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ABSTRACT

Can Childcare Benefits Increase Maternal Employment? Evidence from Childcare Benefits Policy in Japan*

We estimate the policy impacts of the resumption of income thresholds for childcare benefits (CB) policy in April 2012 on female labor market participation, expenditure on childcare services, and child health outcomes using the Longitudinal Survey of Newborns in the 21st Century in Japan. We use a regression discontinuity design and find that the reduction of CB payments in households where the annual income of the higher-earning exceeded their threshold encouraged mothers to start working as part-time workers or self-employed, both in terms of intensive and extensive margins of labor supply. Furthermore, we find that some mothers who started working as part-time workers because of the cuts in CB used to work full-time before giving birth and quit after giving birth. Even though the mothers resumed work outside the home, expenditure on childcare services and child health outcomes were little affected. Our results imply that the CB payments had a negative income effect on employment of mothers who used to work outside the home before giving birth and might prevent some mothers from pursuing their lifetime careers, especially among higher-income households.

JEL Classification: J16, J21, J38

Keywords: maternal re-employment, child health, birth separation, childcare benefits policy, means test, regression discontinuity design

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I Introduction

This paper estimates whether or not reduction in childcare benefits (CB) increases the intensive and extensive margins of the labor supply of mothers in relatively higher-income households in Japan, which are characterized by a low birth rate and women's low labor force participation. This study also identifies in which employment statuses the CB reduction promotes the employment of mothers and investigates the causal impacts on childcare service fees and child health outcomes.

In many countries, the main purpose of introducing CB is to increase the fertility rate and reduce the financial burden of parenting. Therefore, numerous studies have examined the direct impact of the expansion of CB on fertility and child outcomes.[1] Moreover, the expansion of CB can have the same effect as an increase in exogenous nonlabor income because it is generally a government subsidy. Thus, through income effects, CB expansion can discourage parents, especially mothers, from employment.

However, it is difficult to estimate the causal effect of the CB expansion on maternal employment because CB is expanded endogenously, reflecting not only the declining birth rate but also the economic conditions that force mothers to work. Addressing these endogeneity issues, many studies focused on the exogenous variation of CB between groups or around a clear threshold and estimated causal impacts on female employment using difference-in-differences (DID), regression discontinuity design (RDD), and so on. However, the results are mixed across countries: some studies showed that mothers reduced their employment,[2] while other studies found that the CB expansion encouraged mothers to return to the labor market again.[3]

These mixed results across countries are probably due to variations in the female employment rate and available childcare services. For the female employment rate, the Organisation

[1] See the following studies for fertility (Milligan (2005); Cohen, Dehejia, and Romanov (2013); González (2013); Laroque and Salanié (2014); Garganta, Gasparini, Marchionni, and Tappatá (2017)), and for child health outcomes (Dahl and Lochner (2012); Milligan and Stabile (2009, 2011); Naoi, Akabayashi, Nakamura, Nozaki, Sano, Senoh, and Shikishima (2017)).

[2] See Tamm (2010); González (2013); Garganta, Gasparini, and Marchionni (2017); Bessho (2018); Collischon, Kühnle, and Oberfichtner (2020)

[3] See Gustafsson and Stafford (1992); Blau and Tekin (2007); Bettendorf, Jongen, and Muller (2015); Givord and Marbot (2015)

for Economic Cooperation and Development (OECD) Family Database (2016) shows that female employment rates range from 30% to over 80% (see Figure 1). The female employment rate is high in many European countries, notably in Scandinavia. In contrast, Japan is low on the list (63.2%, 26th out of 40 countries) and lower than the European Union and OECD averages as well as the United States and Italy, which belong to the G7. For the availability of childcare services, the same database shows that childcare enrollment rates (including both formal and informal childcare) also differ internationally, ranging from almost zero to over 60% (see Figure 2). We can confirm that, along with the United States, Japan has a lower childcare enrollment rate among the surveyed countries (22.5%, 28th out of 46 countries).

Indeed, many studies found that Japanese women have chosen to quit their job after childbirth because of limited accessibility to childcare services.[4] Under the above circumstances, parents, especially mothers, cannot use childcare services even if they receive monetary support from the government. These results suggest that the expansion of CB does not affect maternal employment in Japan, which is different from previous studies that focused on countries or regions with easy access to childcare services and found that the expansion of CB encourages mothers to work. Therefore, clarifying the causal relationship between CB and maternal employment will provide important evidence in a country where, as in Japan, both the female employment rate and the childcare enrollment rate have been low to date.

In Japan, CB have been expanded many times since they were introduced in the early 1970s with regard to the following thresholds such as child birth order, child age, and the higher-income parent's (the recipient's) annual income (see Figure 3). These changes were implemented in response to the declining birthrate and economic stagnation; therefore, we are unable to precisely infer causality from CB expansion to employment. However, because of regime change from the Liberal Democratic Party (LDP) to the Democratic Party of Japan (DPJ), monthly CB benefits were increased significantly and the premium paid to parents of younger children, and thresholds based

[4] See Yu (2005); Raymo and Lim (2011); Steinberg and Nakane (2012). Moreover, the World Economic Forum (2018) shows that Japan recorded a low score in "Economic Participation and Opportunity" (see `http://www3.weforum.org/docs/WEF_GGGR_2018.pdf`).

on child birth order and recipient's annual income were abolished from April 2010 to October 2011. Regarding the above CB expansion in Japan, using structural estimation methods, Bessho (2018) simulated the impacts from the removal of thresholds in April 2010 and found that the CB expansion discouraged parents from employment. However, the 2010 expansion involved three changes at once: increase in the monthly payment, increase in eligible age for payment, and removal of income thresholds, so the effect of each change cannot be estimated separately.

Fortunately, CB were subject to another exogenous variation in Japan. In April 2012, an income threshold was reintroduced in response to the government's growing fiscal deficit problem. As a result, CB were reduced to one third of the previous amount (>3 children or ≤3 years old) or half (otherwise) if the recipient's income exceeded the thresholds. Considering the exogenous variations around the income threshold revived in CB as a natural experiment, we estimate the effect of the CB reduction on maternal employment using RDD. At the same time, to identify the mechanism of the causal impact on maternal employment, we also estimate the effects on maternal employment status and child-related outcomes.

The main findings are summarized below. First, comparing households near the income threshold using RDD, we find that the large-scale CB reduction in higher-income households in Japan increased maternal employment. We also find the likelihood of mothers working outside the home, i.e., the extensive margins of maternal labor supply, increased by 6.89 percentage points (p.p.) after the reduction of CB. In terms of the intensive margins, the weekly working hours of mothers also increased by about 2.7 hours. As a result, the maternal annual earned income increased by JPY 310,400 (≈ USD 2928), even though the average decrease in CB was JPY 165,200 (≈ USD 1558).[5] This implies that additional earned income more than fully compensated for the CB reduction. In terms of magnitude, these three estimated values are sufficiently large compared with the mean values (0.416, 13.503 hours, JPY 948,220, respectively). However, monthly fees for childcare services and child health indicators were little affected by the reduction in CB. Moreover, the above results are robust to manipulation, choice of bandwidth, and effects from baseline covariates.

[5] The yen-dollar exchange rate (1 USD ≈ 106 JPY) used here is from August 2020.

Second, we examined how the CB reduction affected the employment status of mothers. We find that, after the CB reduction, the ratios of part-time workers and self-employed rose by as much as the fall in the ratio of housewives among mothers belonging to the treatment group above the income threshold. The magnitude of the effect was larger for part-time workers (5.53 p.p.) than for self-employed workers (3.90 p.p.).

Finally, we examined who started working after the CB reduction by estimating the effects on transitions of maternal employment statuses from the prebirth and post-treatment periods. We find that half of the mothers who started working part-time after giving birth were part-time just before giving birth; however, the other half were either full-time workers or unemployed. For the treated mothers who used to be full-time workers before giving birth, we also confirm that they were likely to choose full-time jobs while using parental leave (PL) just after giving birth, then leave the labor market and return to work as a part-time worker. Meanwhile, most mothers who were self-employed after the CB reduction used to be self-employed before giving birth. Therefore, the background mechanism deriving the main results is that the CB reduction encouraged mothers belonging to the treatment group to not only choose the same employment type that they were engaged with before giving birth, but also join the workforce again and choose part-time jobs in which workers can adjust hours to work flexibly.

This study contributes to the literature in several ways. First, we analyze the impact of the reduction in CB, i.e., reduction in exogenous nonlabor income, as in Cohen et al. (2013). However, they focused only on the direct effect of CB reduction on fertility. To the best of our knowledge, this study is the first to examine the side effects of CB reduction, such as maternal employment, childcare service fees, and child health outcomes. Second, we focus on the resumption of the CB income threshold for higher-income households. Although CB are a financial support policy for child-rearing households, it remains an open question whether high-income households should receive these benefits. From an optimal tax allocation perspective, our second contribution is to discuss the significance of CB income thresholds by comparing the size of the reduction in CB and the increase in household income because of maternal employment. Finally, many studies

confirm that policy changes regarding CB affect maternal employment. However, few studies show the mechanism through which the policy change affects maternal employment decisions: who was affected by the change in CB? Thus, our final contribution is to identify the mechanism through which the CB reduction increased female employment by examining the transition in maternal employment statuses.

This paper proceeds as follows. Section II describes Japan's CB policy, and Section III describes our empirical methods. We describe the data in Section IV and present the results in Section V. We discuss the background mechanism driving the main results in Section VI Finally, we summarize the results in Section VII.

II Policy Background

A Child Benefit Policy

Following the enforcement of the Child Allowance Act to provide financial assistance to parents raising many children, the Japanese Ministry of Health, Labour, and Welfare (MHLW) introduced the CB in 1972. At first, eligibility for the CB depended on various thresholds, including the child birth order, child age, and annual income of the higher earning parent (recipient). With respect to the income threshold examined in this paper, this policy initially targeted households in which the recipient earned less than JPY two million ($\approx$ USD 18,868), including payroll tax. Then, as the birthrate declined and the economy stagnated, the Japanese government has relaxed these thresholds and increased both the number of recipients and monthly payments. Detailed information on the expansion of CB is shown in Table 1.

After many expansions regarding the qualification for eligibility, in April 2010, all parents raising at least one child aged $\leq$15 years became eligible for receipt of CB, and additionally the income threshold was abolished. Prior to fiscal 2010, parents received JPY 5,000 ($\approx$ USD 47) for their first and second children, plus JPY 10,000 ($\approx$ USD 94) for their third and any subsequent

children ≤ these children graduated from primary school or ≤ they reached 12 years old. In addition, all parents were paid JPY 10,000 for each child aged ≤3 years. However, it should be noted that these payments were offered only to the parents whose recipient's income was below JPY 7.8 million (≈ USD 73,585), excluding tax (JPY 8.6 million, including tax).

Since April 2010, all parents have been eligible to receive JPY 13,000 (≈ USD 123) for any child ≤ he or she reached 15 years old and graduated from junior high school because the DPJ, which had a manifesto to expand social security, took power from the LDP, which had held power for many years, in December 2009. As a result, parents raising children aged 13−15 years benefited from the new expansion of CB and received larger payments. However, from October 2011, the eligibility rule for receipt of CB on the basis of child age and birth order was instituted again because of the large budget deficit. All parents were eligible to receive JPY 10,000 for each child aged ≤15 years. Moreover, they were additionally paid JPY 5,000 if they had at least one child aged ≤3 years or younger or if they raised three children or more. As a result, only those parents became eligible for more CB after October 2011. CB were reduced instead for parents raising only one or two children aged 3−12 years and who exceeded the income threshold. However, we cannot find the appropriate control group to compare with the treatment group because all parents raising children aged ≤15 years were affected by the policy changes in October 2011.

In April 2012, the income threshold rule was revived, and the amount of CB decreased from JPY 10,000 to JPY 5,000 if the recipient's annual income exceeded the income threshold. This threshold varied by the number of dependent relatives, including number of nonworking children aged less than 23 years and a nonworking spouse (see Appendix Table A-1), and it was also relaxed according to the spouse's deductions (see Appendix Table A-2), which was determined by the annual income of the recipient's spouse. This allows the recipient's spouse to avoid becoming eligible for CB reduction by decreasing hours to work or stopping. Fortunately, we found the appropriate control group in which the recipient's annual income was below the income threshold because CB payments for these households remained unchanged even after the income threshold was revived. Therefore, we regard households in which recipient's income was above the threshold

as the treatment group. This asymmetric change around the revived income threshold allows us to identify the causal effect of the CB reduction on the treatment groups.

The existing tax credits for dependents were reduced at the same time.[6] As a result, the payroll tax and inhabitant tax increased depending on annual earned income (see the detailed information about the policy change in Appendix Table A-3). This policy change was supposed to generate the same effect on maternal employment as the CB reduction, although the abolition of the dependent tax deduction may have promoted maternal employment, especially for higher-income households. Fortunately, no other policy changes that might have affected maternal employment occurred at the same time. Therefore, taking into account the reduction in tax credits for dependents, we consider the variation in CB as exogenous shocks from a quasi-natural experiment.

B Monthly Childcare Benefits: Examples

We show the changes to monthly CB between 2011 and 2012 in Figure 4. The total payments from both policies are calculated per child. We use monthly benefits as of December each year, which is the month that the survey was conducted. The temporal variations are in red (parents raising children aged ≤ 3 years and >2 children), blue (children aged $3-12$ years and two children or fewer), and green (households over their income threshold and two children or fewer) for CB. We plot intertemporal variations in the annual CB payments in Figure 5.

These figures show that CB changed notably after the first policy change was implemented in October 2011. Following this change, CB payments varied by eligibility conditions, but most parents suffered a reduction in payments because households in our sample are raising two children or fewer on average. After April 2012, the distribution of CB payments shifted to the left. This temporal variation in CB is used to identify the effects of CB reduction on female employment and the use of childcare services.

[6] As for the payroll tax, the exemption for parents with a child <15 years old was abolished from JPY 380,000 (≈ USD 3,585), and moreover, the exemption for parents with children aged 16 or older but under 19 years old was reduced from JPY 630,000 (≈ USD 5,943) to JPY 380,000. As for the inhabitant tax, the exemption for the former parent was abolished from JPY 330,000 (≈ USD 3,113) and the exemption for the latter parent was reduced from JPY 450,000 (≈ USD 4,245) to JPY 330,000.

III Empirical Method

We begin by discussing the difficulties in identifying the policy impacts of CB. The outcome variables that we focused on are maternal labor outcomes and parental behaviors relative to child-raising expenditure from panel data of all households who had at least one newborn from May 10 to 24, 2010. A simple comparison of outcome variables before and after the policy change allows us to estimate the causal effect of CB reduction occurred in April 2012 if and only if there were no other shocks during the same period and the policy treatment was randomly assigned. However, it might be possible that the outcome variables were affected by some unobserved shocks over time, regardless of the CB policy change, and that the assignment of the treatment was determined by unobservable factors. The former concern generates (1) an omitted variable bias, and the latter one causes (2) a selection bias.

Controlling for (1) omitted variable bias and (2) selection bias is usually difficult because we cannot observe all the information on household decision making about the outcome variables. To address these biases, the DID method is very effective for estimating the treatment effects between treated and control groups.[7] However, we did not employ this method for three reasons. First, the method can remove the effects of unobservable time-invariant factors that may affect not only the outcome variables but also the assignment of treatment, however, the method is not good enough at removing the effects of unobservable time-variant factors. The outcomes of our interest, i.e., maternal employment and child health, are likely to be affected by unobservable time-varying factors such as effects form the other policies and changes in unobservable household characteristics over time. Then, it is difficult to obtain a consistent estimator due to (1) omitted variable bias. Second, the DID method is very effective for estimating the overall average treatment effect (ATE) of CB reduction between two groups of households above and below the income threshold, however this method is not good enough at locally verifying the randomness of treatment assignment and estimating the local average treatment effect (LATE) around the threshold. If parents, especially in the neighborhood of the threshold, adjusted working hours or changed their employment status

[7] See Bettendorf et al. (2015); Collischon et al. (2020); Garganta et al. (2017); Givord and Marbot (2015).

to avoid eligibility of the CB reduction (manipulation), the assumption that the CB reduction was randomly assigned would not be held, and (2) selection bias should make it difficult to accurately estimate the effects of CB reduction. Finally, this method requires similarity in the movement of outcome variables between the control and treatment groups (common trend assumption). However, we cannot adequately test whether the common trend assumption holds or not because our data cover only two periods (2010−2011) before the CB reduction took place in April 2012.

Instead of the DID method, we use RDD to remove (1) omitted variable bias, and verify the effect of (2) selection bias. We confirm whether or not the outcome variables discontinuously jump at the income thresholds using the 2012 data (post-treatment period) when the CB reduction was implemented. As a robustness check, we also do the same thing using the 2011 data (pretreatment period) to ensure that discontinuous jumps were not pre-existing prior to the treatment. Following Lee and Lemieux (2010), we estimate the following equation for the RDD model:

$$\begin{aligned} y_{it} &= a_{lt} + (\alpha_{rt} - \alpha_{lt})\, D_{it} + \beta_{lt}\, (Income_{it} - c_{it}) + (\beta_{rt} - \beta_{lt})\, D_{it}\, (Income_{it} - c_{it}) + \varepsilon_{it} \\ D_{it} &= 1[Income_{it} - c_{it} \geq 0] \end{aligned} \tag{1}$$

Let the subscripts i and t denote households and periods in equation (1) estimated using data covering 43,767 households and two periods (2011 and 2012). On the left-side of the first equation, y_{it} is a vector of dependent variables, i.e., maternal labor status (maternal annual income, weekly hours of work for mothers, dummy variable equal to one if the mother works outside the home, dummy variable of full-time [part-time] employment that equals one if the mother works full-time [part-time]), and parental behavior regarding expenditure on childcare services. On the right-side of the first equation, α_{lt} and α_{rt} [β_{lt} and β_{rt}] represent constant terms [coefficients] of the left- and right-side income thresholds, respectively. In the second line of equation (1), we define treatment status D_{it} equals to one if the recipient's income including tax $Income_{it}$ exceeds their income threshold c_{it}. This means that the running variable of households is determined by the Gap $Income_{it} - c_{it}$, and that the cutoff point is zero at this boundary.

Here, the parameter of interest is $\alpha_{rt} - \alpha_{lt}$, the coefficient of D_{it}. If the parameter is significantly different from zero, we can conclude that the outcome variable discontinuously jumps at the cutoff point, i.e., the reduction of CB has a statistically significant impact on that outcome variable. After all, by identifying $\alpha_{rt} - \alpha_{lt}$, this study can estimate LATE around the income thresholds.

Moreover, we employ the Imbens−Kalyanaraman optimal bandwidth (see Imbens and Kalyanaraman (2012)) for the main estimation. The results from RDD, however, might vary by the choice of bandwidth; therefore, we present other estimated results when both double and half of the selected bandwidth are used as a robustness check. For the running variables, we use a triangular kernel function that is useful in dealing with the large variances of the outcome variables such as annual income and childcare service fee. It is noted that we set JPY 20 million as the upper bound of the Gap because the income thresholds of the recipients are determined within the range of JPY 8.33−11.26 million, depending on recipients' annual earned income. For the error term, let ε_{it} be the idiosyncratic effects, where ε_{it} is assumed to be $IID\ (0, \sigma_{\varepsilon}^2)$.

The RDD method focusing only on households near the threshold to ensure similarity of the baseline covariates can mitigate (1) omitted variable bias, but may accentuate (2) selection bias if parents manipulated the treatment. Hence, to identify causality from our estimated results, we must confirm the three assumptions below (proposed by **?**):

Assumption 1 (Non-manipulation): No households manipulated their hours of work or employment status to avoid becoming eligible for the treatment of the CB reduction.

Assumption 2 (Local randomization of baseline covariates): The household characteristics did not differ discontinuously between above and below the income threshold.

Assumption 3 (Irrelevance of including baseline covariates): Even though baseline covariates that do not meet Assumption 2 and are probably correlated with post-treatment outcomes are additionally included in regressions, the results estimated by RDD remain unchanged.

To ensure the internal validity of our results, we conduct three tests for each assumption. For Assumption 1, we conduct a t-test to confirm whether the outcome of the control group differed between before and after the CB reduction in subsection B of Section V. If we observe the substantial difference, we conclude that mothers manipulated their recipients' income to avoid becoming eligible for the CB reduction. For Assumption 2, we run a t-test to check whether there are differences of the mean of the baseline covariate between above and below the threshold after the CB reduction in subsection C of Section V. For Assumption 3, we directly add the baseline covariates not passing the test for Assumption 2 in the regression under the assumption of additive separability of baseline covariates, and confirm that the estimated coefficients remain the same in Appendix Tables A-7 and A-8 .

We also test the sensitivity of the results to a range of bandwidths in subsection D of Section V according to the checklist proposed by **?**.

IV Data

In this research, we use the Longitudinal Survey of Newborns in the 21st Century, a national representative government statistics survey conducted by the Japanese MHLW. The most important feature of this survey is the relatively low rate of attrition. Although this survey has been conducted for 6 years, more than half of households continued to complete the survey; therefore, the collection rate exceeds 85% every year.

The objective of this longitudinal survey is to capture information for the planning, formation, and implementation of necessary measures to deal with the declining birth rate in Japan. This survey has two cohorts, which have been surveyed since 2001 and 2010, respectively. We use the surveys of the 2010 cohort because our research interest is the policy impact of CB changes from an across-the-board payment to a differentiated payment scheme according to children's characteristics and annual income of parents after October 2011.[8] The subjects of this survey are all households

[8] We can use up to the sixth survey conducted on December 1, 2015.

with children, including twins and triplets, who were born between May 10 and 24, 2010. After specifying the subjects, the MHLW distributed and collected questionnaires by mail on December 1 each year. Hence, the child age at the time of the Xth survey was X years and 6 months old. Regarding the timing of the CB changes, we consider the period after April 2012 when the policy transition was completed, as the treatment period.[9]

To confirm whether the baseline covariates other than the CB changes cause the outcome variable to jump in the neighborhood of the income threshold of the CB, we construct many demographic variables such as characteristics of respondents, their spouse and their children, information regarding full-time caregivers, childcare facilities in use, and employment status before and after childbirth. We explain how these variables were created below.

A Data Description: Maternal Employment Outcomes

We use various quantitative and qualitative variables reflecting maternal employment outcomes for each respondent as dependent variables. Below we explain which data we used and how we constructed the dependent variables.

The first variable we focus on is decision-making about whether to work outside the home or the extensive margins of labor supply. We create a dummy variable of the extensive margins which equals one if a mother works at least one hour a week or zero otherwise. The second variable measures weekly hours worked, reflecting the intensive margins. This variable has six categories of 0, <20, 20−40, 40−50, 50−60, and >60 hours. We assign 0, 10, 30, 45, 50, and 60 hours as the variable value for each category, respectively. The third variable is female annual earned income. This is a continuous variable with a minimum value of JPY 10,000. The final variables are maternal employment status. We create dummy variables equal to one for each of the following: mother is a housewife, a nonworker, a student, a full-time worker, a part-time worker, self-employed, and a house worker.

[9] For the robustness test, we also estimate our model using the responses to the questionnaire on December 1, 2011 and ensure that discontinuities in 2012 are not caused by the potential differences.

B Data Description: Childcare Service Fee and Child Outcomes

CB can be used to purchase any consumption goods and/or childcare services, but previous studies (see Boca and Flinn (1995); Lundberg, Pollak, and Wales (1997); Kooreman (2000)) showed that parents are likely to spend it on their children. These studies suggested that parents raising young children are more likely to utilize childcare services if the CB reduction encourages mothers to work outside the home, and if they cannot rely on other family members, such as grandparents or siblings, for childcare support. Previous studies also show that the expansion of CB improves child health outcomes (see Milligan and Stabile (2009, 2011)).

Thus, we next identify whether CB reduction affects parental behavior in terms of the expenditure for their children. Here, total monthly expenditures for childcare in units of JPY 10,000 are included in our dataset. Therefore, to test whether the CB reduction affected child health outcomes, we regard the total monthly expenditure as a dependent variable and create a dummy variable equal to one if a 2010 newborn, mainly targeted in this survey, became sick or injured, or zero otherwise, and another dummy variable equal to one if the newborn was hospitalized at least once, or zero otherwise.

C Data Description: Other Characteristics

To test whether individual characteristics discontinuously jump around the income threshold, we compare the following characteristics of households below and above the threshold. The summary statistics for the below variables are shown in Tables 2−5.[10]

First, we create variables reflecting current mothers' and fathers' characteristics. One of the most important factors is the fathers' earned income and the income from other sources. The other crucial variable is the reduction in dependents' deductions. Before April 2010, parents were eligible to receive dependents' deductions, depending on the number of children aged 18 years or younger they raised. The deduction differed by mothers' income after other income deductions had been removed. Using information on mothers' and fathers' annual earned income, we calculate the

[10] More detailed definitions of the above covariates are provided in Appendix Tables A-4 −A-6 .

increase in payroll tax paid by the parent. The purpose of constructing this payroll tax reduction variable is to normalize the difference in dependents' deductions based on number of children and their ages. By examining whether the mean amount of increase in the payroll tax is balanced above and below the cutoff, we clarify whether policy changes other than the CB change caused the outcome variable to jump in the neighborhood of the income threshold. Moreover, we create quantitative variables for ages of parents and the number of family members residing together, and qualitative dummy variables indicating whether each parent graduated from university, whether each parent is living away from the family, and whether the respondent lives in a designed city or a special ward.

Second, we construct dummy variables for usual caregivers and the childcare facilities in use. Many previous studies showed that the expansion of accessibility to a childcare facility enhances female labor market participation.[11] These previous studies suggested that the expansion of childcare accessibility lowers childcare costs, including both monetary costs for childcare services and opportunity costs of mothers related to working outside the home. In Japan, the expansion of childcare availability varying at the prefecture level increases the maternal employment rate (see Asai, Kambayashi, and Yamaguchi (2015)). Therefore, the more likely mothers in one group were to use childcare services, the more likely they would be to work outside the home. In this case, childcare accessibility makes the determination of maternal employment biased. Thus, we compare the balance in the use of childcare services between the treated and control groups. We also have data on children's characteristics such as whether the surveyed newborn was a twin or triplet, ages of newborns and older children, and gender of child. Because few households had four children or more, the summary statistics and the results of the balance test will be shown for a maximum of three children, including the newborn in 2010.

Third, we create dummy variables representing whether or not mothers and fathers use services from work and life support programs for childrearing. Finally, we consider each parent's employment status before and after giving birth in 2010. For the post-birth period, we also use information

[11]For details, see Lee and Lee (2014); Bauernschuster and Schlotter (2015); Nollenberger and Rodríguez-Planas (2015); Nishitateno and Shikata (2017); Padilla-Romo and Cabrera-Hernández (2019); Müller and Wrohlich (2020).

about the use of PL and other work-life support programs after giving birth in 2010.

V Results

A Main Results

We estimate the effect of the CB reduction on the labor supply of mothers belonging to the treatment group in which annual recipient's income exceeds their threshold. As mentioned in Section III, we use RDD for identification and see discontinuous jumps at the cutoff point of the recipient's income. We first show the results of the CB payments (Figure 6) to ensure that the annual CB payments decreased for households belonging to the treatment group. Subsequently, we show the results of the likelihood of mothers working (Figure 7), weekly hours of work for mothers (Figure 8), annual earned income for mothers (Figure 9), childcare service fee (Figure 10), child health outcomes (Figure 11), and employment status of mothers (Figures 12−13). We also show the estimated coefficients and the results from the hypothesis testing in Table 6.

From the figures on the left in Figures 6−13 and Table 6, we have six main findings. First, the payments of CB decreased by approximately JPY 165,200 in households just over the income threshold in 2012. Second, the employment rate of mothers increased by about 6.89 p.p. for extensive margins, and hours of work for mothers increased by about 2.718 hours for intensive margins. Third, the annual income earned by mothers also increased by JPY 310,400 at the 10% significance level. Fourth, childcare service fees increased although with a marginal level of significance. Fifth, child health outcomes were not affected. Finally, mothers were more likely to work as part-time employees and self-employed by about 5.53 and 3.9 p.p., respectively.

Moreover, we also display the results of comparable outcomes to confirm whether or not there are similar jumps at the cutoff point of the household threshold in 2011, 1 year before the CB reduction was implemented. If there was discontinuity in 2012, but not in 2011, the discontinuity would be because of the effect of the CB reduction rather than potential differences between the below and above cutoff points. The figures on the right in 6−13 show that all the dependent

variables do not jump at the cutoff point in 2011. Therefore, we conclude that the changes in the outcome variables were not due to potential differences in outcome variables before CB changes, but due to post-treatment differences, i.e., the CB reduction.

B Effects of Manipulation

To confirm that Assumption 1 holds, we will confirm whether the CB reduction was treated as an exogenous shock for the first robustness check. Mothers whose income or their husband's income had already exceeded the income threshold in the pretreatment period could have incentives to manipulate their employment outcomes, especially their working hours, to avoid incurring the CB reduction. If such manipulation occurred, our results would be contaminated by selection bias (as discussed by **?**).

We examine this possibility by testing the mean differences of each dependent variable between pre- and post-treatment for the control group. We focus on the subsample that covers the narrow range from the cutoff point to JPY 100,000 ($\approx$ USD 943) below the cutoff point. Restricting samples within the narrow range may prevent individual characteristics from becoming unbalanced and confounded. The p-test results for each dependent variable are shown in Table 7. Table 7 compares the outcome variables below the cutoff point of recipients' income threshold between 2011 (column 3) and 2012 (column 4) and tests the null hypotheses that the mean differences of the dependent variables are zero. If the null hypotheses are significantly rejected, especially for maternal employment outcomes, we say that households manipulated their income threshold in 2012 in response to the CB reduction.

We find no significant differences regarding all maternal employment outcomes. If manipulation had taken place, maternal employment outcomes should have been altered below the income threshold between pre- and post-treatment. Hence, we conclude that Assumption 1 is established because CB reduction did not encourage mothers, especially those whose recipients' income were just over their cutoff points, to manipulate their recipients' income thresholds. Nevertheless, the child health outcome variable shows that the mean differences are significant at the 5% level. This

result suggests that the values of this variables change over time; therefore, we consider these changes as baseline changes in this variable.

C Effects of the Baseline Covariates

As the second step of the robustness check, we confirm whether the current baseline covariates, except the reduction in annual CB payments, jump discontinuously at the cutoff point. If the current baseline covariates jump discontinuously at the cutoff point, Assumption 2 breaks down and we cannot identify whether the effect on outcomes is caused by the CB reduction or by jumps in the baseline covariates. Moreover, if the jumps in the current baseline covariates affect the recipients' annual income, which is the running variable, and determines treatment status, then selection bias is probably present.

To verify whether Assumption 2 holds, we conduct a balance test of covariates by calculating the mean difference of each covariate between below and above the cutoff point and implement a p-test for each difference of covariates. We extract subsamples from the narrow range between the lower bound (JPY 100,000 below the cutoff point) and the upper bound (JPY 100,000 above the cutoff point). The results of the balance tests are shown in Tables 8−10. As for the individual characteristics from the 2012 data, we observe significant differences at the 5% level in the means of father's payroll tax increase and child age (2nd and 3rd) between over and below the cutoff point. However, there is a very small sample of parents who have two or more children in addition to the 2010 newborn.[12] Hence, to calculate the optimal bandwidth and LATE, we incorporate only the dummy variable of father's payroll tax increase, which has 27,969 observations, as an explanatory variable.[13] The results remain almost unchanged, so we conclude that the selection bias is minimal.[14]

[12] Table 4 shows that 5,566 and 889 households have 2nd and 3rd children among the 29,725 households.

[13] In the Appendix, we compare the results of the RDD regressions when both including and excluding these baseline covariates that differ between below and above the cutoff point. The estimated coefficients are presented in Appendix Tables A-7 and A-8 .

[14] However, controlling the covariate of a father's payroll tax increase may lead to post-treatment bias because the resumption of the income threshold for CB could simultaneously affect the covariate as well as the outcome variables. Therefore, we do not include the covariate in the main RDD estimation.

We also checked the balance of the past baseline covariates relevant to parental characteristics just before and after giving birth in 2010. If the past baseline variables affect both the outcome variables and the variable indicating whether to be treated D_{it}, the past baseline variables are considered as the confounding variables; therefore, we need to control for them to mitigate the selection bias in estimating the RDD regressions. The results of the balance tests are shown in Table 11. Table 11 shows that treated mothers were less likely to be nonworkers and more likely to work full-time before giving birth to a 2010 newborn, and after giving birth, more treated mothers took PL and continued to work full-time while using PL. In particular, the likelihood that mothers were nonworkers before giving birth and the likelihood that mothers worked full-time while using PL after giving birth were different around the cutoff point at the 5% level of significance.[15] The results also remain almost unchanged; therefore, we conclude that selection bias is minimal for past baseline covariates.

D Effects of Bandwidth

As the final step of the robustness check, we test the sensitivity of the results to a range of bandwidths in accordance with the recommended checklist proposed by **?**. As mentioned in Section III, we employed the optimal bandwidths proposed by Imbens and Kalyanaraman (2012) for the main results. In Tables 12 and 13, we show the results using bandwidths that are half and double the original bandwidth.

In Tables 12 and 13, we ensure that the estimated results and their statistical hypothetical testing remain unchanged even though the range of the bandwidths changed, except for annual earned income and the likelihood of part-time work. The results imply that all outcomes, except these two variables, provide robustness against the different bandwidths. For annual earned income, the estimate using the optimal bandwidth is significant at the 10% level; however, the estimate using half and double bandwidths are insignificant. For the likelihood of part-time work, the coefficient of the treatment effect is significant at the 1% level only while using the optimal and double the

[15] In Appendix Tables A-7 and A-8 , we also show the estimated coefficients including the past baseline covariates.

optimal bandwidth; the estimate using half bandwidth is insignificant.

Finally, we test whether the means of these two variables are significantly different using the same range in subsection C of Section V . Table 14 shows a significant difference for both dependent variables at the 10% level, and this result is qualitatively the same as the results in subsection A of Section V. Hence, we conclude that the main results shown in subsection A of Section V provide robustness against the range of bandwidths.

VI Background Mechanism of the Main Results

In subsection A of Section V, we found that mothers were more likely to work as part-time workers or be self-employed by reviving the income thresholds for CB. Nevertheless, it is not clear who these mothers are before giving birth; i.e., did these mothers used to work as a full-time worker, part-time worker, or did not work? Thus, we examine transitions of the employment statuses of the mothers who worked as part-time workers or were self-employed after giving birth.

We construct separate dummy variables equal to one if the mother was a part-time worker in 2012 (the post-treatment period), but in 2009 (prebirth period), she was a full-time worker, part-time worker, nonworker, student, self-employed, or house worker, or zero otherwise. Similarly, we constructed separate dummy variables equal to one if the mother was self-employed in 2012 (the post-treatment period), but in 2009 (prebirth period), she was a full-time worker, part-time worker, nonworker, student, self-employed, or house worker. Thus, we have 12 dependent dummy variables (six employment statuses as of 2009 multiplied by two employment statuses as of 2012).

Using the same RDD model as equation (1), we compare the likelihood of each transition of employment status of mothers from 2009 to 2012 between the treated and control groups. The summary statistics and results are shown in Tables 15 and 16, respectively. From Table 15, we confirm that mothers who were part-time workers in 2012 were ether full-time workers, part-time workers, or nonworkers in 2009. However, we find that almost all mothers who were self-employed in 2012 were also self-employed in 2009.

As shown in Figure 14, Table 16 shows differences in transition patterns of employment status between part-time and self-employed workers in 2012. Regarding part-time workers, half of them were mothers who worked part-time in 2009 (3.51 p.p. increase, or 53% of mothers who worked part time in 2012); however, the other half were mothers who were full-time workers or were nonworkers in 2009 (1.76 p.p. and 1.29 p.p. increase, or 27% and 20% of mothers who worked part time in 2012, respectively). These results show that the CB reduction encouraged mothers in the treatment group not only to return to the same employment status, but also to start working as part-time workers, which is easier to adjust to than the work-style of full-time workers.

The remaining challenge is to clarify the employment status patterns for mothers working full-time before giving birth and who transitioned to part-time in 2012 after the CB reduction. Specifically, we identify whether: (A) these mothers transitioned directly from full-time to part-time without any interruption for childrearing, or (B) they quit full-time after giving birth, became housewives once, and then were reemployed as a part-time worker. The two cases have different implications: i.e., the former case means that the CB reduction discouraged mothers from working full-time, while the latter case means that it promoted maternal employment.

To examine this question, we also construct a dummy variable equal to one if a mother worked as a full-time worker in 2009 (prebirth), quit her prior job in 2010 (postbirth), and worked as a part-time worker in 2012 (post-treatment), or zero otherwise. Using this dummy variable as a dependent variable, we estimate the impact of the CB policy change from the same RDD model in equation (1) [Case (B)]. Comparatively, we consider the non-career interruption case using the same RDD model in which the dependent variable is the dummy indicating one if the mother was a part-time worker in 2012 (the post-treatment period), but in 2009 (prebirth period), she was a full-time worker [Case (A)].

We adopt Case (B) if the estimated result of Case (B) is more similar to those of Case (A) + Case (B) in the second row of Table 16, and Case (A) otherwise. We obtain similar coefficients for Case (A) + Case (B) (0.0176 in Table 16) and for Case (B) (0.0179 in Table 17); thus, Case (B) can

be adopted.[16] This result shows that almost all mothers who worked full-time before giving birth and finally worked part-time in 2012 resigned from their previous full-time jobs once in 2010.

The above discussion suggests that mechanisms through which the CB reduction encouraged maternal employment are partially different between part-time and self-employed workers. For self-employed workers, the CB reduction encouraged mothers to return to the same employment status. For part-time workers, the CB reduction also caused mothers who had worked as full-time workers before the birth and exited the labor market once after giving birth to become newly part-time workers.

We therefore conclude there are two channels through which cuts to child benefits promote maternal employment (see Figure 14): if mothers became eligible for the CB reduction, (1) those who used to be part-time workers or self-employed returned to the same employment status, and (2) those who used to be not working or full-time workers before the birth started to work as part-time workers after the CB reduction. It is noted that those who used to be full-time workers interrupted their career once and returned to work as part-time workers.

VII Concluding Remarks

Does CB policy affect maternal labor market participation and outcomes related to the children? To answer this question, we estimated the policy impacts of the reduction in the CB payment because of the resumption of the income threshold on maternal employment outcomes, childcare service fees, and child health outcomes.

Using the Longitudinal Survey of Newborns in the 21st Century, which is the follow-up survey of parents giving birth to newborns in the period May 10−24, 2010, we created objective variables reflecting changes in maternal employment such as maternal working probability, weekly working hours, and annual maternal earned income. Additionally, to discuss the impact on maternal employment in more detail, we created a dummy variable to represent the current maternal em-

[16] For Case (A), LATE could not be computed because few respondents worked as a full-time worker in 2009 (pre-birth), did not interrupt her prior job in 2010 (post-birth), and worked as a part-time worker in 2012 (post-treatment).

ployment statuses: housewife, full-time worker, part-time worker, nonworker, self-employed, and house worker. We also investigated the impacts on childcare expenditure and child health outcomes using monthly childcare service fee and two dummy variables indicating whether the 2010 newborn became sick and whether the newborn was hospitalized.

The income threshold varied by household depending on the annual income of the higher earning parent (recipient), number of dependent relatives, and amount of tax deductions. Thus, we employed RDD as the main estimation method to compare households just below and above their income thresholds. Here, we found that the CB reduction in households whose recipient's income exceeded the income threshold promoted maternal employment both in terms of intensive and extensive margins. Additionally, we found a decrease in the number of housewives and an increase in the numbers of part-time workers and self-employed by the same percentage. This result means that housewives were replaced by part-time and self-employed workers because of the reduction in child benefits. While maternal employment increased, little impact was detected on childcare costs and child health outcomes. We also found that these results are robust to manipulation of the cutoff point, choice of bandwidth, and effect of baseline covariates.

We also explored who decided to work more after the reduction in CB payments. We found that mothers who started working because of the CB reduction were nonworkers before giving birth or full time workers while using PL after giving birth. We also found that the treated mothers were likely to return to their prior employment status after giving birth; however, half of the effect on part-time workers stemmed from mothers who had worked as full-time workers and nonworkers. These results suggest that some treated mothers who took PL as full-time workers later quit their full-time jobs and started working part time.

It is true that some mothers who took PL in Japan quit their jobs after the PL ended. Table 18 presents the proportion of parents applying for PL from the Basic Survey of Gender Equality in Employment Management by the MHLW in 2012, when the income threshold for CB was revived. It shows that 83.6% of mothers took PL, 10.2% of whom quit their former job after the PL ended. Moreover, the share of mothers taking PL is lower for contract workers by 12.2 p.p. than for all

mothers. However, the 15th National Fertility Survey by the MHLW shows that full-time workers were more likely to continue working with PL (59.0%) rather than work part time (10.6%), be self-employed or do a side-job (8.7%) in 2010−2014 (see Table 19). This table shows that most female workers who took PL were full-time. These anecdotal evidence suggest that the CB payment reduction encouraged mothers who used to work full-time before giving birth and quit their job at the end of her PL to return to work part-time. In turn, this means that these mothers would not have returned to the labor market if the income threshold had not been revived.

Consequently, our findings imply that, especially for mothers from high-income families, the government would be better advised to spend on policies that make it easier to return to the labor market after giving birth (e.g. increase in the number of nursery schools) rather than providing child benefits.

Appendix

In subsection C of Section V, the balance tests of baseline covariates were not passed with respect to the increase in fathers' payroll tax for current baseline covariates, and the likelihood that mothers were nonworkers before giving birth and the likelihood that mothers worked full time while using PL after giving birth for past baseline covariates at the 5% significance level. If the jumps in these variables affected the discontinuity of the post-treatment outcomes, then Assumption 3 would not hold and the results of section V would have omitted variable biases. Therefore, we directly control these variables one by one in the following RDD estimation equation with control variables (CV) to confirm whether these variables affect the findings in subsection A of Section V:

$$\begin{aligned} y_{it} &= a_{lt} + (\alpha_{rt} - \alpha_{lt})\, D_{it} + \beta_{lt}\, (Income_{it} - c_{it}) + (\beta_{rt} - \beta_{lt})\, D_{it}\, (Income_{it} - c_{it}) + \gamma_t X_{it} + \varepsilon_{it} \\ D_{it} &= 1[Income_{it} - c_{it} \geq 0] \end{aligned} \tag{2}$$

The only change is X_{it}, representing the baseline covariates that did not pass the balance test. If the parameters $\alpha_{rt} - \alpha_{lt}$ did not change significantly after adding X_{it}, we can conclude that the

discontinuity of outcome variable was influenced not by the baseline variables but by the reduction of CB. The results of (2) are shown in Appendix Tables A-7 and A-8 . For fathers' leave for care nursing, the baseline covariate had little detrimental effect on our main findings because the estimated coefficients $\alpha_{rt} - \alpha_{lt}$ are quite similar to those in subsection A of Section V.

The results also remain largely unchanged, so we conclude that there is little selection bias for current and past baseline covariates. However, the number of observations for estimation decreased about 2,000 after adding the covariate, and moreover, these estimated coefficients had the same sign, but the magnitudes were different to those in subsection A of Section V. Therefore, we conclude that Assumption 3 holds and our main findings are robust against current and past covariates.

Ethical Statements

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Conflicts of Interest

We had no competing interests with other people or organizations that could influence or bias the contents of this paper.

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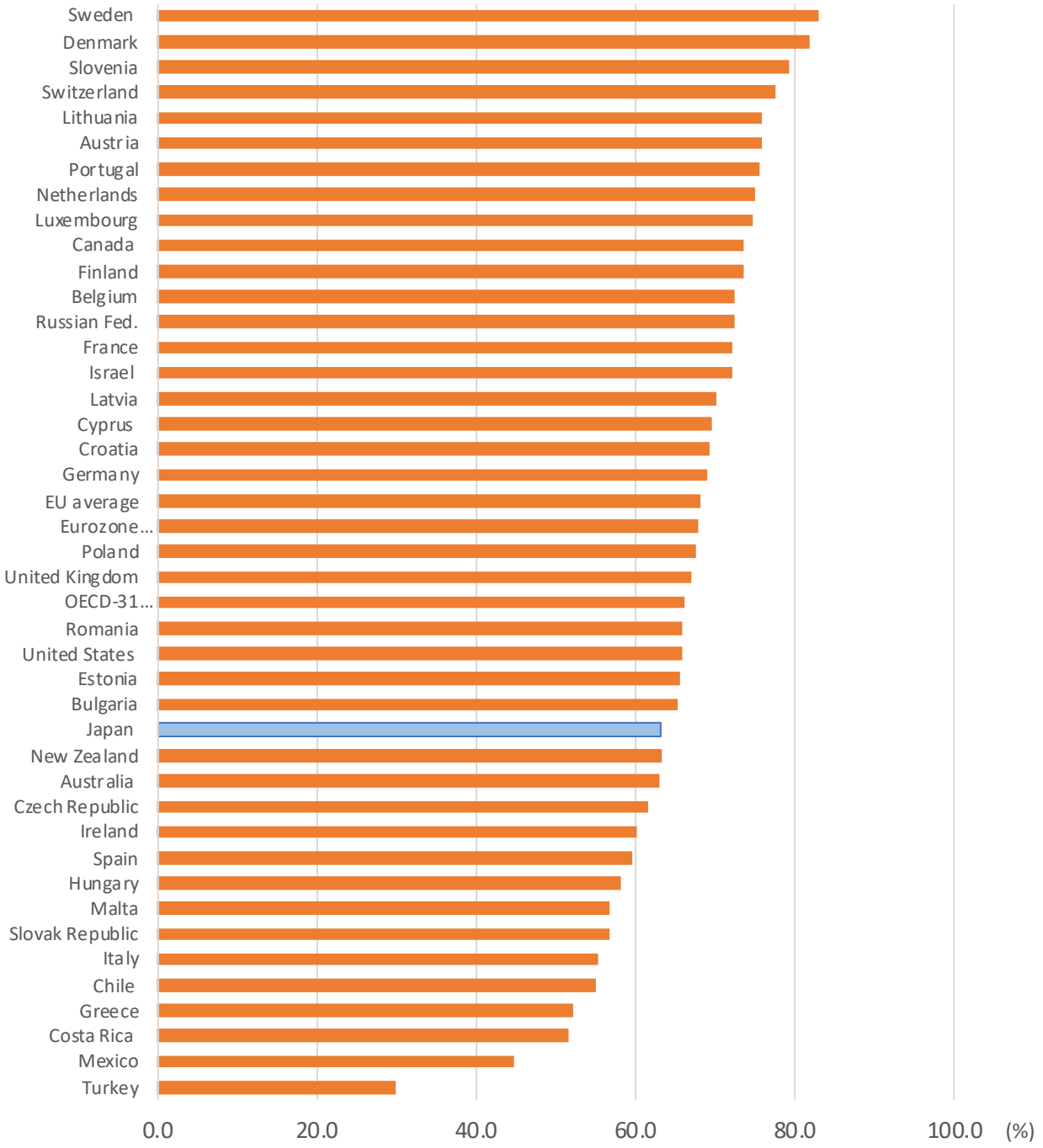
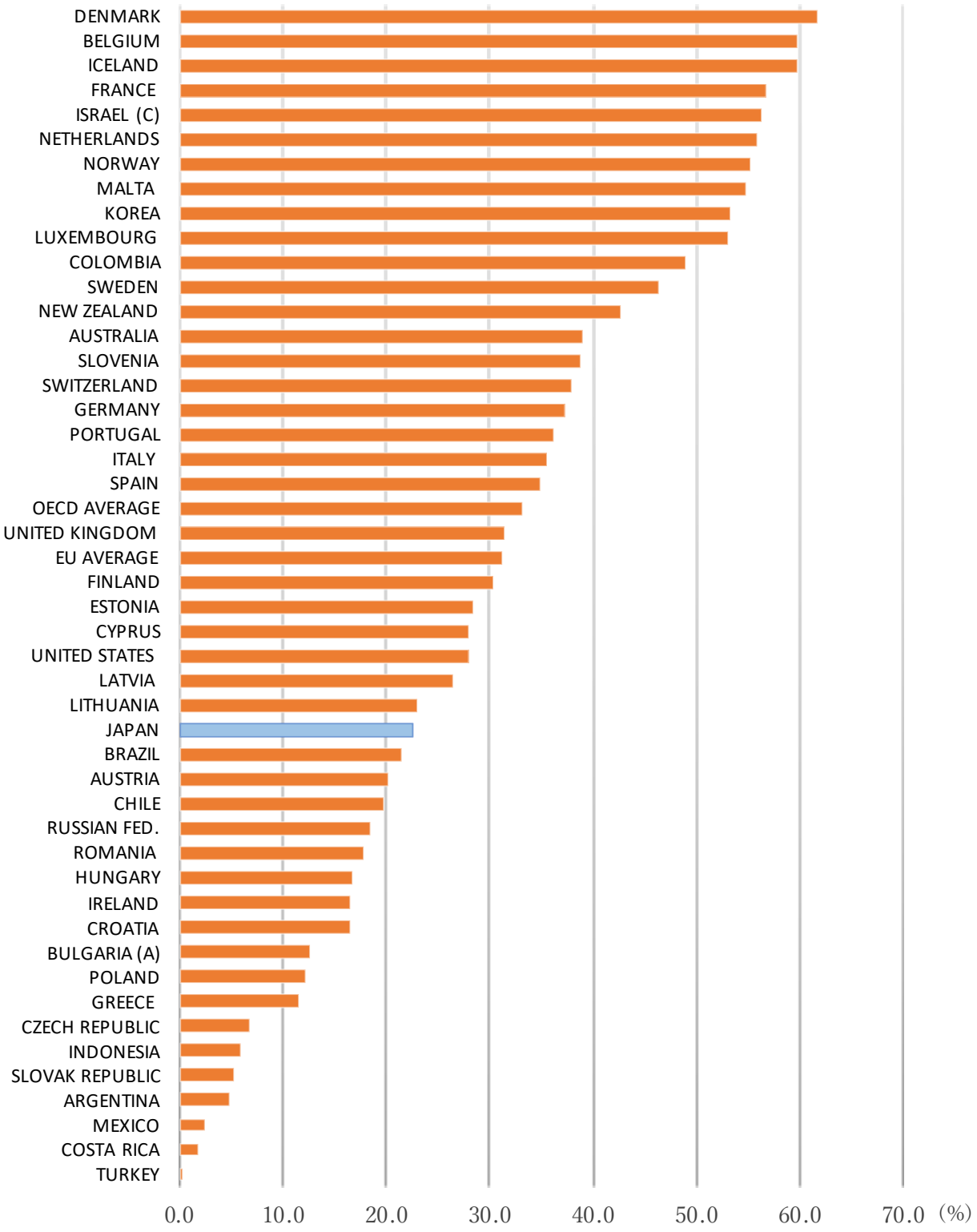
Figure 1: Maternal Employment Rate, 2014 or Latest Available Year (%)



Note: The data comes from OCED Family Database (LMF 1.2). Denmark and Finland data are from 2012; Chile, Germany and Turkey data are from 2013. Employment rate (%) refers to the proportion of women (15-64 years old) with at least one child aged 0-14 employed part-time or full-time.[a]

[a] The female employment rate is based on data for all ages for Japan and 15-74 years for Sweden. Data on mothers of children aged 0-15 years for Canada, 0-18 years for Sweden, and 0-17 years for the United States are used.

Figure 2: Childcare Enrollment Rate for 0-2 Years olds, 2016 or Latest Available Year (%)



Note: The data comes from the OCED Family Database (PF 3.2). The United States data are from 2011; Switzerland and Malta data are from 2014; Japan and Argentina data are from 2015.

Figure 3: Variations in Child Benefits

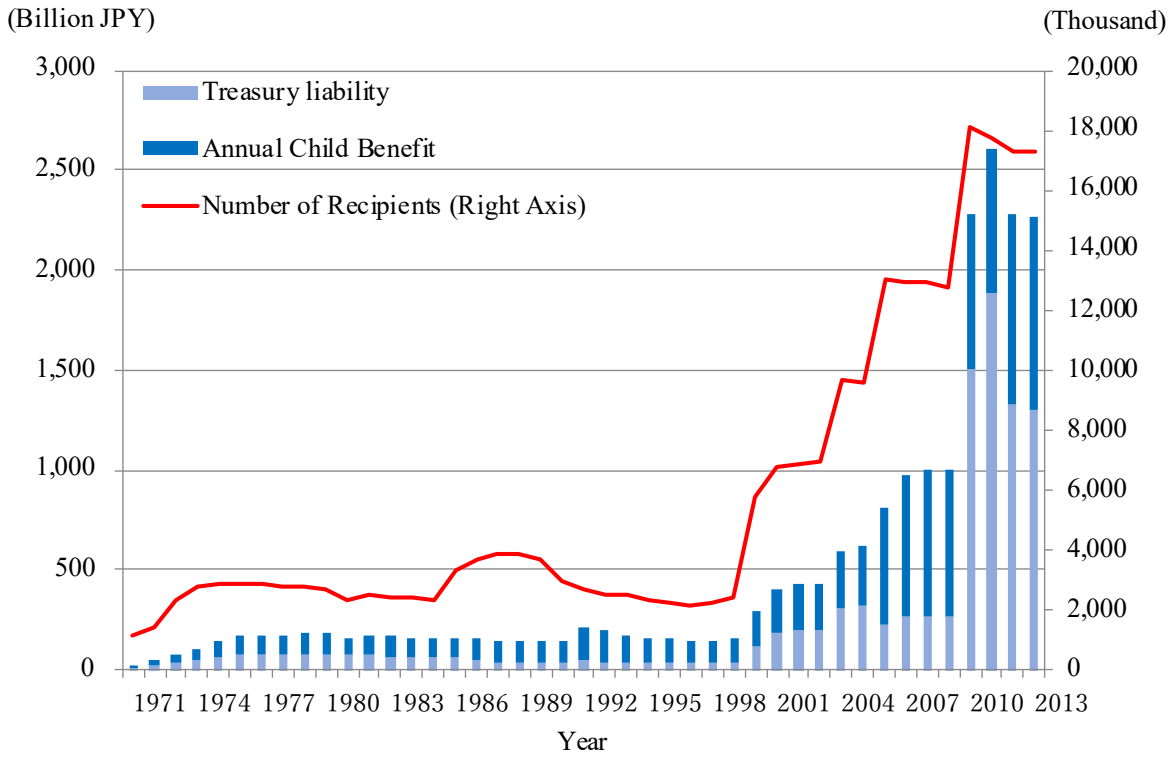


Figure 4: The History of Expansion in Child Benefit Policy from 1971 to 2013

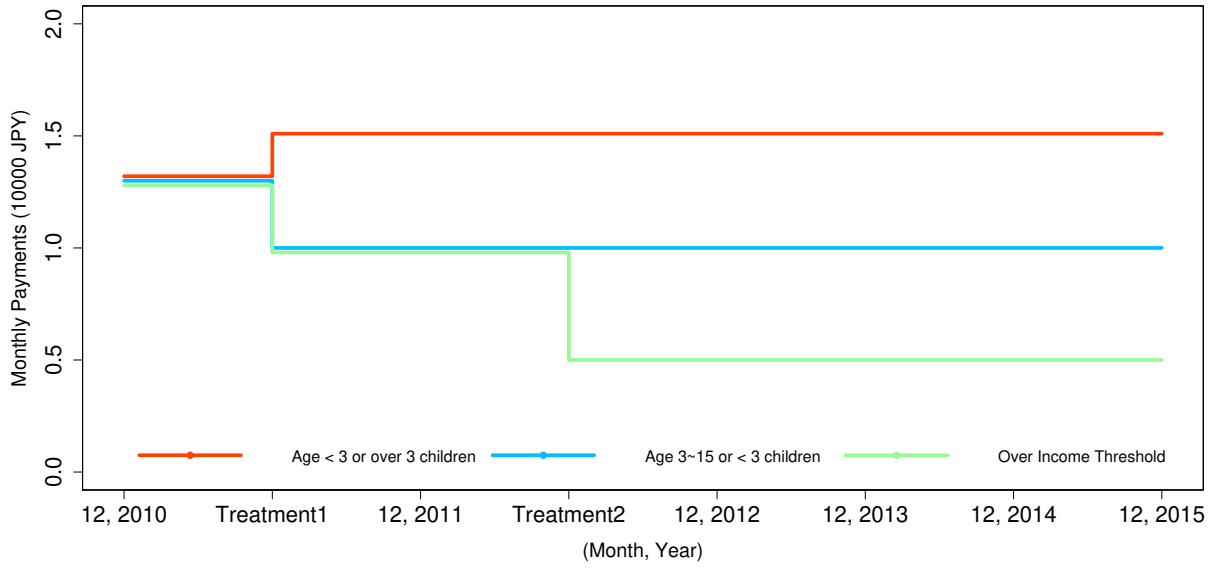


Figure 5: Change in CB Payments between 2011 and 2012

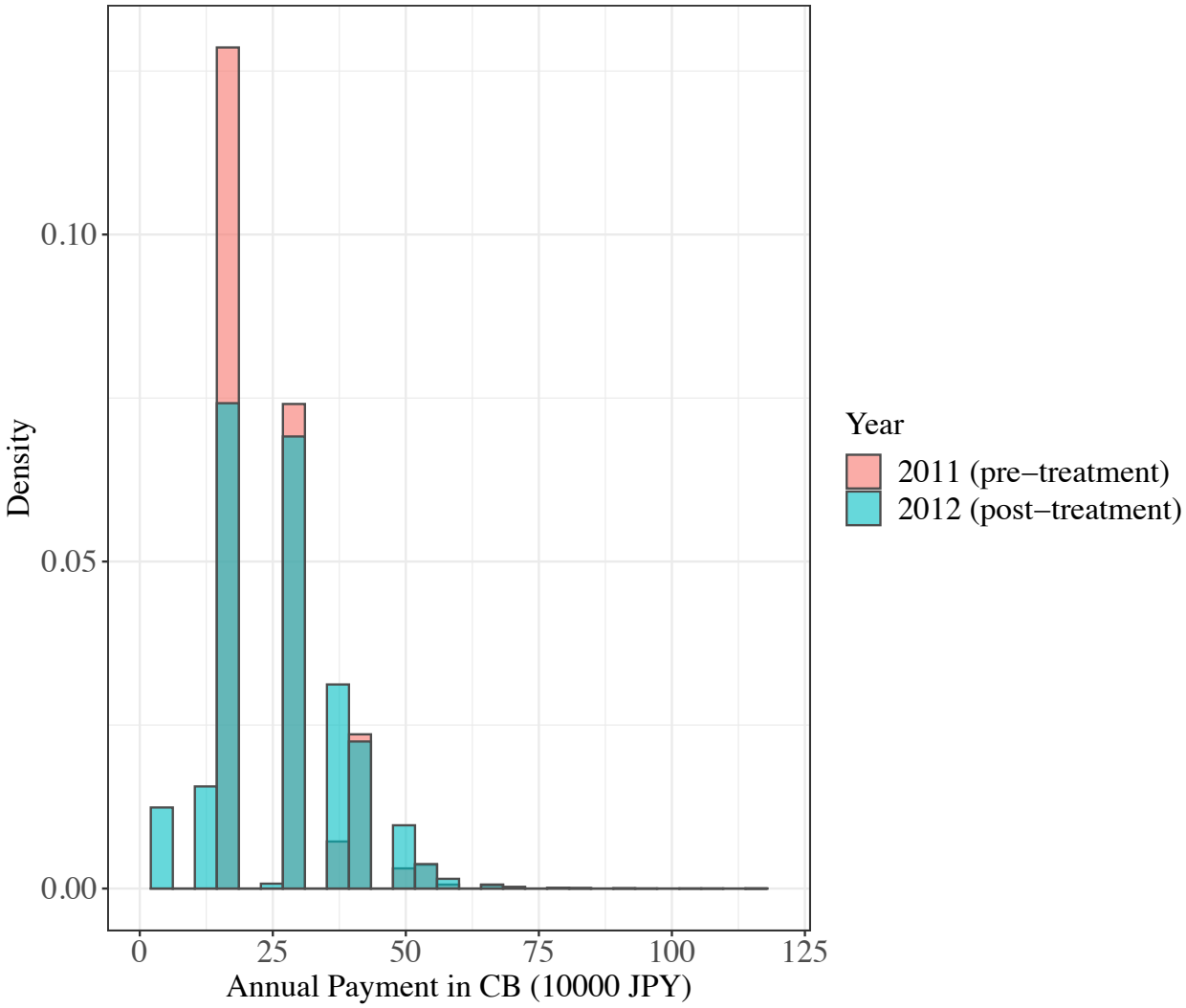


Figure 6: Effect on Annual Payments of Child Benefits (Left: 2012, Right: 2011)

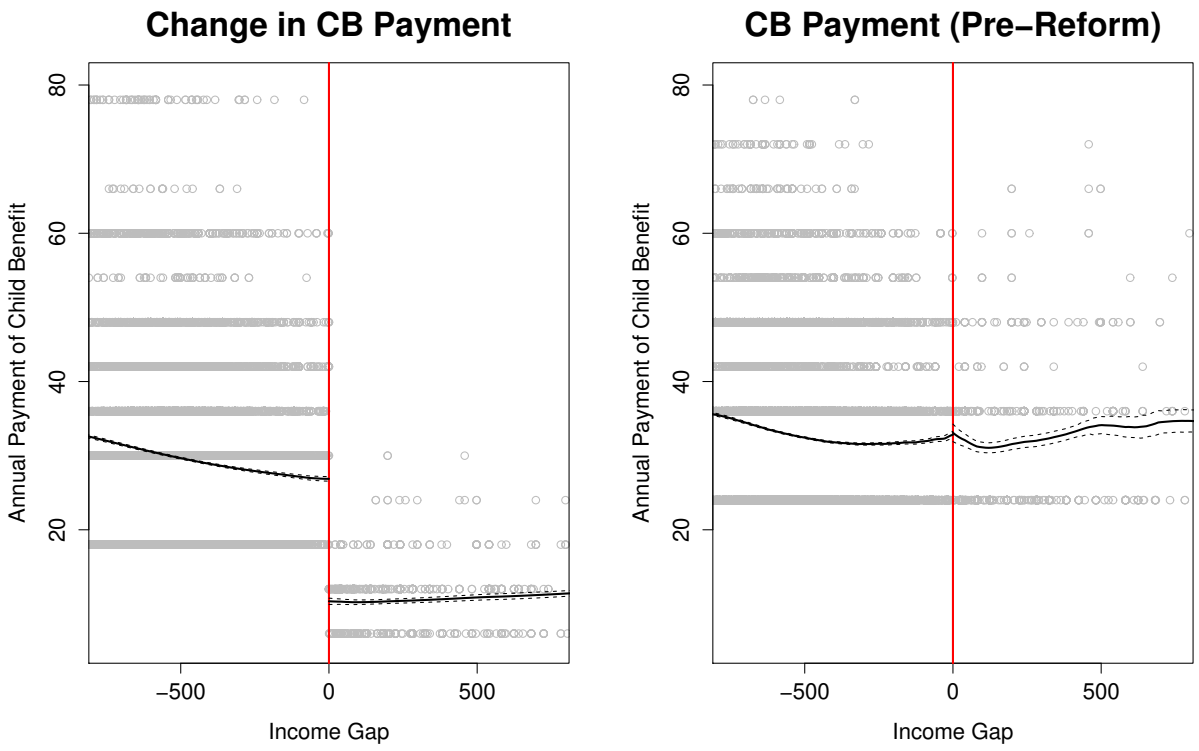


Figure 7: Effect on Maternal Working Probability (Left: 2012, Right: 2011)

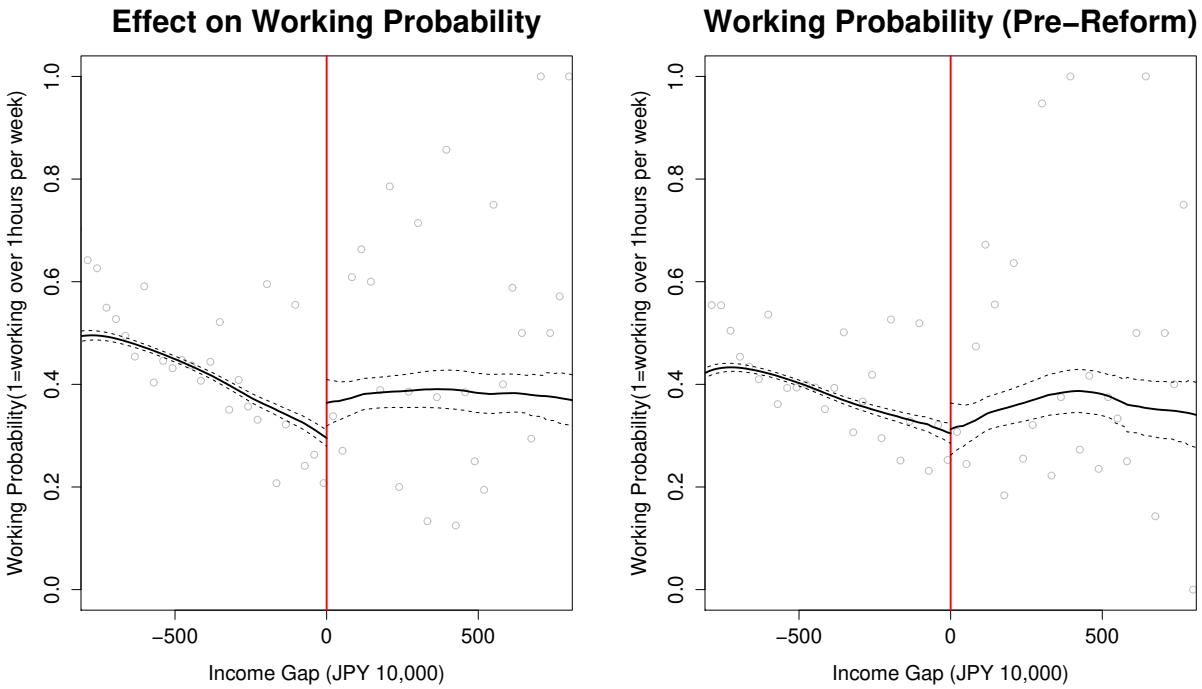


Figure 8: Effect on Maternal Weekly Working Hours (Left: 2012, Right: 2011)

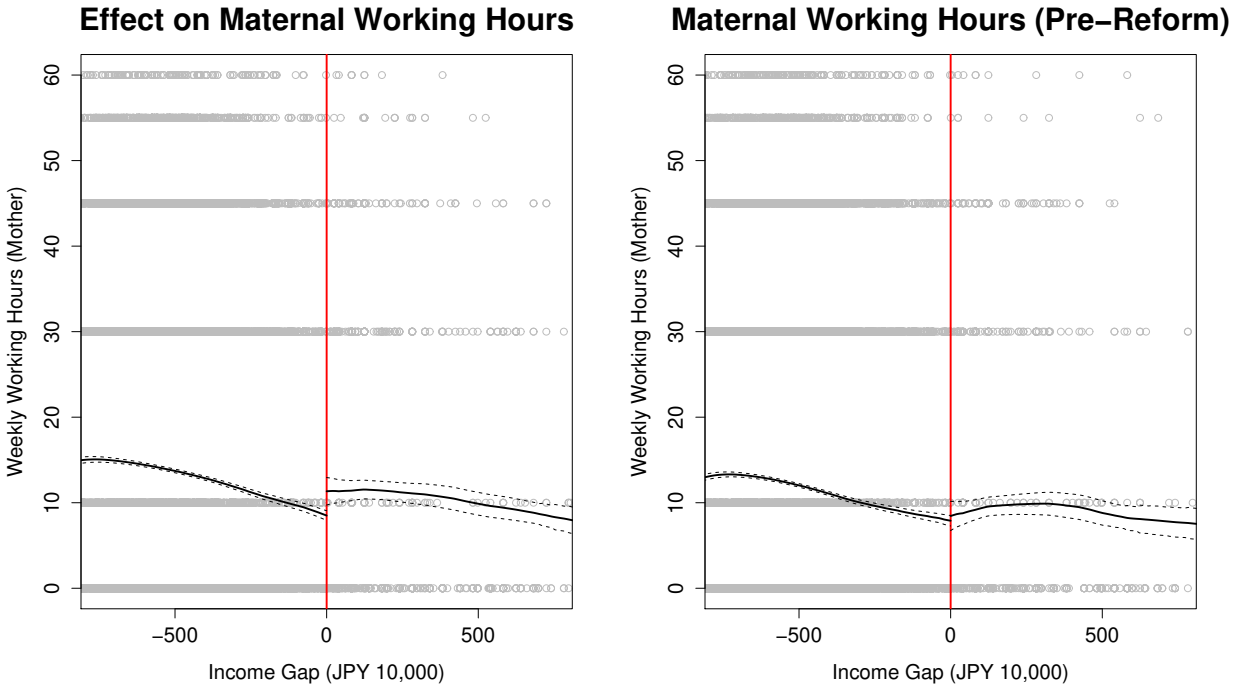


Figure 9: Effect on Maternal Annual Earned Income (Left: 2012, Right: 2011)

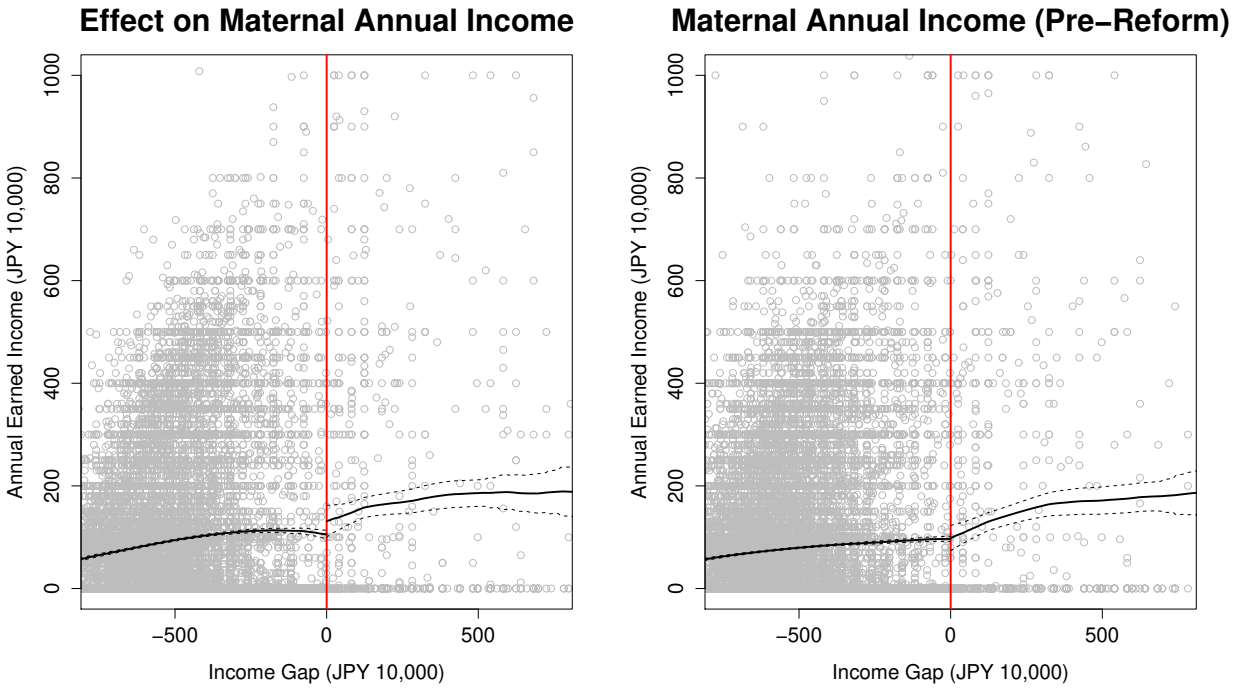


Figure 10: Effect on Childcare Service Fees (Left: 2012, Right: 2011)

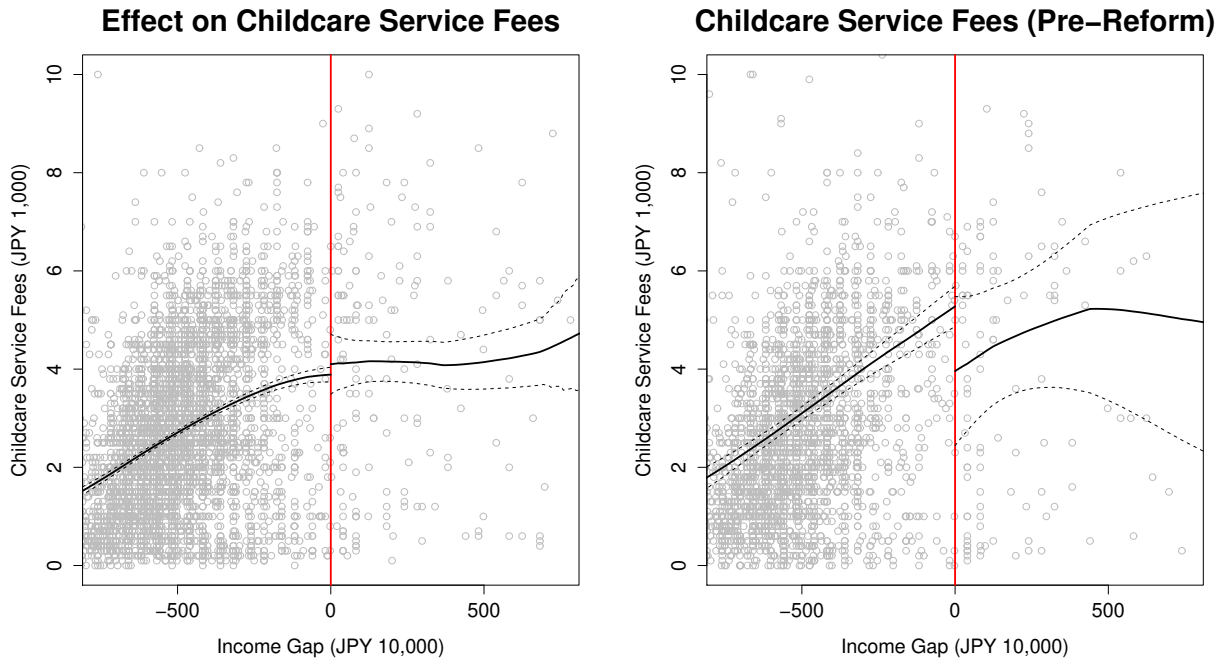


Figure 11: Effect on Getting Sick and Being Hospitalization (Left: 2012, Right: 2011)

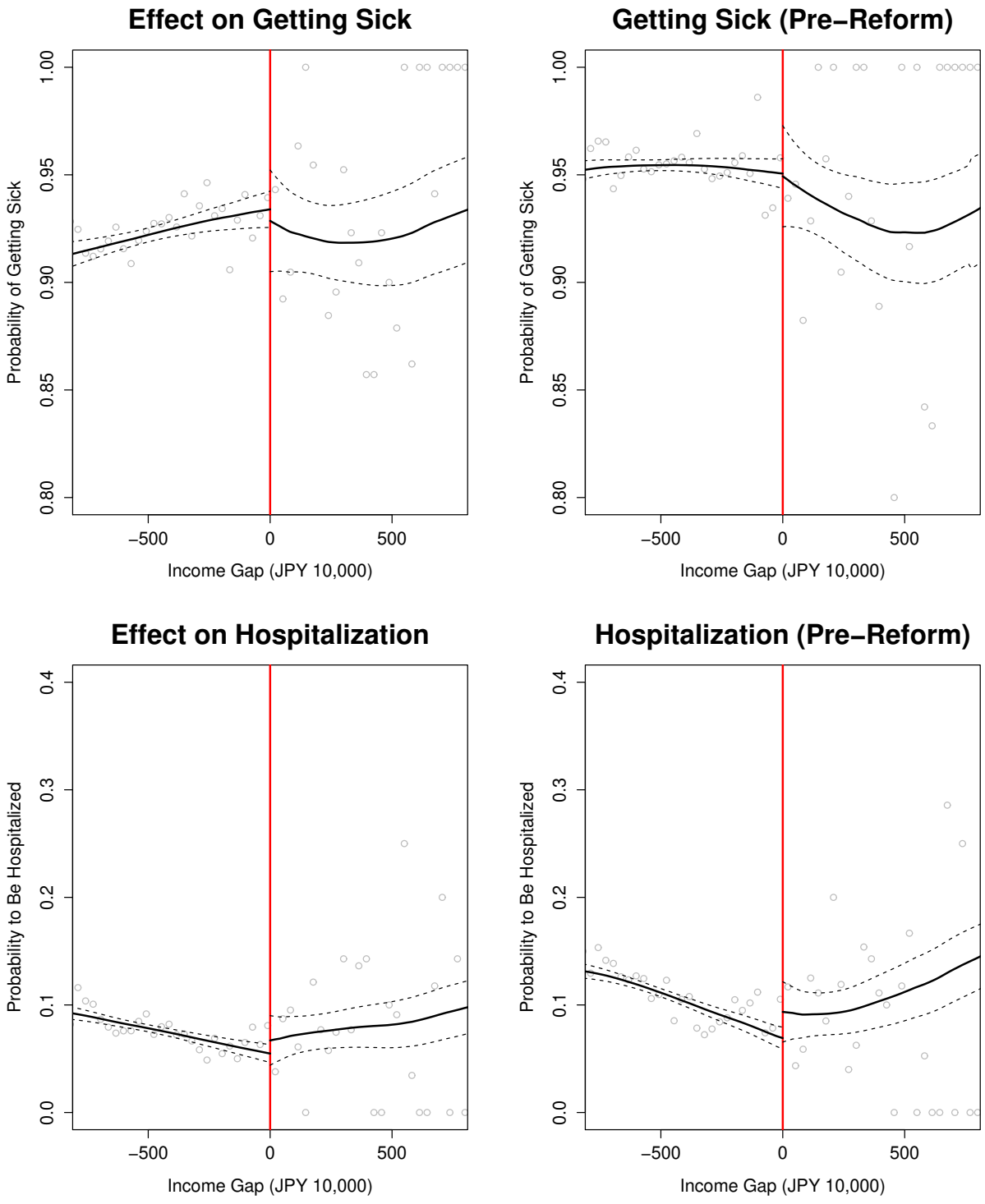


Figure 12: Effect on Maternal Employment Status 1 (Left: 2012, Right: 2011)

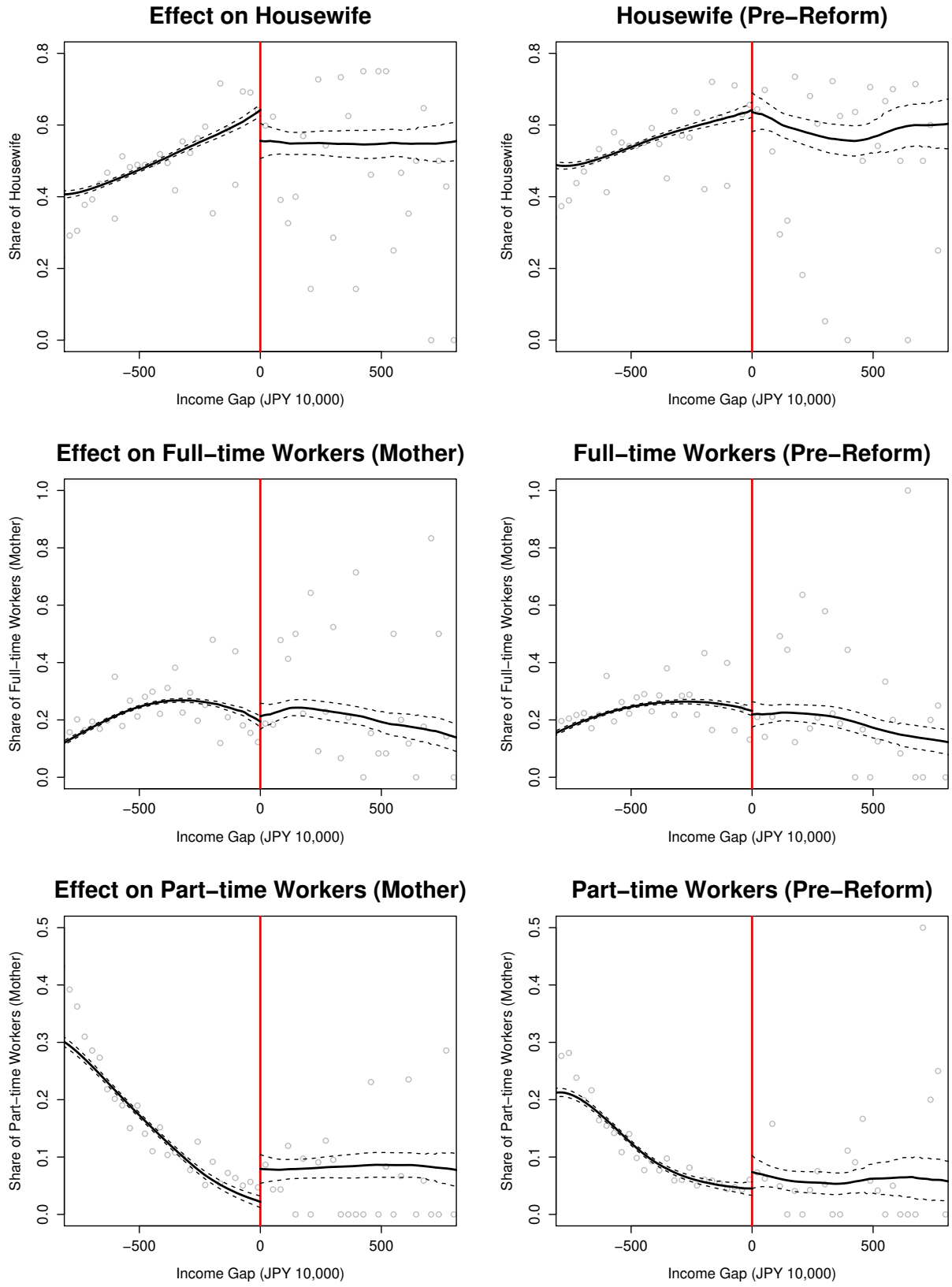


Figure 13: Effect on Maternal Employment Status 2 (Left: 2012, Right: 2011)

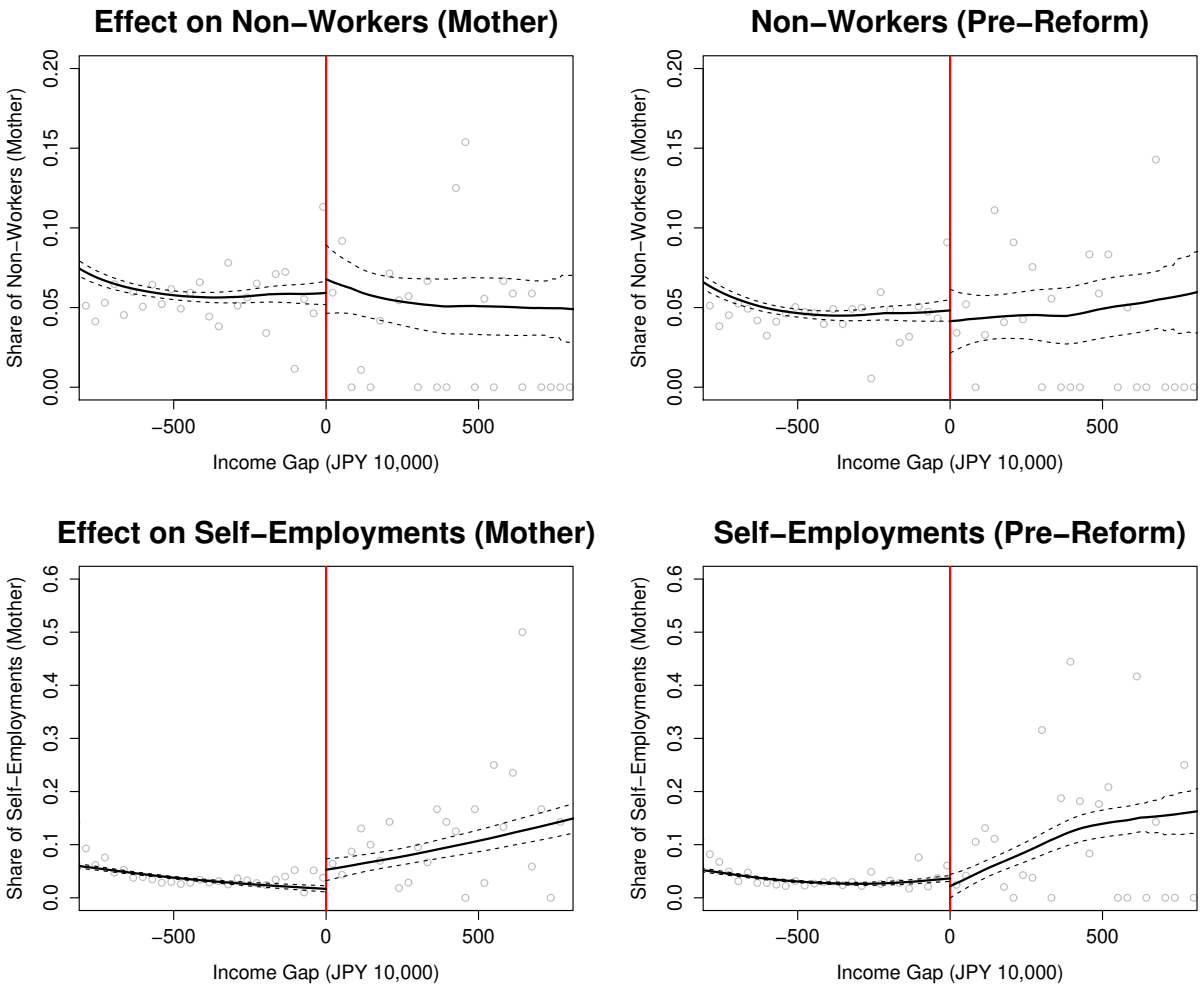
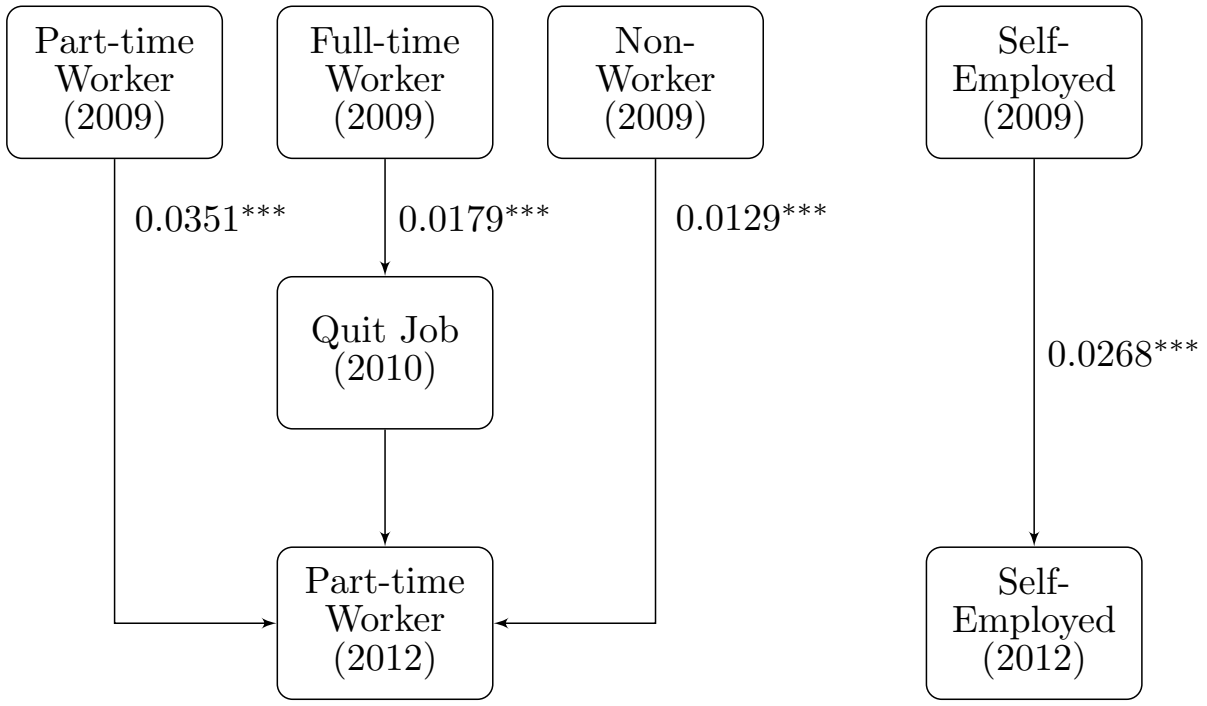


Figure 14: Results for Transition of Maternal Employment Status



Note: Reported numbers mean the estimated coefficients of mothers in each transition group. Parentheses ( ) refer to the percentage of each employment status in 2009 of mothers who started working as part-time workers in 2012. $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

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Table 1: Transitions of the Child Benefit Policy (CB) in Japan

Enacted Fiscal Year	Target Children	Age Limit	Income Threshold (JPY, million)	Monthly Payment from the CB (JPY)
1972	≥ Third	≤ 15 (≤ JHS Graduation)	2	3
1974	≥ Third	≤ 15 (≤ JHS Graduation)	3.22	4
1975	≥ Third	≤ 15 (≤ JHS Graduation)	4.15	5
1986	Second	< 2	3.406 (5.589)	2.5
	≥ Third	≤ 15 (≤ JHS Graduation)	3.406 (5.589)	5
1992	All	< 3	↓ Gradually Updated	5 (≤ Second), 10 (≥ Third)
2000	All	≤ 5 (≤ KG Graduation)	↓ Gradually Updated	5 (≤ Second), 10 (≥ Third)
2001	All	≤ 5 (≤ KG Graduation)	5.963 (7.8)	5 (≤ Second), 10 (≥ Third)
2004	All	≤ 9 (≤ 3rd Grade in PS)	5.963 (7.8)	5 (≤ Second), 10 (≥ Third)
2006	All	≤ 12 (≤ PS Graduation	7.8 (8.6)	5 (≤ Second), 10 (≥ Third)
2007	All (≥ 3 years old)	12 (≤ PS Graduation)	7.8 (8.6)	5 (≤ Second), 10 (≥ Third)
	All (< 3 years old)	≤ 12 (≤ PS Graduation)	7.8 (8.6)	10
Regime Change from DPJ to LDP				
April 2010	All	≤ 15 (≤ JHS Graduation)	No Income Threshold	13
October 2011	All (≥ 3 years old)	≤ 15 (≤ JHS Graduation	No Income Threshold	**10 (≤ Second)**
				15 (≥ Third and ≤ 12 years old)
	All (< 3 years old)	≤ 15 (≤ JHS Graduation)	No Income Threshold	**15**
Revival of Income Threshold				
April 2012	All	≤ 15 (≤ JHS Graduation)	**≥ Income Threshold**	**5**
	All	≤ 15 (≤ JHS Graduation)	≤ Income Threshold	15 (cont'd)

Note: The abbreviations indicate as follows: JHS-Junior High School, KG - Kindergarten, PS - Primary School, CB - Child Benefit. Threshold of Household Income for the Employees' Pension Subscriber are expressed in the parentheses ( ). LDP and DPJ mean the Liberal Democratic Party and the Democratic Party of Japan.

Table 2: Summary Statistics: Treatment Status and Dependent Variables

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
Treatment Status Variables							
ChildBenefit	29,725	29.104	11.320	6	18	36	114
Difference from Income Threshold	29,725	−479.469	250.564	−1,084	−617.800	−367.800	1,997.900
Dependent Variables							
Annual Earned Income (Mother)	26,292	94.822	162.894	0	0	120	4,679
Weekly Working Hours (Mother)	29,603	13.503	18.159	0	0	30	60
Working Probability (Dummy, Mother)	29,603	0.416	0.493	0	0	1	1
Childcare Service Fee	11,771	2.725	1.841	0	1.300	3.800	31.500
Newborns Getting Sick (Dummy)	28,481	0.922	0.269	0	1	1	1
Hospitalized Newborns (Dummy)	28,481	0.079	0.270	0	0	0	1
Housewife (Dummy)	29,437	0.479	0.500	0	0	1	1
Non-Worker (Dummy, Mother)	29,437	0.059	0.236	0	0	0	1
Student (Dummy, Mother)	29,437	0.002	0.043	0	0	0	1
Full-Time Worker (Dummy, Mother)	29,437	0.228	0.420	0	0	0	1
Part-time Worker (Dummy, Mother)	29,437	0.174	0.379	0	0	0	1
Self-employed (Dummy, Mother)	29,437	0.041	0.199	0	0	0	1
Side-job (Dummy, Mother)	29,437	0.008	0.088	0	0	0	1

Table 3: Summary Statistics: Current Characteristics and Childcare Environment

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
Current Characteristics							
Payroll Tax Gain (Mother)	29,578	8.725	6.685	3.550	3.550	10.650	93.720
Payroll Tax Gain (Father)	27,969	24.133	13.174	3.550	14.200	28.400	117.150
Age at 2010 (Mother)	29,384	33.100	5.530	18	29	36	81
Age at 2010 (Father)	29,725	31.274	4.682	16	28	35	52
Annual Earned Income (Father)	24,631	496.694	268.320	0	350	600	10,000
Weekly Working Hours (Father)	28,100	50.216	11.095	0	45	60	60
Annual Other Income	25,267	29.128	77.330	0	0	30	2,930
University Graduate (Dummy, Mother)	29,725	0.499	0.500	0	0	1	1
University Graduate (Dummy, Father)	29,725	0.481	0.500	0	0	1	1
Living by oneself (Dummy, Mother)	29,705	0.0002	0.015	0	0	0	1
Living by oneself (Dummy, Father)	28,904	0.025	0.157	0	0	0	1
Living in Large City (Dummy)	29,725	0.292	0.454	0	0	1	1
# of Families Living Together	29,725	3.209	1.209	1	2	4	11
Weekly Hours for Childcare Service	10,003	15.796	7.364	1	10	20	42
Usual Caregiver							
Mother	29,725	0.924	0.265	0	1	1	1
Father	29,725	0.491	0.500	0	0	1	1
Grandmother	29,725	0.150	0.357	0	0	0	1
Grandfather	29,725	0.063	0.242	0	0	0	1
Nursery Teacher	29,725	0.087	0.282	0	0	0	1
Childcare Mom	29,725	0.038	0.191	0	0	0	1
Kindergarten Teacher	29,725	0.387	0.487	0	0	1	1
Nintei-Kodomoen Teacher	29,725	0.005	0.068	0	0	0	1
Childcare Facilities in Use							
Registered Public Nursery School	11,382	0.406	0.491	0	0	1	1
Registered Private Nursery School	11,382	0.407	0.491	0	0	1	1
Nintei-Kodomoen	11,382	0.034	0.181	0	0	0	1
Local Municipality's Facility	11,382	0.035	0.185	0	0	0	1
Childcare Facility Inside Office	11,382	0.047	0.212	0	0	0	1
Non-Registered Childcare Facility	11,382	0.059	0.236	0	0	0	1
Home Childcare Service	11,382	0.005	0.071	0	0	0	1
Kindergarten	11,382	0.005	0.071	0	0	0	1

Table 4: Summary Statistics: Child's Characteristics and Use of Work-Life Support System

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
Child's Characteristics							
Twin or Triple (Dummy)	29,725	0.018	0.132	0	0	0	1
Younger Newborn (Dummy)	29,725	0.180	0.385	0	0	0	1
Female (Dummy, Newborn)	29,725	0.485	0.500	0	0	1	1
Female (Dummy, 1st Children)	19,659	0.487	0.500	0	0	1	1
Female (Dummy, 2nd Children)	5,581	0.474	0.499	0	0	1	1
Female (Dummy, 3rd Children)	891	0.507	0.500	0	0	1	1
Child's Age (1st Children)	19,591	5.319	3.756	0	4	7	27
Child's Age (2nd Children)	5,566	5.135	3.706	0	2	7	22
Child's Age (3rd Children)	889	5.013	3.687	0	2	7	21
Work-Life Support Systems							
Parental Leave (Dummy, Mother)	11,843	0.119	0.324	0	0	0	1
Short Working Hours (Dummy, Mother)	11,843	0.219	0.414	0	0	0	1
Remote Work (Dummy, Mother)	11,843	0.014	0.116	0	0	0	1
No Late-night Work (Dummy, Mother)	11,843	0.113	0.317	0	0	0	1
No Overtime Work (Dummy, Mother)	11,843	0.107	0.310	0	0	0	1
Flex System (Dummy, Mother)	11,843	0.049	0.217	0	0	0	1
Working Hours Shift (Dummy, Mother)	11,843	0.168	0.374	0	0	0	1
Firm-own Kindergarten (Dummy, Mother)	11,843	0.058	0.233	0	0	0	1
Re-employment Support (Dummy, Mother)	11,843	0.024	0.153	0	0	0	1
Leave for Care Nursing (Dummy, Mother)	11,843	0.230	0.421	0	0	0	1
Parental Leave (Dummy, Father)	25,218	0.001	0.034	0	0	0	1
Short Working Hours (Dummy, Father)	25,218	0.010	0.098	0	0	0	1
Remote Work (Dummy, Father)	25,218	0.004	0.061	0	0	0	1
No Late-night Work (Dummy, Father)	25,218	0.005	0.073	0	0	0	1
No Overtime Work (Dummy, Father)	25,218	0.010	0.101	0	0	0	1
Flex System (Dummy, Father)	25,218	0.058	0.235	0	0	0	1
Working Hours Shift (Dummy, Father)	25,218	0.037	0.188	0	0	0	1
Firm-own Kindergarten (Dummy, Father)	25,218	0.004	0.065	0	0	0	1
Re-employment Support (Dummy, Father)	25,218	0.002	0.039	0	0	0	1
Leave for Care Nursing (Dummy, Father)	25,218	0.047	0.211	0	0	0	1

Table 5: Summary Statistics: Past Characteristics

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
Characteristics in 2009 (Pre-birth)							
Non-Worker in 2009 (Dummy, Mother)	29,606	0.378	0.485	0	0	1	1
Student in 2009 (Dummy, Mother)	29,606	0.006	0.075	0	0	0	1
Full-Time Worker in 2009 (Dummy, Mother)	29,606	0.367	0.482	0	0	1	1
Part-time Worker in 2009 (Dummy, Mother)	29,606	0.203	0.402	0	0	0	1
Self-employed in 2009 (Dummy, Mother)	29,606	0.034	0.180	0	0	0	1
Side-job in 2009 (Dummy, Mother)	29,606	0.005	0.070	0	0	0	1
Non-Worker in 2009 (Dummy, Father)	29,185	0.008	0.092	0	0	0	1
Student in 2009 (Dummy, Father)	29,185	0.004	0.063	0	0	0	1
Full-Time Worker in 2009 (Dummy, Father)	29,185	0.874	0.331	0	1	1	1
Part-Time Worker in 2009 (Dummy, Father)	29,185	0.018	0.132	0	0	0	1
Self-employed in 2009 (Dummy, Father)	29,185	0.093	0.290	0	0	0	1
Side-job in 2009 (Dummy, Father)	29,185	0	0	0	0	0	0
Characteristics in 2010 (Post-birth)							
Take Parental Leave (Dummy, Mother)	29,420	0.250	0.433	0	0	0	1
Take Parental Leave (Week, Mother)	29,420	11.189	23.105	0	0	0	192
Full-Time Worker (Dummy, Mother)	29,527	0.031	0.173	0	0	0	1
Part-time Worker (Dummy, Mother)	29,527	0.040	0.195	0	0	0	1
Full-Time Worker with PL (Dummy, Mother)	29,527	0.208	0.406	0	0	0	1
Part-time Worker with PL (Dummy, Mother)	29,527	0.023	0.150	0	0	0	1
Use Work-Life Program (Dummy, Mother)	26,853	0.098	0.297	0	0	0	1
Quit Work (Dummy, Mother)	29,642	0.313	0.464	0	0	1	1
Take Parental Leave (Dummy, Father)	26,645	0.019	0.135	0	0	0	1
Take Parental Leave (Week, Father)	26,645	0.100	1.764	0	0	0	96
Full-Time Worker (Dummy, Father)	28,903	0.870	0.336	0	1	1	1
Part-time Worker (Dummy, Father)	28,903	0.020	0.140	0	0	0	1
Use Work-Life Program (Dummy, Father)	26,428	0.172	0.378	0	0	0	1
Quit Work (Dummy, Father)	28,903	0.040	0.196	0	0	0	1
Use Childcare Service (Dummy)	29,701	0.042	0.200	0	0	0	1

Table 6: Treatment Effects for Each Outcome Variables: Local Average Treatment Effects (LATE)

Dependent Variables	Bandwidth	Observations	Estimate	Std. Error	z value	$Pr(>\|z\|)$
Child Benefit	810.4	27646	**−16.52**	0.3342	−49.42	**0*****
Working Probability	632.2	22543	**0.0689**	0.0270	2.557	**0.0106****
Weekly Working Hours	663.0	24203	**2.718**	0.9400	2.891	**0.0038*****
Annual Earned Income	488.9	12264	31.04	16.06	1.9326	0.0533*
Childcare Service Fee	674.2	9869	0.0778	0.2127	0.3659	0.7145
Newborns Getting Sick	956.4	28208	−0.0080	0.0132	−0.6046	0.5454
Hospitalized Newborns	902.5	27661	0.0099	0.0127	0.7778	0.4367
Housewife	563.9	18574	**−0.0877**	0.0297	−2.958	**0.0031*****
Full-Time Worker (Mother)	411.2	8535	0.0183	0.0280	0.6533	0.5136
Part-time Worker (Mother)	643.9	22962	**0.0553**	0.0149	3.712	**2.056e-04*****
Non-Worker (Mother)	687.9	24962	0.0096	0.0135	0.711	0.4771
Self-employed (Mother)	1203.3	29411	**0.0390**	0.0112	3.48	**0.0005*****
House Worker (Mother)	-	-	-	-	-	-

Note: All estimated results show the coefficients of $D_{i,2012}$, 2012, that is, $(\alpha_l - \alpha_r)$. For the row of share of house workers, the balance test cannot be implemented because most respondents did not choose the status of house worker, in a case of which we draw (-) in each cell of the row of Share of House Worker. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table 7: Manipulation Checks: Mean Differences in Dependent Variables between 2011 and 2012

Statistic	Degree of Freedom	Mean of Control Group (2011)	Mean of Control Group (2012)	Difference (p-value)
Dependent Variables				
Annual Earned Income (Mother)	86.766	16.0758	32.0667	0.3003
Working Probability (Mother)	125.27	0.1538	0.1061	0.4203
Weekly Working Hours (Mother)	131.56	4.4776	4.2537	0.9196
Childcare Service Fee	12.219	5.1154	2.1857	0.4535
Newborns Getting Sick	62	1	0.9206	0.02412**
Hospitalized Newborns	99.758	0.1587	0.0476	0.04118**
Housewife	129	0.7692	0.7576	0.8765
Non-Worker (Mother)	124.74	0.0769	0.1212	0.3998
Students (Mother)	-	-	-	-
Full-Time Worker (Mother)	127.39	0.0462	0.0606	0.7154
Part-time Worker (Mother)	64	0.0154	0	0.3211
Self-employed (Mother)	116.17	0.0923	0.0455	0.2941
House Worker (Mother)	-	-	-	-

Note: Control Group covers the households whose annual income were within the range between the income threshold and JPY100,000 below its threshold. The last column displays p-values obtained from the t-test to test differences between the means of the dependent variables of 2011 and 2012. For the shares of students (Mother) and house workers (Mother), the balance test cannot be implemented because most respondents did not choose either of the two statuses. Therefore, we draw (-) in each cell of the rows of the two statuses. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table 8: Balance Tests: Current Characteristics

Statistic	Degree of Freedom	Treatment (Gap: ≥ 0 and < 10)	Control (Gap: >-10 and < 0)	Difference (p-value)
Current Characteristics				
Payroll Tax Increase (Mother)	23.411	14.2065	11.1621	0.2191
Payroll Tax Increase (Father)	30.504	39.3344	70.6545	**2.477e-10*****
Age at 2010 (Mother)	49.999	36.8261	38.1364	0.2484
Age at 2010 (Father)	43.746	34.8750	34.7015	0.8587
Annual Earned Income (Father)	28.273	818.2727	979.6552	0.0881*
Weekly Working Hours (Father)	84.428	56.7391	54.0625	0.0542*
Annual Other Income	21.8	47.5000	13.9667	0.0880*
University Graduate (Mother)	39.948	0.5833	0.5970	0.9092
University Graduate (Father)	35.071	0.7083	0.8209	0.295
Living by oneself (Father)	57.272	0.0417	0.0896	0.3834
Living in Large City	40.428	0.4167	0.5522	0.2638
# of Families Living Together	24.721	3.9167	4.2537	0.4912
Weekly Hours for Childcare Service	6.6991	18.200	12.375	0.3873

Note: Treatment Group covers the households whose annual income were within the range between the income threshold and JPY 100,000 above its threshold in 2012. Control Group covers the households whose annual income were within the range between the income threshold and JPY100,000 below its threshold in 2012. The last column displays p-values obtained from the t-test to test differences between the means of the covariates from the two groups. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table 9: Balance Tests: Child's Characteristics

Statistic	Degree of Freedom	Treatment (Gap: ≥ 0 and < 10)	Control (Gap: > -10 and < 0)	Difference (p-value)
Usual Caregiver				
Mother	29.114	0.9583	0.9851	0.5504
Father	39.948	0.417	0.4030	0.9092
Grandmother	31.611	0.1250	0.0597	0.3897
Grandfather	35.309	0.0417	0.0299	0.8015
Nursery Teacher	35.309	0.0417	0.0299	0.8015
Childcare Mom	66	0	0.0149	0.321
Kindergarten Teacher	35.425	0.2500	0.1642	0.4019
Nintei-Kodomoen Teacher	-	-	-	-
Childcare Facilities in Use				
Registered Public Nursery School	13.495	0.2857	0.4444	0.5436
Registered Private Nursery School	13.199	0.2857	0.3333	0.851
Nintei-Kodomoen	-	-	-	-
Local Municipality's Facility	6	0.1429	0	0.3559
Childcare Facility Inside Office	-	-	-	-
Non-Registered Childcare Facility	12.127	0.1429	0.1111	0.8637
Child's Characteristics				
Twin or Triple	66	0	0.0299	0.1589
Younger Newborn	38.445	0.0833	0.0746	0.8959
Female (Newborn)	40.121	0.5000	0.5075	0.9512
Female (1st child)	26.708	0.5000	0.4769	0.8669
Female (2nd child)	7.1969	0.5714	0.4923	0.7191
Female (3rd child)	9.638	0.2000	0.5714	0.2217
Child's Age (1st child)	20.105	9.6667	9.1538	0.6835
Child's Age (2nd child)	6.4598	11.2857	6.0923	**0.0164****
Child's Age (3rd child)	7.785	12.2000	3.1429	**0.0019*****

Note: Treatment Group covers the households whose annual income were within the range between the income threshold and JPY 100,000 above its threshold in 2012. Control Group covers the households whose annual income were within the range between the income threshold and JPY100,000 below its threshold in 2012. The last column displays p-values obtained from the t-test to test differences between the means of the covariates from the two groups. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table 10: Balance Tests: Use of Work-Life Support Systems

Statistic	Degree of Freedom	Treatment (Gap: ≥ 0 and < 10)	Control (Gap: >-10 and < 0)	Difference (p-value)
Work-Life Support Systems				
Parental Leave (Mother)	5.0164	0.25	0.50	0.4851
Short Working Hours (Mother)	4.5652	0.125	0.250	0.6751
Remote Work (Mother)	-	-	-	-
No Late-night Work (Mother)	3	0	0.25	0.391
No Overtime Work (Mother)	3	0	0.25	0.391
Flex System (Mother)	3	0	0.5	0.1817
Working Hours Shift (Mother)	4.5652	0.125	0.250	0.6751
Firm-own Kindergarten (Mother)	-	-	-	-
Re-employment Support (Mother)	-	-	-	-
Leave for Care Nursing (Mother)	4.1677	0.125	0.500	0.2967
Parental Leave (Father)	-	-	-	-
Short Working Hours (Father)	18	0.0526	0	0.3306
Remote Work (Father)	51	0	0.0192	0.322
No Late-night Work (Father)	-	-	-	-
No Overtime Work (Father)	-	-	-	-
Flex System (Father)	29.846	0.1579	0.1346	0.8145
Working Hours Shift (Father)	23.648	0.2105	0.0769	0.2075
Firm-own Kindergarten (Father)	-	-	-	-
Leave for Care Nursing (Father)	32.804	0.0526	0.0577	0.9354

Note: Treatment Group covers the households whose annual income were within the range between the income threshold and JPY 100,000 above its threshold in 2012. Control Group covers the households whose annual income were within the range between the income threshold and JPY100,000 below its threshold in 2012. The last column displays p-values obtained from the t-test to test differences between the means of the covariates from the two groups. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table 11: Balance Tests: Past Baseline Covariates

Statistic	Degree of Freedom	Treatment (Gap: ≥ 0 and < 10)	Control (Gap: >-10 and < 0)	Difference (p-value)
Characteristics in 2009 (Pre-birth)				
Non-Worker in 2009 (Mother)	35.306	0.5769	0.8000	**0.0463****
Students in 2009 (Mother)	-	-	-	-
Full-Time Worker in 2009 (Mother)	29.78	0.2308	0.0588	0.0604*
Part-time Worker in 2009 (Mother)	33.463	0.1154	0.0588	0.4172
Self-employed in 2009 (Mother)	53.896	0.0385	0.0706	0.5021
Side-job in 2009 (Mother)	84	0	0.0118	0.3202
Non-Worker in 2009 (Father)	-	-	-	-
Students in 2009 (Father)	-	-	-	-
Full-Time Worker in 2009 (Father)	38.051	0.7500	0.7910	0.6931
Part-time Worker in 2009 (Father)	26.148	0.0833	0.0149	0.2609
Self-employed in 2009 (Father)	41.148	0.1667	0.1791	0.8919
Side-job in 2009 (Father)	-	-	-	-
Characteristics in 2010 (Post-birth)				
Take PL in 2010 (Mother)	26.394	0.2609	0.0597	0.0503*
Weeks of Taking PL in 2010 (Mother)	23.413	17.5652	2.8806	0.0848*
Full-Time Worker in 2010 (Mother)	64	0	0.0154	0.3211
Part-time Worker (Mother)	-	-	-	-
Full-Time Worker with PL in 2010 (Mother)	25.213	0.3043	0.0462	**0.0175****
Part-time Worker with PL in 2010 (Mother)	64	0	0.0154	0.3211
Use Work-Life Program in 2010 (Mother)	21	0.1364	0	0.0829*
Quit Work in 2010 (Mother)	32.893	0.1667	0.0896	0.3725
Take PL in 2010 (Father)	23	0.0417	0	0.3277
Weeks of Taking PL in 2010 (Father)	23	0.0833	0	0.3277
Use Work-Life Program in 2010 (Father)	32.877	0.2083	0.0893	0.2095
Quit Work in 2010 (Father)	-	-	-	-
Use Childcare Service in 2010	66	0	0.0448	0.0832*

Note: Treatment Group covers the households whose annual income were within the range between the income threshold and JPY 100,000 above its threshold in 2009 (upper half) or 2010 (lower half). Control Group covers the households whose annual income were within the range between the income threshold and JPY100,000 below its threshold in 2009 or 2010. The last column displays p-values obtained from the t-test to test differences between the means of the covariates from the two groups. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table 12: Bandwidth Choice: Payment of Child Benefit, Maternal Employment, and Child's Outcomes

Dependent Variables	Bandwidth	Observations	Estimate	Std. Error	z value	$Pr(>\|z\|)$
Child Benefit						
Optimal-BW	810.4	27646	**−16.52**	0.3342	−49.42	**0****
Half-BW	405.2	8334	**−17.60**	0.5319	−33.09	**4.33e-240****
Double-BW	1620.8	29718	**−15.91**	0.2771	−57.41	**0*****
Working Probability						
Optimal-BW	632.2	22543	**0.0689**	0.0270	2.557	**0.0106****
Half-BW	316.1	4789	**0.0756**	0.0365	2.071	**0.0384****
Double-BW	1264.3	29413	**0.0568**	0.0222	2.555	**0.0106****
Weekly Working Hours						
Optimal-BW	663.0	24203	**2.718**	0.9400	2.891	**0.0038*****
Half-BW	331.5	5824	**2.717**	1.2524	2.169	**0.0301****
Double-BW	1326.1	29580	**2.237**	0.7891	2.834	**0.0046*****
Annual Earned Income						
Optimal-BW	488.9	12264	31.04	16.06	1.9326	0.0533*
Half-BW	244.4	3007	19.37	22.17	0.8737	0.38226
Double-BW	977.7	26192	12.77	13.17	0.9697	0.33219
Childcare Service Expenditure						
Optimal-BW	674.2	9869	0.0778	0.2127	0.3659	0.7145
Half-BW	337.1	2378	0.3622	0.2774	1.3054	0.1918
Double-BW	1348.5	11756	−0.1837	0.1853	−0.9916	0.3214
Newborns Getting Sick						
Optimal-BW	956.4	28208	−0.0080	0.0132	−0.6046	0.5454
Half-BW	478.2	12613	0.0088	0.0171	0.5131	0.6079
Double-BW	1912.9	28479	−0.0142	0.0118	−1.2018	0.2294
Hospitalized Newborns						
Optimal-BW	902.5	27661	0.0099	0.0127	0.7778	0.4367
Half-BW	451.3	10341	0.0010	0.0163	0.0628	0.9499
Double-BW	1805.0	28479	0.0093	0.0114	0.8097	0.4181

Note: All estimated results show the coefficients of $D_{i,2012}$, that is, $(\alpha_l - \alpha_r)$. "Optimal-BW" means the bandwidth calculated using the method suggested by Imbens and Kalyanaraman (2012). "Half-BW" and "Double-BW" mean half and double the Optimal-BW, respectively. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table 13: Bandwidth Choice: Maternal Employment Statuses

Dependent Variables	Bandwidth	Observations	Estimate	Std. Error	z value	$Pr(>\|z\|)$
Housewife						
Optimal-BW	563.9	18574	**−0.0877**	0.0297	−2.958	**0.0031*****
Half-BW	281.9	4180	**−0.1020**	0.0410	−2.487	**0.0129*****
Double-BW	1127.8	29409	**−0.0763**	0.0236	−3.240	**0.0012*****
Full-Time Worker (Mother)						
Optimal-BW	411.2	8535	0.0183	0.0280	0.6533	0.5136
Half-BW	205.6	2493	0.0328	0.0412	0.7973	0.4253
Double-BW	822.5	27527	−0.0390	0.0214	−1.8222	0.0684
Part-time Worker (Mother)						
Optimal-BW	643.9	22962	**0.0553**	0.0149	3.712	**2.056e-04*****
Half-BW	322.0	5632	0.0330	0.0204	1.621	0.1051
Double-BW	1287.9	29413	**0.0896**	0.0125	7.157	**8.262e-13*****
Non-Worker (Mother)						
Optimal-BW	687.9	24962	0.0096	0.0135	0.711	0.4771
Half-BW	343.9	5977	0.0190	0.0184	1.031	0.3024
Double-BW	1375.8	29416	0.0139	0.0112	1.247	0.2123
Self-employed (Mother)						
Optimal-BW	1203.3	29411	**0.0390**	0.0112	3.48	**0.0005*****
Half-BW	601.6	20356	0.0243	0.0133	1.83	0.0673*
Double-BW	2406.5	29437	**0.0385**	0.0107	3.60	**0.0003*****

Note: All estimated results show the coefficients of $D_{i,2012}$, that is, $(\alpha_l - \alpha_r)$. "Optimal-BW" means the bandwidth calculated using the method suggested by Imbens and Kalyanaraman (2012). "Half-BW" and "Double-BW" mean half and double the Optimal-BW, respectively. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table 14: Robustness Tests: Annual Earned Income and the Likelihood of Parttime Work for Mothers.

Statistic	Degree of Freedom	Treatment	Control	Difference (p-value)
Annual Earned Income	24.838	128.7273	32.0667	**0.0554***
Part-time Worker (Mother)	23	0.125	0	**0.0830***

Note: Treatment Group covers the households whose annual income were within the range between the income threshold and JPY 100,000 above it threshold in 2012. Control Group covers the households whose annual income were within the range between the income threshold and JPY100,000 below its threshold in 2012. The last column displays p-values obtained from the t-test to test differences between the means of the covariates from the two groups.

Table 15: Transition Patterns of Employment Status from 2009 (Prebirth Period) to 2012 (after the CB Reduction): Summary Statistics

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
PT (Full-Sample)	29,437	0.174	0.379	0	0	0	1
FT (2009) → PT (2012)	29,599	0.042	0.200	0	0	0	1
PT (2009) → PT (2012)	29,636	0.074	0.262	0	0	0	1
Non-Worker (2009)→ PT (2012)	29,581	0.050	0.219	0	0	0	1
Student (2009) → PT (2012)	29,695	0.001	0.030	0	0	0	1
Self-employed (2009)→ PT (2012)	29,692	0.003	0.055	0	0	0	1
House Worker (2009)→ PT (2012)	29,697	0.001	0.028	0	0	0	1
Self-employed (Full-Sample)	29,437	0.041	0.199	0	0	0	1
FT (2009) → Self-employed (2012)	29,618	0.006	0.078	0	0	0	1
PT (2009) → Self-employed (2012)	29,655	0.006	0.074	0	0	0	1
Non-Worker (2009)→ Self-employed (2012)	29,600	0.007	0.086	0	0	0	1
Student (2009)→ Self-employed (2012)	29,714	0.0001	0.012	0	0	0	1
Self-employed (2009)→ Self-employed (2012)	29,711	0.021	0.143	0	0	0	1
House Worker (2009)→ Self-employed (2012)	29,716	0.0001	0.010	0	0	0	1
FT (2009) → PT (2012)	29,437	0.041	0.199	0	0	0	1
FT (2009) → Quit Work → PT (2012)	29,650	0.027	0.161	0	0	0	1
FT (2009) → Non-interruption → PT (2012)	29,656	0.015	0.122	0	0	0	1

Note: FT and PT mean Full-time and Part-time Worker, respectively.

Table 16: Transition Patterns of Employment Status from 2009 (Prebirth Period) to 2012 (after the CB Reduction): Local Average Treatment Effect (LATE)

Dependent Variables	Bandwidth	Observations	Estimate	Std. Error	z value	$Pr(>\|z\|)$
Part-time (Full-Sample)	643.9	22962	**0.0553**	0.0149	3.712	**2.056e-04*****
FT (2009) → PT (2012)	835.2	27736	**0.0176**	0.0079	2.2318	**0.0256****
PT (2009) → PT (2012)	758.8	26814	**0.0351**	0.0101	3.481	**5.003e-04*****
Non-Worker (2009)→ PT (2012)	688.8	25085	**0.0129**	0.0064	2.0282	**0.0425****
Student (2009) → PT (2012)	-	-	-	-	-	-
Self-employed (2009) → PT (2012)	-	-	-	-	-	-
House Worker (2009) → PT (2012)	-	-	-	-	-	-
Self-employed (Full-Sample)	1203.3	29411	**0.0390**	0.0112	3.48	**0.0005*****
FT (2009) → Self-employed (2012)	900.5	28736	0.0064	0.0052	1.228	0.2193
PT (2009) → Self-employed (2012)	-	-	-	-	-	-
Non-Worker (2009)→ Self-employed (2012)	1036.2	29517	−4.961e-05	0.0040	−0.0123	0.9902
Student (2009)→ Self-employed (2012)	-	-	-	-	-	-
Self-employed (2009) → Self-employed (2012)	1285.6	29687	**0.0268**	0.0088	3.041	**0.0024*****
House Worker (2009) → Self-employed (2012)	-	-	-	-	-	-

Note: We cannot estimate LATE when some transition patterns of employment status are used as the dependent variable because most respondents did not choose these transition patterns, in cases of which we draw (-) in each cell of the corresponding rows. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table 17: Transition Patterns of Employment Status from 2009 (Prebirth Period) to 2012 (after the CB Reduction): Local Average Treatment Effect (LATE) for Mothers Who Quit their Prior Job in 2010 (Postbirth Period)

Dependent Variables	Bandwidth	Observations	Estimate	Std. Error	z value	$Pr(>\|z\|)$
Case (B): Quit and Interruption						
FT(2009) → Quit Job(2010) → PT(2012)	859.6	27972	**0.0179**	0.0069	2.590	**0.0096*****

Note: FT and PT mean Full-time and Part-time Worker. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table 18: Anecdotal Facts about Parental Leave (PL) in 2012

Share of Worker (%)	Female	Male
Worker taking PL	83.6	1.89
Contract Worker taking PL	71.4	0.24
Worker who took PL and quit after PL finished	10.2	0.04

Source: The Basic Survey of Gender Equality in Employment Management taken by the Ministry of Health, Labor and Welfare in 2012.

Table 19: Percentage of Wives Who Continued to Work after Childbirth with or without Parental Leave (PL)

Marriage Year /	Employment Status before 1st child's birth		
1st Child's Birth Year	Full-time	Part-time	Self-employment or Side-job
2010~2014	69.1 (59.0)	25.2 (10.6)	73.9 (8.7)

Source: The 15th National Fertility Survey.

Appendix Table A-1 : Income Threshold by the Number of Children Aged 15-22 Years under Parental Dependency

# of Dependent Relatives	After-tax Income Threshold (JPY, Million)	Pre-tax Income Threshold (JPY, Million)
0	6.220	8.333
1	6.600	8.756
2	6.980	9.178
3	7.360	9.6
4	7.740	10.021
5	8.120	10.421
6	8.500	10.82
7	8.880	11.22
8	9.260	11.62
9	9.640	12.02

Note: After-Tax Income Threshold is calculated by subtracting the payroll tax deduction from the household income. We calculate the pre-tax income threshold according to the following formula: income threshold = (after-tax income threshold + JPY1.7 million) / 0.95+JPY80,000. The maximum number of the dependent children of our dataset is nine, and hence, the results here are not shown up to nine dependents.

Appendix Table A-2 : Dependent Deduction and Increases of Payroll Tax by Annual Income Levels

Spouse Income (JPY, Million)	Spouse Deduction (JPY, Million)
$\geq$ 1.03 & < 1.05	0.38
$\geq$ 1.05 & < 1.10	0.36
$\geq$ 1.10 & < 1.15	0.31
$\geq$ 1.15 & < 1.20	0.26
$\geq$ 1.20 & < 1.25	0.21
$\geq$ 1.25 & < 1.30	0.16
$\geq$ 1.30 & < 1.35	0.11
$\geq$ 1.35 & < 1.40	0.06
$\geq$ 1.40 & < 1.45	0.01

Note: Annual Income includes the earned income plus all taxes. The second and third columns indicate the amounts of dependent deduction and increased amounts of payroll tax when children are less than 16 years old. Parentheses of these columns show when children are high school students (16-18 years old).

Appendix Table A-3 : Payroll Tax Threshold, the amount of Dependent Deduction, and the amount of Increased Payroll Tax

Annual Income (JPY, Million)	Dependent Deduction (JPY, Million)	Increase of Payroll Tax (JPY, Thousand)
< 1.95	0.38 (0.25)	19 (12.5)
≥ 1.95 & < 3.3	0.38 (0.25)	38 (25)
≥ 3.3 & < 6.95	0.38 (0.25)	76 (50)
≥ 6.95 & < 9	0.38 (0.25)	87.4 (57.5)
≥ 9 & < 18	0.38 (0.25)	125.4 (82.5)
≥ 18	0.38 (0.25)	152 (100)

Note: Annual Income is the earned income including all taxes. Dependent Deduction and Increase of Payroll Tax are presented at the level of children aged less than 16 years old before graduating from junior high school. The parenthesis ( ) in this table means the level of high school students aged 16-18 years before graduation.

Appendix Table A-4 : Definitions for Baseline Covariates

Baseline Covariates	Definition
Current Characteristics	
Payroll Tax Gain (M&F)	JPY 19,000 for child in JHS (JPY 12,500 for child in HS) if the household income is < JPY 1.95 million JPY 38,000 for child in JHS (JPY 25,000 for child in HS) if the household income is ≥ JPY 1.95 million and < JPY 3.3 million JPY 76,000 for child in JHS (JPY 50,000 for child in HS) if the household income is ≥ JPY 3.3 million and < JPY 6.95 million JPY 87,400 for child in JHS (JPY 57,500 for child in HS) if the household income is ≥ JPY 6.95 million and < JPY 9 million JPY 125,400 for child in JHS (JPY 82,500 for child in HS) if the household income is ≥ JPY 9 million and < JPY 18 million JPY 152,000 for child in JHS (JPY 100,000 for child in HS) if the household income is ≥ JPY 18 million
Age at 2010 (M&F)	Ages of each parent at the point of time when the 2010 survey was conducted
Weekly Working Hours (F)	0 hour if a categorical measure of fathers' weekly working hours is 0 10 hours if a categorical measure of fathers' weekly working hours is < 20 hours 30 hours if a categorical measure of fathers' weekly working hours is ≥ 20 and < 40 hours 45 hours if a categorical measure of fathers' weekly working hours is ≥ 40 and < 50 hours 50 hours if a categorical measure of fathers' weekly working hours is ≥ 50 and < 60 hours 60 hours if a categorical measure of fathers' weekly working hours is ≥ 60 hours
Annual Earned Income (F)	Continuous variable of fathers' annual earned income in units of JPY 10,000
Annual Other Income	Continuous variable of income from sources other than employment in units of JPY 10,000
University Graduate (M&F)	= 1 if each parent graduated from university or 0 otherwise
Living by oneself (M&F)	= 1 if each parent is living away from the family or 0 otherwise
Living in Large City	= 1 if the respondent lives in a designed city or a special ward or 0 otherwise.
# of Families Living Together	The number of family members residing together with the surveyed newborn.
Weekly Hours for Childcare Services	A continuous variable reflecting weekly hours that parents use a childcare service with a minimum value of 1 hour.
Usual Caregiver	
Mother	= 1 if the daily caregiver for the 2010 newborn is mother or 0 otherwise
Father	= 1 if the daily caregiver for the 2010 newborn is father or 0 otherwise
Grandmother	= 1 if the daily caregiver for the 2010 newborn is grandmother or 0 otherwise
Grandfather	= 1 if the daily caregiver for the 2010 newborn is grandfather or 0 otherwise
Nursery Teacher	= 1 if the daily caregiver for the 2010 newborn is a nursery school teacher or 0 otherwise
Childcare Mom	= 1 if the daily caregiver for the 2010 newborn is a childcare mother (so-called childcare mom) or 0 otherwise
Kindergarten Teacher	= 1 if the daily caregiver for the 2010 newborn is a kindergarten teacher or 0 otherwise
Nintei-Kodomoen Teacher	= 1 if the daily caregiver for the 2010 newborn is a teacher in a Nintei-Kodomoen or 0 otherwise

Note: "M&F" means both mothers and fathers. "M"and"F" mean only mothers and only fathers, respectively. "JHS" means a junior high school for 13 to 15-year-old children. "HS" means a junior high school for 16 to 18-year-old children. Nintei-Kodomoen is a facility that combines the advantages of both kindergarten and nursery school by integrating education and childcare in an integrated manner.

Appendix Table A-5 : Definitions for Baseline Covariates (cont'd)

Baseline Covariates	Definition
Childcare Facilities in Use	
Registered Public Nursery School	= 1 if a household has access to a registered public childcare facility for the surveyed newborn or 0 otherwise
Registered Private Nursery School	= 1 if a household has access to a registered private childcare facility for the surveyed newborn or 0 otherwise
Nintei-Kodomoen	= 1 if a household has access to a Nintei-Kodomoen for the surveyed newborn
Local Municipality's Facility	= 1 if a household has access to a childcare facility run by a local municipality for the surveyed newborn or 0 otherwise
Childcare Facility Inside Office	= 1 if a household has access to a childcare facility inside office for the surveyed newborn or 0 otherwise
Non-Registered Childcare Facility	= 1 if a household has access to a non-registered childcare facility for the surveyed newborn or 0 otherwise
Child's Characteristics	
Twin or Triple	= 1 if the surveyed newborn is a twin or triple, or 0 otherwise
Younger Newborn	= 1 if the respondent gave birth to a younger newborn after the 2010 newborn or 0 otherwise
Female (Newborn)	= 1 if the 2010 newborn of a household is female or 0 otherwise
Female (1st child)	= 1 if the 1st child of a household is female or 0 otherwise
Female (2nd child)	= 1 if the 2nd child of a household is female or 0 otherwise
Female (3rd child)	= 1 if the 3rd child of a household is female or 0 otherwise
Child's Age (1st child)	Age of the 1st child of a household as of each survey period
Child's Age (2nd child)	Age of the 2nd child of a household as of each survey period
Child's Age (3rd child)	Age of the 3rd child of a household as of each survey period
Work-Life Support Systems (M&F)	
Parental Leave (M&F)	= 1 if a father utilizes the parental leave program as of each survey period or 0 otherwise
Short Working Hours (M&F)	= 1 if a father utilizes the short-time working hours program as of each survey period or 0 otherwise
Remote Work (M&F)	= 1 if a father utilizes the remote work program as of each survey period or 0 otherwise
No Late-night Work (M&F)	= 1 if a father utilizes the no late-night work program as of each survey period or 0 otherwise
No Overtime Work (M&F)	= 1 if a father utilizes the no overtime work program as of each survey period or 0 otherwise
Flex System (M&F)	= 1 if a father utilizes the flexible working time program as of each survey period or 0 otherwise
Working Hours Shift (M&F)	= 1 if a father utilizes the staggered working hours program as of each survey period or 0 otherwise
Firm-own Kindergarten (M&F)	= 1 if a father utilizes a firm-own kindergarten as of each survey period or 0 otherwise
Leave for Care Nursing (M&F)	= 1 if a father utilizes the leave for care nursing program as of each survey period or 0 otherwise

Note: "M&F" means both mothers and fathers. "M"and"F" mean only mothers and only fathers, respectively.

Appendix Table A-6 : Definitions for Baseline Covariates (cont'd)

Baseline Covariates	Definition
Characteristics in 2009 (Pre-birth)	
Non-Worker in 2009 (M&F)	= 1 if each parent was a non-worker before giving the surveyed newborn as of 2009 or 0 otherwise
Students in 2009 (M&F)	= 1 if each parent was a student before giving the surveyed newborn as of 2009 or 0 otherwise
Full-time Worker in 2009 (M&F)	= 1 if each parent was a full-time worker before giving the surveyed newborn as of 2009 or 0 otherwise
PT Worker in 2009 (M&F)	= 1 if each parent was a part-time worker before giving the surveyed newborn as of 2009 or 0 otherwise
Self-employed in 2009 (M&F)	= 1 if each parent was a self-employment before giving the surveyed newborn as of 2009 or 0 otherwise
Side-job in 2009 (M&F)	= 1 if each parent did a side-job before giving the surveyed newborn as of 2009 or 0 otherwise
Characteristics in 2010 (Post-birth)	
Take PL in 2010 (M&F)	= 1 if each parent utilized the parental leave program as of 2010 or 0 otherwise
Take PL in 2010 (Week, M&F)	Weeks which each parent utilized the parental leave program as of 2010
FT in 2010 (M&F)	= 1 if each parent worked as a FT as of 2010 or 0 otherwise
PT Worker in 2010 (M&F)	= 1 if each parent worked as a PT as of 2010 or 0 otherwise
FT with PL in 2010 (M&F)	= 1 if each parent worked as a FT while using parental leave as of 2010 or 0 otherwise
PT with PL in 2010 (M&F)	= 1 if each parent worked as a PT while using parental leave as of 2010 or 0 otherwise
Use Work-Life Program in 2010 (M&F)	= 1 if each parent used at least one work-life support program as of 2010 or 0 otherwise
Quit Work in 2010 (M&F)	= 1 if each parent quit the job just after giving the surveyed newborn as of 2010 or 0 otherwise
Use Childcare Service in 2010	= 1 if each parent utilized a childcare service as of 2010 or 0 otherwise

Note: "M&F" means both mothers and fathers. "M"and"F" mean only mothers and only fathers, respectively. "PL" means parental leave. "FT" and "PT" mean Full-time and Part-time Worker, respectively.

Appendix Table A-7 : Robustness Tests with Covariates: Child Benefit, Maternal Employment, and Child's Health

Dependent Variables	Bandwidth	Observations	Estimate	Std. Error	z value	$Pr(>\|z\|)$
Child Benefit						
Non-Covariate	810.4	27646	**−16.52**	0.3342	−49.42	**0*****
With Payroll Tax Increase (F)	810.4	27265	**−20.52**	0.3844	−53.37	**0*****
With Non-worker in 2009 (M)	810.4	27544	**−16.46**	0.3325	−49.52	**0*****
With FT taking PL in 2010 (M)	810.4	27472	**−16.68**	0.3350	−49.81	**0*****
Working Probability						
Non-Covariate	632.2	22543	**0.0689**	0.02695	2.557	**0.0106****
With Payroll Tax Increase (F)	632.2	22434	**0.0865**	0.0267	3.239	**0.0012*****
With Non-worker in 2009 (M)	632.2	22479	**0.0579**	0.0218	2.653	**0.0080*****
With FT taking PL in 2010 (M)	632.2	22431	**0.1018**	0.0218	4.663	**3.112e-06*****
Weekly Working Hours						
Non-Covariate	663.0	24203	**2.718**	0.9400	2.891	**0.0038*****
With Payroll Tax Increase (F)	663.0	24075	**3.708**	0.9290	3.992	**6.563e-05*****
With Non-worker in 2009 (M)	663.0	24129	**2.365**	0.7992	2.960	**0.0031*****
With FT taking PL in 2010 (M)	663.0	24076	**3.931**	0.7881	4.988	**6.099e-07*****
Annual Earned Income						
Non-Covariate	488.9	12264	31.04	16.06	1.9326	0.0533*
With Payroll Tax Increase (F)	488.9	12240	**39.50**	15.70	2.516	**0.0119** **
With Non-worker in 2009 (M)	488.9	12237	**30.71**	14.21	2.162	**0.0306****
With FT taking PL in 2010 (M)	488.9	12212	**43.15**	14.00	3.082	**0.0020*****
Childcare Service Fee						
Non-Covariate	674.2	9869	0.0778	0.2127	0.3659	0.7145
With Payroll Tax Increase (F)	674.2	9769	0.3662	0.2066	1.7726	0.0763*
With Non-worker in 2009 (M)	674.2	9847	0.0797	0.2011	0.3962	0.6919
With FT taking PL in 2010 (M)	674.2	9835	0.3049	0.2019	1.5100	0.1310
Newborns Getting Sick						
Non-Covariate	956.4	28208	−0.0080	0.0132	−0.6046	0.5454
With Payroll Tax Increase (F)	956.4	26726	−0.0043	0.0132	−0.3289	0.7422
With Non-worker in 2009 (M)	956.4	28101	−0.0080	0.0132	−0.6086	0.5428
With FT taking PL in 2010 (M)	956.4	28030	−0.0043	0.0133	−0.3268	0.7438
Hospitalized Newborns						
Non-Covariate	902.5	27661	0.0099	0.0127	0.7778	0.4367
With Payroll Tax Increase (F)	902.5	26618	0.0103	0.0128	0.8098	0.4181
With Non-worker in 2009 (M)	902.5	27559	0.0104	0.0127	0.8170	0.4139
With FT taking PL in 2010 (M)	902.5	27492	0.0103	0.0127	0.8117	0.4170

Note: All estimated results show the coefficients of $D_{i,2012}$, that is, $(\alpha_l - \alpha_r)$. The row of "Non-Covariate" displays the LATE estimated results obtained in Table 6. The row of "With Payroll Tax Increase (F)" displays the results of estimations in which the increase in payroll tax for fathers is added as a covariate. The row of "With Non-worker in 2009 (M)" display the results of estimations in which when the dummy indicating one if the mother was non-worker just after giving birth is added as a covariate. The row of "With FT taking PL in 2010 (M)" display the results of estimations in which the dummy indicating one if the mother worked as a full-time worker (FT) with parental leaves just after giving birth is added as a covariate. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Appendix Table A-8 : Robustness Test with Covariates: Maternal Employment Status

Dependent Variables	Bandwidth	Observations	Estimate	Std. Error	z value	$Pr(>\|z\|)$
Housewife						
Non-Covariate	563.9	18574	**−0.0877**	0.0297	−2.958	**0.0031*****
With Payroll Tax Increase (F)	563.9	18522	**−0.1027**	0.0295	−3.478	**0.0005****
With Non-worker in 2009 (M)	563.9	18529	**−0.0764**	0.0253	−3.021	**0.0025****
With FT taking PL in 2010 (M)	563.9	18489	**−0.1118**	0.02575	−4.340	**1.425e-05*****
Full-Time Worker (Mother)						
Non-Covariate	411.2	8535	0.0183	0.0280	0.6533	0.5136
With Payroll Tax Increase (F)	411.2	8519	0.0365	0.0274	1.3302	0.1835
With Non-worker in 2009 (M)	411.2	8509	0.0142	0.0243	0.5824	0.5603
With FT taking PL in 2010 (M)	411.2	8494	0.0285	0.0172	1.661	0.0968*
Part-time Worker (Mother)						
Non-Covariate	643.9	22962	**0.0553**	0.0149	3.712	**2.056e-04*****
With Payroll Tax Increase (F)	643.9	22846	**0.0478**	0.0147	3.244	**1.178e-03*****
With Non-worker in 2009 (M)	643.9	22896	**0.0542**	0.0148	3.666	**2.464e-04*****
With FT taking PL in 2010 (M)	643.9	22847	**0.0520**	0.0150	3.472	**5.167e-04*****
Non-Worker (Mother)						
Non-Covariate	687.9	24962	0.0096	0.0135	0.711	0.4771
With Payroll Tax Increase (F)	687.9	24798	0.0095	0.0136	0.6985	0.4848
With Non-worker in 2009 (M)	687.9	24886	0.0105	0.0135	0.7776	0.4368
With FT taking PL in 2010 (M)	687.9	24825	0.0063	0.0135	0.4622	0.6439
Self-employed (Mother)						
Non-Covariate	1203.3	29411	**0.0390**	0.0112	3.48	**0.0005*****
With Payroll Tax Increase (F)	1203.3	27686	**0.0402**	0.0113	3.561	**3.695e-04*****
With Non-worker in 2009 (M)	1203.3	29298	**0.0394**	0.0111	3.542	**0.0004*****
With FT taking PL in 2010 (M)	1203.3	29218	**0.0357**	0.01122	3.177	**0.0015****
House Worker (Mother)						
Non-Covariate	-	-	-	-	-	-
With Payroll Tax Increase (F)	-	-	-	-	-	-
With Non-worker in 2009 (M)	-	-	-	-	-	-
With FT taking PL in 2010 (M)	-	-	-	-	-	-

Note: All estimated results show the coefficients of $D_{i,2012}$, that is, $(\alpha_l - \alpha_r)$. The row of "Non-Covariate" displays the LATE estimated results obtained in Table 6. The row of "With Payroll Tax Increase (F)" displays the results of estimations in which the increase in payroll tax for fathers is added as a covariate. The row of "With Non-worker in 2009 (M)" display the results of estimations in which when the dummy indicating one if the mother was non-worker just after giving birth is added as a covariate. The row of "With FT taking PL in 2010 (M)" display the results of estimations in which the dummy indicating one if the mother worked as a full-time worker (FT) with parental leaves just after giving birth is added as a covariate. We have no results when the dependent variable is "House Worker (Mother)" because most respondents did not choose the status of house work.$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$