	50.320	11.858 ***
Both parents college graduate	-16.045	19.350	-21.230	14.970
Youngest child's childcare center status (ref. Not enrolled)				
4 hours or less	-13.114	31.672	-40.011	24.039 †
5 to 7 hours	-13.114	13.395	-42.041	10.037 ***
8 to 10 hours	13.285	13.400	-54.974	10.194 ***
11 hours or more	80.159	34.678 *	-97.958	28.187 ***
Everyday childcare support for youngest child				
Grandparents	19.271	8.372 *	-3.618	6.389
Friends	54.305	34.726	-39.235	27.493
Babysitters	-0.400	44.452	4.548	33.594

***, **, *, and † indicate statistical significance at levels of 0.1%, 1%, 5%, and 10%, respectively.

Table 4: Fathers' weekday work styles and childcare time (minutes)

		SWS (n=331)			NSWS1923 (n=187)			NSWS2308 (n=402)		
		White	Gray	Blue	White	Gray	Blue	White	Gray	Blue
(1) Weekday	Mean	56	51	44	12	25	18	29	26	26
	Std.Err.	13.1	9.5	3.5	3.5	7.8	7.6	5.9	7.5	4.4
(2) Weekend	Mean	117	91	65	74	67	33	95	59	72
	Std.Err.	13.5	17.7	10.8	13.2	16.5	10.8	14.9	14.2	9.1
(2) / (1)		2.1	1.8	1.5	6.2	2.7	1.8	3.3	2.3	2.8

Table 5: Fathers' childcare time estimation results

	(1) Weekday		(2) Weekly average	
	dy/dx	Std. Err.	dy/dx	Std. Err.
NSWS1823 (Evening)	-0.597	0.101 ***	-0.237	0.060 ***
NSWS2308 (Late night and early morning)	-0.150	0.081 †	-0.104	0.058 †
Standard Schedule	-0.312	0.018 ***	-0.182	0.024 ***

***, **, *, and † indicate statistical significance at levels of 0.1%, 1%, 5%, and 10%, respectively.

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Appendix: Occupation categories

The Survey on Time Use and Leisure Activities asks respondents about their occupations. For the purposes of this analysis, occupations were categorized as follows.

White collar	Grey collar	Blue collar
Managing public servants	Clerical technicians	Security workers
Corporate/group executives	Product salespersons	Farmers
Other management-level careers	Sales-adjacent workers	Forestry workers
Engineers	Salespeople	Fishers
Teachers	Home life support workers	Production/processing workers (metal products)
Researchers	Nursing care service workers	
Healthcare professionals	Healthcare service workers	Production/processing workers (nonmetal products)
Social welfare professionals	Life hygiene service workers	
Legal professionals	Food service preparers	Machine assembly workers
Management/finance/insurance professionals	Customer service workers/waiters	Machine repair/maintenance workers
Religionists, writers, editors, artists, designers, photographers, video artists, musicians, stage artists	Residential/office building superintendents	Product inspectors
	Other service industry workers	Machine inspectors
		Production/production-adjacent workers
Other professionals		Railway drivers
General clerical workers		Automobile drivers
Accounting clerical workers		Ship/plane pilots
Production clerical workers		Other transport workers
Sales clerical workers		Fixed/construction machinery operators
Outside sales clerical workers		Civil engineering/construction workers
Transport/post clerical workers		Electricians
		Miners
		Shipping workers
		Cleaners
		Packaging workers
		Other transport/cleaning/packaging etc. workers