Households' Responses to Childcare Fees: Childcare Usage and Parental Labor Supply[*]

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Abstract

We examine the response of households with preschool children to the fee of accredited childcare centers. Exploiting the fact that the fee is determined by a step function of the municipality resident tax, we identify the effects of the increased fee on the use of childcare centers and parental employment by the regression discontinuity design. After confirming the substantial jump in the childcare fee charged to the households, we show no discernible jump in the use of childcare centers or the fraction of mothers with positive pretax salary income.

Keywords: Childcare demand; Childcare cost; Maternal labor supply.
JEL Classification: J13; J22; H40.

保育料が保育所利用と親の就業に与える影響

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＜要旨＞

　本稿では認可保育所の保育料の変化に対して未就学児のいる世帯がどのように行動を変化させるのかを検証した。保育料が市町村住民税の課税額によって不連続に決まっていることを保育料が保育所利用に与える影響の識別に利用する回帰不連続法によって、認可保育所の保育料の増加が認可保育所の利用や両親の労働供給に与える影響を推計した。保育料自体は閾値の前後で不連続に変化していることを確認したのちに、この保育料の変化が保育所の利用率や、母親の就業率、両親の労働所得に対して統計的に有意な影響を与えないことを明らかにした。

1 Introduction

Rapid population aging urges our society to increase the labor supply of women without lowering fertility further. The availability of reliable childcare at an affordable price is one of the key factors to determine female labor supply and fertility. At the same time, we are facing capacity constraints caused by limited supply of childcare workers and facilities. Therefore, it is important to understand how the demand for childcare responds to its price and the implications for household labor supply.

We examine the effects of fees for publicly provided childcare on the demand for childcare and parents' labor supply, exploiting the discontinuities in the fee by the municipality resident tax in Japan. We use a panel dataset of all households with preschool children in a large city, which is constructed from the tax records and the user lists of accredited childcare centers in this city. Since the fee for the accredited childcare centers is a step function of the amount of the municipality resident tax, we apply the regression discontinuity design (RDD) to identify the causal effects of the fee on the use of the accredited childcare centers and labor supply (proxied by pretax salary income).

As described by Blau and Currie (2006), economic theory predicts that the demand for accredited childcare center decreases with the fee. Although this decrease could be partly compensated by substitution with other childcare options, the increased childcare cost would make some parents (mostly mothers) withdraw from labor force to take care of their children at home. Along with this prediction, existing empirical studies in the United States (Morrissey, 2016), Canada (Baker et al., 2008; Lefebvre and Merrigan, 2008) and Japan (Oishi, 2002; Zhou and Oishi, 2005; Shimizutani and Noguchi, 2004) find significant negative effects of a higher price on the demand for childcare and maternal employment, although the evidence from Europe is more mixed.

We depart from the existing studies by exploiting the discontinuous jump in the fee schedule. The regression discontinuity design allows us to identify the causal effects of the fee on the use of childcare centers and labor supply more rigorously than methods used in the existing literature. Also, since the fee is uniformly applied to all accredited childcare centers in the municipality, our results are not biased by the positive correlation between price and quality often observed in the privately provided childcare services.

After showing the discontinuous jumps in the childcare fees by the sum of the city resident tax imposed to each parent, we begin with estimating the effect of the fee on the use of accredited childcare centers. We find no significant decrease in the use of childcare centers for households whose city resident tax is just above the threshold (i.e. facing higher fees). As expected from the negligible effect on the use of childcare centers, we find no significant decrease in maternal employment, which is captured by a positive pretax salary income.

We also investigate the effect on salary income of both parents. On the one hand, for families that stay in the accredited childcare centers, an increase in their fee implies a decrease in their disposable income, thus they may increase their labor supply. On the other hand, the effect for families that substitute other childcare options is ambiguous because, while they also face a decrease in their disposable income, it may be optimal to rather reduce work hours depending on the fee schedule of the alternative arrangement (e.g. switching to a kindergarten and working part time). Despite these predictions, we find no systematic change in household labor income for the entire sample or subgroups divided by the use of accredited childcare centers.

Despite the clear discontinuity in the fee schedule, we find no systematic response of childcare use, maternal labor supply or the household income. There are two potential reasons for the lack of significant effects. First, about half of the respondents did not know the accurate fee at the time of application, according to the supplemental survey we conducted. Since they did not understand which side of the threshold they were on, they did not adjust anything. Second, limited capacity made some applicants unresponsive to the temporary changes in the fee. Since children already enrolled to an accredited childcare center can stay in the same center until they enter primary school, while about 20 percent of new applications are declined, some parents may be willing to pay a higher fee for one year to secure the slot in subsequent four or five years. In either case, it is worth emphasizing that the household may respond differently to permanent and more easily recognizable changes in the fee.

The rest of the paper is organized as follows. Section 2 reviews the related literature. Sections 3 and 4 describe institutional backgrounds and the data, respectively. Section 5 presents the empirical results, and Section 6 discusses our results with supplemental surveys about knowledge on the fee. Section 7 concludes.

2 Related Studies

Many studies have investigated how the cost of childcare affects the demand for such care and mothers' labor supply. Theory suggests that reducing the costs of childcare increases maternal labor supply by reducing the cost of work (Blau and Currie, 2004). Empirically, however, substantial variations exist in the estimated elasticity of childcare cost on female labor supply (Blau and Currie, 2004; Morrissey, 2016; Akgunduz and Plantenga, 2018).

Studies in the United States, where a large share of childcare is provided in the private market and where families' out-of-pocket costs vary widely, tend to find a strong, negative association between childcare costs and maternal labor supply. Morrissey (2016) summarizes that the estimated elasticity of maternal employment to childcare price in the United States ranges from -0.025 to -1.1, with estimates clustering near -0.05 to -0.25. This implies that a 10 percent reduction in the childcare price is likely to increase maternal employment by 0.5-2.5 percent. Blau and Currie (2004) point out, however, that some of the existing studies may overstate the effect of childcare cost on maternal labor supply by ignoring the existence of unpaid childcare and the endogeneity of observed childcare prices.

In Canada, the province of Que´bec introduced a new childcare policy in 1997, which made licensed childcare for children aged 4 available at the subsidized fee of $5 per day. The policy was extended to younger children in successive years and all children became eligible in 2000. Studies examined this policy find a significant increase in maternal labor supply (Baker et al., 2008; Lefebvre and Merrigan, 2008), although there was also some crowding out of existing arrangements (Baker et al., 2008).

Studies from European countries tend to find a smaller (Givord and Marbot 2015 for France, Bettendorf et al. 2015 for Netherlands) or even insignificant (Lundin et al. 2008 for Sweden) effect of the increased subsidy for childcare. Authors of these studies argue that their estimated effects are smaller because the labor force participation of mothers of young children were already high (and in Sweden, the price of childcare was already low) even before the policy change.

In Norway, a cash-for-care subsidy was introduced in 1999. All parents with children aged one to three who did not attend publicly subsidized daycare can receive this subsidy, thus it increases the relative price of childcare for young children. Studies on this reform tend to find

a negative effect on the use of formal childcare and maternal labor supply (Schøne, 2004; Naz, 2004; Hardoy and Schøne, 2010; Andersland and Nilsen, 2016). Similar reform in Germany also decreased maternal labor supply, although the size of the effect is rather small (Gathmann and Sass, 2018; Collischon et al., 2020).

Most studies mentioned above take the differences-in-differences approach exploiting some policy changes, except for old studies in the United States that typically rely on Type-II Tobit or more complicated structural models. To the best of our knowledge, no study has exploited the discontinuous change in the fee of publicly provided childcare to estimate the demand for the formal care for young children or maternal employment.

In terms of methodology, Black et al. (2014) is the closest study to us, although their main interest is to estimate the effect of increased income on children's development in the long run. They examined the effect of disposable income at age 5 on various outcomes measured in junior high school in Norway, exploiting the discontinuous change in childcare price based on family income. An important difference between their study and ours is that most children at age 5 in Norway enrolled in daycare centers regardless of price, thus there was little room that the price could affect maternal labor supply. In contrast, we examine the use of formal childcare and maternal labor supply of younger children in an urban municipality in Japan, where the enrollment rate to the accredited childcare center is as low as 25-35 percent.

In Japan, Oishi (2002) estimates the effect of childcare cost on maternal labor supply using micro data from the Basic Survey on People's Life 1998. Applying a Type-II Tobit model to deal with non-random selection into employment, she shows that the fees for the licensed day-care centers have significantly negative effects on the labor force participation of mothers, with elasticity about -0.60. She also finds that mothers with lower income are more elastic. Note that, however, the number of mothers using the licensed day-care centers has increased substantially and the composition has also changed since 1998; thus her results may no longer hold in Japan today.

Relatedly, Zhou and Oishi (2005) and Shimizutani and Noguchi (2004) use the contingent valuation method to estimate the price elasticity of the demand for formal childcare. Both studies conclude that the childcare demand is price elastic in Japan, although their methodology does not allow them to examine the effect on maternal employment or labor supply. In contrast, our data are based on the actual use of day- care centers and labor income, which

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enable us to examine the effect on labor supply as well as childcare demand.

Lastly, the capacity expansion of licensed daycare centers is known to have an insignificant (Asai et al., 2015) or small positive effect (Nishitateno and Shikata, 2017) on employment rate for mothers in the local labor market, although the effect seems to be growing larger recently (Yamaguchi et al., 2018). These studies also find substitution from alternative childcare arrangements.

3   Institutional Background

We examine the effect of the monthly fee of accredited childcare centers in an anonymous large city in the Kanto region of Japan. Accredited childcare centers provide full-day care for preschool children and are the most popular type of center-based childcare in Japan, which accounts for about 90 percent of the center-based services in Japan. Although only about 30 percent of accredited childcare centers are public and others are run by private organizations, allocation of the vacant slots and collection of the fee are centralized at the municipality level and managed by the local governments. To become an accredited childcare center, it must meet certain operational requirements. Once the requirements are met, the center is eligible for government subsidies [1]. Given the strict quality requirements and heavy subsidy, accredited childcare centers are relatively cheap and of high quality. Thus they are preferred to other center-based childcare options by most of the parents.

The fee schedule of accredited childcare centers is set by the municipality government. In most municipalities, including our study site, the fee is a step function of the municipality resident tax imposed to the parents or households, reflecting the ability-to-pay principle. Although the shape of this step function differs substantially across municipalities,[2][3] the same fee schedule is applied to all accredited childcare centers in the same municipality. Thus, within a municipality, the price is not correlated with the quality of childcare.

The amount of municipality resident tax is determined by each individual's income in a

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[1]For more detail, please see Fukai (2017).

[2]While the upper limit of monthly fee is set to 104,000 yen by the national government, few municipalities set the fee exceeding 100,000 yen per month. Regarding the lower end, many municipalities including the city we study set zero for low-income households exempted from the municipality resident tax.

[3]Since other municipalities set different thresholds in their fee schedule, in theory, it is possible that households just above the threshold of this city are more likely to migrate to other municipalities. However, as we check later, the distribution of the city income tax is smooth enough to ignore such migration.
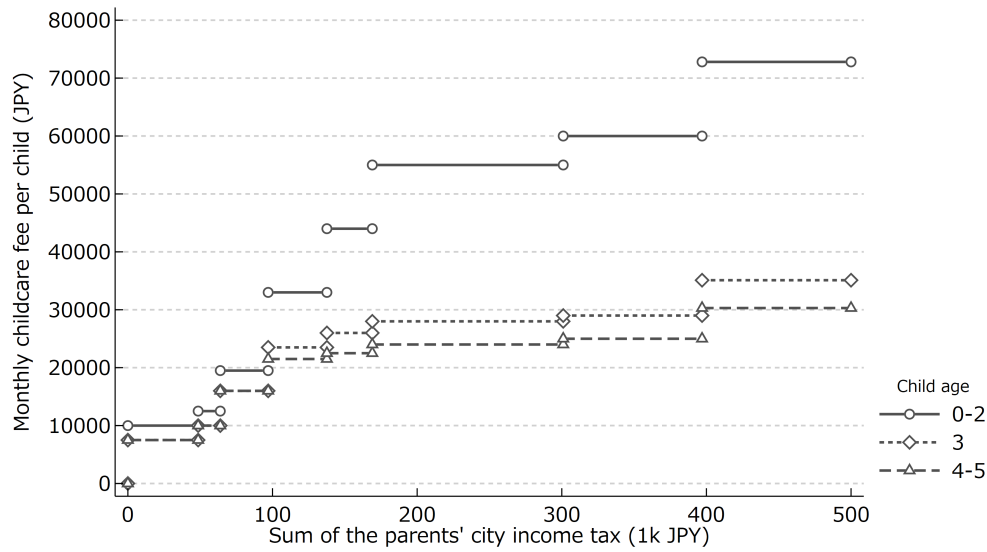
Figure 1: Childcare Fee Schedule

Note: This figure shows the schedule of monthly childcare fees by child age in the city we studied. Each age is the age as of April 2nd of the corresponding fiscal year (April-March).

calendar year. The total tax amount is a sum of lump-sum part (fixed amount per person) and the part proportional to the taxable income. The second part is determined as 6 percent taxable income (common to national income tax) minus adjustment deductions applied only to the local resident tax. Hereafter we call this second part "the city income tax."

Figure 1 shows the fee schedule set by the city we study. This city determines the fee based on the sum of the city resident tax paid by the parents of the child.[4] The parents' imposed positive city income tax is divided into eight categories based on the amount of city income tax[5]. As we elaborate later, we cannot include those with zero city income tax in our RDD analysis, thus Figure 1 covers only those with positive city income tax. The fee is zero for low-income households exempted from the city resident tax, and the households that pay only the lump-sum part of the tax pay slightly lower fee than the first category shown in Figure 1.

It is noteworthy that the fee for younger children is more expensive: there is a substantial gap between age 2 and 3, and a smaller gap between 3 and 4. Although the thresholds for the discontinuous change remain the same, the size of the jump in the fee at each threshold

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[4]That is, excluding other household members such as grandparents and older siblings.

[5]Strictly speaking, the part of city tax based on income before receiving some tax credits such as mortgage tax relief. If one parent or neither lived in the city at the beginning of the year and filed tax in other municipalities, the fee is determined based on the city resident tax they would have had paid if they had lived in this city.
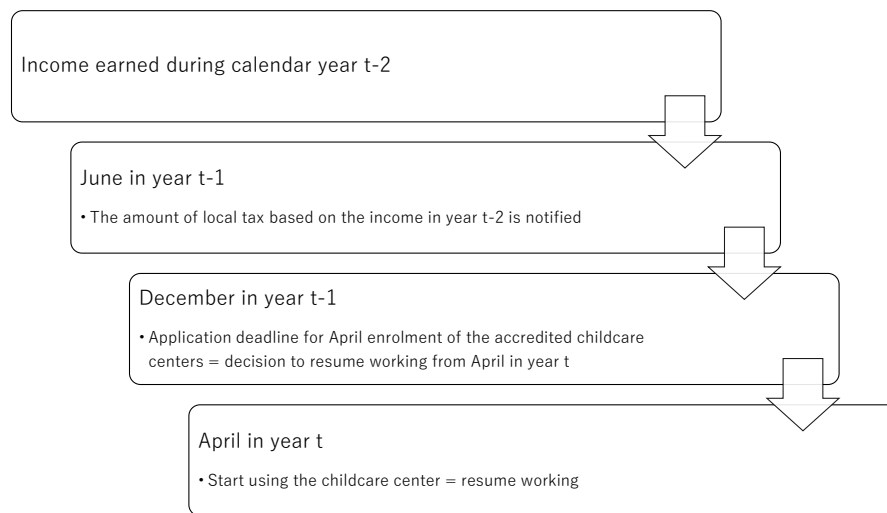
Figure 2: Timing of Information and Decision Making

Note: This chart shows the flow that parents go through in using accredited childcare centers. In particular, it shows when parents are informed of tax information, which is key in determining the fee for childcare.

becomes smaller for older children. Furthermore, although not shown on Figure 1, if two or more children from the same household are enrolled to accredited childcare centers, the second and higher order children receive a 50 percent- discount. Single-parent households also receive substantial discounts.

Like other large cities in Japan, the demand for accredited childcare centers exceeds the supply capacity in the city we studied. Among the two-parent households, priority is given to those with both parents working full-time. Therefore, full-time employment of both parents is thought to be a "necessary condition" for applicants to accredited childcare centers in this city. Furthermore, it is difficult to find a vacant slot in months other than April. Also, since most of the slots for children aged 2 and older are filled by children who continued to be enrolled from the previous year, mothers typically go back to work full-time [6] by the first April before the child's second birthday. Even if both parents are working full-time and the child is younger than 2, 20 percent of the new application for April enrollment are declined.[7]

Since the amount of city resident tax imposed on each individual is determined based on the previous year's income, there is a time lag between earnings and the childcare fee. The

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[6] "Full-time" here includes so-called "*jitan*," shorter-time arrangement (typically 7 hours per day).

[7] A majority of the declined applicants end up with other childcare options and are not counted as "waiting children" in official statistics.

timing of decision making and information provision is summarized in Figure 2. An important point is that the parents make a decision to resume working from next April by December of the previous year, and their local tax amount has been already determined by then. For those already enrolled to the accredited childcare centers, the monthly fee from September in year t to August in year t+1 is determined by the city resident tax based on the income earned during year t-1.

4 Data and Empirical Model

4.1 Data

We use administrative data on the tax records of a large city in the Kanto region of Japan, augmented with administrative records of users of the accredited childcare centers. The dataset covers the population of households with preschool children living in the city at the beginning of 2018. The available information includes a selected part of tax record, such as pretax salary income and taxable income, from 2014 to 2017 as well as the month and year of birth, sex, and relationship to the head of the household for each household member at the beginning of 2018. [8]

Before examining the construction and descriptive analysis of the data, we should note that the data do not include people from households who moved out of the city before January 2018. Also, since the tax records of each year is available only for individuals who lived in the city at the beginning of the corresponding year, the information prior to moving into the city is missing for those who moved into the city after 2015. Note that in our analysis, we use income and employment status in 2017/2016 as outcome variables, which are observed for households residing in 2018/2017. Also, the childcare fee in April 2017/2016 is determined by the tax amount based on income earned in 2015/2014, which are observed in 2016/2015. Thus, the analysis sample consists of people from households who have lived in the city for at least three consecutive years.

Table 1 calculates, for each child's age in April 2018, the percentage of parents who lived in this city in each year from 2015 to 2017. Note that this table presents the number of children,

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[8]Since the municipality resident tax is imposed on the income in the previous year, the data as of 2018 contains income information up to 2017.

Table 1: Percentage of Parents Who Lived in the City in the Past Three Years by Age of Child

Age of child in April 2018	Obs.	Percentage by year		
		2017	2016	2015
0	7,594	84.4	67.8	53.0
1	10,414	90.6	76.1	62.0
2	10,917	92.9	84.2	71.3
3	10,605	93.7	86.8	78.8
4	10,759	95.8	90.1	83.5
5	10,637	96.6	92.2	86.5
6	10,558	96.8	93.0	88.7
7	10,527	97.9	94.8	91.5

Note: This table shows, for each child's age as of April 2018, the percentage of the household that lived in the city under analysis between 2015 and 2017. Note that the unit of observation of this table is children rather than households, while the unit of observation in other tables and figures are households.

while the unit of observation in other tables and figures are households. The table shows that the smaller the age of the child, the more likely it is that the family moved to that city after 2015; for example, about half of the parents of children aged 0 or 1 in 2018 moved to the city after 2015. This reflects the fact that many couples moved into the city when they got married or had children. It also shows that they tend to continue to live in the city once their children reach a certain age, such as 4 to 7 years old. [9]

For the sample construction, we cleaned the raw data provided to us through the following steps; Table 2 presents the sample size remaining at each step, starting with the total 66,977 households. First, we restricted our sample to household with preschool children in 2017/2016. We next dropped households whose composition is too complicated to identify the parents of each child.[10] Then, we removed single- parent households because they are eligible for discounted fees that add noise to our identification strategy. In addition, we dropped households with mothers 60-year-old or older, for fear of errors in the recorded household composition.[11] At this point, the cleaned sample includes 58,198 households.

We next constructed our analysis sample from the cleaned data as follows. First, we limited our sample to the households in which both parents had lived in the city for at least three

[9]Note that the RDD can identify the causal effect of the fee regardless of exclusion of the people from households who moved in recently. However, if the impact of the childcare fee is different for those who recently moved in, our estimates represent the causal effects for those who continue to live in the city at least for three years.

[10]For example, households lived with a sibling couple or other family members.

[11]They are unlikely to be biological mothers. Although they may be adopted mothers, it is also possible that the relationship to the head is misreported in the residential registration form.

Table 2: Sample Construction

Data cleaning	Obs.	(%)
(1) Number of all households in the raw data	66,977	100%
(2) Households with preschool children	62,413	93%
(3) Unique pairs of children and parents are identified	61,667	92%
(4) Both parents are living in the household	58,203	87%
(5) Age of mother is below 60	58,198	87%
Sample restriction		
(6) Cleaned sample	58,198	100%
(7) Both parents lived in the city two years ago	51,025	88%
(8) Households income information is not missing	49,376	85%
(9) The sum of parents' city income tax is positive	47,970	82%

Note: This table shows how we constructed our analysis sample. Rows 1-5 show the data cleaning to analyzable samples, and rows 6-9 show the restriction process to the analysis samples.

consecutive years. As noted above, childcare fees applied in April are determined by income two years prior. Thus the childcare fee category cannot be calculated if the parents did not live in the city two years ago. Eighty-eight percent of the cleaned sample met the criteria. Next, we dropped 1,649 households for which parents' income information was not available, probably because they did not file tax returns or claim deductions for dependents. Finally, among households exempt from the city income tax, there are two categories of childcare fees, but the data provided to us do not provide information to distinguish between the two categories. Thus, we restrict our sample to the households imposed positive city income tax, resulting in a total of 47,970 unique households in our analysis.

As mentioned earlier, we are provided with tax records for the years 2014-2017. We use tax information in 2014 and 2016 to calculate the childcare fee applied in April 2016 and 2017, respectively, and we construct the indicator of mother's employment and household income using pretax salary income in 2016 and 2017. Thus, practically we have data for two years, and we pool data from these two years to maximize the sample size and increase our statistical power. Most households have data available for both 2017 and 2018, 34,289 out of 47,970 households in row 9 of Table 2; 6,952 households have data available only for 2016, and 6,729 households have data available only for 2017. Adding these numbers together, we identify 47,970 unique households.

Once we had cleaned up the administrative data on tax information, we combined the data
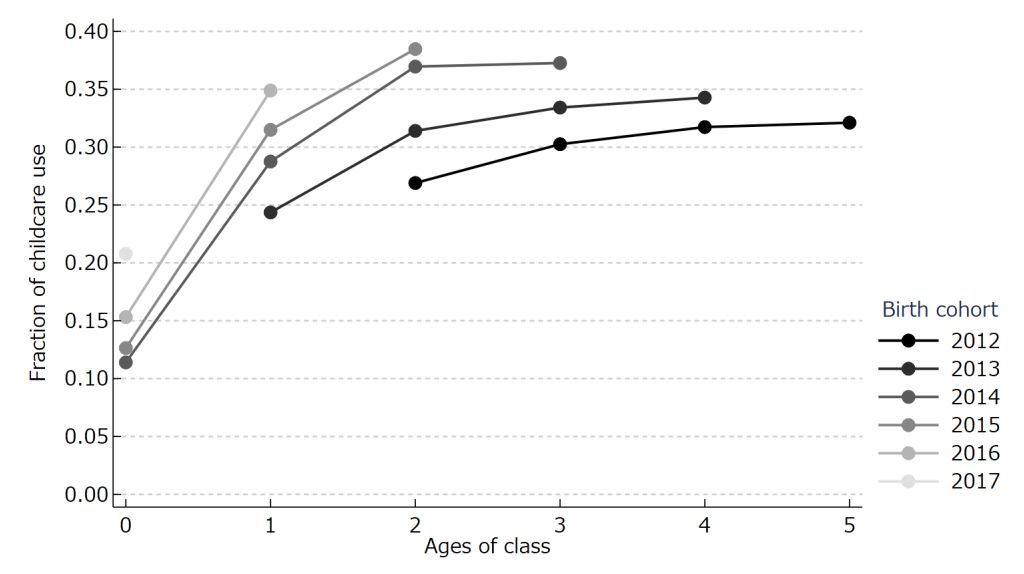
Figure 3: Fraction of Childcare Use by Birth Cohorts

Note: This figure shows the percentage of childcare use at each age for each birth year cohort.

with administrative information on the use of accredited childcare centers. The available information includes the indicator of users, and for users, the actual fee category determined by the city office. In the online appendix, we compare the actual fee category determined by the city office and the calculated fee category based on the tax records. We confirm that, based on the tax record, the actual fee category is successfully retrieved for 98.7 percent of the households using the accredited childcare centers.[12]

Figure 3 illustrates the percentage of children enrolled to accredited childcare centers for each birth year cohort. The figure shows that 30-40 percent of children in this city use childcare centers, and when they do, most households start using childcare centers between the ages of 0 and 2. In addition, the percentage of children using childcare centers is higher for children born more recently, confirming that the demand for childcare is increasing and the capacity of accredited childcare centers is also increasing in this city, as pointed out in previous studies (Asai et al., 2015; Fukai, 2017; Nishitateno and Shikata, 2017).

Table 3 presents the descriptive statistics of our analysis sample; the means of each variable listed for the 2016 and 2017 data. The number of children shows that many households have

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[12]Online Appendix Table A1 shows the cross-tabulation of actual and calculated fee categories. Within each category, admittedly, the errors are concentrated near the thresholds because small differences matter more. However, as shown in Online Appendix Figure A1, they are quantitatively negligible even near the thresholds.

Table 3: Summary Statistics

	Year	
	2016	2017
Number of children in the household	1.76	1.77
	[0.75]	[0.75]
Number of individuals in the household	3.75	3.78
	[0.81]	[0.79]
Age of father	37.38	37.50
	[5.52]	[5.53]
Age of mother	35.55	35.69
	[4.81]	[4.86]
Household salary income (10k JPY)	770.00	782.16
	[447.70]	[448.83]
Father's salary income (10k JPY)	651.02	651.92
	[388.94]	[388.85]
Mother's salary income (10k JPY)	118.98	130.24
	[198.79]	[204.62]
Maternal labor force participation rate	0.54	0.57
	[0.50]	[0.50]
Percentage of childcare use	0.26	0.31
	[0.44]	[0.46]
Percentage of childcare use in the last year	0.21	0.25
	[0.41]	[0.43]
Number of households	41,241	41,018

Note: This table shows the descriptive statistics in our sample for analysis constructed in row 9 of Table 2, showing the mean and standard deviation of each variable for 2017 and 2018. The standard deviations are shown in brackets. Note that the majority of households in 2017 and 2018 are the same households. Most households have data available for both 2017 and 2018, 34,289 out of 47,970 households in row 9 of Table 2; 6,952 households have data available only for 2016, and 6,729 households have data available only for 2017. Adding these numbers together, we identify 47,970 unique households.

two children, with a mean of about 1.8. The average ages of fathers and mothers are 37-38 and 35-36, respectively. According to the Vital Statistics in 2018 (Ministry of Health, Labour and Welfare, MHLW), the average mother's age at first birth in Japan is 30.7 years old. The parents' average age tends to be a little high in our sample, but it is reasonable, considering that many of the households surveyed have two children. We can also see that the household's salary income is about 7.7-7.8 million yen, with just over 80 percent of it earned by the father[13]. The employment rate of mothers is just under 60 percent. According to the 2015 National Survey on Living Standards (MHLW) results, mothers' employment rate in households with preschool children in Japan is around 60 percent. This suggests that the city we studied is close to the average employment rate of mothers in Japan. The percentage of households using childcare centers is increased from 21 percent in 2015 to 31 percent in 2017.

We next investigate the distribution of the city income tax of both parents, the determinant of the childcare fee. Figure 4 illustrates the distribution of the city income tax in 2015, which determines childcare fee in April 2017. The dotted vertical lines indicate the thresholds between the childcare fee categories. The smooth distribution of city income tax without any distortion at the thresholds implies no manipulation of income on the basis of childcare fees.[14] Also, the range of the applicable income bracket for each childcare fee category is different, and the number of households in each category is different accordingly.

We finally check the averages of the main outcome variables: the calculated care fees,[15] the use of childcare centers, maternal employment, and household salary income by the calculated childcare fee categories. Figure 5 shows the average value of each outcome for each category of childcare fees defined by the city income tax imposed on both parents. The size of each circle indicates the number of households included in the category. Panel (a) confirms that the higher the childcare fee category, as defined, the higher the calculated childcare fee charged to the household if all preschool children in the household were to use the accredited child-care centers. Looking at the use of childcare centers (Panel (b)), there seems to be a U-shaped relationship between the childcare fee and the percentage of households using childcare cen-

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[13]Salary income does not necessarily provide a sufficient measure of total household income, but for reasons of data availability we use labor income as a proxy.

[14]We checked for the presence of income manipulation and confirmed the absence of income manipulation using the method proposed by McCrary (2008). Those results are available upon request.

[15]Here we use the fee calculated based on the tax record, because the actual fee category determined by the city office is not available for households not using the accredited childcare centers.
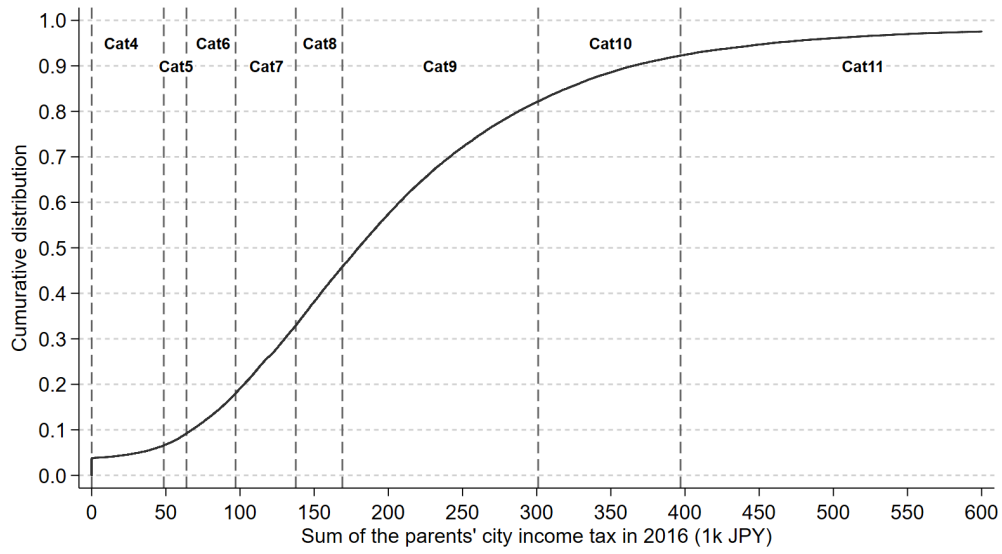
Figure 4: Cumulative Distribution of Sum of the Parents' Part of City Resident Tax Proportional to Taxable Income

Note: The figure shows the cumulative distribution function of the sum of city income tax of both parents, where "Cat" is an abbreviation for category, corresponding to the categories shown in Figure 1.

ters, except for the highest category. The drop at the highest fee category is probably due to the substitution to other childcare options, as they have to pay almost as much for accredited childcare centers as for high-quality private options. As expected from the use of childcare centers, the employment rate of mothers is also U-shaped: low in the middle and high in the lower and higher childcare fee categories (Panel (c)). Lastly and not surprisingly, the higher the childcare fee categories, the higher the household salary income (Panel (d)). As can be seen, some outcomes have systematically related to childcare fee categories, indicating that simple comparisons between categories are insufficient and the RDD analysis is necessary.

4.2   Empirical Model: Regression Discontinuity Design (RDD)

Our goal is to examine the impact of childcare fees on the use of childcare centers, household income, and maternal employment. A naive way would be to compare outcomes in groups with high and low childcare fees, using the variation in the tiered childcare fees. However, as shown in Figure 5, household income and other factors are correlated strongly. Hence, a simple comparison of households belonging to each childcare fee category cannot identify the causal effect of childcare fees.

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Figure 5: Sample Mean by the Childcare Fee Category

(a) Childcare fee

(b) Fraction of childcare use

(c) Maternal employment rate

(d) Household salary income
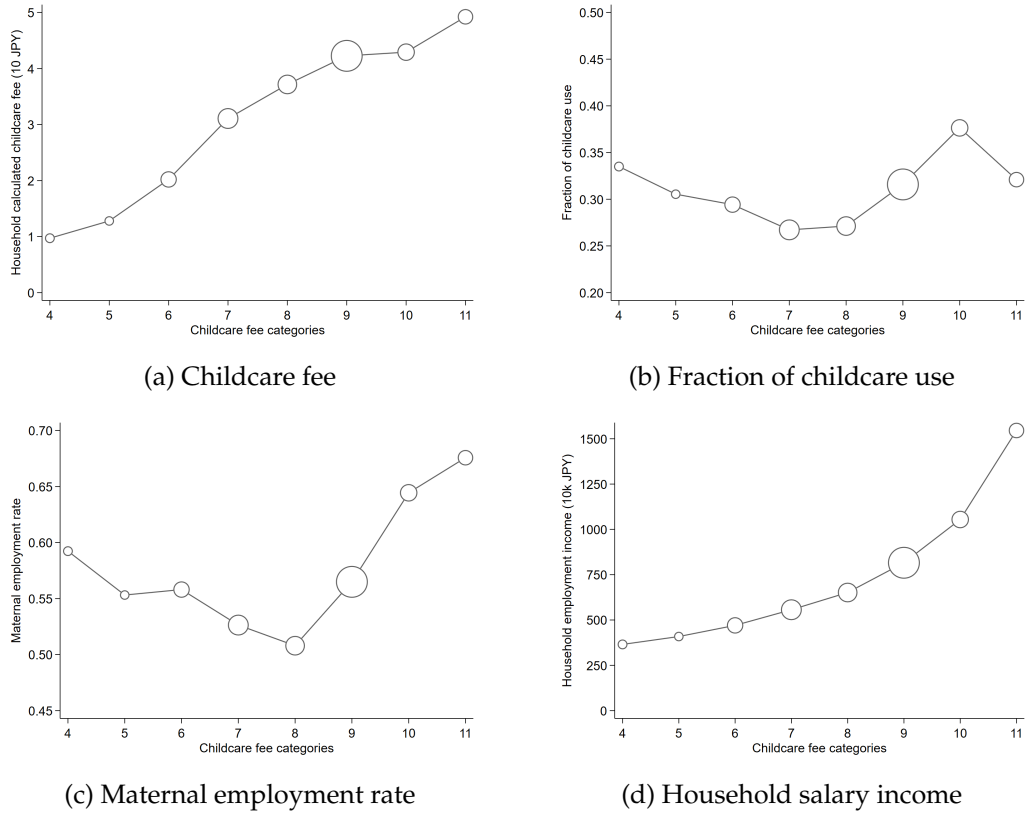
Note: This figure plots the mean value of each variable by the childcare fee category shown in Figure 1. The panel (a) shows the monthly fee of childcare, (b) the percentage of childcare centers used, (c) the employment rate of the mother, and (d) the annual salary income of the household, and . The size of each point indicates the number of households included in that category. The running variable, the horizontal axis, is the sum of city income tax imposed to the parents which is normalized to zero at the cutoffs of childcare fee category.

We therefore employ the regression discontinuity design, focusing on households who are around the income thresholds that determine the childcare fee categories. The discontinuity we exploit here is that the amount of the childcare fee is a staircase depending on the amount of the city resident tax, as shown in Figure 1. Assuming that households do not adjust their taxable income along with the childcare fee brackets, the effect of childcare fees can be identified by comparing those who happen to be below the threshold and have low childcare fees with those who happen to be above the threshold and have high fees. The key condition here is that households do not manipulate their income so that they do not exceed the threshold for the childcare fee. As shown in Figure 4, there is no distortion in the distribution of the amount of city income tax, thus it is reasonable to assume that such an adjustment has not occurred.

We use a sharp RDD to estimate the effect of the childcare fee on the use of childcare centers, household income, and mothers' employment. Specifically, we estimate the following equation:[16]

$$y_i = \beta_0 + \beta_1 1[t_i \geq c] + 1[t_i \geq c]f_l(t_i - c) + 1[t_i < c]f_r(c - t_i) + X_i'\gamma + u_i, \qquad (1)$$

where subscript i indicates household, c is the threshold of the city income tax between the childcare fee categories, t_i is the sum of city income tax imposed to the parents in household i, f_l and f_r are unknown smooth functions approximated by the local linear regression which is robust to trends away from the threshold. We also controlled for age of father and mother, and year fixed effects, which are included in X. β_1 is the RDD estimate of the treatment effect of childcare fee on outcome variables denoted by y: the calculated childcare fees charged to the household if all children were to use the accredited childcare centers[17], an indicator of the use of childcare centers, mother's employment as defined by whether or not they have a positive salary income, and household pretax salary income.

# 5   Empirical Findings

5.1   Main Results

To begin with, we graphically examine the differences in outcome variables around the threshold of the childcare fee category. Figure 6 shows the four outcomes around the threshold, combining all the childcare fee categories and standardizing the threshold to zero. Each point represents the mean value included in each bin. First, Panel (a) confirms a significant jump in the childcare fee at the threshold. The average gap is about 5,000 yen per month between the households below and above the threshold. On the other hand, Panels (b)-(d) show no clear difference in the use of childcare centers, mother's employment, or household salary income. Given the relatively small variances of the outcome variables around the threshold, we interpret that the childcare fee has no effect on the use of childcare centers, maternal employment, or household salary income

We next estimate equation (1) to provide a more rigorous estimate of the effect of childcare

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[16]See Calonico et al. (2017) for details on the implementation of RDD.

[17]This variable is examined to check whether our identification strategy is working well.

Figure 6: Graphical Evidence: RD Plot of Each Variable

(a) Childcare fee

(b) Fraction of childcare use

(c) Maternal employment rate

(d) Household salary income
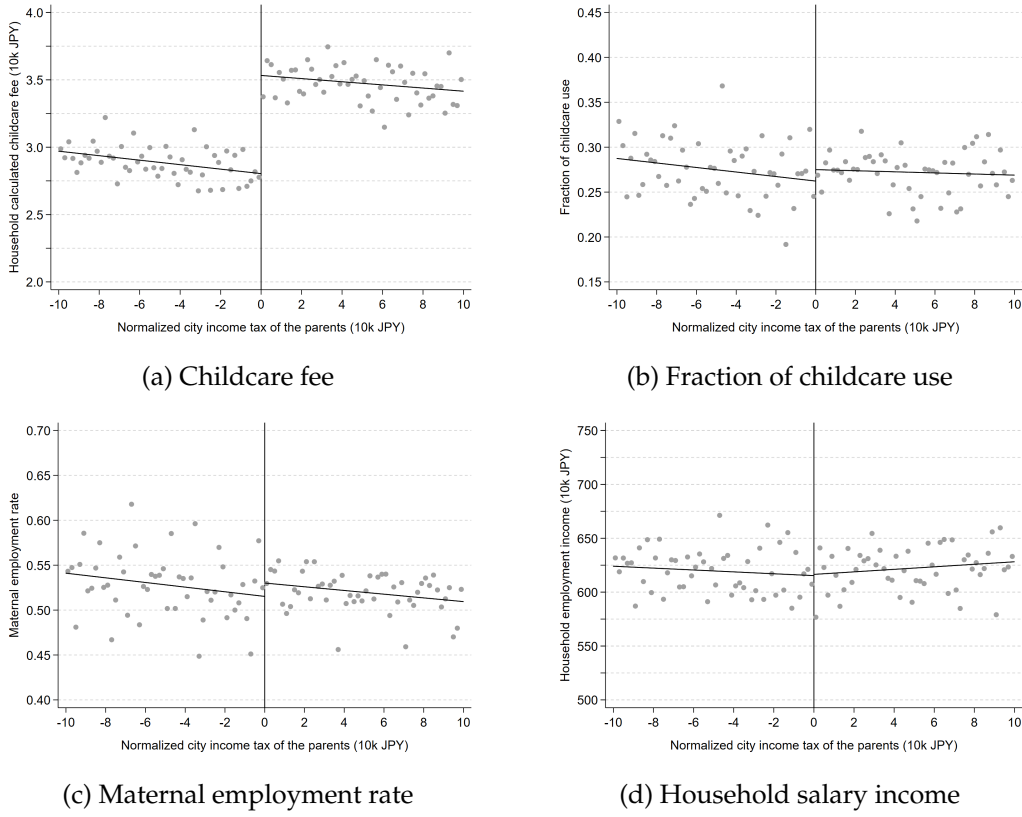
Note: This figure compares each variable before and after the threshold at which the childcare fee category changes. All of the childcare fee categories shown in Figure 1 are combined, and 100,000 yen before and after the threshold is shown in the figure. The panel (a) shows the monthly fee of childcare, (b) the percentage of childcare centers used, (c) the employment rate of the mother, and (d) the annual salary income of the household

fees. We estimate equation (1) separately for each category of childcare fees to capture heterogeneity by the level of childcare fees, which is strongly correlated with household income as seen in Panel (d) of Figure 5.

Figure 7 shows the RDD estimates (β_1 in the equation 1) for childcare fees, use of childcare centers, household income and maternal employment, respectively. Panel (a) confirms jumps in childcare fees around the threshold. The difference in childcare fees at each threshold is consistent with the changes shown in Figure 1, which assures us that our data and estimates are in the right place. In contrast, the estimated coefficients of the discontinuity in the use of child care centers, maternal employment, and household income are statistically insignificant at the 5 percent level for most cases, and there is no systematic pattern across the categories.[18]

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[18]The only exception is the positive effect on household income at the threshold between classes 9 and 10, where

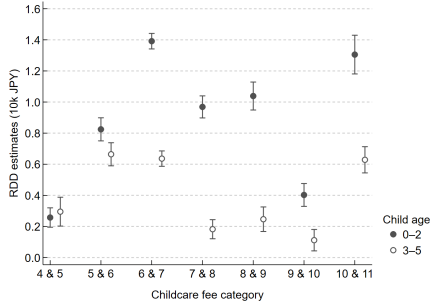Figure 7: RDD Estimates by Childcare Fee Category
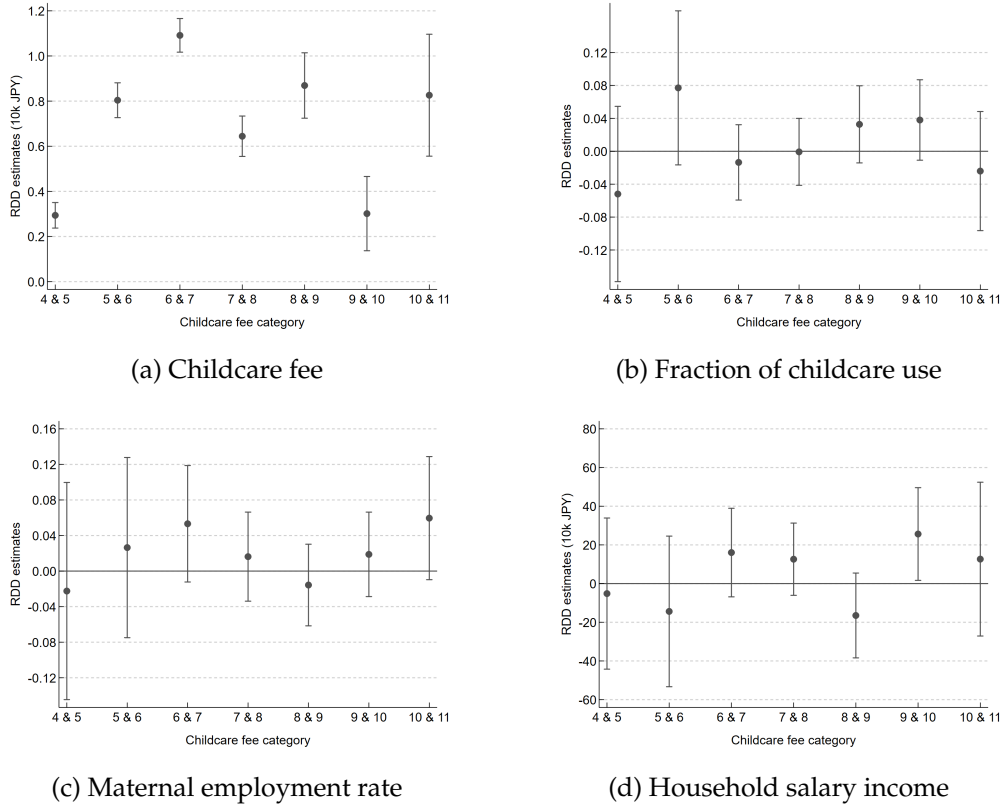
(a) Childcare fee

(b) Fraction of childcare use

(c) Maternal employment rate

(d) Household salary income

Note: This figure shows the coefficient values and 95% confidence intervals for the RDD estimates for each variable. The RDD estimates are done for each of the childcare fee categories shown in Figure 1, with the optimal bandwidth developed by Calonico et al. (2020). Standard errors are clustered by household.

In particular, no statistically significant jump is observed at the threshold between categories 6 and 7, where the monthly childcare fee changes by about 10,000 yen.

5.2   Subsample Analysis

While the pooled analysis of all households do not reveal any discernible effects, the effects of childcare fees may be heterogeneous across households. To explore potential heterogeneity, we divide the sample by the age of the youngest child, the use of childcare centers in the previous year, and the number of children. As shown in Figure 1, the jumps on the fee schedule are larger for infants aged 0-2 than for toddlers aged 3-5. Also, households that used the childcare centers in the previous year may have different information than those who did not. Furthermore, the
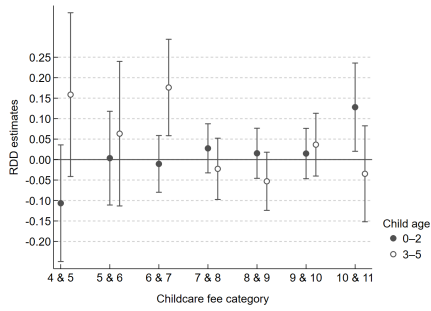
the jump in the fee is rather small.

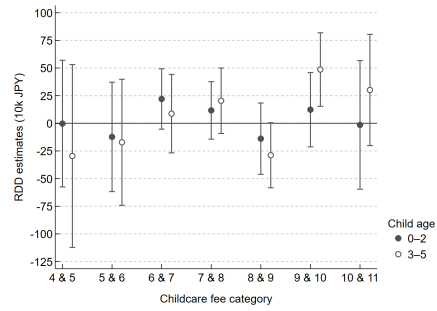Figure 8: RDD Estimates by Age of Youngest Child

(a) Childcare fee
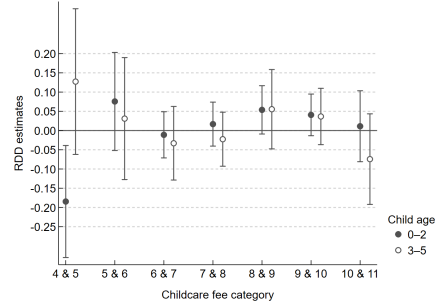
(b) Fraction of childcare use

(c) Maternal employment rate

(d) Household salary income

Note: This figure shows the coefficient values and 95% confidence intervals for the RDD estimates for each variable. The RDD estimates are done for each of the childcare fee categories shown in Figure 1, with the optimal bandwidth developed by Calonico et al. (2020). Standard errors are clustered by household. Of the total 74,044 observations, $N = 38,032$ for the youngest child aged 0-2 years, and $N = 36,012$ for the youngest child aged 3-5 years.

first child parent may not have as much knowledge as parents with multiple children in terms of childcare fees. To take these points into account, we will examine the effects of childcare fees by dividing the sample.

First, we divide the sample by the age of the youngest child in the household. As mentioned above, the changes in the childcare fee between the fee categories are larger for infants aged 0-2 than for toddlers aged 3-5. Also, as summarized in Figure 2, most mothers who continue the same full-time job after childbirth return from the maternity leave when the child is younger than 2. Figure 3 confirms that the enrollment rate of each cohort does not increase much from age 3. Furthermore, toddlers aged 3-5 also have an option to go to kindergarten, whose fees are set differently. Thus, if the childcare fees have any effects, the effects should be stronger for infants aged 0-2.

Figure 8 presents the results. Panel (a) confirms the larger jumps in the childcare fees for age 0-2. In contrast, the estimated effects on childcare use shown in Panel (b) are statistically insignificant for all thresholds except for the threshold between class 4 and 5 for age 0-2, where the jump in the fee is relatively small. Furthermore, Panel (c) shows mostly insignificant and occasionally *positive* effects on maternal employment rate, despite the theoretical prediction of a *negative* effect on maternal labor supply at the extensive margin. Lastly, Panel (d) shows that the effect on household salary income is marginally positive for age 3-5 at the threshold between 9-10, but the jump in the fee at this threshold is rather small. Overall, the few significant jumps are at thresholds with relatively small jumps in the fees and often of the opposite direction; therefore we interpret them as consequences of some random noises.

Second, we divide the sample by whether or not the household had used a child- care center in the previous year, because the effect of fees on the decision to start using a childcare center may be different from the effect on the decision to continue using it. Since mothers who use the childcare in the previous year are likely to be already employed, their labor supply response is whether to continue or quit the job. Given the rigidity of the labor market in Japan, many would hesitate to quit for a few thousand yen per month. Also, the relationships built with the childcare staff add a non-pecuniary cost of switching to other childcare options. Hence we expect that those who are considering to start using the childcare are more sensitive to the fee than incumbents considering to continue using.

Motivated by these hypotheses, Figure 9 presents the subsample analysis by whether or not the household had used a childcare center in the previous year. However, it also shows no systematic patterns between the two groups. Like the results by the age of the youngest child shown in Figure 8, there are a few marginally significant coefficients reported in Figure 9, but they are not necessarily in consistent sign with the theoretical predictions.

We also conducted the following subsample analyses in the Online Appendix. Since households with more than one children may have better knowledge on childcare fees, we divided the sample by the number of children (Figure A2). Further, we interacted it with the age of youngest children (Figure A4). Motivated by the informal care potentially provided by grandparents, we limited the sample to nuclear households (Figure A3).[19] None of them show any discernible differences from the main sample, and most of the estimates for the effect on child-

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[19]The sample size of three-generation households was not large enough for RDD.

Figure 9: RDD Estimates by Childcare Status of the Previous Year
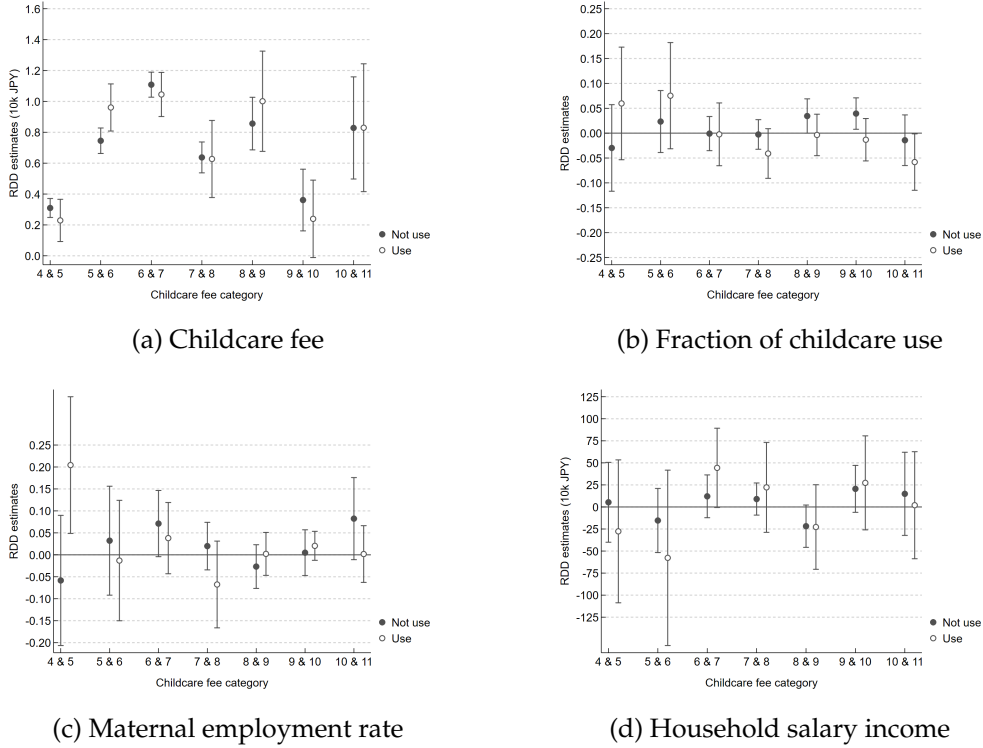
(a) Childcare fee

(b) Fraction of childcare use

(c) Maternal employment rate

(d) Household salary income

Note: This figure shows the coefficient values and 95% confidence intervals for the RDD estimates for each variable. The RDD estimates are done for each of the childcare fee categories shown in Figure 1, with the optimal bandwidth developed by Calonico et al. (2020). Standard errors are clustered by household. Of the total 74,044 observations, $N = 53,151$ did not use an accredited childcare center in the previous year and $N = 20,893$ did use an accredited childcare center in the previous year.

care use, maternal employment and household salary income are statistically insignificant.

Overall, we conclude that there is no significant impact of childcare fees on the use of childcare centers, household salary income, or maternal employment. The next section discusses the potential reasons for the lack of significant effects.

6   Discussion: Why No Effect?

Despite the clear discontinuity in the fee schedule, we do not observe any systematic response of childcare use or maternal labor supply. The effect on the household income is also insignificant for the most case, though occasionally marginally positive. We also observe no systematic pattern across subsamples.

Table 4: Answers to the Question "When you file the application to the accredited childcare center for the first time for this child, did you know the fee?"

1) I knew the fee accurately	43.8%
2) I tried but could not understand the fee	24.7%
3) I thought I knew the fee but it turned out wrong	6.6%
4) I did not care.	24.9%

Note: This table summarizes the answer to the Question "When you file the application to the accredited childcare center for the first time for this child, did you know the fee?" in a supplemental survey for parents of children enrolled to accredited childcare centers operated by the city in December 2020.

One potential reason of the lack of significant effect is the lack of correct knowledge about the fee among the applicants. That is, if some applicants do not understand which side of the threshold they are on, they cannot respond accordingly. To explore this possibility, we conducted a supplemental survey for parents of children enrolled to accredited childcare centers operated by the city in December 2020.[20] The unit of observation is child (not household), and among 6477 children, we received 1,408 responses from web and 1,280 by mail (response rate=41.5%).

We asked whether the respondent knew the childcare fee charged in April of the first year of enrollment when they filed the application in December of the previous year. Table 4 summarizes the answers. 43.8% answered that they knew the fee correctly at the time of application. This ratio is within the range of 40-50% for subsamples defined by the age at entry, birth order, or current age (except for 52% for current age 0 cohort). It is hard to tell whether this is large enough for the RDD to detect any discernible changes. Furthermore, we cannot rule out the possibility that those who answered "3" are concentrated around the thresholds. Yet, 43.8% is too large to claim that few applicants understood their correct fee. Thus, we tentatively conclude that the lack of correct knowledge of the fee may have attenuated the estimated effects substantially, but not entirely.

Another possibility is that households did not respond to temporary fluctuations in the fee because enrollment in the corresponding year would ensure slots in the subsequent years. As explained in Section 3, the demand for accredited childcare centers exceeds the supply capac-

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[20] Admittedly, the users of publicly operated accredited childcare centers are not a random sample of all users of the accredited childcare centers in this city, the targeted population covers about 30% of all users in the accredited childcare centers in this city.

ity in this city, and 20 percent of the new applications are declined.[21] But children who are already enrolled to an accredited childcare center can stay in the same center as long as the household satisfies the eligibility criteria (e.g. both parents are working full-time). Thus, if the households started to use the childcare center at age 0, this implicitly assures the slots for the coming five years. This is particularly valuable for regular employees who took maternity leave, because they cannot return to the job without finding a slot in childcare services, and once they lose their job it is very difficult for women with young children to find another regular job in Japan. In contrast to such implicit long-term value of enrollment at younger age, the fee is renewed every year. Furthermore, the fee is more likely to change in the next year for households closer to the threshold. Although this is just a speculation without direct evidence, such dynamic consideration may make households unresponsive to the fee change around the category thresholds.

These two potential reasons can also explain why our results are different from earlier studies in Japan (Oishi (2002); Zhou and Oishi (2005); Shimizutani and Noguchi (2004)), which typically conclude that the demand for childcare in Japan is price elastic. First, in studies using contingent valuation method (Zhou and Oishi (2005); Shimizutani and Noguchi (2004)), by construction of the survey, respondents explicitly know the price when they make decisions. Also, since the question is virtual, it is unlikely that many respondents consider the possibility to get a slot in the subsequent years.

Oishi (2002)'s settings are closer to this paper. She uses the actual data of childcare use and employment and the childcare fee is estimated based on the taxable income and the prefecture of residence. Thus it is possible that some in the sample do not understand the actual fee, although the errors may be larger for our sample around the threshold. However, the composition of the sample is quite different. First, mothers' earnings are much higher in our sample, reflecting the increase in women who continue working full-time after childbirth in the two decades.[22] Also, about one-third of Oishi (2002)'s sample were family workers in self-

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[21]Note that the excess demand itself cannot explain the lack of effects in our empirical framework. The RDD assumption implies the distribution of willingness to pay for childcare does not discontinuously change at the thresholds, thus the fraction of households whose willingness to pay is lower than the fee should jump with the fee. Since the acceptance rate does not jump at the thresholds either, the fraction of households who use childcare centers mus be proportional to the fraction of households whose willingness to pay is lower than the fee.

[22]The mean (median) of earnings of mothers who use the accredited childcare centers was 1,450,000 yen (800,000 yen) and 2,464,900 yen (2,101,200 yen) in Basic Survey on People's Life 1998 and our sample, respectively. Only 36.5% of Oishi (2002)'s sample were imposed social security premiums (likely to be regular employees), while 63.3% of our sample earn more than 1,300,000 yen.

employed households, while 90% of our sample are salaried workers. Furthermore, informal care by grandparents was a widely used outside option in 1998, but it is no longer available for the majority of our sample.[23] Thus, the value of securing the slots in subsequent years are likely to be much larger for our sample than Oishi (2002)'s. That is, the second reason is much more relevant for our sample.

The above two potential reasons may also explain the difference from studies in the United States and Canada (Morrissey (2016); Baker et al. (2008); Lefebvre and Merrigan (2008)). In addition, substantial differences in institutional settings also affect the results. For example, in many of the US studies summarized in Morrissey (2016), the childcare fees are per hour, thus parents may use the care part-time, while the accredited childcare centers in Japan is available only full-time with fixed monthly fee. The daycare center in Quebec studied by Baker et al. (2008); Lefebvre and Merrigan (2008) do not require employment of parents.

7   Conclusion

We have shown that a change in the fee of accredited childcare centers does not make households change their use of the childcare centers or labor supply significantly. We exploit the discontinuous jump in the fee by the city income tax as the source of identification. Despite the substantial changes in the childcare fee charged to the households, our RDD estimates show no discernible effects on the use of accredited childcare centers, household salary income, or mother's employment for the pooled sample and subsamples defined by the age of the youngest child and the use of childcare centers in the previous year.

Our results are different from the existing studies in Japan (Oishi (2002), Zhou and Oishi (2005), Shimizutani and Noguchi (2004)), which typically conclude that the demand for childcare is price elastic and the higher childcare cost decreases maternal employment. Part of this difference may be attributed to the actual change in the society: more women continue working fulltime after the childbearing now than the later 1990s or early 2000s, when these studies were conducted. The composition of women who continue to work has also changed, and the gender-related social norm has also changed.

Another possibility is that the difference comes from the difference in methodology. Our

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[23] According to the Basic Survey on People's Life 1998, about 30% of infants under age 2 whose mothers were working were primarily taken care of by their grandparents. But the same figure decreased to 8% in 2019 survey.

RDD estimates are interpreted as the causal effect of the fee increase caused by exceeding the threshold. If applicants near a threshold do not know which side of the threshold they are, they do not respond, but this does not necessarily mean that they would not respond to price changes that are recognized more easily. Although our supplemental survey shows that nearly half of the applicants knew the fee correctly, we cannot rule out the possibility that those near the thresholds are less likely to have known the correct fee than those in the middle of the fee categories.

Also, the fee is renewed every year, while most children are enrolled to childcare centers for 4-6 years. Recall that about 20 percent of the new applicants are declined in this city. Since children already enrolled to an accredited childcare centers can stay in the same center as long as their parents satisfy the qualification, households concerned with future risk of being wait-listed may not respond to the temporary fluctuations in the fee. This does not necessarily imply the demand inelasticity to permanent price changes.

Hence, we should not generalize our results too much, although it might be tempting to conclude that the demand for childcare services is price inelastic. Rather, the lack of responses in our empirical framework implies that the households' decision-making is more dynamic and complicated than the one-shot decision on childcare use and labor supply. It also suggests a vicious cycle in that the limited capacity makes some households start using the childcare earlier than they actually need for fear of losing the slots in subsequent years, generating further excess demand.

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Appendix

A Supplementary Figures and Tables

Table A1: Comparison of Actual and Calculated Childcare Fee Categories

		Calculated fee categories									
		1 − 3	4	5	6	7	8	9	10	11	Total
	1 − 3	816	7	2	11	10	1	3	1	2	853
	4	12	701	18	17	1	1	0	0	0	750
	5	7	2	536	10	1	0	0	0	0	556
	6	6	3	3	1,845	7	0	1	1	0	1,866
Actual fee categories	7	4	2	0	3	2,897	8	5	0	1	2,920
	8	10	0	0	1	6	2,530	22	1	0	2,570
	9	6	3	0	4	5	14	8,175	4	0	8,211
	10	3	1	1	2	1	2	16	2,479	2	2,507
	11	4	0	0	0	3	0	9	13	1,499	1,528
	Total	868	719	560	1,893	2,931	2,556	8,231	2,499	1,504	21,761

Note: This table compares administrative information on actual childcare fee categories with childcare fee categories calculated from income information for households using childcare centers in our analysis sample.
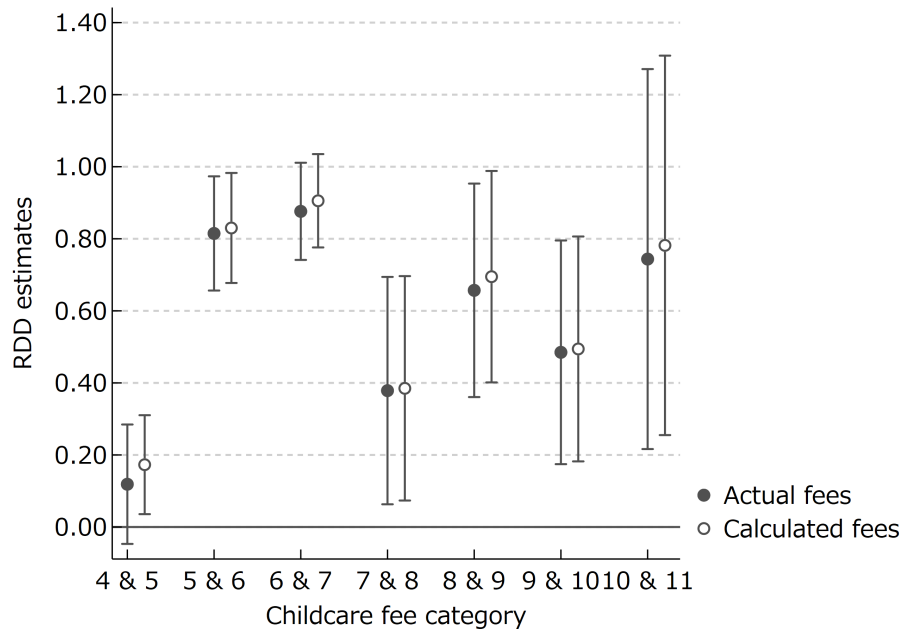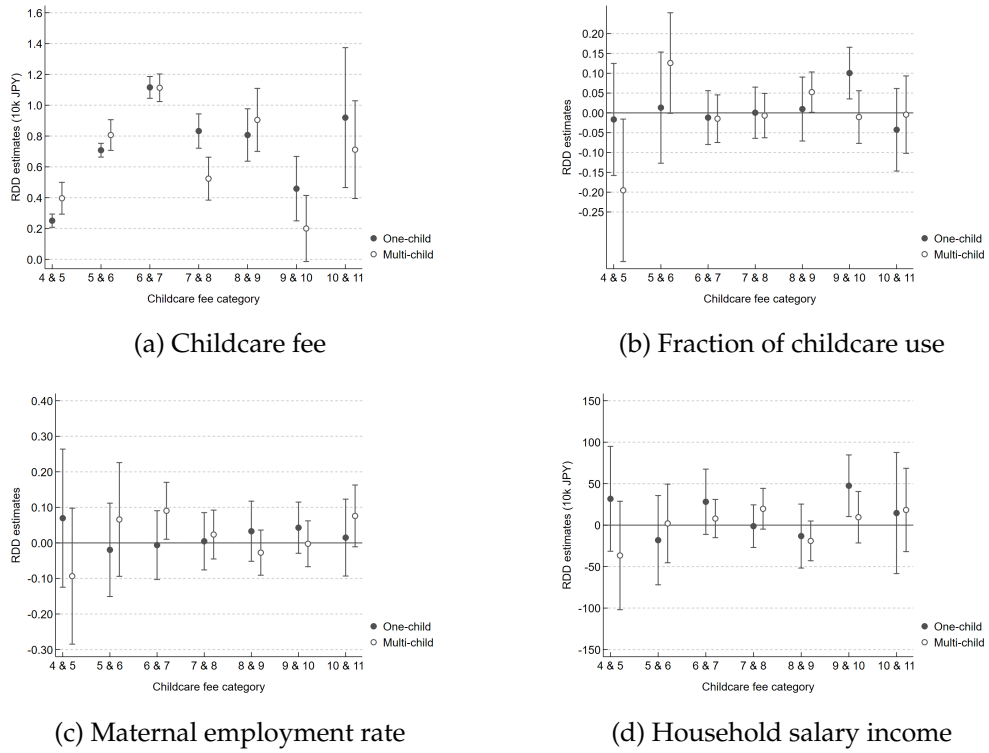
Figure A1: Comparison of Actual and Calculated Childcare Fees

Note: This figure shows the coefficient values and 95% confidence intervals for the RDD estimates for childcare fee. We perform our estimation using childcare fees calculated from the actual childcare fee categories for those who use childcare centers and those calculated from income information, respectively. The RDD estimates are done for each of the childcare fee categories shown in Figure 1, with the optimal bandwidth developed by Calonico et al. (2020). Standard errors are clustered by household.

Figure A2: RDD Estimates by Number of Children

(a) Childcare fee

(b) Fraction of childcare use

(c) Maternal employment rate

(d) Household salary income

Note: This figure shows the coefficient values and 95% confidence intervals for the RDD estimates for each variable. The RDD estimates are done for each of the childcare fee categories shown in Figure 1, with the optimal bandwidth developed by Calonico et al. (2020). Standard errors are clustered by household. Of the total 74,044 observations, $N = 26,963$ for households with one child, and $N = 47,081$ for households with multiple children.

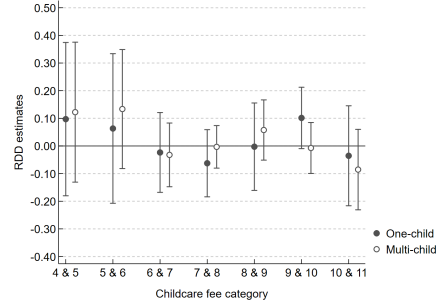Figure A3: RDD Estimates of Nuclear Household
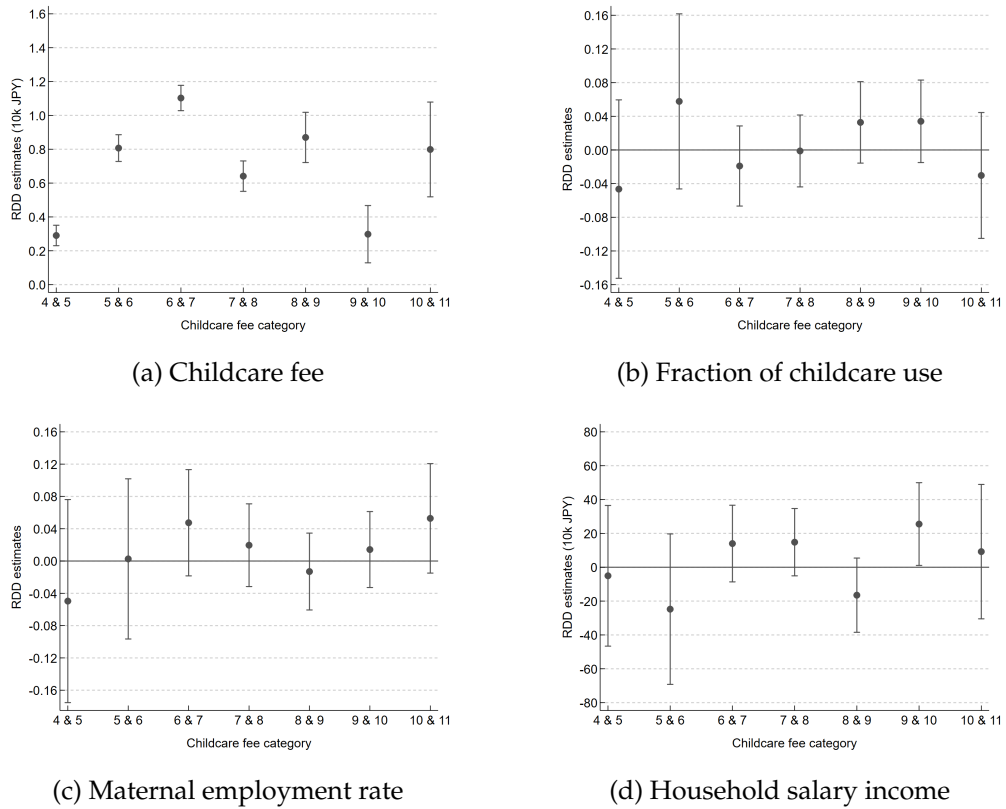
(a) Childcare fee

(b) Fraction of childcare use

(c) Maternal employment rate

(d) Household salary income

Note: This figure shows the coefficient values and 95% confidence intervals for the RDD estimates for each variable. The RDD estimates are done for each of the childcare fee categories shown in Figure 1, with the optimal bandwidth developed by Calonico et al. (2020). Standard errors are clustered by household. Of the total 74,044 observations, 72,453 observations, or 97.9%, were nuclear households.

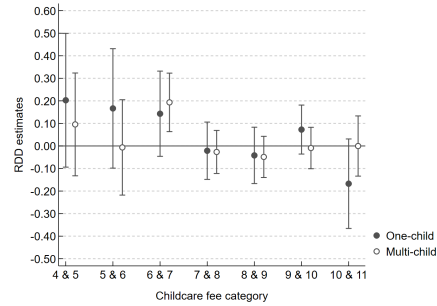Figure A4: RDD Estimates by Number of Children and Age of Youngest Child
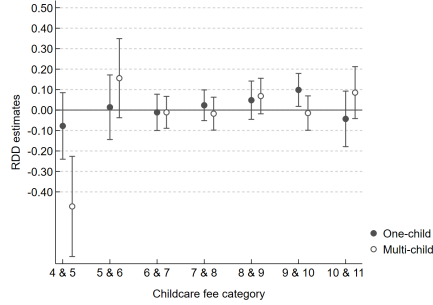
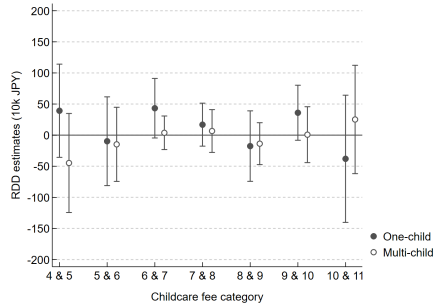(a) Fraction of childcare use: Age 0-2
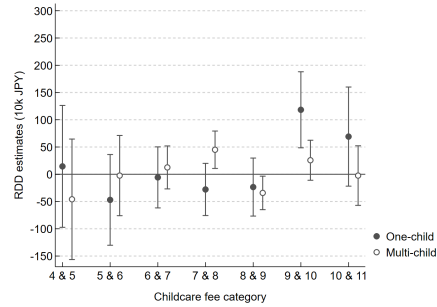
(b) Fraction of childcare use: Age 3-5
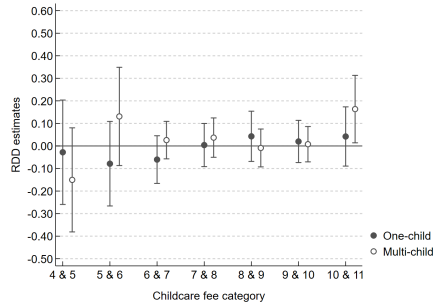
(c) Maternal employment rate: Age 0-2

(d) Maternal employment rate: Age 3-5

(e) Household salary income: Age 0-2

(f) household salary income: Age 3-5

Note: This figure shows the coefficient values and 95% confidence intervals for the RDD estimates for each variable. The RDD estimates are done for each of the childcare fee categories shown in Figure 1, with the optimal bandwidth developed by Calonico et al. (2020). Standard errors are clustered by household. The results of the RDD estimates on childcare fees are not included here because the fees are uniquely determined for each age group when the number of children is one. Of the total 74,044 observations, $N = 14,485$ for the youngest child aged 0-2 years with one child; $N = 23,547$ for the youngest child aged 0-2 years with more than one child; $N = 12,478$ for the youngest child aged 3-5 years with one child; and $N = 23,534$ for the youngest child aged 3-5 years with more than one child.