

Table 1 Parity Distribution of Married Women:

for first-marriage couples who have been married for 15-19 years

Survey Year	Total (Number of cases)	Parity					Completed N of Children (±S.E.)
		None	1 child	2 children	3 children	4 children or more	
1977	100.0% (1,427)	3.0%	11.0	57.0	23.8	5.1	2.19 (±0.023)
1982	100.0 (1,429)	3.1	9.1	55.4	37.4	5.0	2.23 (±0.022)
1987	100.0 (1,755)	2.7	9.6	57.8	25.9	3.9	2.19 (±0.019)
1992	100.0 (1,849)	3.1	9.3	56.4	26.5	4.8	2.21 (±0.019)
1997	100.0 (1,334)	3.7	9.8	53.6	27.9	5.0	2.21 (±0.023)
2002	100.0 (1,257)	3.4	8.9	53.2	30.2	4.2	2.23 (±0.023)
2005	100.0 (1,078)	5.6	11.7	56.0	22.4	4.3	2.09 (±0.027)
2010	100.0 (1,385)	6.4	15.9	56.2	19.4	2.2	1.96 (±0.023)

Source: IPSS (2012) "Report on the Fourteenth Japanese National Fertility Survey in 2010".

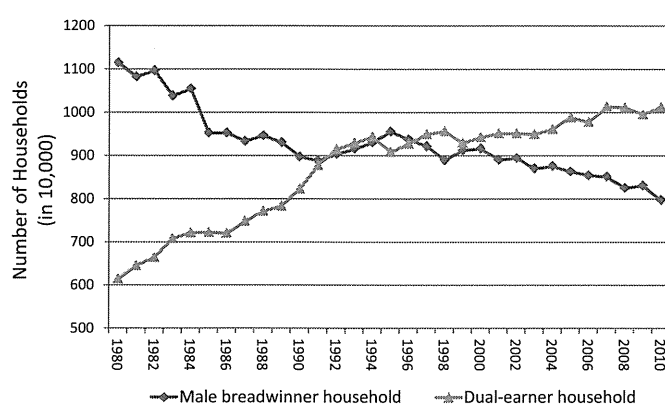
In addition to the trends toward later and less marriage, it is noteworthy that fertility of married couples is increasingly more responsible for the fertility decline in the recent period than before. A demographic analysis employing a decomposition method shows that up to one third (33.3%) of the decline in total fertility rate (TFR) in 1990-2005 is explained by the decline in fertility of first marriage couples, while it explains only one in eighth (12.5%) of the TFR decline in 1975-1990³ (Iwasawa 2008). In accord with the trend, the Japanese National Fertility Surveys reveals that the completed number of children for married women in 15-19 years of their first marriage started to decline since 2002 after staying around 2.2 for three decades (Table 1). In 2010, it reached to below 2 (1.96) for the first time since beginning of the survey (Table 1). The parity distribution of the same group of women shows that much fewer percentages of women get parity three and more while percentages of women who completed one child or stayed childlessness are increasing. The table figure suggests that as percentage of women who ever have two children become lower than before in recent years. In other words, the transition to the second birth becomes more and more selective among Japanese couples.

³ The rest of TFR decline in each period is due to the decline in first marriage rates among women in reproductive ages.

2.2. Gender equality in Japan

Japanese families have been dominated by a notion of traditional gender role division which assures men work outside home and women stay at home for household tasks and childrearing throughout the post-WWII period.

Figure 1 Number of male-breadwinner household and dual-earner household



Source: Statistics Bureau (each year), “Labour Force Survey”

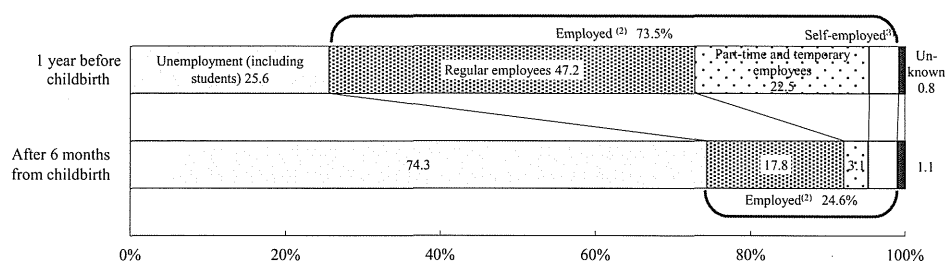
Note: Male-breadwinning household is a household which only a husband is an employee of non-agricultural industries and a wife is either unemployed or in non-labor force. Dual-earner household is a household which both a husband and a wife are employees of non-agricultural industries.

However, the recently emerging trend of the increase in dual-earner couples urges a sign of the change. The number of dual-income households increased and lagged behind that of male single-earner households since the 2000s (See Figure 1). The trend of dual-earner household shows even steeper rise among households with women in their childbearing ages of 25-34 (Cabinet Office 2005).

The increase in wives’ labor force participation is, on the one hand, pushed by the decline in men’s wage due to the prolonged deflation economy which continued over ten years since the late 1990s till very recent period (Cabinet Office 2005). To sustain household consumption, increasing share of house wives started working part-time to supplement husbands’ income (Cabinet Office 2005).

Figure 2 Women’s employment status changes over first birth in 2001 and 2010

a. Mothers of the 2001 newborn cohort



b. Mothers of the 2010 newborns cohort



Note:1) Among the valid sample of the 1st wave surveys of the 2001 cohort (47,010 in total) and the 2010 cohort (38,554 in total), the cases which a subject child is the only child and lives with a mother are used for the tabulations (22,914 cases for the 2001 cohort and 18,100 cases for the 2010 cohort).

2) “Employed” includes leaves of absence such as childcare leaves.

3) “Self-employed, etc.” includes “Self-employed and family business workers”, “Home workers” and “Others”.

Source: The 1st Longitudinal Survey of Newborns in the 21st Century (2001 cohort and 2010 cohort) .

On the other hand, proportion of working wives who continue their employment over childbearing are also increasing in the past ten years in Japan. Figure 2 shows the percentages of wives’ employment status before and after the first birth in 2001 and 2010. It is clear from this figure that the birth of the first child is a major factor that makes Japanese women resign from employment. However, the percentage of employed mothers after six months from first birth is showing a substantial increase from 25% in 2001 to 37% in 2010. It is noteworthy that the majority of the increase is achieved by mothers of regular employees.

Japanese government have been enacted a series of new policies that aim to effectively utilize women’s labor force participation during the childbearing period by gradually extending applicability of

childcare leave to a wider range of employees, e.g. employees of small or medium sized companies or non-regular employees (such as part-time employees, temporary employees, dispatched employees, contract employees, and fixed-term employees) who satisfy certain requirements⁴. Therefore, gradual prevalence of childcare leave is also, in part, contributing to the increasing share of dual-earner couples among childbearing ages.

In addition, Japanese government tries to facilitate gender equality within households by encouraging men's greater involvement with household tasks, especially, childrearing. However, men's participation in domestic sphere is at much slower pace than women's participation in labor force. For example, a comparison of time-use surveys reveals that, in average, only a little less than one hour per day is spent for household chores and child rearing by Japanese husbands who have at least one pre-school child, despite of that more than three hours are spent by husbands in western countries such as USA, Sweden and Germany (Cabinet Office 2006). In contrast, women spend nearly eight hours per day in average, for these domestic tasks in Japan despite that women in those western countries do so about 6 hours (Cabinet Office 2006). The latest time use survey reveals the same picture for men while women's hours spent for housework and childcare are reduced for one hour in 2011 (Statistics Bureau 2012). In addition, a percentage of male eligible workers who take up childcare leave is only 1.89% in 2012 Japan⁵ in which indicates another evidence of lower degree of men's commitment to childcare. Therefore, the progress of men's participation in unpaid work is much disproportional to women's participation in paid work in Japan.

Both the theory (McDonald 2000) and empirical evidence from cross-national study (Myrskylä, Kohler and Billari 2013) suggest, the existing gap between relatively high degree of gender equality in market employment and low degree of gender equality in the family life can be seen as the major cause

⁴ Non-regular employees are entitled to take childcare and family care leave under the 2005 Revised Act. These non-regular employees have to satisfy all of the following requirements:
(1) Employees who have been employed on a continuous basis by the same employer for 1 year or longer; and
(2) Employees who are expected to be continuously employed beyond the date on which the child reaches 1 year of age.

⁵ Ministry of Health, Labour and Welfare (2013) "Basic Survey of Gender Equality in Employment Management"

of very low fertility. It is, then, important to know whether fertility is likely to recover once gender role division within the family life becomes more symmetric. In addition, achieving equal opportunities across genders is a global political agenda. Japanese government has also been taking a series of actions to improve gender equalities at home and work place, partially, in response to demographic pressure of sharp decline in current and future labor force. Therefore, it is particularly important for the government and policy makers to understand how gender equality in both market labor and family life relates to fertility behaviors in current Japan and what will be the consequences of the change into a more gender egalitarian society in future fertility.

3. Previous studies on gender equality and second births

Several country-specific studies are conducted in Europe and the US to investigate the relationship between spousal role sharing in domestic work such as housework and childcare, and the transitions to the second birth. Using data from Hungary and Sweden where prevalence of the dual-earner family is high for both countries while gender relations in the home is rather more traditional in Hungary than in Sweden, Oláh (2003) found that a positive link between men's participation in domestic tasks and the likelihood of the second births in both countries.

However, evidence from Italy and Spain where traditional male-breadwinner families are still highly prevalence suggests that opportunity cost of women's employment is still very high so that men's hours in childcare do not alter the trade-off (Cooke 2003). But in Italy, Cooke (2003) found that men's greater participation in childcare relates to higher likelihood of second births in the youngest marriage cohort, and interpreted this as a sign of the change in the relationship.

In addition, using cross-national time use surveys, Sullivan, Billari and Altintas (2014) found significant evidence of recent increases in the contribution of younger, more highly educated fathers to child care and core domestic work in very low fertility countries such as Germany, Italy, Spain and Slovenia. They interpret these findings as suggestive evidence for a process of cross-national social

diffusion of more egalitarian domestic gender relations which likely to facilitate recent upturns in fertility (Sullivan, Billari and Altintas 2014).

In the US, the relationship between wife's housework share and the second birth intensity among dual-earner couples is found to be U-shaped by indicating that both traditional and egalitarian division of housework appears to be positively related to a higher chance of having a second child (Torr and Short 2004) as similar to a Finnish study of gender attitudes and fertility intention (Miettinen, Basten and Rotkirch 2011). The results imply the existing of two heterogeneous couples regarding divisions of gender roles, namely gender-traditional and gender-non-traditional couples. Then, men's greater participation in housework relates positively to the likelihood of the second births among those gender-non-traditional couples, possibly by reducing wives' burden of the "second shift".

In Japan, several studies examined the relationship between fertility and men's participation in domestic work. But many of them are examining fertility intention rather than fertility behavior. These studies found that husbands' greater participations in childcare (Fujino 2006, Koba, Yasuoka and Urakawa 2009) and housework (Fujino 2006) relate to wives' higher fertility intention. Using two-wave panel data, Nishioka and Hoshi (2009) also found that husband's greater participation in housework increases wife's fertility intention. In analyzing panel data, Yamaguchi (2009) also found a positive relationship between husband's greater share in childcare and marital satisfaction though husband's share in housework did not affect marital satisfaction. As marital satisfaction positively relates to fertility intention, Yamaguchi (2009) suggests that improving work-family balance is likely to increase marital fertility through increasing wife's marital satisfaction. There are a few exceptions too as Mizuochi (2010) and Fujino (2002) did not find significant effects of husband's participations in childcare and housework, respectively, on wife's fertility intention. In general, most of the studies find a positive link between men's greater participation in domestic work and fertility intention of married women. However, it is not clear how much of these positive links are actualizing as behavior.

Longitudinal data is necessary to examine the causal linkage between spousal role sharing and

fertility behavior. Few studies examine fertility behaviors in relation to men's participation in domestic roles using longitudinal data in Japan. Using the Japanese Panel Survey of Consumers (JPSC), Abe and Oi (2004) conducted multivariate probit model and fixed effect model to examine married women's probability of childbirth and number of children, respectively. Their study found a positive effect of husband's hours spent on domestic tasks including both housework and childcare, on birth probability. They also found that the positive effect is stronger in younger cohort. However, it is not clear in their model whether the time order of husband's time spent for domestic work and fertility outcomes is appropriately set or not. In their model, it is likely that both husband's time spent on domestic work and fertility outcomes are measured at the same survey wave so that husband's time for domestic work is increased as a result of the childbirth. Even if they use husband's domestic work hours at t-1 wave, the problem still remains as it is likely that husbands spend more time for domestic work than before if his wife is already pregnant at t - 1 wave. Therefore, even using panel data, setting an appropriate time order to analyze the effect of spousal role sharing on birth behavior urges great caution.

Toda and Higuchi (2011) use larger sample of the Longitudinal Survey on Adults in the 21st Century, conducted by Japanese Ministry of Health, Labour and Welfare to examine the relationship between husband's participation in domestic work and fertility. By taking advantage of the large samples size, they divide their analytical sample into six groups according to wife's employment (employed or not) and parity (parity 0,1 and 2). This makes sample size of each group ranging from 100 to 500. Using data from the second and third wave survey, they use husband's hours spent on housework including childcare for both working day and non-working day measured at t-1 to link the childbirth probability between time t-1 to t. Also they avoid contamination in time ordering of the causality by excluding women who are supposed to be pregnant at the survey in t-1. However, as mentioned, the result is based on only one-year of observation between November 2003 and November 2004. Their measure of the hours spent on domestic work does not allow one to separate childcare and other housework, neither. In the analysis of Toda and Higuchi (2011), they found the only limited relationship between husbands'

participations in domestic work and second birth probabilities. Only husband's domestic work hours in non-working days have a positive link to the second birth probability of women without employment. Neither husband's domestic work hours in working days nor fertility of employed women was found to be statistically significant. This result contradicts to our expectation of that husband's participation in domestic work should have a stronger positive effect on fertility of employed women rather than that of housewives.

In conclusion, the results of previous studies on the relationship between husband's domestic work participation and fertility are ambiguous in Japan due to the data limitation and methodological difficulties. This study overcomes these problems by using newly available large panel data of the new born babies and their parents. By taking advantage of the panel data, the study also employs an innovative method to construct the measure of domestic work participations of each spouse. The details for the data and method are described in the following section.

4. Data and analytical strategy

4.1. Data

The data used for the analysis is the 1st through 6th wave data from the "Longitudinal Survey of Newborns in 21st Century (LSN21, thereafter)" conducted by Japanese Ministry of Health, Labour and Welfare. The LSN21 is the largest and one of the latest longitudinal surveys in Japan. The survey is annual panel survey which subjects to all babies born in Japan in 10-17th January or in 10-17th July in 2001. Thus, the households of 53,575 babies are the sample of this survey. The mail survey method is used to distribute and collect questionnaires. The first questionnaire is mailed to the households of sample babies six months after their births. Among all, 47,015 questionnaires are filled out and returned. Thus, the valid response rate was 88% in the first wave survey. Thereafter, the response rates have been above 90% in the subsequent waves.

In addition to its relatively large sample size with high response rates, the LSN21 covers wide

range of topics such as babies' physical and emotional developments, sickness and care situations as well as household compositions and both parents' socio-economic status, values on family and childrearing, and involvement with household tasks and childrearing activities. Birth year and month of a new born baby are also recorded in the subsequent surveys. Therefore, it is possible to relate a broad set of covariates to transition rate of the second birth. For these advantages, the LSN21 is the best panel data that I can use for the determinants of second birth in Japan.

It should be worth mentioned that the LSN21 has no left-truncated observations for the analysis of the second birth. As being a cohort panel of newborn babies, observation of the study starts at six months after the birth of the first child for all respondents in our analytical data, and the survey takes place annually. Therefore, all covariates including husband's and wife's participations in housework and childcare are measured at the same timing since the birth of the first child for all respondents. This is a potentially important advantage in analyzing the effect of spousal role sharing in fertility as the amount of domestic work as well as the patterns of spousal role sharing can be quite different according to age of the first child as well as pregnancy and arrival of the second child. In previous studies (Abe and Oi 2004, Toda and Higuchi 2011), husband's domestic work hours are measured at various time points in the duration since first birth. Therefore, the results may be much affected by both the duration since the first birth and associated couples' living conditions in the beginning of the observations. As much of these initial differences are unobserved, estimated effects of husband's participation in domestic work suffer from omitted variable bias in the models of previous studies (Abe and Oi 2004, Toda and Higuchi 2011). Our use of the LSN21 can avoid this bias at a greater degree than previous studies as comparison is made across respondents in the same birth duration since the first birth.

4.2. Measurement of domestic work participation

Both husband's and wife's participations in household work is measured in the first through third wave surveys by six items with each four-point scale which ask respondents how often each spouse

participates in those activities. The six given items are 1) cooking, 2) doing dishes, 3) cleaning rooms, 4) washing clothes, 5) taking out garbage and 6) shopping daily goods. To each item, each spouse's participation is rated as "Not at all" (0 point), "Rarely" (1 point), "Sometimes" (2 points) and "Always" (3 points). Similarly, the frequencies of childcare provisions are also measured by six items with the same four-point scale for each spouse. For example, these six items in the first wave are 1) feeding, 2) changing a diaper, 3) bathing, 4) bedding, 5) nursing and playing, and 6) taking outside for a walk. However, only first three items are maintained in the second and third waves, while three other items are replaced to different items adjusting to the growth of the subject newborns⁶. Therefore, in the analysis, only first three items are used for constructing the scales for childcare.

About 90% of the questionnaires were filled by wives, mothers of the subject newborns, in the survey. Therefore, in construction of the measurements, only questionnaires assigned by wives are used. Thus, in this study, measurement of domestic work participation is based on wife's evaluation on husband's and her own commitments to household tasks and childrearing activities. Also as husband's domestic work participations are measured only when the husband presents in the household. Therefore, we used households which both a wife and a husband are presented and attended all three waves of the survey.

It is tempting to use the household work situation measured at wave 1 in the model because it can be used without worrying about pregnancy for all respondents. However, as shown in Table 2, there are considerable degree of the within-individual changes in the frequencies of housework and childcare provided by husbands. Table 2 shows the distributions of husbands and wives who changed their frequencies on each childcare and housework item between survey waves. Husband's "perceived" participations in each housework and childcare activity are surprisingly inconsistent. Percentages of husbands who stay in the same levels of participation in a variety of activities are ranging from 44% in

⁶ The item on changing diaper is replaced to "cleaning up excrement" in the third wave survey as using a diaper cannot be conditioned at child's age of 2 and a half years old.

feeding to 69% in washing clothes. The rest of 30 to 55% of husbands are perceived to change their levels of commitment to each household activity. Furthermore, the changes in husbands' participation in each activity can be observed not only between wave 1 and wave 2 but also wave 2 and wave3 at almost same degrees.

Table 2 Distribution of the changes in frequencies on childcare and housework (%)

a. Childcare

		Changes in frequency (%)	Feeding	Bathing	Changing diaper
a. Husband					
Wave 1 -> Wave 2	Increase		43.1	15.7	19.6
	Same		44.0	62.5	61.0
	Decrease		12.9	21.8	19.4
	n		15,056	15,359	15,196
Wave 2 -> Wave 3	Increase		31.1	15.4	17.1
	Same		54.3	65.7	62.4
	Decrease		14.6	19.0	20.5
	n		15,127	15,395	15,270
b. Wife					
Wave 1 -> Wave 2	Increase		0.7	24.7	0.7
	Same		97.2	61.4	97.9
	Decrease		2.0	13.9	1.3
	n		15,474	15,271	15,459
Wave 2 -> Wave 3	Increase		1.3	17.9	1.0
	Same		89.6	69.4	96.8
	Decrease		9.0	12.7	2.2
	n		15,496	15,368	15,472

b. Housework

		Changes in frequency (%)	Cooking	Doing a dish	Clearing home	Washing clothes	Taking out garbage	Shopping
a. Husband								
Wave 1 -> Wave 2	Increase		15.3	21.6	21.7	18.0	19.1	19.1
	Same		65.1	55.7	58.9	65.9	61.8	54.5
	Decrease		19.6	22.7	19.3	16.1	19.1	26.5
	n		15,204	15,249	15,236	15,195	15,359	15,291
Wave 2 -> Wave 3	Increase		16.8	20.1	19.8	15.6	16.3	21.7
	Same		67.9	58.5	61.2	69.1	65.1	57.0
	Decrease		15.3	21.4	19.0	15.4	18.6	21.3
	n		15,252	15,292	15,278	15,237	15,394	15,323
b. Wife								
Wave 1 -> Wave 2	Increase		4.7	4.4	7.9	2.7	20.5	9.7
	Same		92.3	92.0	87.5	94.2	59.9	85.7
	Decrease		2.9	3.6	4.6	3.1	19.6	4.7
	n		15,414	15,401	15,397	15,394	15,083	15,396
Wave 2 -> Wave 3	Increase		3.1	3.5	5.3	2.8	19.2	5.8
	Same		94.4	93.3	90.7	94.8	63.4	89.9
	Decrease		2.6	3.2	4.0	2.5	17.4	4.3
	n		15,468	15,450	15,450	15,432	15,124	15,449

In contrast to husband's domestic work participations, wives are almost always main provider of childcare and household chores. Over 90% of wives declare that they are "always" providing above mentioned household tasks and childcare activities in all three waves, except for taking out garbage and bathing as only a half of them always such activities. Therefore, both housework and childcare are heavily reliance to wives' provisions and wives' frequencies on these domestic tasks do not show much changes within three years of observation as shown in Table 2.

Men's participation in the domestic sphere is much responsive to family situations as well as the child development. For example, previous studies found that both husband's hours spent on housework and childcare (Suruga 2010) and husband's degree of participations in childcare activities (Nishioka 1998, Matsuda 2002) are affected by such factors as wife's employment status, number of pre-school children and age of the youngest child. Also our measurements of husband's domestic work participations are based on the wives evaluations. Therefore, the responses in each item could be quite naive to wife's mood, views or satisfaction regarding to the domestic role sharing at each survey wave. In any case, given the fluctuations in the degrees of domestic work participations experienced by relatively large proportions of husbands, it is risky to choose the measurements of domestic role sharing at one or even each time point. Rather, it is desirable to make full use of the information from all three waves to estimate some sort of the individual-specific means of each spouse's participations in domestic work.

To construct the best practiced measurements on domestic work participation of husband and wife in our data, we take two steps. First, we used the pooling individual data from the first through third wave and applied principal component analysis (PCA) to the six housework items and three childcare items separately for both husband and wife. Each PCA gives only one factor which gives the eigenvalue larger than 1. Therefore, the scores of these four factors are considered to represent the degrees of housework or childcare participation provided by either wives or husbands. In the second step, fixed effect regression models are applied to each of these factor scores. After running a series of the fixed effect models, individual fixed effects of these factor scores are estimated and used as

covariates which represent husband's and wife's participations in the housework and childcare in the hazard models of the second birth. In this way, we could estimate individual-specific averages of domestic work participation controlling for both observed changes in the family situations such as wife's employment, pregnancy and child birth, and unobserved time-constant factors, i.e. wives' tendencies in the evaluation of her husband's domestic work participation. The estimation results of the fixed effect models are shown in Table A-1 and Table A-2 in Appendix.

4.3. Selection of analytical sample

The analytical sample in my study is Japanese married couples 1) who have their first baby as a subject to the survey, 2) whose first birth was a single birth, 3) who were in Japan at the each survey wave, 4) both parents were living together with their first baby through first to third wave survey and retained as a valid respondent until 4th wave survey, and 5) a mother of the subject child filled in the questionnaires through first to third wave survey. Therefore, illegitimate births, births from mixed or foreigner couples or babies residing in abroad were also deleted as heterogeneous cases to birth behaviors of other Japanese couples. I only selected couples who live together at the first through third wave survey because wife's and husband's participation in housework and childcare are collected only when both parents present in the same household. This might induce a potentially strong selection in our analytical sample. However, due to our objective to measure the effects of gender equality at home on the second birth transition, it is necessary. As a result of this selection, the sample size reduced from 47,015 to 10,808⁷.

⁷ A majority of deleted sample is those who had a baby from second or higher ordered birth as a subject to the survey (23,512 cases). Also 584 cases were either multiple birth of the first and higher ordered child or born outside Japan. In addition to them, 826 cases have interval censoring due to the temporal drop-out from the survey before the second birth and they are deleted. Among the rest of 20,810 respondents, 15605 cases are retained after deleting 5,205 cases who did not return the valid questionnaires filled by a mother up to three consecutive waves or who both parents did not live together. The rest of 4,797 cases are deleted due to the listwise selection of the non-missing covariates.

Table 3. Occurrences and Exposures of Second Births in the LSN21 Analytical Sample

Survey waves	2nd birth			Total
	No	Yes	Attrition	
1->2	9,734	694	0	10,428
	93.3	6.7	0	100
2->3	7,170	2,944	0	10,114
	70.9	29.1	0	100
3->4	4,861	2,309	0	7,170
	67.8	32.2	0	100
4->5	3,477	1,105	247	4,829
	72.0	22.9	5.1	100
5->6	2,644	528	160	3,332
	79.4	15.9	4.8	100
Total	27,886	7,580	407	35,873
	77.7	21.1	1.1	100

Occurrences and exposures of second births in the analytical data are shown in Table 3. Second births are most concentrated on the period between second and third waves and third and fourth waves, which correspond to the birth intervals of 1.5-2.5 year and 2.5-3.5 year after the first birth. Thereafter, the occurrence-exposure rates of the second births gradually decline in later birth intervals. Note also that the annual attrition rates are around 5% after 4th wave, which is quite negligible.

5. Statistical modeling and covariates

A discrete-time hazard model is used to analyze correlates of the second birth hazard observed in the LSN21. I have created a person-period data which covers the time period since the first birth till the time when the second birth or censoring occurs. The observation is censored when one of the followings occurs before the second birth; (1) the analytical subject withdraws from the survey after the 4th wave survey, 2) marriage is dissolved after the 4th wave survey, and (3) the time of the 6th wave survey arrives. Complementary log-log model is applied to the person-period data, in order to analyze the factors associating with the second birth hazards of women who gave the first birth in 2001. The model equation is expressed as follows:

$$\ln[-\ln(1-P_t)] = a_t + b_1X_1 + b_2X_2(t) + \dots + b_kX_k(t) \quad \cdot \cdot \cdot \quad (1)$$

P_t : hazard probability, a_t : baseline hazard function, b_k : coefficient of X_k

In the model, the birth interval from the birth of the first child is used as the time variable, which acts as the baseline of hazard probability. Time until second birth or censoring is measured in a unit of month. Therefore, the model is eventually an approximation of a continuous-time model as explained in Allison (1982). The exponential of the coefficient, $\exp(b_k)$ can be directly interpreted as a hazard ratio which represents a ratio of hazards in a given category relative to a reference category.

In the model, the following variables are used as covariates: wife's and husband's employment statuses, couple's participations in housework and childcare activities, wife's anxiety and feelings of burden over child rearing, first child characteristics such as sex and birth month of the first child, whether the first child was born as premature baby or not and whether first birth was a consequence of premarital pregnancy or not, and other household and demographic characteristics such as wife's education levels, coresidence with grandparents, wife's age at first birth, region of residence and size of municipality. The definitions of the covariates used for the analysis are also shown in Table A-3 in Appendix.

It is expected that the relationship between couple's domestic work participations and the hazard of the second birth can vary depending on wife's employment status. Therefore, in the multivariate analysis, we will examine the interaction effects of the couple's domestic work participations and the wife's employment status. It is also possible that the gender relations of couples whose wives continue her full-time employment after first birth are qualitatively different from the majority of other housewife couples. Therefore, we will also provide estimation results by dividing the analytical sample according to whether a wife is full-time employee or staying at home without employment at the 1st wave survey (6 months after the first birth).

6. Results

6.1. Interaction effects of couple's domestic work participations and wife's employment status

The first set of estimation results are shown in Table 5. In Table 5, only both main and interaction effects of couple's domestic work participations and wife's employment status are shown in the form of hazard ratio, the exponential b. The estimation results of the full models including control variables are shown in Table A-4 in Appendix.

Table 5. Hazard ratios of the transition to second birth: Interaction effects

	Model 1	Model 2	Model 3	Model 4	Model 5
Covariates	exp(b)	exp(b)	exp(b)	exp(b)	exp(b)
Couple's participation in housework and child-rearing					
Husband's childcare frequency (Ind. fixed effect)	1.08 ***	1.08 ***	1.08 ***	1.08 ***	1.08 ***
Husband's housework frequency (Ind. fixed effect)	0.99	0.99	0.98	0.99	0.99
Wife's childcare frequency (Ind. fixed effect)	1.01	1.01	1.01	1.01	1.01
Wife's housework frequency (Ind. fixed effect)	1.06 ***	1.06 ***	1.06 ***	1.05 ***	1.11 ***
Wife's employment status (Reference: Not employed or students)					
Not employed or students	1	1	1	1	1
Self-employed or family businesses	0.86 **	0.86 **	0.87 **	0.86 **	0.86 **
Full-time employees	0.86 ***	0.87 ***	0.87 ***	0.86 ***	0.86 ***
Part-time employees	0.67 ***	0.67 ***	0.67 ***	0.67 ***	0.67 ***
Husband's employment status (Reference: Not employed or students)					
Not employed or students	1	1	1	1	1
Self-employed or family businesses	1.50 ***	1.50 ***	1.51 ***	1.50 ***	1.49 ***
Full-time employees	1.45 ***	1.46 ***	1.46 ***	1.46 ***	1.45 ***
Part-time employees	1.18	1.18	1.18	1.18	1.17
Interaction effects:					
Wife's employment status		Husband's	Husband's		
* H usband's child-rearing / housework frequencies (Fixed Effect)		child-rearing	housework		
Not employed or students		1	1		
Self-employed or family businesses		1.08	1.25 ***		
Full-time employees		0.98	0.99		
Part-time employees		0.98	1.03		
Wife's employment status				Wife's	Wife's
* W ife's child-rearing / housework frequencies (Fixed Effect)				child-rearing	housework
Not employed or students				1	1
Self-employed and family businesses				1.04	1.09
Full-time employees				1.01	0.89 ***
Part-time employees				0.92	0.95
Constant	0.015 ***	0.015 ***	0.015 ***	0.015 ***	0.015 ***
Number of person-period	68503	68503	68503	68503	68503
Number of samples	10808	10808	10808	10808	10808
Number of events	7580	7580	7580	7580	7580
Chi-square values	3371.174	3371.498	3379.055	3375.922	3378.800
Degree of freedom	39	42	42	42	42

*, p<.10, **, p<.05, ***, p<.01

First, Model 1 serves as a base model and the estimated results are interpreted as follows. The model indicates that husband's greater participation in childcare as well as wife's greater commitment to

housework contributes to the higher hazard of the transition to the second child. Whereas wife's employment leads to lower hazard of the second birth, husband's stable employment which is indicated as a full-time employment or self-employment positively relates to the second birth hazard. Therefore, gender equality in the market labor measured by wife's employment relates negatively to the second birth hazard. However, gender relations in domestic sphere have mixed effects on the second birth hazard.

Model 2 through Model 5 shows the interaction effects between wife's employment status and each measure of couple's domestic work participations. Only one set of the interaction effects are estimated in each model to avoid complexity in the interpretation. The results indicate that both husband's and wife's housework participations have the interaction effects with wife's employment status. In Model 3, husband's greater participation in housework can compensate negative effects of the wife's self-employment on the transition to the second birth. Self-employed wives are highly likely to be involved with family businesses of her husband. In our analytical sample, 53% of their husbands are also self-employed. It is also likely that these self-employed couples spend a time together both at home and workplace. The result indicates that only in such a situation, husband's greater participation in housework has a positive effect on the second birth hazard in Japan. In Model 5, a full-time employed wife further declines her chance of having the second child when she has a greater commitment to housework. This effect is considered as a negative consequence of the "second shift" among full-time employed wives on fertility outcomes.

In sum, this first set of the analysis suggests that second birth hazard is in general high among the families with traditional gender role division where a husband works outside and a wife stays at home for home making and childrearing. However, husbands' greater participations in childcare can further increase the chance of the second birth irrespective of wife's employment statuses. In terms of couple's participation in housework, we find significant interaction effects with wife's employment status. First, husband's greater participation in housework boosts the second birth hazard of self-employed wives. Second, wife's greater commitment to housework reduces a chance of the second birth among

full-time employed wives. For the former relationship, it is not clear from our analysis what aspects of self-employed couples lead to the higher chance of the second birth. However, such factors as the proximity of home and workplace, flexible work hour arrangement and higher gender equality at workplace can be possible conditions to make husband's greater housework commitment increase fertility of working wives. The latter relationship confirms the negative fertility response to the "second shift" among full-time employed wives.

6.2. A comparison of full-time wives and housewives on the correlates of the second births

In the second set of the analysis, we compare the effects of couples' employment status, domestic work participations as well as other covariates on the second birth hazard between full-time employed wives and housewives. The analytical sample is divided by wives' employment status at wave 1 survey. The estimation results are shown in Table 6.

Correlates of the second birth hazard are substantially different across two sub-samples. In fact, the estimation result of the housewife sample is much the same as the all sample results in Table 5 (or Table A-4). This is because housewives are the majority after giving the first birth in Japan as shown in Figure 2. Therefore, we mainly interpret correlates of the second birth hazard for the sample of full-time employed wives and contrast them to those of the housewife sample.

First, wife's deeper commitment to housework leads to higher second birth hazard only among housewives. Contradicting our expectation, the effect of wife's housework commitment was not negative in the full-time worker sample as shown in Table 5. We suspect that this was because some of the wives resigned their full-time employment after the wave 1 survey. For example, we have 13% of wives who resigned her full-time employment and 7% of wives turned their employment to part-time jobs in the full-time worker sample. In addition, these wives who resigned a full-time employment have higher hazard of second birth than the other wives. The family situations of these resigned wives are supposed to become much resemble to the housewife sample where effect of wife's housework

Table 6. Hazard ratios of the transitions to second birth: Full-time wives and housewives

Covariates	Wife's employment status at wave 1	
	Full-time employee	Not employed
	exp(b)	exp(b)
Couple's participation in housework and child-rearing		
Husband's childcare frequency (Ind. fixed effect)	1.09 **	1.07 ***
Husband's housework frequency (Ind. fixed effect)	0.98	0.98
Wife's childcare frequency (Ind. fixed effect)	1.04	1.01
Wife's housework frequency (Ind. fixed effect)	1.00	1.08 ***
Wife's employment status (Reference: Not employed or students)		
Not employed or students	1.48 ***	1
Self-employed or family businesses	1.54	0.81 **
Full-time employees	1	0.68 ***
Part-time employees	1.01	0.64 ***
Husband's employment status (Reference: Not employed or students)		
Not employed or students	1	1
Self-employed or family businesses	1.22	1.51 ***
Full-time employees	1.36	1.45 ***
Part-time employees	0.72	1.28
Wife's education level (Reference: High school)		
Junior high school	0.64	0.98
High school	1	1
Vocational school / Junior college / Technical college	1.24 ***	1.11 ***
University / Graduate school	1.17 *	1.15 ***
Coresidence with parents (Reference: Not living together)		
Living together	1.18 **	1.04
Wife's take-up of childcare leave		
Did not take childcare leave	1	-
Took childcare leave from a company of 1-99 regular employees	1.01	-
Took childcare leave from a company of 100-499 regular employees	1.10	-
Took childcare leave from a company of over 500 regular employees	1.01	-
Took childcare leave from public office (inc. public schools)	1.30 ***	-
Wife's anxiety and feelings of burden over child-rearing		
Anxiety or distress over child-rearing		
Feel a lot	0.89	0.76 ***
Feel a bit	1	1
Feel almost none	1.13 *	1.12 ***
Score on feelings of burden over child-rearing (Reference: 0 point)		
0 point	1	1
1-2 points	1.07	1.00
3-4 points	1.14	0.97
5-8 points	0.87	0.81 **
First child characteristics		
Sex of the first child (Reference: Male)		
Female	0.90 **	1.00
Premature, underweight baby (Reference: No)		
Yes	0.72	0.62 ***
Premarital pregnancy (Reference: No)		
Yes	1.14 *	1.16 ***
Month of birth (Reference: Born in January)		
Born in July	0.96	1.06 **

*: p<.10, **: p<.05, ***: p<.01

Table 6. continued

Covariates	Wife's employment status at wave 1	
	Full-time employee	Not employed
	exp(b)	exp(b)
Demographic Characteristics		
Birth interval spline (Base point: 0 year)		
0-3 year	2.27 ***	2.18 ***
3-4 year	0.68 ***	0.63 ***
4-6 year	0.70 ***	0.63 ***
Wife's age at first birth (Reference: Age 25-29)		
Age -24	1.04	1.19 ***
Age 25-29	1	1
Age 30-34	0.78 ***	0.71 ***
Age 35-	0.38 ***	0.30 ***
Area of residence (Reference: Kanto)		
Hokkaido	0.89	0.99
Tohoku	1.02	1.12 **
Kanto	1	1
Hokuriku	1.06	1.03
Chubu	0.96	1.16 ***
Kinki	1.06	1.15 ***
Chugoku	0.97	1.17 ***
Shikoku	1.18	1.15 *
Kyusyu and Okinawa	1.25 **	1.27 ***
Size of the municipality where the respondent resides (Reference: Other cities)		
14 Largest cities	0.87 *	0.93 **
Other cities	1	1
Rural districts	1.24 ***	1.12 ***
Constant	0.011 ***	0.015 ***
Number of person-period	12305	52492
Number of samples	1896	8327
Number of events	1349	5844
Chi-square values	665.057	2657.645
Degree of freedom	43	39

*: p<.10, **: p<.05, ***: p<.01

participation is positive. Thus, the effects of wife's housework participation on the second birth hazard are likely to be canceled out due to wives' employment changes. Therefore, we could conclude that the positive effect of wife's housework commitment on the second birth was largely observed phenomenon among gender traditional couples.

Second, we expect that a husband's participation in housework would reduce wife's burden of the "second shift" and, thus, contributes to sustaining fertility of full-time working wives. However, this effect was not found. Instead, living with either a wife's or husband's parent(s) are positively relating to