Time Allocation to Housework and Childcare in Japan

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Abstract

This study examines whether the bargaining power affects a couple's time allocation to housework and childcare by distribution factors in Japan, based on the "collective" model which assumes that the final distribution within the households should be Pareto-efficient. We estimate the function of household production time using micro-data from the Survey on Time Use and Leisure Activities at two points in time (2011 and 2016), and examine the changes in and structure of the allocation of couples' housework and childcare time. Four variables are considered in distribution factors: wife's relative wage, wife's relative age, wife's relative education level, and male-to-female sex ratio in the region. Our results show that the collective approach can explain the Japanese intra-family time allocation. Specifically, we find that high wife's relative wage reduces her own housework time and increases her husband's housework time and childcare time. The effect of wife's relative wage gets stronger in 2016. This study also shows that wife's relative age is significant for explaining distribution factors. At the same time, it is inappropriate to take relative education as a distribution factor.

Keywords: Collective model; Intra-family time allocation; Time use survey

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1 Introduction

Previous social norms advocated families had a homemaking mother and a breadwinning father in the 1960s in Japan. Nowadays, such traditional social norms are rapidly changing, with the number of dual-income households having exceeded the number of households with a full-time housewife[2]. With the employment rate of married women at large increased (Nagamachi & Yugami, 2015), married couples must often decide how much time to devote to housework, childcare. Despite the persistent imbalance in time spent on housework and childcare between employed fathers and employed mothers in Japan, the time gap between men and women spending on housework and childcare activities is shrinking[3].

Numerous empirical studies have provided evidence on intra-family time allocation mechanism of housework and childcare in different countries. Ueda (2005) found that a spouse with higher wages can reduce her or his own housework time and increase the other spouse's housework time by the same amount of time, and Yamamura and Tsutsui (2019) thought age gaps between husbands and wives influence their allocation of housework in Japanese household. ALvarez and Miles (2003) studied the reasons behind the asymmetric distribution of housework within Spanish two-earner couples, and argued that a higher fraction of women's income is associated with fewer hours spent on housework. Hersch and Stratton (1994) argued that husbands do less housework than wives as husbands' relative earnings increase in the US. Kimmel and Connelly (2007) stated that women with higher wages spend more time on childcare activities in the US, and emphasized that childcare time is not suitable to be classified as housework time.

However, what are the theoretical approaches to support empirical work on this issue? The early "unitary" household model reconciles the single household's utility framework with the presence of multiple individuals. Under budget and time constraints, household members decide to allocate their time to produce goods and services to maximize the household's utility, which simultaneously determines the housework and leisure time, labor supply, and consumption for market goods (Becker, 1965; McElroy, 1997). Then, the Nash bargaining model was developed, which assumes that the maximum utility that a family member can achieve when remaining single determines one's threat point (or fallback position). The threat point serves as the reservation utility, changes in which can affect the internal resource allocation (time allocation) within household (Manser & Brown, 1980; McElroy & Horney,

[2] According to the Gender Equality Bureau Cabinet Office, the number of dual-income families was roughly twice that of full-time housewife families in 2017.

[3] In Japan, the Survey on Time Use and Leisure Activities show that (1) employed mothers did 47 times more housework in 1996, but did 13 times more housework in 2016 than employed fathers; (2) employed mothers did 6.3 times more childcare in 1996, but did 3.5 times more childcare in 2016 than employed fathers.

1981). However, it has been argued that a weakness of the framework is that Nash bargaining does not demonstrate Pareto efficiency (Pierre-Andre Chiappori, 1988; Pierre-André Chiappori, 1991), and the collective model overcome this.

The collective model was initially developed by Chiappori (1992), Chiappori (1988) and Apps and Rees (1988). Considering each individual in the household has a respective utility function and heterogeneous preferences, the collective model is more suitable in which increases the efficiency of resource allocation within households. In the collective approach, the individual decision process is determined by one's bargaining power within the household under the assumption that the final distribution within the household should be Pareto-efficient. Empirical studies that analyze intra-household time allocation and household production or expenditure based on the collective model have emerged (Aronsson, Daunfeldt, & Wikström, 2001; Browning & Gørtz, 2012; Cherchye, De Rock, & Vermeulen, 2012; Kalenkoski, Ribar, & Stratton, 2008). Blundell, Chiappori, and Meghir (2005) presented a collective labor supply model, incorporating parental care of their children into the theoretical model. Blundell, Pistaferri, and Saporta-Eksten (2018) adopted a structural life cycle approach in which the couple decides the time allocation to market-work activities, childcare activities, and leisure. They found that the couple's childcare times can substitutes for child services in the home production function, and the wife's reaction to childcare time is relatively stable. However, there is a minimal study that used the collective model, and empirically analyzed the time allocation between housework and childcare in Japan. One such work is Yoshida (2009), who examined the factors that affect the couple's decision process concerning housework and childcare. The results showed that both members of the couple's wage rates have statistically significant effects on the time allocated to housework and childcare.

This study primarily addresses issues such as the extent to which a collective approach explains the intra-family time allocation in Japan. Increasing in a wife's relative bargaining power vis-à-vis her husband is a critical factor that determines the time spent by each husband and wife in household production activities. Shifts in bargaining power are due to the wife's wages from the labor market catalyzing time allocation within household in favor of wives. Once the wife engages in market labor and earns wages, the wife's bargaining power in housework and childcare will increase, and then husband has less bargaining power, such changes in bargaining power influence the degree of time allocation couples respectively devote to housework and childcare.

This study also contributes to the literature as follows. First, it uses a collective model to empirically analyze the determinants of husband-wife time allocations for housework and childcare in Japan. We focus on the "distribution factors" that affect an individual's intrafamily

bargaining power, and use four proxy variables such as wife's relative wage, wife's relative age, wife's relative education level, and male-to-female sex ratio in the region. Second, we use microdata from the Survey on Time Use and Leisure Activities for 2011 and 2016. The survey is the nationally representative time-use survey in Japan and it collects salary information for household members since 2011. Thirdly, we divide time use in home-produced goods into housework time and childcare time to examine if there is heterogeneity between two activities.

The main findings of this study as follows: First, we confirm that the collective approach can explain the Japanese intra-family time allocation. Specifically, we find that high wife's relative wage reduces her own housework time and increases her husband's housework time and childcare time. The effect of wife's relative wage gets stronger in 2016. This study also shows that wife's relative age is significant for explaining distribution factors. At the same time, it is inappropriate to take relative education as a distribution factor. Finally, there is heterogeneity between housework time and childcare time.

The remainder of this study proceeds as follows. Section 2 explains the theoretical approach. The data and analytical framework are presented in Section 3. Section 4 discusses the empirical results. Lastly, Section 5 summarizes the findings and addresses future issues.

2 Theoretical Approach

This study relies on the standard collective time-use theoretical approach introduces by Blundell et al. (2005), analyze individual time-use in a two-person group within a household.

In the collective framework, there are two individuals (decision-makers) in the household, to wit, the husband and wife. Each individual has a utility function defined by observed leisure time, individually produced public good in the household (shopping, and housework, among others) and child welfare, which represents husband's or wife's rational preferences. We assume the time-use decision-making always derives from Pareto-efficient outcomes of a bargaining process (Browning, Chiappori, and Lechene, 2006), and the decision-making process is also stable in the household (Browning, Chappori, and Weiss, 2014). The collectively rational behavior in the collective time-use theoretical approaches is the result of the maximization problem which difined by a weighted sum of the decision-maker utility functions, with the weights representing the bargaining power of the husband and the wife. The weightes refers to the Pareto weights, which is considered as a function of the individual's (the husband's) wage rates, income, and distribution factors, and also is continuous differentiability between zero and unity. It represents the relative weight in the household, in the sense that it reflects the relative "bargaining power" of the husband and wife within the household. In the weights λ, distribution factors is very different from the other variables which affect only the Pareto weight

(or says decision process), but do not influence the household budget constraint nor individual preferences (Browning, Chappori, and Weiss, 2014).

There exists a two-step negotiation process by bargaining power in the collective approach (P. A. Chappori, 1992; Blundell, Chappori, and Meghir 2005). In the first step, the household profits are maximized by the husband and the wife choosing their respective contributions to public goods (household chore-production), and according to a given sharing rule, residual non-labour income is allocated between the husband and the wife. In the second step, each individual maximizes his or her utility to allocate private goods (time and commodity consumption), conditional on the sharing outcomes and budget constraint obtained in the first step. This study focus on household bargaining takes place over the time allocation to public goods—housework activities and childcare activities.

In general, the bargaining power within the household depends on distribution factors (Browning & Gørtz, 2012). As mentioned above, the variables are positively correlated with individual i's bargaining powers, in the sense that the higher the coefficient for distribution factor, the stronger the individual's intra-family bargaining power becomes, and the more dominant the individual can be in intra-family time allocation of housework and childcare. Or, to put it differently, distribution factors affect an individual's intrafamily bargaining power, they exert a salient influence on how husbands and wives split housework and childcare duties between themselves. The distribution factor z has been considered as "the relative wage" (wife-to-husband wage ratio), "the relative age" (wife-to-husband age ratio), "the relative education level[4]" (wife-to-husband years of schooling ratio), and so on (Browning, Chappori, and Weiss, 2014). "Sex ratio" (Porter, 2016; Rapoport, Sofer, & Solaz, 2011) and "singles/non-singles ratio" (Van Klaveren & Ghysels, 2012) are also be used in the previous paper. In this study, we also add "male-to-female sex ratio" as one of the distribution factors, for our database can access the information on the respondent's living region. Theoretically, the relative wage (the relative age, the relative education level, or sex ratio) represents one's bargaining power within the household. The higher one's wage (the younger one's age, the higher one's education level, or the fewer people of the same sex) vis-à-vis one's spouse, the stronger one's bargaining power is in intra-family time allocation, resulting in a smaller share in housework and childcare. The reverse is also true.

3 Empirical Framework

3.1 Empirical Model

[4] Some previous study use "age difference" (the husband's age minus the wife's age) and "years of schooling" (the husband's years of schooling minus the wife's years of schooling). We also estimated by control "age difference" and "years of schooling", the results are almost the same as in Table 1.

Based on Eq. (5), we specify two empirical models, Eq. (6) and Eq. (7). We run Eq. 6 in an empirical analysis of dual-income households because the data of the wife's wage information can be observed, and run Eq. (7) in the sample of the full-time housewife households.

$$h_{it}^{j} = \alpha_0 + \alpha_1\left(\frac{w_w^j}{w_h^j}\right) + \alpha_2\left(\frac{w_w^j}{w_h^j}\right) \times year\ dummy + \boldsymbol{z_i^j\sigma} + \left(\boldsymbol{z_i^j} \times \boldsymbol{year\ dummy}\right)\boldsymbol{\beta} + \alpha_3 Hhincome_i^j + \boldsymbol{HhC_i^j\,\gamma} + \boldsymbol{Reg_i^j\,\xi} + u \tag{6}$$

$$h_{it}^{j'} = \kappa_0 + \kappa_{1h} w_h^{j'} + \kappa_{2h} w_h^{j'} \times year\ dummy + \boldsymbol{z_i^{j'}\sigma} + \left(\boldsymbol{z_i^{j'}} \times \boldsymbol{year\ dummy}\right)\boldsymbol{\beta} + \kappa_3 Hhincome_i^{j'} + \boldsymbol{HhC_i^{j'}\,\gamma} + \boldsymbol{Reg_i^{j'}\,\xi} + v \tag{7}$$

where h_i^j is individual *i*'s housework time or childcare time in family "*j*" at day "*t*." Appendix 1. shows the detailed contents of time spent on housework activities and childcare activities, where the definition of housework time is the total amount of time spent on housework and shopping by minutes. Day "*t*" refers to weekday and weekend in our empirical analysis (Gracia & Ghysels, 2017; Kimmel & Connelly, 2007), because a large number of prior studies record the time use gap between weekday and weekend. w_h^j and w_w^j are the hourly wage for the husband and wife[5], respectively. $\left(\frac{w_w^j}{w_h^j}\right)$ denotes relative wage between the wife and the husband as one of the distribution factors in dual-income households. The *year dummy* is one of the two time points of the micro-data, that is, 2016. $\left(\frac{w_w^j}{w_h^j}\right) \times year\ dummy$ is the interaction terms between relative wage and year dummy. The other distribution factors (z_i^j) include the relative age (the wife's age/the husband's age), the relative education (the wife's years of schooling/the husband's years of schooling), and the male-to-female sex ratio (the number of females aged 15–59 in *Ken* where the respondent lives / the number of males who 15–59 in the same area). $Hhincome_i^j$ refers to non-labor annual income of the household in family j, which does not include the wife's and the husband's wage. We control for the household nonlabor yearly income, which implies the household with higher income may more willingly substitute market-purchased goods for home-produced commodities. We also control for household characteristics, $\boldsymbol{HhC_i^j}$. At a certain wage rate, changes in the number of children can lead to changes in the couple's housework time and childcare time (Blundell et al., 2005). We, therefore, control the number of children in various age groups: the number of children aged 0

[5] Wage refers to a respondent's income over the last one year, if the respondent is a self-employment, operating profit which is one's annual sales minus expenses is the individual's annual income information; if the respondent has a side business, income from the side business should be contained in the annual income; if the respondent has been engaged in current work for less than a year, the annual income is one's estimated annual income.

to 2, the number of children aged 3 to 5, and the number of children aged 6 to 17[6]. The theoretical model described above does not assume that other people (such as parents of the couple) help with the housework or childcare, but we control for the dummy of the couple lives with their parent (or parent-in-law) (pr_i^j). Also, variables for "whether the couple lives in the three major metropolitan areas" and *Ken* fixed effect are included. The definition of variables is almost the same in housewife households with couple j', but the controlled individual i's wage rates here do not represent distribution factors. It should be emphasized that, in many empirical studies that discussed the time allocation for housework and childcare, market labor time is included as an essential explanatory variable. However, the collective model also shows the first-order condition for market labor time, as well as the husband and the wife's consumption and household consumption on home production, by solving the household utility maximization problem described by Eq. (3). Therefore, we cannot control market labor time in the estimation.

3.2 Data[7]

The empirical analysis is based on anonymized micro-data from the *Survey on Time Use and Leisure Activities* (the STULA) by the Japanese Ministry of Internal Affairs and Communications in this study.[8] To capture the changes in the time allocation of housework and childcare, we use the two-point time data, the 2011 STULA and the 2016 STULA. In the empirical analysis, the result of 2011 is the baseline results.

The STULA is one of the Survey on Time Use and Leisure Activities questionnaire forms, which is the representative national time use data. The STULA is conducted every five years by the Statistics Bureau of Japan since 1976 for collecting data on daily patterns of time allocation and leisure activities. The STULA requires each of the household members who aged ten and older report on his/her daily activities during the designated two days in 15-minute intervals (from 4:00 a.m. until 4:00 a.m. the following day). The STULA records respondents' daily diary during any two different days of the surveyed period (24 h/day), distinguishing between holidays, weekend days, and weekday. The STULA classifies time use activities such as housework time, shopping, childcare time, and market time into separate categories based

[6] We only control for "the number of children aged 6 to 17" in the estimation on housework time.

[7] It should be pointed out that the results of this study are the original analysis conducted by the author based on the data–the *Survey on Time Use and Leisure Activities*, and are different from the statistical data information created and released by the *Statistics Bureau of the Ministry of Internal Affairs and Communications*.

[8] The STULA has been conducted every five years in designated areas by the *Japanese Ministry of Internal Affairs and Communications* since 1976. It mainly surveys citizens' allocation of time over a single day and what they had chiefly done in daily life during any two days of the surveyed period. The questionnaire includes twenty question items about personal life activities, 15 minutes being a category for each one, and some other items about the respondents' age, education, and employment status. The total sample comprises approximately 190,000 people from approximately 77,000 families in 2001 and 190,000 people from approximately 80,000 families in 2006.

on a time unit of 15 minutes. The 2011 and 2016 STULA provided the data on respondents' annual income or profit (including tax)[9]. Household's characteristics are also recorded by the household head in the STULA.

We selected the sample for estimations based on the following principles. First, to focus on the housework time of the husband and wife, we restricted the sample to those correspondents who are from married households with an employed husband aged 18 to 59 years. Second, in the analysis of time allocation concerning childcare, we further restricted our sample to couples with at least one child aged six or younger. With these restrictions placed on the sample, we found that the minimum of the wife's housework and childcare time included 0 in some of the households with a full-time housewife. However, the zeros might be due to transitory effects, that is, the wife does housework and childcare, but she was ill on the day of the survey and did not perform these activities. To improve the validity of the empirical estimates, we excluded data where the wife's housework and childcare time did not exceed 15 minutes.[10]

3.3 Descriptive statistics of variables

According to the individual's employment status, we further split the full sample into households with regularly employed couples and households with regularly employed husband and irregularly employed wife in the estimation of time allocation in dual-income households, and into households with regularly employed husband in the estimation of time allocation in full-time housewife households. Appendices 2-3 present the descriptive statistics of the sample on housework time and childcare time allocation in dual-income households. Appendices 4-5 offer the descriptive statistics of the sample on housework time and childcare time allocation in full-time wife households. Figures 1-4 are histograms describing the average of the couple's housework time and childcare time in each household type， that are drawn based on the mean of the descriptive statistics in Appendices 2-5.

Figure 1 shows that employed wives spend about 13 times more (200 minutes per day) time on housework activities than employed husbands (16 minutes per day) on weekday. Although the gap in housework time between employed husband and employed wife has narrowed during weekend, the employed wife still undertakes the main housework activities.

[9] Annual income or profit (including tax) refers to a respondent's income over the last one year, if the respondent is a self-employment, operating profit which is one's annual sales minus expenses is the individual's annual income information; if the respondent has a side business, income from the side business should be contained in the annual income; if the respondent has been engaged in current work for less than a year, the annual income is one's estimated annual income.

[10] In the empirical analysis, we estimated the data without this sample restriction, and the results are almost identical to Table 1, with only minor differences in values.

In the subsample (2) of households with regularly employed couples, regularly employed wives do more housework than regularly employed husbands, 6.8 times more on weekday, and about three times more on weekend. Subsample (3) in Figure 1 shows irregularly employed wives spend more time on housework activities than both their husbands and regularly employed wives in the subsample (2).

[Figure 1]

Figure 2 demonstrates that employed wives do more childcare than employed husbands, 4.8 times more on weekday, and two times more on weekend. Households in which both husband and wife in subsample (2) are regular employers show a similar trend. However, in subsample (3), the differences in childcare time increase between regularly employed husbands and irregularly employed wives. Figures 1 and 2 imply that employed husbands in any employment status still spend more time on childcare than on housework, and that employed wives undertake most of the unpaid domestic work, especially housework activities.

[Figure 2]

Figures 3 and 4 present the average housework time and the average childcare time of couples in full-time wife households. In all the samples, full-time wives spend 30 times as much time as their husbands on housework on weekday, and they also spend 11 times as much time as husbands on childcare on weekday. The difference in housework time and childcare time between couples in full-time wife households on weekend is almost the same as that in dual-income households. Also, the data in the subsample (2) is nearly the same as the full sample (1) because most of the husbands are regular employees in full-time wife households in Japan.

[Figure 3]

[Figure 4]

For the relative hourly wage in Appendices 2-5, the employed wives' hourly wage is lower than their employed husbands in dual-income households, especially in subsample (3), which includes households with regularly employed husband and irregularly employed wife. In contrast, the difference in hourly wages between regularly employed husband and regularly employed wife is not very large (subsample (2)). The average hourly wage of regularly employed husbands in full-time housewife households is between 22,00 yen and 27,00 yen. The wife-to-husband age ratio is about 0.96 in all samples. Husbands and wives have almost the same number of years of education. Indeed, *the 14th Basic Survey of Birth Trends* shows that most people tend to marry someone with the same educational experiences (educational assortative marriage). There is little difference in the gender ratio between men and women aged 18 to 59 in the county where the individual lives. In the housework time sample, most families have children aged 6-18. In the childcare time sample, most dual-income households

have children aged 3-5, while most full-time housewife households have children aged 0-2. Couples are more inclined to cohabit with their mothers (or mothers-in-law) than with fathers (or fathers-in-law) The household nonlabor annual income of dual-income households is higher than that of full-time housewife households.

4 Estimation Results

For our multivariate analyses of spouses' time spent on housework and childcare, we faced a statistical challenge: specifically, the reported amounts of time devoted to each activity are nonnegative, with substantial numbers of observations massed massing? at zero, especially for husbands' time. If the ordinary least square estimation is used, this will lead to biases and inconsistent estimates. Thus, we needed multivariate models that are appropriate for censored-dependent variables. Therefore, this study uses Tobit models as an econometric model. In section 4， we estimated selected coefficients and marginal effects on the expected value of the censored outcome, conditional on housework or childcare time being above zero.

4.1 Estimation results on time allocation in dual-income households

Tables 1-2 describe the estimation results of housework time and childcare time in dual-income households, respectively.[11] The average marginal effect of the Tobit models on time use is reported[12]. There are three panels in? each table. Panel A in Tables 1 and 2 reports the estimated results of housework and childcare time allocation for the overall sample. Panel B lists the results of housework and childcare time allocation for subsample of households with regularly employed couples. Panel C describes the results of housework and childcare time allocation for the subsample of households with regularly employed husband and irregularly employed wife.

[Table 1]

[Table 2]

4.1.1 Estimation results on housework time allocation in dual-income households

Our main parameter of interest is the coefficient of the relative hourly wage of wife-to-husband in dual-income households, which says a higher relative wage implies more power and correspondingly less time devoted to housework and childcare in the household. As shown in Panel A of Table 1, the wife's relative wage has a statistically significant effect on the couple's housework time. As expected, the wife's relative wage has a strongly negative impact on her

[11] To check the robustness, we re-estimated this equation with a nuclear family. The results of all the dependent variables are fully robust with respect to sign and significance. Although the marginal effect value has changed slightly, it does not affect our conclusion (the same as in Table 1). These results are available from the author.

[12] The detailed coefficient estimates are available upon request.

housework time and a strong positive impact on her spouse's housework time. The marginal effect means that if dependent variables increase with the wife's relative hourly wage at a constant rate, doubling the wife's relative wage/a twofold increase in the wife's relative wage leads to an increase of 1.99 minutes per day in the husband's housework time and a decrease of 14.12 minutes in the wife's housework time on a weekday. The results of the time allocation estimations on weekend show the same trend. In the results of the interaction terms between the relative wage and year dummy, the estimated coefficients of the husband's housework time are almost non-significant. Still, the effect of the interaction terms on the wife's housework time gets stronger in 2016. In Panel B of Table 1, the wife's relative wage has a positive impact on the regularly employed husband's housework time and a negative effect on the regularly employed wife's housework time on weekday. However, the result on the effect of relative wages in wife's housework time on weekend has lost its significance. Turning to households with regularly employed husband and irregularly employed wife as shown in Panel C of Table 1, we find no statistically significant results in any column except for the effect on wife's housework time on weekend. In general, the higher the wife's relative wages, especially for the regularly employed wives, the stronger her bargaining power, which leads to shorter housework time on the part of the wife and longer housework time on that of the husband. Although the coefficient value of the marginal effect is small in each panel, there is still a gap in the impact on the wife and husband. We argue that the difference between the husband's and wife's housework time may be partially due to the wife's originally spending more time on housework than her husband.

The other main parameter of interest is the coefficient of the relative age. The wife's relative age is negatively and significantly related to husbands' housework time on the weekend. The result shows that the relatively older wife has lower bargaining power compared to their husband, which leads to her husband doing less housework (Browning & Gørtz, 2012; Kalenkoski et al., 2008). The marginal effect of relative age on husbands' housework time is 28.82 on the weekend in Panel A. However, and we cannot find a statistically significant impact of the relative age on weekday in all panels. In the hypothesis of the collective model, the bargaining power is remarkably higher if the wife's years of schooling are higher than her husband's, which entails her performing relatively less housework. But, the effect of the wife's relative education on husband's and wife's housework time is mixed, as shown in Table 1. We argue that the mixed result may be related to the educational assortative marriage phenomenon in Japanese society, that is, many Japanese people tend to choose to marry a spouse who has a similar education level (Schwartz & Mare, 2005). Browning and Gørtz (2012) also considered that the parameter estimates for the years of schooling variables (or their difference) could not

be treated as distribution factors. Hence, the results may also imply that it is inappropriate to take relative education as a distribution factor in this study. The effect of the sex ratio is almost not significant. Marriage market matching is related to age and education level. However, as the sex ratio data we use does not involve detailed information on individuals' characteristics, we may not be able to observe how the sex ratio influences an individual's bargaining power.

4.1.2 Estimation results on childcare time allocation in dual-income households

Table 2 reports the estimation results on childcare time allocation in dual-income households. The marginal effect of the relative hourly results on the weekday shows that a twofold increase in the wife's relative wage only leads to an increase of 5.22 and 9.62 minutes per day in the husband's childcare time in Panels A and B, respectively. However, we find that the relative wages in 2016 had a positive impact on couples' childcare time across all the panels. We cannot find a statistically significant effect of the relative age on couples' childcare time. One possible interpretation is that, Japan's seniority-based wage system installs a positive correlation between wage and age, especially in the case of regularly employed husbands. This means that the older one is, the higher one's wage. Wives may, therefore, be mainly responsible for childcare activities, although older wives have lower bargain power and their bargaining power weakens with age. The higher the wife's relative year of schooling, the less the time the husband devotes to childcare activities. However, the wife's relative year of schooling has almost no statistically significant effect on childcare time allocation. Numerous previous researches pointed out that not only is there a substitute relationship between employed husband and employed wife for time spent on childcare activities, but also that highly educated mothers will spend more time in childcare activities (Guryan, Hurst, & Kearney, 2008). Numerous researches have demonstrated that there is substitution relationship between the respective childcare time of employed husbands and employed wives, and that highly educated mothers tend to spend more time on childcare activities. The effect of the sex ratio is almost not significant in Table 2.

Generally speaking, the impact of bargaining power on childcare time is different from its effect on housework time. The results above indicate an interesting outcome: the distribution factors affect the negotiation process and can explain time allocation to housework activities in households in Japan except for (wives') childcare time. Hence, we can conclude that there is heterogeneity between childcare time and housework time, and the result implies the necessity to distinguish childcare time from housework time (Kimmel and Connelly, 2007; Yoshida, 2009).

4.2 Estimation results on housework time and childcare time in full-time housewife households

Tables 3 and 4 respectively report the estimation results (the average marginal effect of the Tobit models[13]) of housework time and childcare time in full-time housewife households. There are two panels in each table. Panel A in Tables 3 and 4 describe the estimated results of housework and childcare time allocation for the overall sample. Panel B lists the results of housework and childcare time allocation for the subsample of households with regularly employed husband.

[Table 3]

[Table 4]

4.2.1 Estimation results on housework time allocation in full-time housewife households

In respect of the husband's hourly wage in Table 3, the increase in husband's hourly wage increases his wife's housework time in full-time housewife households. The marginal effects of the husband's hourly wage vis-à-vis his spouse's housework time are 31.56 on weekday and 36.18 on weekend in Panel A. The results of the wife's relative age show that senior wives spend more time on housework activities. The wife's relative year of schooling and the female-to-male ratio have almost no statistically significant effect on housework time allocation. The result of the main parameters in panel B is nearly the same as in Panel A.

4.2.2 Estimation results on childcare time allocation in full-time housewife households

Table 4 reports the estimation results on childcare time allocation in full-time housewife households on the weekend. The increase in the husband's hourly wage only increases his weekend childcare time in full-time housewife households. An increase in the husband's hourly wage leads to an increase of 37.88 minutes per day in his childcare time in Panel A, and to an increase of 44 minutes per day in Panel B. The relative age relates to an increase in husband's childcare time of 75 minutes per day, and an increase in wife's childcare time of 73 minutes per day on the weekend in Panel A. The effect of the relative age in Panel B shows results similar to those in Panel A. The marginal effect of the wife's relative years of schooling is that it increases her childcare time by about 50 minutes per day on the weekend the female-to-male ratio has no statistically significant effect on the couple's housework time allocation.

5 Conclusion

In this study, we used the 2011 and 2016 *Surveys on Time Use and Leisure Activities* to analyze

[13] The detailed coefficient estimates are available upon request.

the time allocation to housework and childcare. We refocused the attention on (1) to what extent a collective approach, which assumes intra-family bargaining power, explains the intra-family time allocation in Japan, (2) if there is heterogeneity between housework time and childcare time.

To investigate these two points, we presented a collective model with essential elements of distribution factors used for analyzing intra-family time allocation. According to a methodology proposed by Blundell, Chappori, and Meghir (2005), distribution factors can be used to account for the way husbands and wives divide housework and childcare duties between themselves, for they affect an individual's intra-household bargaining power. Our estimation of the distribution factors indicates that as far as the female spouse is concerned, a larger value of relative wage implies higher bargaining power, which brings about a decrease in her housework time and an increase in her husband's housework and childcare time. The effect of the relative hourly wage on the wife's bargaining power in terms of housework gets stronger in 2016, but its impact on the couple's childcare time is positive. In this way, we confirm that the collective approach can explain the intra-family time allocation, and the positive influence that the wife's higher wage compared to the husband has on her power in the family bargaining process.

Additionally, this study also shows that the relative age is significant in explaining distribution factors. At the same time, it is inappropriate to take the relative education and sex ratio as a distribution factor. Finally, it is meaningful to distinguish childcare time from housework time for empirical analyses.

However, we noticed that there are still problems to be resolved. Whether in the collective model theory or in the empirical analysis, we have not discussed the time allocation to leisure, so the topic should be examined in the future.

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Figures

Fig. 1 The average housework time in dual-income households

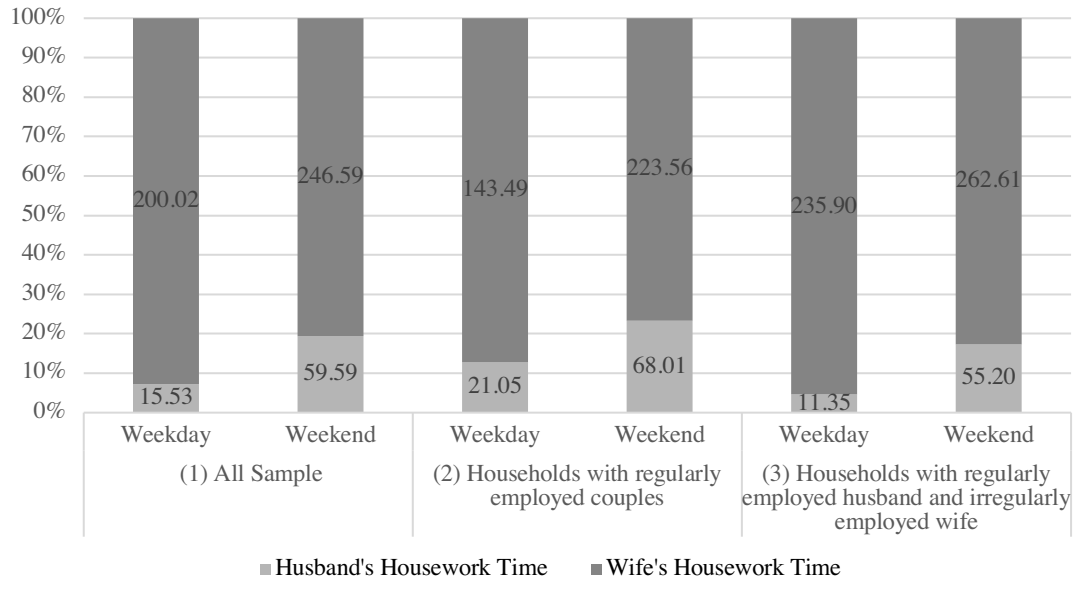


Fig. 2 The average childcare time in dual-income households

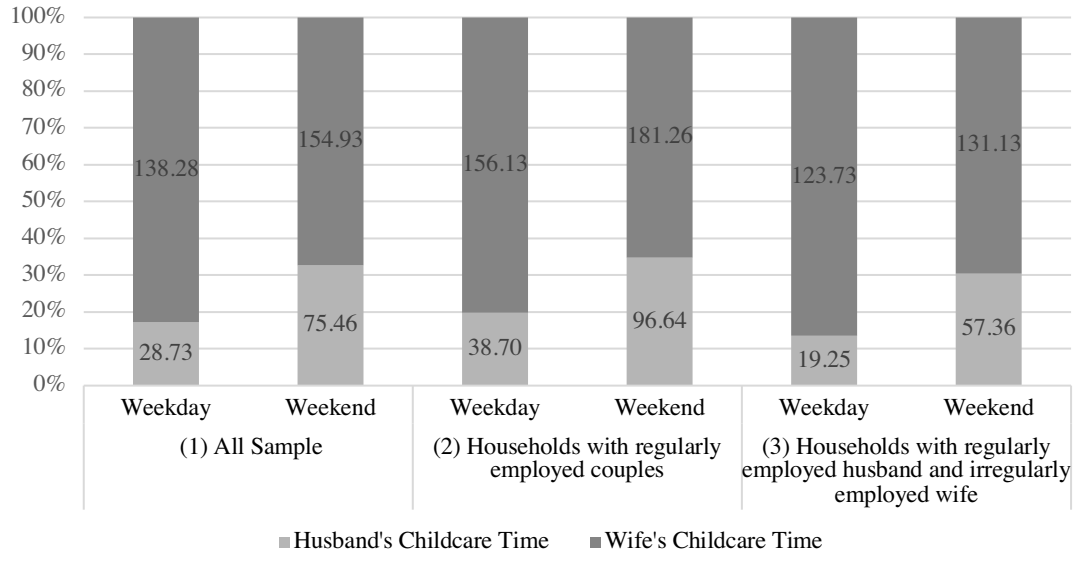


Fig. 3 The average housework time in full-time housewife households

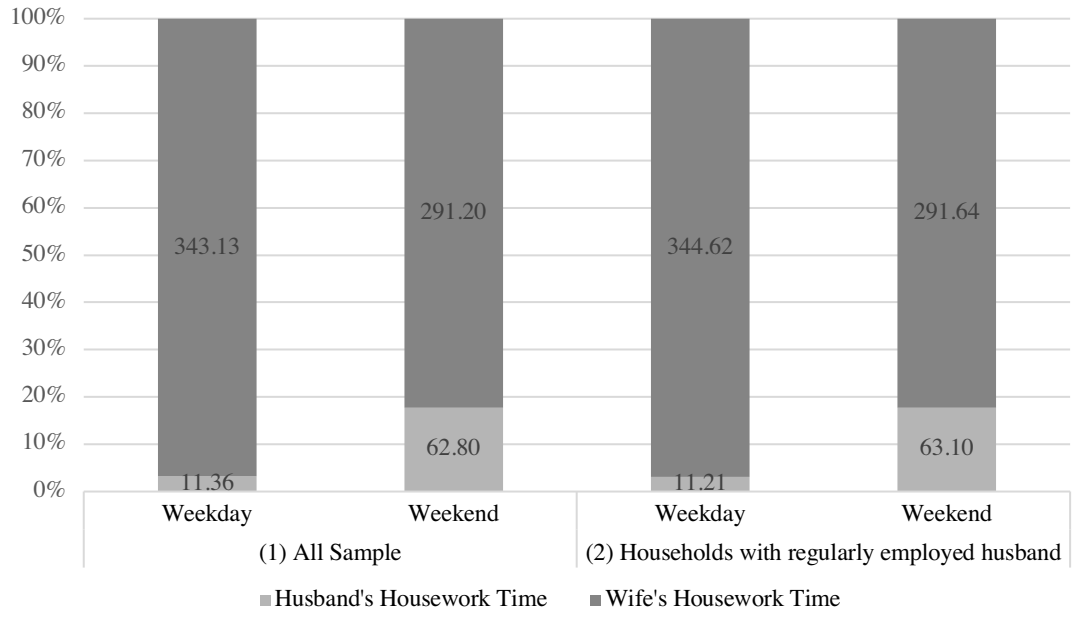
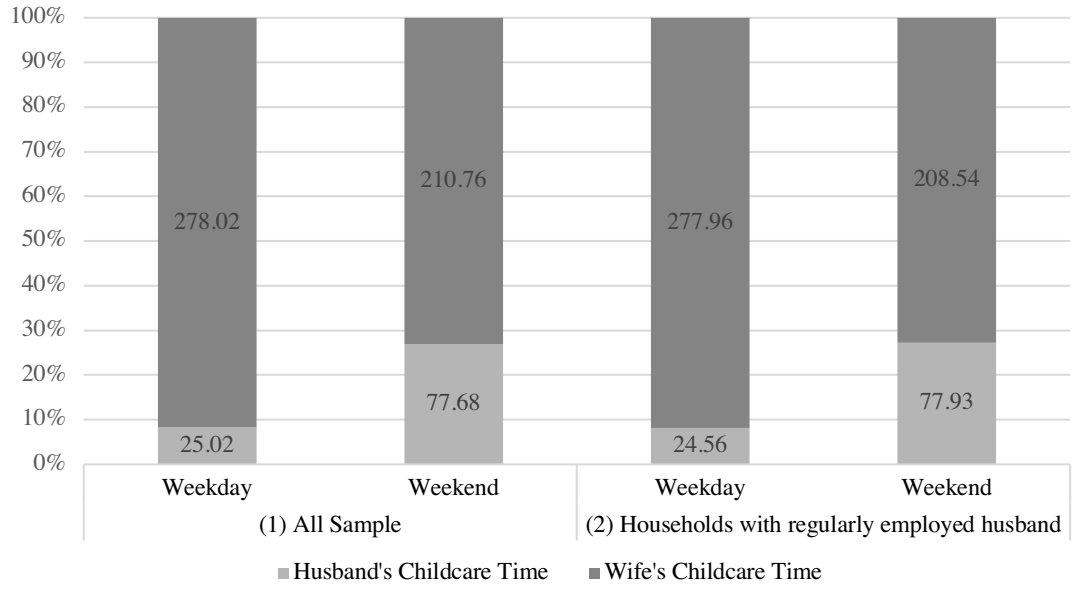


Fig. 4 The average childcare time in full-time housewife households



Tables

Table 1 Estimation results of housework time in dual-income households

	Panel A. All Sample							
	Weekday				Weekend			
	Husband		Wife		Husband		Wife	
Relative Hourly Wage	1.99	***	-14.12	***	2.06	***	-6.43	***
	(0.76)		(5.49)		(0.73)		(1.92)	
Relative Hourly	0.56		-12.74	*	-1.85		-11.15	***
Wage*year2016	(0.99)		(7.21)		(1.46)		(3.30)	
Relative Age	1.92		8.80		-28.82	***	19.59	
	(5.45)		(16.85)		(9.37)		(15.44)	
Relative Age*year2016	-0.41		3.98		31.46	**	28.08	
	(7.53)		(24.51)		(13.31)		(22.75)	
Relative Years of Schooling	2.46		-21.49	**	-16.29	***	-1.96	
	(2.69)		(9.32)		(5.04)		(8.37)	
Relative Years of	1.91		-0.59		-3.62		-11.62	
Schooling*year2016	(3.64)		(12.99)		(6.84)		(11.63)	
Female-Male Ratio	-67.06		303.97		20.78		-553.34	**
	(70.59)		(242.25)		(129.35)		(226.25)	
Female-Male	0.96		9.60		33.82		83.65	*
Ratio*year2016	(14.43)		(47.97)		(26.09)		(45.46)	
Hh Char and Region controls	Yes		Yes		Yes		Yes	
Number of Obs	15,465		15,465		26036		26036	
F	3.34	***	13.99	***	4.19	***	12.63	***

NOTE:

* Significant at the 1% level

** Significant at the 5% level

*** Significant at the 10% level

Table 1 Estimation results of housework time in dual-income households (Continued)

	Panel B. Households with regularly employed couples								Panel C. Households with regularly employed husband and irregularly employed wife							
	Weekday				Weekend				Weekday				Weekend			
	Husband		Wife		Husband		Wife		Husband		Wife		Husband		Wife	
Relative Hourly Wage	2.82	***	-4.22	*	2.65	**	-0.43		-0.64		-3.76		-1.55		-7.39	**
	(1.00)		(2.32)		(1.27)		(2.64)		(0.90)		(4.51)		(1.59)		(3.48)	
Relative Hourly Wage*year2016	-2.27	*	0.73		-5.77	**	-4.75		1.59		-22.54	***	-3.88		-7.48	
	(1.31)		(3.72)		(2.40)		(4.24)		(1.67)		(7.64)		(2.85)		(5.98)	
Relative Age	1.89		29.53		-27.97		58.91	**	6.81		9.73		-30.45	***	-11.28	
	(10.77)		(24.50)		(18.89)		(29.08)		(6.64)		(22.79)		(11.36)		(19.18)	
Relative Age*year2016	-2.29		-34.08		-1.93		-2.04		-5.72		42.95		49.03	***	48.79	
	(14.34)		(34.85)		(24.53)		(39.20)		(9.03)		(33.85)		(16.93)		(29.94)	
Relative Years of Schooling	8.97	*	6.91		-18.74	*	11.45		-3.37		-26.73	**	-20.48	***	-10.15	
	(4.88)		(12.51)		(9.59)		(14.30)		(3.20)		(12.47)		(6.23)		(10.95)	
Relative Years of Schooling*year2016	-11.45		6.92		5.59		-2.72		6.57		15.29		-4.90		-8.23	
	(7.05)		(17.84)		(12.78)		(19.60)		(4.19)		(17.65)		(8.51)		(15.33)	
Female-Male Ratio	-139.05		-511.03		-305.90		-787.01	**	1.35		519.77		158.98		-455.37	
	(133.53)		(334.03)		(227.20)		(374.87)		(77.72)		(330.81)		(165.00)		(294.58)	
Female-Male Ratio*year2016	50.99	*	3.25		67.37		156.35	**	-24.55		19.65		22.42		23.90	
	(29.22)		(68.76)		(49.30)		(78.38)		(15.61)		(62.83)		(31.71)		(58.12)	
Hh Char and Region controls	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Number of Obs	5,515		5,515		9,246		9,246		9,108		9,108		15,377		15,377	
F	2.07	***	3.94	***	2.6	***	4.59	***	1.74	***	9.02	***	2.93	***	7.14	***

Table 2 Estimation results of childcare time in dual-income households (Continued)

	Panel B. Households with regularly employed couples								Panel C. Households with regularly employed husband and irregularly employed wife							
	Weekday				Weekend				Weekday				Weekend			
	Husband		Wife		Husband		Wife		Husband		Wife		Husband		Wife	
Relative Hourly Wage	9.62	***	1.26		-2.10		-2.20		-8.10	*	-19.27	**	-5.93		-1.34	
	(3.11)		(6.04)		(2.37)		(5.57)		(4.49)		(8.22)		(4.56)		(5.77)	
Relative Hourly Wage*year2016	-7.16	**	1.63		9.32		13.43	**	4.44		40.61	***	4.64		2.84	
	(3.48)		(7.35)		(5.95)		(6.85)		(5.76)		(14.62)		(7.90)		(12.10)	
Relative Age	-10.01		26.85		-48.37		-9.24		8.11		-57.18		-34.91		35.17	
	(30.80)		(68.98)		(42.08)		(51.37)		(17.64)		(44.03)		(29.66)		(39.92)	
Relative Age*year2016	-0.41		-19.59		67.82		-77.53		-24.85		127.61	**	65.69		-87.26	
	(38.39)		(83.19)		(57.20)		(75.13)		(24.11)		(59.99)		(41.01)		(57.33)	
Relative Years of Schooling	-48.88	***	-80.46	**	-22.15		-22.02		2.75		9.81		-56.86	***	10.90	
	(15.94)		(32.84)		(26.96)		(31.15)		(9.16)		(24.53)		(18.73)		(25.09)	
Relative Years of Schooling*year2016	15.16		94.54	**	-1.78		34.94		-8.64		-13.35		46.09	*	-14.32	
	(21.66)		(45.07)		(34.57)		(42.70)		(12.04)		(32.44)		(24.63)		(33.59)	
Female-Male Ratio	-848.77	*	233.25		-317.48		1285.71		-476.66		-601.14		241.31		-1228.30	*
	(470.44)		(906.49)		(710.49)		(862.37)		(307.72)		(725.70)		(531.52)		(709.60)	
Female-Male Ratio *year2016	55.47		-212.91		248.21	*	78.09		31.71		219.09		-160.91		-2.28	
	(86.55)		(185.59)		(135.87)		(162.49)		(57.53)		(137.01)		(99.45)		(133.08)	
Hh Char and Region controls	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Number of Obs	1,384		1,384		2,443		2,443		1,636		1,636		2,646		2,646	
F	5.35	***	11.57	***	2.48	***	7.66	***	5.7	***	4.18	***	12.3	***	4.8	***

Table 2 Estimation results of childcare time in dual-income households

	Panel A. All Sample			
	Weekday		Weekend	
	Husband	Wife	Husband	Wife
Relative Hourly Wage	5.22 **	-5.55	-0.81	0.60
	(2.29)	(5.36)	(1.79)	(3.57)
Relative Hourly	-1.99	6.19	10.10 **	9.21 *
Wage*year2016	(2.47)	(6.27)	(4.03)	(4.96)
Relative Age	-4.00	-13.15	-32.33	12.73
	(16.26)	(36.48)	(24.69)	(31.57)
Relative Age*year2016	-0.86	26.98	70.57 **	-73.05
	(21.34)	(48.00)	(33.56)	(45.19)
Relative Years of Schooling	-15.10 *	-31.62	-41.74 ***	2.28
	(8.83)	(20.05)	(15.53)	(18.84)
Relative Years of	4.66	42.50	24.05	8.72
Schooling*year2016	(11.62)	(26.21)	(20.16)	(25.63)
Female-Male Ratio	-824.85 ***	-190.00	-42.83	-41.14
	(263.85)	(560.90)	(429.17)	(536.91)
Female-Male Ratio	78.23	39.10	22.42	10.17
*year2016	(49.23)	(108.68)	(80.03)	(101.80)
Hh Char and Region controls	Yes	Yes	Yes	Yes
Number of Obs	3,186	3,186	5,309	5,309
F	6.22 ***	10.39 ***	4.55 ***	11.21 ***

NOTE:

* Significant at the 1% level

** Significant at the 5% level

*** Significant at the 10% level

Table 3 Estimation results of housework time in full-time housewife households

	(Panel A) All Sample								(Panel B) Households with regularly employed husband							
	Weekday				Weekend				Weekday				Weekend			
	Husband		Wife		Husband		Wife		Husband		Wife		Husband		Wife	
Husband's Hourly Wage	-3.79		31.56	***	5.51		36.18	***	-2.51		28.46	**	4.98		33.57	***
	(2.57)		(10.95)		(4.54)		(8.59)		(2.44)		(11.18)		(4.65)		(8.71)	
Husband's Hourly Wage*year2016	-2.32		18.40		3.91		-7.92		-2.34		20.08		5.08		-3.97	
	(3.90)		(18.81)		(6.77)		(12.95)		(3.70)		(19.09)		(6.87)		(13.03)	
Relative Age	-5.09		75.49	***	-4.83		69.66	***	-0.78		65.69	**	-0.64		62.18	***
	(5.98)		(26.60)		(11.47)		(20.65)		(6.21)		(27.24)		(12.07)		(21.27)	
Relative Age*year2016	-7.03		-1.38		9.48		-12.58		-10.34		-2.59		8.17		15.06	
	(8.57)		(41.77)		(17.61)		(33.79)		(8.83)		(42.53)		(18.56)		(33.70)	
Relative Years of Schooling	4.62		5.16		-10.01		-15.33		5.40	*	6.90		-12.15	*	-22.11	*
	(3.03)		(14.10)		(6.80)		(11.37)		(3.13)		(14.41)		(7.18)		(11.84)	
Relative Years of Schooling*year2016	-8.90	*	-35.78		-13.82		7.97		-10.31	**	-40.18	*	-12.48		14.10	
	(4.87)		(22.67)		(10.25)		(17.79)		(4.97)		(23.28)		(10.68)		(18.56)	
Female-Male Ratio	93.20		662.42		421.61	**	-442.16		42.72		703.36		345.87	*	-580.30	*
	(93.97)		(428.24)		(188.31)		(329.57)		(96.81)		(444.40)		(195.52)		(341.43)	
Female-Male Ratio*year2016	-32.04	*	2.89		-80.35	**	25.35		-28.29		-20.77		-76.31	**	30.84	
	(17.40)		(80.87)		(36.39)		(64.02)		(17.62)		(82.08)		(37.13)		(65.35)	
Hh Char and Region controls	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Number of Obs	7,349		7,349		12,372		12,372		7,041		7,041		11,843		11,843	
F	1.36	***	17.27	***	2.48	***	9.8	***	1.24	***	16.88	***	2.43	***	9.96	***

NOTE: * Significant at the 1% level; ** Significant at the 5% level; *** Significant at the 10% level

Table 4 Estimation results of housework time and childcare time in full-time housewife households

	(Panel A) All Sample				(Panel B) Households with regularly employed husband			
	Weekday		Weekend		Weekday		Weekend	
	Husband	Wife	Husband	Wife	Husband	Wife	Husband	Wife
Husband's Hourly Wage	1.93	14.96	37.88 ***	-18.03	3.57	5.76	44.06 ***	-13.61
	(7.57)	(18.04)	(13.43)	(20.30)	(7.58)	(18.22)	(13.74)	(20.97)
Husband's Hourly Wage*year2016	-7.31	-66.69 **	-33.60 *	3.66	-8.80	-50.03	-39.68 **	-1.29
	(11.48)	(33.56)	(18.31)	(28.11)	(11.54)	(34.05)	(18.65)	(28.67)
Relative Age	4.64	-41.67	75.32 ***	72.69 **	4.12	-69.40	84.99 ***	60.52 *
	(13.77)	(44.69)	(21.94)	(32.27)	(14.47)	(45.69)	(23.23)	(33.45)
Relative Age*year2016	-12.18	-0.70	-84.92 **	-148.09 ***	-19.48	47.27	-95.74 ***	-130.84 **
	(20.27)	(72.31)	(35.31)	(53.03)	(20.79)	(74.42)	(36.80)	(54.06)
Relative Years of Schooling	2.42	31.84	-7.51	52.41 ***	5.62	22.84	1.58	50.75 **
	(7.94)	(23.64)	(12.85)	(20.45)	(8.07)	(24.16)	(13.64)	(21.10)
Relative Years of Schooling*year2016	3.52	-70.14 *	-30.15	45.90	-1.25	-56.33	-33.96	49.51
	(11.24)	(39.20)	(20.62)	(31.49)	(11.40)	(39.93)	(21.56)	(32.59)
Female-Male Ratio	-48.04	-1117.39	-551.15	-354.12	-152.08	-1132.81	-522.41	-193.38
	(257.84)	(844.41)	(408.95)	(601.46)	(261.59)	(870.64)	(426.38)	(620.02)
Female-Male Ratio *year2016	-11.69	-42.94	-59.88	-5.58	-7.71	-74.31	-89.61	-8.87
	(45.41)	(146.13)	(79.39)	(117.62)	(46.61)	(148.70)	(80.74)	(119.96)
Hh Char and Region controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of Obs	2,949	2,949	4,905	4,905	2,831	2,831	4,720	4,720
F	10.28 ***	11.25 ***	3.35 ***	13.56 ***	9.77 ***	11.02 ***	3.16 ***	13.09 ***

NOTE: * Significant at the 1% level; ** Significant at the 5% level; *** Significant at the 10% level

Appendix 1 Definition of housework time and childcare time

Behavior type		Content sample
Housework Activities	*Housework*	Cook, clean, take out the trash, do the laundry, iron the clothes, make the quilt, hang the quilt, sort and clean the clothes, take care of the family, keep the books, mow the garden, the bank and the town hall, repair the cars, repair the furniture
	Shopping	Food, daily necessities, durable good, leisure supplies and other shopping
Childcare Activities		Changing diapers, taking care of infants and young children, accompanying children, accompanying children to learn, visiting classrooms, accompanying children to play, and sports meeting support

Appendix 2 Descriptive Statistics of Housework Time in Dual-income Households

	All sample				Households with regularly employed couples				Households with regularly employed husband and irregularly employed wife			
	Weekday		Weekend		Weekday		Weekend		Weekday		Weekend	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Husband's Housework Time	15.531	(44.833)	59.589	(97.305)	21.054	(50.548)	68.011	(104.265)	11.346	(39.501)	55.202	(93.161)
Wife's Housework Time	200.020	(134.370)	246.589	(161.264)	143.486	(109.966)	223.559	(159.272)	235.903	(136.048)	262.611	(160.848)
Relative Hourly Salary	0.679	(0.801)	0.695	(0.797)	0.927	(0.864)	0.953	(0.900)	0.485	(0.633)	0.502	(0.627)
Relative Hourly Salary*year2016	0.343	(0.589)	0.348	(0.568)	0.486	(0.724)	0.489	(0.722)	0.240	(0.372)	0.252	(0.399)
Relative Age	0.963	(0.082)	0.965	(0.084)	0.966	(0.082)	0.966	(0.081)	0.962	(0.080)	0.965	(0.084)
Relative Age*year2016	0.496	(0.486)	0.502	(0.487)	0.519	(0.487)	0.515	(0.488)	0.488	(0.485)	0.500	(0.487)
Relative Years of Schooling	1.004	(0.165)	1.001	(0.166)	1.024	(0.163)	1.016	(0.162)	0.989	(0.163)	0.989	(0.164)
Relative Years of Schooling*year2016	0.518	(0.518)	0.521	(0.516)	0.552	(0.527)	0.541	(0.523)	0.501	(0.509)	0.513	(0.510)
Male-Female Ratio	0.996	(0.044)	0.996	(0.044)	0.996	(0.042)	0.996	(0.042)	0.995	(0.045)	0.995	(0.045)
Male-Female Ratio *year2016	0.510	(0.497)	0.514	(0.497)	0.533	(0.496)	0.526	(0.496)	0.501	(0.497)	0.513	(0.497)
the Number of Children Aged 0 to 2	0.108	(0.335)	0.111	(0.334)	0.163	(0.405)	0.173	(0.409)	0.074	(0.276)	0.076	(0.279)
the Number of Children Aged 3 to 5	0.159	(0.406)	0.154	(0.400)	0.167	(0.413)	0.176	(0.418)	0.154	(0.400)	0.145	(0.393)
the Number of Children Aged 6 to 18	0.828	(0.953)	0.804	(0.946)	0.702	(0.926)	0.699	(0.917)	0.924	(0.964)	0.889	(0.960)
Cohabiting with House-head's Father	0.034	(0.181)	0.027	(0.163)	0.042	(0.200)	0.035	(0.183)	0.030	(0.171)	0.023	(0.150)
Cohabiting with House-head's Mother	0.099	(0.298)	0.091	(0.287)	0.121	(0.326)	0.113	(0.317)	0.085	(0.279)	0.075	(0.263)
Cohabiting with Non-House-head's Father	0.006	(0.076)	0.006	(0.077)	0.007	(0.083)	0.006	(0.075)	0.005	(0.073)	0.006	(0.077)
Cohabiting with House-head's Mother	0.020	(0.139)	0.022	(0.147)	0.023	(0.149)	0.028	(0.164)	0.018	(0.133)	0.019	(0.136)
Household Income	70.857	(136.388)	69.868	(134.800)	76.763	(133.939)	73.854	(132.175)	66.444	(136.128)	66.530	(135.737)
Year2016	0.514	(0.500)	0.518	(0.500)	0.537	(0.499)	0.530	(0.499)	0.506	(0.500)	0.517	(0.500)

Appendix 3 Descriptive Statistics of Childcare Time in Dual-income Households

	All sample				Households with regularly employed couples				Households with regularly employed husband and irregularly employed wife			
	Weekday		Weekend		Weekday		Weekend		Weekday		Weekend	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Husband's Childcare Time	28.729	(70.533)	75.458	(139.528)	38.703	(82.086)	96.637	(157.160)	19.254	(57.220)	57.364	(119.399)
Wife's Childcare Time	138.282	(164.943)	154.933	(181.673)	156.134	(187.625)	181.259	(198.080)	123.732	(140.675)	131.134	(162.779)
Relative Hourly Salary	0.782	(0.872)	0.799	(0.897)	0.984	(1.026)	1.010	(1.048)	0.549	(0.501)	0.575	(0.579)
Relative Hourly Salary*year2016	0.428	(0.730)	0.411	(0.629)	0.557	(0.917)	0.547	(0.791)	0.303	(0.427)	0.287	(0.391)
Relative Age	0.962	(0.098)	0.962	(0.099)	0.966	(0.094)	0.967	(0.095)	0.960	(0.099)	0.959	(0.100)
Relative Age*year2016	0.539	(0.485)	0.525	(0.486)	0.547	(0.486)	0.546	(0.486)	0.544	(0.482)	0.515	(0.485)
Relative Years of Schooling	1.020	(0.178)	1.023	(0.175)	1.032	(0.170)	1.032	(0.170)	1.010	(0.184)	1.010	(0.175)
Relative Years of Schooling*year2016	0.569	(0.523)	0.559	(0.529)	0.582	(0.526)	0.585	(0.530)	0.572	(0.521)	0.543	(0.523)
Male-Female Ratio	0.998	(0.043)	0.997	(0.043)	0.998	(0.042)	0.994	(0.043)	0.998	(0.044)	0.998	(0.043)
Male-Female Ratio *year2016	0.556	(0.496)	0.541	(0.496)	0.563	(0.495)	0.560	(0.493)	0.563	(0.494)	0.534	(0.498)
the Number of Children Aged 0 to 2	0.524	(0.572)	0.542	(0.561)	0.649	(0.583)	0.654	(0.564)	0.414	(0.533)	0.440	(0.540)
the Number of Children Aged 3 to 5	0.771	(0.572)	0.757	(0.574)	0.666	(0.589)	0.665	(0.579)	0.858	(0.536)	0.842	(0.556)
Cohabiting with House-head's Father	0.020	(0.140)	0.013	(0.115)	0.022	(0.146)	0.012	(0.110)	0.019	(0.136)	0.014	(0.119)
Cohabiting with House-head's Mother	0.046	(0.209)	0.047	(0.211)	0.051	(0.219)	0.047	(0.211)	0.038	(0.191)	0.044	(0.206)
Cohabiting with Non-House-head's Father	0.005	(0.068)	0.002	(0.049)	0.003	(0.054)	0.002	(0.040)	0.007	(0.082)	0.003	(0.058)
Cohabiting with House-head's Mother	0.011	(0.106)	0.015	(0.123)	0.009	(0.096)	0.016	(0.127)	0.014	(0.118)	0.013	(0.114)
Household Income	32.211	(79.729)	29.733	(67.458)	42.775	(89.765)	39.153	(78.093)	21.684	(59.162)	21.495	(54.537)
Year2016	0.558	(0.497)	0.544	(0.498)	0.565	(0.496)	0.564	(0.496)	0.566	(0.496)	0.536	(0.499)

Appendix 4 Descriptive Statistics of Housework Time in Households of full-time housewife

	All sample				Households with regularly employed husband			
	Weekday		Weekend		Weekday		Weekend	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Husband's Housework Time	11.365	(39.517)	62.802	(96.366)	11.206	(39.526)	63.104	(96.487)
Wife's Housework Time	343.134	(163.649)	291.204	(161.202)	344.617	(163.778)	291.636	(160.978)
Husband's Hourly Salary	0.256	(0.220)	0.255	(0.229)	0.261	(0.222)	0.260	(0.231)
Husband's Hourly Salary*year2016	0.111	(0.194)	0.110	(0.201)	0.114	(0.196)	0.113	(0.204)
Relative Age	0.965	(0.090)	0.963	(0.093)	0.965	(0.089)	0.963	(0.091)
Relative Age*year2016	0.413	(0.482)	0.409	(0.481)	0.416	(0.483)	0.411	(0.481)
Relative Years of Schooling	0.969	(0.162)	0.971	(0.161)	0.967	(0.161)	0.968	(0.158)
Relative Years of Schooling*year2016	0.415	(0.494)	0.412	(0.492)	0.418	(0.493)	0.413	(0.491)
Male-Female Ratio	0.997	(0.047)	0.996	(0.046)	0.996	(0.046)	0.996	(0.046)
Male-Female Ratio *year2016	0.423	(0.492)	0.420	(0.491)	0.427	(0.492)	0.423	(0.492)
the Number of Children Aged 0 to 2	0.286	(0.508)	0.289	(0.512)	0.283	(0.505)	0.289	(0.511)
the Number of Children Aged 3 to 5	0.262	(0.490)	0.257	(0.488)	0.264	(0.492)	0.260	(0.490)
the Number of Children Aged 6 to 18	0.656	(0.873)	0.639	(0.855)	0.667	(0.878)	0.647	(0.856)
Cohabiting with House-head's Father	0.013	(0.114)	0.016	(0.127)	0.013	(0.115)	0.017	(0.128)
Cohabiting with House-head's Mother	0.047	(0.213)	0.049	(0.215)	0.047	(0.212)	0.048	(0.213)
Cohabiting with Non-House-head's Father	0.002	(0.049)	0.005	(0.068)	0.003	(0.051)	0.005	(0.068)
Cohabiting with House-head's Mother	0.014	(0.118)	0.015	(0.123)	0.015	(0.121)	0.015	(0.123)
Household Income	46.040	(125.959)	50.362	(130.118)	44.702	(126.120)	49.092	(129.646)
Year2016	0.426	(0.495)	0.423	(0.494)	0.430	(0.495)	0.426	(0.495)

Appendix 5 Descriptive Statistics of Childcare Time in Households of full-time housewife

	All sample				Households with regularly employed husband			
	Weekday		Weekend		Weekday		Weekend	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Husband's Childcare Time	25.020	(61.526)	77.676	(131.395)	24.564	(61.639)	77.930	(131.425)
Wife's Childcare Time	278.021	(197.659)	210.758	(195.174)	277.964	(197.626)	208.545	(193.710)
Husband's Hourly Salary	0.224	(0.196)	0.220	(0.190)	0.228	(0.195)	0.223	(0.190)
Husband's Hourly Salary*year2016	0.098	(0.171)	0.096	(0.186)	0.099	(0.172)	0.098	(0.188)
Relative Age	0.958	(0.096)	0.953	(0.100)	0.959	(0.094)	0.953	(0.098)
Relative Age*year2016	0.398	(0.476)	0.386	(0.472)	0.403	(0.477)	0.387	(0.472)
Relative Years of Schooling	0.978	(0.168)	0.980	(0.167)	0.974	(0.168)	0.977	(0.163)
Relative Years of Schooling*year2016	0.409	(0.499)	0.397	(0.494)	0.413	(0.498)	0.399	(0.493)
Male-Female Ratio	0.995	(0.046)	0.995	(0.046)	0.994	(0.046)	0.995	(0.046)
Male-Female Ratio *year2016	0.411	(0.489)	0.402	(0.488)	0.416	(0.490)	0.403	(0.488)
the Number of Children Aged 0 to 2	0.713	(0.582)	0.729	(0.583)	0.704	(0.581)	0.725	(0.583)
the Number of Children Aged 3 to 5	0.653	(0.586)	0.649	(0.590)	0.658	(0.586)	0.653	(0.589)
Cohabiting with House-head's Father	0.005	(0.073)	0.007	(0.085)	0.006	(0.075)	0.008	(0.087)
Cohabiting with House-head's Mother	0.019	(0.138)	0.022	(0.148)	0.019	(0.138)	0.022	(0.147)
Cohabiting with Non-House-head's Father	0.001	(0.026)	0.001	(0.035)	0.001	(0.027)	0.001	(0.036)
Cohabiting with House-head's Mother	0.006	(0.078)	0.008	(0.087)	0.006	(0.079)	0.008	(0.088)
Household Income	19.261	(84.232)	19.144	(72.861)	18.774	(85.076)	18.882	(73.056)
Year2016	0.415	(0.493)	0.405	(0.491)	0.420	(0.494)	0.407	(0.491)