Access to Formal Childcare for Toddlers and Parental Employment and Earnings*

Taiyo FUKAI† Ayako KONDO§¶

April 18, 2022

PRELIMINARY: PLEASE DO NOT CITE

Abstract

This study examines the effect of availability of accredited childcare centers, the most popular category of publicly-licensed childcare centers in Japan, on mothers' employment and earnings. We focus on mothers with children less than two years old, most of whom are returning from parental leave to full-time work under excess demand for center-based childcare. We construct an instrument from the first-round assignment process of April enrollment and find that the enrollment to an accredited childcare center increases mothers' employment rate by 21.7-25.8 percentage points. The effect of such enrollment on mothers' annual salary income is 1,200,009 JPY for zero-year-old children and 649,134 JPY for one-year-old children.

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

*This research was conducted as a part of the Economic and Social Research Institute (ESRI) research project. We would like to thank the anonymous city that provided the administrative data and allowed us to conduct a supplemental survey, and Hiroshi Nomura from ESRI who helped our negotiation with the city.
†Assistant Professor, Faculty of Humanities and Social Sciences, University of Tsukuba
‡Visiting Senior Researcher, Economic and Social Research Institute, Cabinet Office, Government of Japan
§Professor, Institute of Social Science, the University of Tokyo
¶Visiting Senior Researcher, Economic and Social Research Institute, Cabinet Office, Government of Japan

1 Introduction

Limited access to formal childcare for young children is viewed as one of the major obstacles to gender equality in the labor market. Given that mothers tend to spend disproportionately more time on parenting than fathers, better access to reliable childcare at affordable price is believed to increase female labor supply. Therefore, policy makers have tried to expand publicly subsidized childcare, especially in countries with low labor force participation rate of women with children. However, previous empirical studies find mixed results for the causal effect of increased supply of publicly subsidized childcare, suggesting that the effectiveness of such policy depends on various factors such as the availability of alternative options and the age of child covered by the policy. Given the financial cost to expand childcare subsidy, it is crucial to explore the conditions under which the policy is effective.

This study investigates the effect of enrollment in heavily subsidized center-based care on employment and earnings for mothers having children less than two years old under substantial excess demand for the subsidized care. We exploit the explicit assignment rule of accredited childcare centers, the most popular category of publicly licensed childcare centers in Japan, to identify the causal effect of being accepted for mothers at the borderline. Since most of them are planning to return to full-time work before the legally guaranteed parental leave expires, the availability of affordable full-day care is critical for them to continue their career. Although the enrollment is highly endogenous, administrative data from an urban municipality allows the comparison of applicants whose ex-ante probability of acceptance in the first round of the assignment process is almost equal. Thus, the acceptance in the first round can be used as an instrument for the actual enrollment

Extant literature has examined the effect of better access to formal childcare on maternal labor supply. However, most studies have focused on the expansion of kindergarten for children older than three.[1] This contrasts the growing policy interest in exploring the effectiveness of early childcare provision, as many developed countries have already achieved near universal coverage of pre-school programs for children just below the school entry age. Several recent studies investigating the expansion of public childcare coverage for two or three-year-old children under excess demand for formal childcare typically find a statistically significant positive effect for mothers' employment (Bauernschuster and Schlotter, 2015; Nollenberger and Rodríguez-Planas, 2015; Carta and Rizzica, 2018). Concurrently, they find that the increase in mothers' employment rate

[1]Studies on the extended Kindergarten coverage for five- or four-year-old children in the United States tend to find that the effect on labor supply is insignificant or significant only for single mothers (Cascio, 2009; Fitzpatrick, 2010, 2012). Interestingly, Goux and Maurin (2010) find a similar pattern for two-year-old children in France, suggesting that two-parent families may have better access to alternative options. Havnes and Mogstad (2011) also found that the expansion of subsidized childcare for 3-6 year-old children in Norway did not increase labor supply of mothers, but crowded out of informal care. In contrast, studies on a child care reform in Quebec typically found sizable effects (Baker et al., 2008; Lefebvre and Merrigan, 2008). This reform cover children aged zero to five, but the existing studies have not paid much attention to how the effect varies with child's age.

is substantially smaller than the increase in enrollment rate. Evidence for children younger than two is even scarce. A relevant study by Eckhoff Andresen and Havnes (2019) reports that the increased supply of public childcare for one- and two-year-old children in Norway increased mothers' labor supply significantly. We add evidence for mothers of zero- and one-year old children in Japan.

Focusing on borderline mothers with children less than two years old, this study provides a plausible estimate for the effect of full-day formal care availability after the legally guaranteed parental leave expires. The effect can be different between mothers who return to their previously held jobs and those who start a new job post maternal leave. On the one hand, mothers returning from a parental leave already have a job and are more likely to be employed than those searching for a new job when formal childcare is available. On the other hand, they may try to continue their job even in the absence of the formal care, because quitting the current job may also lower their future earnings. This study contributes to the literature by adding evidence on the first group, while existing studies on mothers of older children are likely to cover the second group.

Furthermore, the present study is different from the existing ones as its research design explicitly focuses on mothers who are affected by a marginal increase in the capacity. The sample is limited to the applicants for accredited childcare centers who were ranked at the same priority score by the city government. Among them, the probability of acceptance is determined by the competition ratio of centers they listed on the application and the previous year's taxable income. Under tolerable assumptions, the acceptance is quasi-random conditional on observed characteristics. We can identify the local average treatment effect for the marginal household who would be newly enrolled to an accredited childcare center when a slot was increased. In contrast, most of the existing studies identify the effect by exploiting either regional differences in the timing of expansion or discontinuity in the eligibility based on birth date of the child. Mothers induced to use childcare as a result of policy change may include those who would not have even considered to join the wait-list before the expansion.

We find that the enrollment to an accredited childcare center significantly increases mothers' employment and salary income, without affecting father's employment and income. Enrollment to an accredited childcare center increases the employment of a mother of a zero- and one- year-old child by 25.4 percentage point and 21.8 percentage point, respectively. Given that more than 90% of mothers of enrolled children are employed, this estimate should be interpreted as the fraction of mothers who resign because they cannot use accredited childcare centers. While the effect is substantial, it also implies that the remaining 75% manage to work using other childcare options.

The average effect on mothers' annual salary income is 1,172,160JPY (10,465USD) for a zero-year-old and

620,560JPY (5,541USD) for one-year-old.[2] The effect on the salary income of mothers of zero-year-old is almost equal to the decline in employment times average income before birth. The effect on salary income of mothers of one-year-old is smaller than predicted from the decline in employment. This suggests that women with lower potential earnings tend to resign when their application were declined at the first round (i.e., compliers to the instrument).

Further, the estimated effects from the IV model are close to those from simple OLS regressions with the same set of control variables. Since the take-up rate of applicants accepted in the first round is extremely high, labor force attachment and earnings capacity are not correlated with the probability to receive a slot in the post adjustment process after being declined in the first round. In contrast, controlling for past income and the priority score used in the assignment process substantially changes the estimated coefficients in the simple OLS regressions, suggesting the importance of endogenous selection in childcare use.

Compared to the existing studies in Europe, our estimates are on the larger side. There are two reasons for this. The first reason is substantial excess demand for accredited childcare centers. Extant research in Europe shows that expansion of programs with substantial excess demand, such as ECC in Germany and public childcare in Norway before 2002 reform, also had a significant positive effect on maternal employment (Bauernschuster and Schlotter, 2015; Eckhoff Andresen and Havnes, 2019). In contrast, Kleven et al. (2020) find that large expansion of nursery care in Austria did not increase maternal employment. Although Kleven et al. (2020) do not emphasize this, the supply of nursery care after expansion seems to have exceeded the demand.

The second reason is limited availability of alternative care. Studies that find negligible effects of childcare expansion on maternal employment tend to find crowding out of alternative care (Kleven et al., 2020; Goux and Maurin, 2010). The availability of informal care by grandparents and relatives is limited in urban areas in Japan, because most households are nuclear families, and many grandparents are still working. The market for other kinds of paid childcare services is thin because the accredited childcare centers are so attractive.

The rationing rule of accredited childcare centers give priority to mothers with full-time jobs. This may also affect the effect. On the one hand, as shown by Guner et al. (2020), child-related transfers conditional on market work should increase female labor supply substantially, whereas child-credit unrelated to market work should decrease it. Existing studies often finds that enrollment rate after expansion exceeds maternal employment rate (Kleven et al., 2020; Nollenberger and Rodríguez-Planas, 2015; Goux and Maurin, 2010). This cannot happen in Japan because both parents must work to be eligible for accredited childcare centers. On the other hand, the rationing rule makes it difficult for unemployed mothers to get a slot. In contrast, the

[2]Calculated based on 1USD=112JPY, the average exchange rate in 2017.

large expansions studied in the extant research induce some mothers to start searching for a new job.

Earlier studies using Japanese data also exploit the regional differences in the capacity per population of pre-school children. Nishitateno and Shikata (2017) find that, during the period between 2000 and 2010, the improvement in daycare accessibility increased maternal employment. However, the increase in enrollment to accredited childcare centers substantially exceeds the increase in maternal employment, suggesting crowding out of other options such as kindergartens.[3] Yamaguchi et al. (2018) show that the effect is heterogeneous and negatively correlated with the tendency to use childcare. According to their estimates, the treatment effect is stronger for those having smaller chance to enroll under the current rationing rule. Although the estimates of the present study are not directly comparable to the aforementioned studies, the current estimates can be viewed as a lower bound of the effect of increased childcare capacity on maternal employment in Japan, if the same pattern holds in an urban area and for children younger than two.

The remainder of the paper is organized as follows. Section 2 describes institutional background such as assignment process of accredited childcare centers. Section 3 explains the identification strategy, which is threefold depending on data availability. Section 4 describes currently available data and Section 5 presents OLS and IV results. Section 6 presents the preliminary conclusion.

2 Institutional Background

This study investigates the application process of accredited childcare centers in an anonymous large city in Kanto region, Japan. Accredited childcare centers are the most popular category of publicly licensed childcare centers in Japan, which account for approximately 90 percent of the center-based services in Japan. Accredited childcare centers must meet certain operational requirements and provide full-day care for preschool children. These centers are relatively inexpensive but high quality from the viewpoint of users owing to the strict regulations and substantial government subsidies. Thus, they are preferred to other center-based childcare options by most parents.[4]

[3]There are two separate pre-school system in Japan. One is daycare centers for children whose parents are working or unavailable for some other reasons, and the other is kindergartens as educational institution. Kindergartens are an important option for three- to six-year-old children but irrelevant for children younger than two. See Nishitateno and Shikata (2017) and Yamaguchi et al. (2018) for more details. Informal care provided by grandparents used to be popular alternative in Japan. Asai et al. (2015, 2016) show that the effect of childcare expansion in the 1990s was offset by the crowding out of informal care by grandparents. 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, and according to the Labour Force Survey, the labor force participation rate of women aged 65-69 rose from 26.5% to 39.0% during the same period.

[4]The fee schedule of accredited childcare centers is set by the municipality government. In most municipalities, including our study site, the fee is increased due to the municipality resident tax imposed on the parents or households, reflecting the ability-to-pay principle. Even for households in the highest bracket, the fee is cheaper than other options.

Allocation of the vacant slots in accredited childcare centers is centralized at the municipality level and managed by the local governments. Similar to other large cities in Japan, the demand for accredited childcare centers exceeds the supply capacity in the city under study. Thus, it is difficult to find a vacant slot in months other than April, when all six-year-old children leave childcare centers to enter elementary schools. Further, most slots for children aged two and older are filled by incumbent children who continue to be enrolled from the previous year. Therefore, this study focuses on applications for the classes of zero- and one-year-old children starting in April. Although this timing is best for application, more than 20% of the applicants are not enrolled due to limited capacity.[5]

In Japan, the mandated parental leave is one year post childbirth, and it can be extended for another year (six months until 2016) in case the child cannot be enrolled to accredited childcare centers due to limited capacity. Also, the public Employment Insurance pay childcare leave benefits[6] to the insured employees during the mandated parental leave, including the extended period due to the unavailability of childcare slot. Hence, most mothers who return to the same company after parental leave prefer to start using childcare centers in April when the child is zero or one year old.

The application and assignment process of April enrollment in the city we study is as follows. First, each applicant submits an ordered list of childcare centers according to their preference. If a household is accepted in one of the listed centers but decides not to use it, this household will be penalized in future applications. Thus, the best strategy is to list all centers which the household would prefer. The number of centers on the list is not limited.[7] The application document also specify the reason why the household needs subsidized childcare from nine options, and certification for the designated reason must be enclosed.[8]

Next, based on the application document, the city government determines whether the applicant satisfies the eligibility conditions. At this stage, the capacity is not considered, and all applicants who satisfy the conditions are acknowledged as "eligible." [9] Thereafter, for each eligible applicant, the city government calculates a priority score based on details related to the designated reason (e.g., days and hours of work per week for households who chose "work" as their primary reason to use the subsidized childcare), family structure, and

[5]Note that those ended up with other childcare options are not counted as "waiting children (*taikijido*)" in official statistics.

[6]The replacement rate is 67% (upper limit is about 300,000 JPY/month) for the first six months and 50% (upper limit is about 230,000 JPY/month) afterwards. The benefit from Employment Insurance is tax exempt.

[7]In case the list contains more than 30 centers, the top 30 centers are considered in the first round, and the remaining centers are considered only if they have vacancy at the end of the first round.

[8]Each applicant has to specify one or more reasons from the following list: "work" "childbirth" "disease/disability" "caregiving for a sick family member" "natural disasters" "job search" "schooling" "to avoid child abuse and domestic violence" "other". For each reason (except for "other"), the applicant must submit certification for the situation; for example, a copy of the employment certificate issued by the employer for "work."

[9]Those who were acknowledged as eligible but declined due to the limited capacity can claim an extension of parental leave and benefits until the child's second birthday. The certification of eligibility is also required in application for subsidy to fill the gap between the fee for accredited childcare centers and other childcare options.

current caretaker of the child.

Available slots of each childcare center are allocated to applicants based on the ordered list of preferred childcare centers and the priority score. Applicants with the highest priority score are assigned first, and the preference order is used for allocation for the applicants with the same score. Specifically, for each level of the priority score, each applicant is assigned to a childcare center in their ordered list. If slots are available at more than one centers, the higher ranked ones in the ordered list are assigned first. In case no slot is available in any centers listed by the applicant, the application is declined.[10] Among those with the same priority score and listed for the same childcare center, the city government ranks the applicants based on the designated reason to use the childcare center. Between the applicants with the same priority score and rank, the ones with lower taxable income in the last year get priority.

In practice, among the applicants with the same priority score, the probability of acceptance primarily depends on the availability of remaining slots in the centers listed. The chance to be accepted increases with number of centers listed. This implies that households who are willing to use centers of worse match are more likely to be accepted. Further, as most households choose childcare centers near their home, those living in areas with excess demand for them are comparatively more likely to be declined. To control for the endogenous choice of the listed centers and residential sorting, ideally, the number of centers on the list and most preferred childcare center should be controlled. However, adequate data are currently not available. Therefore, this study controls for the income of both parents before childbirth to mitigate the problem arising from the endogeneity of listed centers.

Most applicants are from households with both parents working full-time. A typical example is a household as follows: one child, who is 0 or 1 year old. The father works full-time, the mother is on childcare leave and expected to restart full-time work from April, and no grandparent lives with them. The priority score of this typical household is 62, which is the median and mode of the distribution of priority score. Its share among all applications is 28.2%. If the mother has already restarted work using other childcare services, the priority score becomes 63. If the child has an older sibling and wants to go to the same childcare center with their sibling, 3 is added to the priority score. There are other, relatively minor, adjustments (see Appendix). Finally, the share of 63–67 score among the applications is 40.3%.

Figure 1 plots the proportion of being accepted at the first round and enrollment in April over the priority score. The vertical line corresponds to 62. The acceptance rate is approximately 0.4 for those with priority

[10]For example, suppose there are two applicants, A and B. A's priority score is 63 and childcare center Z is her third choice. B's priority score is 62 and childcare center Z is her first choice. In the application process, A is assigned first, thus it is possible that A is accepted in childcare center Z while B is declined.

score less than 62, and then jumps up to 0.6 at 62. That is, the borderline cases are concentrated to applications whose priority score is 62. Thus, the empirical analysis focuses on households whose priority score is 62.

The selection process described above is labelled "the first round," and those who were declined in this round may apply for the second round and wait for cancellations or new vacancies. Thus, the proportion of households using the childcare center is higher than the proportion of those accepted at the first round. The process of assignment of the remaining and cancelled slots after the first round is unclear and likely to be affected by unobserved factors such as access to alternative childcare options and parents' labor force attachment. Thus, the actual enrollment status is treated as an endogenous variable, and acceptance at the first-round as an exogenous instrument. Figure 1 shows that applicants whose priority score is higher than 64 are almost always accepted and enrolled, suggesting that the take-up rate of accepted applications is close to 100%.

3 Empirical Model

3.1 The Treatment Effect of Interest

This study aims to identify the causal effect of access to the accredited childcare center on the parents' employment and earnings. The treatment of interest is whether the child is enrolled to an accredited childcare center. As explained in Section 2, the actual enrollment status is affected by many unobserved factors even in cases where the sample is limited to those who applied for accredited childcare centers. Thus, the first-round assignment process is used as the exogenous instrument for the actual enrollment status.

Let D_i denote the treatment dummy which takes 1 if the child is enrolled to an accredited childcare center, and 0 otherwise. Let Y_{1i} and Y_{0i} be the outcome of household i under the treatment and without the treatment, respectively. Then, the treatment effect of the enrollment to an accredited childcare center for household i is defined as $\Delta_i \equiv Y_{1i} - Y_{0i}$. Note that we can observe either Y_{1i} or Y_{0i} for each individual, and the outcome we observe can be written as $Y_i = D_i Y_{1i} - (1 - D_i)Y_{0i} = D_i \Delta_i + Y_{0i}$.

Δ_i cannot be identified by a simple regression of Y_i on D_i unless $\{Y_{1i}, Y_{0i}\}$ and D_i are independent. In the current case, Δ_i and D_i are likely to be positively correlated. It is because the households who would benefit more from using an accredited childcare center would be more eager to get in. Thus $\{Y_{1i}, Y_{0i}\}$ and D_i are likely to be correlated. Hence, we introduce an exogenous instrument.

3.2 The First Round Assignment Process

Let Z_i be an indicator for the first-round acceptance of household i; that is, Z_i takes 1 if accepted at the first round and 0 if declined. Recall the assignment process explained in Section 2. Applicants with the highest priority score are assigned first, and the preference order of childcare centers is used for allocation within the applicant with the same score. Between the applicants with the same priority score,[11] the one with lower taxable income in the last year gets priority. This implies that Z_i is determined by the priority score (S_i), the list of childcare centers that household i is willing to use (C_i), and the previous year's city income tax imposed on the parents (T_i).

Let $c \in C_i$ mean that childcare center c is included in the list of acceptable childcare centers that household i is willing to enroll. Then, for each childcare center, there exist borderline $\bar{S}_c$ and a cut-off $\bar{T}_c$ such that

$$Z_i^c = 1[c \in C_i] * \{1[S_i > \bar{S}_c] + 1[S_i = \bar{S}_c] * 1[T_i \geq \bar{T}_c]\} \tag{1}$$

In words, applications that listed childcare center c is accepted if $S_i > \bar{S}_c$ or, $S_i = \bar{S}_c$ and $T_i \geq \bar{T}_c$. Summing up for each applicant,

$$Z_i = max_{c \in C_i} Z_i^c \tag{2}$$

3.3 Identification of LATE at the Borderline

Let D_{1i} and D_{0i} be the treatment status of household i under $Z_i = 1$ and $Z_i = 0$, respectively. The applicants can be divided into three groups. First, the majority is "complier" who would be enrolled if accepted at the first round, i.e. $D_{1i} = 1$ and $D_{0i} = 0$. Second, there are some "always-taker" with $D_{1i} = D_{0i} = 1$, i.e. households who would eventually use an accredited childcare center even if they are declined at the first round. Third, households who leave the city or lose eligibility between the period of application in December and enrollment in April are classified as "never-taker" with $D_{1i} = D_{0i} = 0$. We assume there is no defier, i.e. $D_{1i} \geq D_{0i} \forall i$. The observed treatment status is written as $D_i = Z_i D_{1i} - (1 - Z_i) D_{0i}$.

It is known that, if Z_i were randomly assigned, the average treatment effect for compliers would be identified by using Z_i as an instrument for D_i (Cornelissen et al., 2018). But as described above, Z_i is not randomly assigned but determined by S_i, C_i, and T_i. Rather, among those with $S_i = \bar{S}_c$ and $c \in C_i$, Z_i^c is discontinuously

[11] Strictly speaking, among those with the same priority score and listed the same childcare center, the city government ranks the applicants based on the designated reason to use the childcare center and some other factors, and this rank overrides the taxable income in the last year. We ignore this ranking because the reason to use is unavailable for those who are not enrolled. Since 98.9% of new users with $S_i = 62$ specify the reason as "work" and most of other reasons are those with higher than "work," we believe it is tolerable to assume all households at the borderline specified "work" as their reason to apply.

determined by T_i. Since $\bar{T}_c$ cannot be predicted, in advance, T_i cannot be manipulated to barely exceed $\bar{T}_c$. Thus, under certain conditions, we can identify the local average treatment effect for those who were at the borderline, in spirit of the regression discontinuity design (RDD).

3.3.1 Ideal case: if $\bar{T}_c$ can be retrieved

Retrieving $\bar{T}_c$ from the data, can help to identify individuals who list c and just above and below $\bar{T}_c$. This is an RDD with T_i as the assignment variable and multiple thresholds $\bar{T}_c$, conditional on $c \in C_i$ and $S_i = \bar{S}_c$. In this case, we can identify the causal effect of accredited childcare center's availability for the marginal applicants who would become able to enroll when the capacity increases marginally.

To retrieve $\bar{T}_c$ for each childcare center and identify who listed the center, full information on C_i is required along with accepting center for each accepted application, in addition to S_i and T_i.

3.3.2 2nd best: if partial information of C_i is available

The full information on C_i and an identifier of the accepting center may not be available due to privacy concerns. However, as mentioned in Section 2, some characteristics of listed childcare centers might be correlated with both the probability of acceptance and $\{Y_{0i}, Y_{1i}\}$. For example, households who are willing to use centers of worse match can include a larger number of centers on the list. Thus, they can increase the chance to be accepted. Although the direction of the bias is ambiguous, it is not plausible to assume the number of listed centers are uncorrelated with $\{Y_{0i}, Y_{1i}\}$. Another example is residential sorting, which induces power couples to live in a particular area of the city, and childcare centers in such areas may receive more applications.

To control for the endogenous choice of the listed centers, additional data on the listed centers can be included—such as the number of centers on the list and anonymous identifier for the best preferred childcare center. However, information on the listed centers is not available currently, and the availability of such information, through further negotiation, is not certain. Therefore, it would be useful to discuss the conditions under which the local average treatment effect at the borderline can be identified.

Let $\tilde{C}_i$ denote partial information of C_i, such as the number of listed childcare centers and anonymous identifier for the best preferred center, which can be observed in the data. Suppose that $\tilde{C}_i$ does not include enough information to identify $\bar{T}_c$, but it fully captures factors that are correlated, both the probability of acceptance and labor market outcomes of the parents. Furthermore, by controlling for the direct effect of previous year's taxable income on the outcomes with and without treatment, we can obtain an unbiased estimator for the local average treatment effect at the borderline.

Specifically, under the following two assumptions, $\{Y_{1i}, Y_{0i}, D_{1i}, D_{0i}\}$ is independent from Z_i conditional on $\{S_i, \tilde{C}_i, T_i\}$.

Assumption 1

Conditional on $\{S_i, \tilde{C}_i, T_i\}$, the remaining component of C_i that affects Z_i is not correlated with $\{Y_{1i}, Y_{0i}, D_{1i}, D_{0i}\}$. That is, $min_{c \in C_i}\{\bar{T}_c\} - E[min_{c \in C_i}\{\bar{T}_c\}|\tilde{C}_i]$ is not correlated with $Y_{1i} - E[Y_{1i}|S_i, \tilde{C}_i, T_i]$, $Y_{0i} - E[Y_{0i}|S_i, \tilde{C}_i, T_i]$, $D_{1i} - E[Y_{Di}|S_i, \tilde{C}_i, T_i]$, and $D_{0i} - E[D_{0i}|S_i, \tilde{C}_i, T_i]$.

Assumption 2

The relationship between T_i and $\{Y_{1i}, Y_{0i}, D_{1i}, D_{0i}\}$ does not change below and above $\bar{T}_c$.

Assumption 1 implies that, conditional on $\{S_i, \tilde{C}_i, T_i\}$, any predetermined characteristics that would affect $\{Y_{0i}, Y_{1i}\}$ should not be correlated with Z_i. This can be verified with data.

In case of assumption 2, there seems no plausible reason for change in the relationship between the previous year's taxable income and the current year's employment or earnings at the threshold. Hence, we admit that this assumption is stronger than the standard RDD assumption that the relationship between T_i and $\{Y_{1i}, Y_{0i}, D_{1i}, D_{0i}\}$ does not discontinuously jump at $\bar{T}_c$, because our sample inevitably includes observations far from the threshold.

Under these assumptions, we can identify the causal effect of accredited childcare center's availability for those with $S_i = \bar{S}$ by using two stage least squares method to the following model with subsample with $S_i = \bar{S}$:

$$Y_i = \beta_0 + \beta_1 D_i + \lambda(\tilde{C}_i) + f(T_i) + \varepsilon_i \quad (3)$$

$$D_i = \gamma_0 + \gamma_1 Z_i + \theta(\tilde{C}_i) + g(T_i) + \mu_i \quad (4)$$

where $\lambda(\tilde{C}_i)$ and $\theta(\tilde{C}_i)$ are fully saturated control for $\tilde{C}_i$ and $f(T_i)$ and $g(T_i)$ are smooth function of T_i.

3.3.3 Preliminary Analysis without Any Information on the Listed Childcare Centers

In the present version, we control for parents' pre-birth earnings as proxy for parents' own human capital and labor force attachment that could be correlated with Z_i through the endogenous choice of listed childcare centers. Although this might be imperfect, it could mitigate the problem.

Also, we limit the sample for those with $S_i = 62$, as this is the borderline score $\bar{S}_c$ for the majority of the accredited childcare centers in this city. By limiting the sample to those with same S_i, the differences between accepted and declined households are already small.

Specifically, we estimate the following linear model by two stage least squares method:

$$Y_i = \beta_0 + \beta_1 D_i + \beta_2 X_i + f(T_i) + \varepsilon_i \quad (5)$$

$$D_i = \gamma_0 + \gamma_1 Z_i + \gamma_2 X_i + g(T_i) + \mu_i \quad (6)$$

where X_i includes ages of mother and father, the third-order polynominal of each parent's salary income in the year prior to the birth of the child and cohort dummies for the sample of age 0. In estimation, we also specify $f(T_i)$ and $g(T_i)$ as cubic functions.

As the existing studies could not distinguish applicants who were close to the borderline, it is informative to observe whether limiting the sample to those with $S_i = 62$ changes the correlation between D_i and Y_i . Hence, simple OLS regressions of equation (5) is presented with different sample restrictions and variables included in X_i.

4 Data

This study combines administrative records of applications for accredited childcare centers, users of accredited childcare centers, and data on the tax records augmented with household structure. The three datasets are merged using an anonymous household identifier provided by the city government, which enables the tracking of the same household over time.

The data regarding the applications for accredited childcare centers cover all applications for April enrollment from 2015 to 2018. The unit of observation is application; that is, if two children from the same household apply, they are counted as two observations. The available information includes the priority score calculated by the city government based on the application, the age of child as of April first, and the application acceptance status in the first round. Currently, the information on the centers listed on the application is unavailable and the procurement of such additional information is still ongoing. The designated reason that the child needs childcare is applicable only to those who actually enrolled in April.

The data on the users of accredited childcare centers cover all children enrolling in any accredited childcare centers as of April first from 2015 to 2018. The unit of observation is child, and the available information includes the age of child as of April first and the fee category based on the city income tax. This dataset covers

not only newly enrolled children, but also incumbent children from the previous year.

The dataset of tax records covers the population of households with preschool children living in the city at the beginning of 2018.[12] The available information includes a selected part of tax record, such as pretax salary income and taxable income from 2014 to 2017, the month and year of birth, sex, and relationship to the head of the household for each household member at the beginning of 2018.[13] Note that tax records include income in each calendar year (from January to December), and not the Japanese fiscal year which starts in April. Unfortunately, pre-tax income other than salary income is not available, but the total amount of taxable income and deductions are available. Thus, we can calculate the city income tax that determines the acceptance at the borderline.

Our data set has an important limitation. Since the tax records of each year are available only for individuals who lived in the city at the beginning of the corresponding year, the prior information about the individuals who shifted into the city after 2015 is unavailable. We use each parent's income in the year prior to child's birth as a control variable in data analysis. Specifically, income in calendar year 2015 is used as "income before birth" of parents of zero-year-old children in 2017, who were born between April 2016 and March 2017. Likewise, income in 2014 is used as pre-birth income of zero-year-old children in 2016 and one-year-old children in 2017. This implies that the sample of zero-year-olds consists of those who lived in the city for three consecutive years (2014 to 2016 or 2015 to 2017) and that of one-year-olds consists of those who lived in the city for four years 2014 to 2017.[14] Since many couples moved into the city when after marriage or children, about one-third of households with zero or one-year-old children are dropped from the main analysis sample (Table B1). In the next section, we confirm that excluding these cases does not change the correlation between the enrollment in accredited childcare centers and parents' income or employment.

Another important limitation is that the payment of childcare leave benefits from the public Employment Insurance cannot be observed in the tax records, as the childcare leave benefits are not included in the taxable income. Therefore, it is difficult to distinguish mothers who are on a childcare leave holding the same job before the child's birth, and those who quit the job permanently. Also, it implies that the taxable income in the year prior to the application is mostly determined by father's income.

Table 1 presents the descriptive statistics of our analysis sample of households with children at age zero. Column (1) of Table 1 includes all households with zero-year-old children as of April 1st in 2017 or 2016. 46%

[12] This is the same dataset as the one used in Fukai and Kondo (2021). For details of data cleaning process, see Fukai and Kondo (2021).

[13] 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.

[14] Furthermore, since the original database includes households who lived in the city as of April 1st in 2018, households who moved out of the city before January 2018 are not included in our data.

of mothers earned positive salary income while only 20% use the accredited childcare centers. 95% of fathers have positive salary income. Since, the city under study is an urban municipality with a relatively higher price and wage level, the average salary income of fathers is higher than national average.[15] Column (2) excludes households whose income before birth is not available, i.e., those who moved to the city after 2015 for 2017 cohort and after 2014 for 2016 cohort, respectively. There is no notable difference between the two columns, and 64% of mothers had positive salary income in the year prior to the birth. Column (3) is limited to those who applied for the accredited childcare center. Not surprisingly, more than 90% of mothers are employed before birth, and about 90% are employed in the outcome year as well. 80% are accepted by an accredited childcare center at the first round, and about the same fraction actually use the accredited childcare center. Other characteristics including parents' age and fathers' earnings are not much different from Columns (1) and (2). Column (4) further limits the sample to those whose priority score is 62. Most of them are nuclear family with one child and both parents having a full-time job. Thus, almost all parents are employed before birth, and mothers' average income is higher than that listed in Column (3). [16] As expected, the fractions accepted in the first round who use the childcare centers are lower, because 62 is the borderline score for most childcare centers. Other characteristics are similar to Column (3).

Table 2 presents the same statistics of households with children at age one in 2017. A notable difference from Table 1 are the statistics regarding the use of accredited childcare centers. The percentage of households using childcare center is higher, because this is the sum of households who started to use at age zero and one . In contrast, when the sample is limited to those who applied, both the percentage accepted in the first round and the percentage using the childcare center becomes substantially lower than that in Table 1, implying more severe competition for slots in the one year old category than zero year old. Nevertheless, mothers' employment rate and income do not decrease. Regarding other characteristics, both the level and differences between columns are similar to those of Table 1.

[15] According to Basic Survey of Wage Structure 2017, the average annual earnings of male full-time employees aged 30-39 was 5,181,000 JPY. Population average including unemployed, self-employed, and part-time workers should be even lower.

[16] Note that existence of older siblings yields a few bonus points in the priority score. Thus, Column (3) includes many households with older siblings, and some of them were on childcare leave for the older sibling in the year prior to the birth of the child. The lower pre-birth income of mothers in Column (3) than (4) is partly attributable to this.

5 Result

5.1 OLS

Tables 3 and 4 present β_1 of simple OLS estimates of equation (5), the coefficients of an indicator of using accredited childcare centers, for households with children at age zero and one, respectively. Each row corresponds to the following outcome variable: mother's employment (a dummy variable indicating positive salary income), mother's salary income (including zero), father's employment and father's income. Each column presents estimates with different sample and control variables.

Column (1) of Table 3 shows that, in households whose child is enrolled to an accredited childcare center, mother's employment rate is 52.7 percentage points higher, and mothers earn 1,154,480 JPY more while fathers earn 629,540 JPY less than households not using accredited childcare centers. Column (2) limits the sample to those whose pre-birth salary income is observed. Excluding households who recently moved in does not alter the result to a significant extent. Column (3) includes controls for cubic functions of last year's taxable income of the household and mother and father's income before birth. The correlation between childcare use and mother's outcome is substantially weaker in Column (3) than in Column (2). This implies that past income is negatively correlated with the probability of using childcare. Intuitively, mothers with weak labor force attachment is unlikely to use childcare and also tend to have lower earnings before birth.

Column (4) limits the sample to those whose priority score is available, i.e. those who applied for accredited childcare centers. This also makes the differences in mothers' outcomes between users and non-users smaller, because mothers with weak labor force attachment are unlikely to apply for childcare centers and are excluded from the sample. However, Column (5) shows that, within the sample of those who apply for childcare centers, adding controls for past income boosts the estimated coefficient of the childcare use dummy on the mother's salary income. It implies that, conditional on the intention to use childcare centers, women's earnings capacity is negatively correlated with the probability of their actual use of childcare centers. Lastly, Column (6) adds controls for priority score as dummy variables for each point to allow flexible relationship between the score and labor force attachment or earnings capacity. This makes the coefficient on mothers' salary income slightly smaller implying a positive correlation between the priority score and earnings capacity.

Table 4 presents the estimated coefficients from the sample of one-year-old in 2017. The relative sizes of coefficients between columns are similar to those in Table 3 except for the following three points. First, coefficients in Column (5) are smaller than those in Column (3), probably because households who start to use childcare centers at age zero are included only in Column (3). Second, adding controls for the priority

score substantially weakens the correlations between childcare use and both outcomes. It is further speculated that the positive correlation between the priority score and earnings capacity may be larger for one-year-olds because women with a low priority score but strong labor force attachment tend to apply at age zero to maximize the chances of enrollment.

Tables 3 and 4 also present the coefficients on father's outcomes. Overall, father's salary income and childcare use are negatively correlated. Adding controls for past income makes this negative correlation weaker, suggesting that men with smaller earnings capacity tend to have wives who continue to work after child's birth. When both past income and priority score are controlled (Column 6), the coefficient becomes statistically insignificant for age zero suggesting that the negative correlation between father's income and childcare use is mostly attributable to the selection into childcare use rather than the causal effect of childcare use. Although it is still statistically significant for the sample of age one, the size of the coefficient is economically small (only 2% of average income).

5.2 IV

We begin with confirming the first stage; that is, the effect of acceptance in the first-round screening process on the actual use of childcare centers. Table 5 presents γ_1 in equation (6), the coefficients of acceptance in the first round on the enrollment to an accredited childcare center. The estimated coefficients can be interpreted as the differences in the enrollment rate between those who were accepted and those who were not accepted in the first round of screening. Columns (1) and (2) show the results for 0-year-old with and without a restriction on the priority score. If the child is accepted in the first round, the probability of using a childcare center increases by 0.53-0.54 percentage points. The estimation is highly precise, and the F-value exceeds 200, indicating that the instrumental variable is sufficiently strong. Columns (3) and (4) show the results for one-year-olds, which are as statistically significant as those for zero-year-olds, and show that acceptance increases the use of childcare centers by 0.46-0.52 percentage points. We subsequently restrict the second stage of the estimation to households with a priority score of 62, where a relatively homogeneous parent pool is likely to satisfy the exclusion restriction. [17]

Tables 6 and 7 summarize the effect of childcare center use on maternal employment and other outcomes, using the initial screening results as the instrumental variable. Tables 6 and 7 present TSLS results along with OLS and reduced from results for the effects on parents' employment status and salary income. Note that each estimation controls for taxable income at the time of application and the employer income of the parents prior

[17] Results from unrestricted sample are presented in the Appendix Tables B2 and B3.

to the birth in a flexible way.

Table 6 shows the results for the use of childcare centers for children at age 0. For maternal employment, the TSLS result shows that the use of childcare centers raises maternal employment by 0.258 percentage points, which is statistically significant. The results also show that the use of childcare centers increases the salary income of mothers by 1.2 million yen in a statistically significant manner. Given that the average salary income earned by mothers with a priority score of 62 points before having children is about 4.1 million yen (column 4 of Table 1), an increase in maternal employment by 0.258 percentage points would imply that average earnings would increase by 1.06 million JPY. Thus, a large part of increase in the average salary income is attributable to the increase in employment.

n respect of the father's employment and salary income, the coefficients are not statistically different from zero in any of the cases, and standard errors are small. Therefore, we confirm the negative relationship between childcare center use and father's income in Table 3 reflects the selection mechanism whereby the households with lower paternal incomes are more likely to use childcare centers.

Table 7 shows the results of childcare center use for children at age 1. The TSLS result for maternal employment demonstrates that using a childcare center raises maternal employment by 0.217 percentage points with statistical significance. It also raises mothers' salary income in a statistically significant manner. On average, the use of childcare centers raises the salary income of mothers by approximately 650,000 yen. The positive effects of childcare center usage on mothers' employment and earnings are smaller. This can be attributed to the reason that the parental leave can be extended for children at age 0. In Japan, the compensated parental leave can be extended until the child turns 2 years old (1.5 in 2016), in cases where the child is not accepted for accredited childcare centers. Therefore, if a mother fails to get an accredited childcare center slot at age 0, she is more likely than mothers with 1-year-old children to extend parental leave instead of resuming work using other childcare options. The differences in alternative options makes the treatment effect of using a childcare center for a one-year-old child smaller than that for a zero-year-old child.

Furthermore, the estimated effect on mothers' salary income is slightly smaller than what would be expected from the effect on employment. Given that the average salary income before having children is about 4.1 million yen (column 4 of Table 2), an increase in maternal employment by 0.217 percentage points would imply an increase of income by 0.89 million JPY. It implies that mothers with higher salary are more likely to switch to alternative options when they are declined in the first round. There is no change in fathers' employment and income by use of childcare centers in the case of one-year-olds as well.

Finally, it is worth mentioning that the differences between the OLS and TSLS estimates are not statistically

significant in both Tables 6 and 7. Thus, the availability of childcare centers can be considered almost random if we control for priority scores at the time of application and past income.

6 Preliminary Conclusion

This paper examined the causal effect of availability of publicly subsidized center-based childcare on the employment and earnings of mothers having zero- and one-year old children. We utilize the administrative records provided by a large urban municipality in Japan and construct an instrument using specific rules for the first- round assignment process of April enrollment. We focus on households with only one child with both parents working full-time, as they are at the borderline of being accepted at the first round. The findings reveal that the enrollment to an accredited childcare center increases the mother's employment rate by 21.7 to 25.8 percentage points. The effect of such enrollment on mothers' annual salary income is 1,200,009 JPY for zero-year-old children and 649,134 JPY for one-year-old children. There is no statistically significant effect on father's employment or earnings.

The coefficient of childcare use on parent's employment and earnings in simple regressions was compared with varied sample criteria and different set of control variables. It confirms that mothers earning capacity, proxied by income before birth of the child, is correlated with the probability of using childcare.

We have also compared the coefficient of childcare use on parent's employment and earnings in simple regressions with different sample criteria and different set of control variables. It confirms that mother's earning capacity, proxied by income before birth of the child, is correlated with the probability of using childcare. The priority score is also positively correlated with mother's employment earnings. In contrast, with the same sample criteria and control variables, the OLS and IV estimates are not significantly different. The priority score is also positively correlated with mother's employment earnings. In contrast, with the same sample criteria and control variables, the OLS and IV estimates are not significantly different.

The estimated effects are smaller for mothers of one-year-old children than zero-year-old children. In case of mothers with priority score 62, income before birth were similar between mothers of zero-year- old and one-year-old. Hence, this difference is not attributable to the differences in the potential earnings. Rather, this may imply the differences in outside options. For mothers of zero-year-old children, some choose to extend the parental leave for another year. Since the parental leave benefit is tax exempt, their salary income on the data is zero. Given the maximum length of this compensated parental leave is two years (1.5 years until 2016), very few mothers of one-year-old children can extend the leave. Instead, more mothers may restart working

using other childcare services, resulting in weaker effects. If mothers with higher salary tend to use alternative childcare services, this correlation may also make the effect on income smaller.

Admittedly, the current results are preliminary with insufficient control for endogenous selection of listed childcare centers on the application. The current analysis can be improved by using additional data on listed childcare centers.

References

Asai, Yukiko, Ryo Kambayashi, and Shintaro Yamaguchi, "Childcare Availability, Household Structure, and Maternal Employment," *Journal of the Japanese and International Economies*, 2015, *38*, 172–192.

_ , _ , and _ , "Crowding-out effect of subsidized childcare," *Available at SSRN 2634283*, 2016.

Baker, Michael, Jonathan Gruber, and Kevin Milligan, "Universal Child Care, Maternal Labor Supply, and Family Well-Being," *Journal of Political Economy*, 2008, *116* (4), 709–745.

Bauernschuster, Stefan and Martin Schlotter, "Public child care and mothers' labor supply—Evidence from two quasi-experiments," *Journal of Public Economics*, 2015, *123*, 1–16.

Carta, Francesca and Lucia Rizzica, "Early kindergarten, maternal labor supply and children's outcomes: Evidence from Italy," *Journal of Public Economics*, 2018, *158*, 79–102.

Cascio, Elizabeth U., "Maternal Labor Supply and the Introduction of Kindergartens into American Public Schools," *The Journal of Human Resources*, 2009, *44* (1), 140–170.

Cornelissen, Thomas, Christian Dustmann, Anna Raute, and Uta Schönberg, "Who Benefits from Universal Child Care? Estimating Marginal Returns to Early Child Care Attendance," *Journal of Political Economy*, 2018, *126* (6), 2356–2409.

Eckhoff Andresen, Martin and Tarjei Havnes, "Child care, parental labor supply and tax revenue," *Labour Economics*, 2019, *61*, 101762.

Fitzpatrick, Maria Donovan, "Revising Our Thinking About the Relationship Between Maternal Labor Supply and Preschool," *Journal of Human Resources*, 2012, *47* (3), 583–612.

Fitzpatrick, Maria Donovan, "Preschoolers Enrolled and Mothers at Work? The Effects of Universal Prekindergarten," *Journal of Labor Economics*, 2010, *28* (1), 51–85.

Fukai, Taiyo and Ayako Kondo, "Households' Responses to Childcare Fees: Childcare Usage and Parental Labor Supply," *Economic Analysis*, 2021, *202.*

Goux, Dominique and Eric Maurin, "Public school availability for two-year olds and mothers' labour supply," *Labour Economics*, 2010, *17* (6), 951–962.

Guner, Nezih, Remzi Kaygusuz, and Gustavo Ventura, "Child-Related Transfers, Household Labour Supply, and Welfare," *The Review of Economic Studies*, 03 2020, *87* (5), 2290–2321.

Havnes, Tarjei and Magne Mogstad, "No Child Left Behind: Subsidized Child Care and Children's Long-Run Outcomes," *American Economic Journal: Economic Policy*, May 2011, *3* (2), 97–129.

Kleven, Henrik, Camille Landais, Johanna Posch, Andreas Steinhauer, and Josef Zweimüller, "Do family policies reduce gender inequality? Evidence from 60 years of policy experimentation," Technical Report, National Bureau of Economic Research 2020.

Lefebvre, Pierre and Philip Merrigan, "Child-Care Policy and the Labor Supply of Mothers with Young Children: A Natural Experiment from Canada," *Journal of Labor Economics*, 2008, *26* (3), 519–548.

Nishitateno, Shuhei and Masato Shikata, "Has Improved Daycare Accessibility Increased Japan's Maternal Employment Rate? Municipal Evidence from 2000–2010," *Journal of the Japanese and International Economies*, 2017, *44*, 67–77.

Nollenberger, Natalia and Núria Rodríguez-Planas, "Full-time universal childcare in a context of low maternal employment: Quasi-experimental evidence from Spain," *Labour Economics*, 2015, *36*, 124–136.

Yamaguchi, Shintaro, Yukiko Asai, and Ryo Kambayashi, "Effects of subsidized childcare on mothers' labor supply under a rationing mechanism," *Labour Economics*, 2018, *55*, 1–17.

List of Figures

1 Priority score and proportion of accepted/using childcare centers 23
2 Priority score and proportion of childcare use / mothers in employment 24

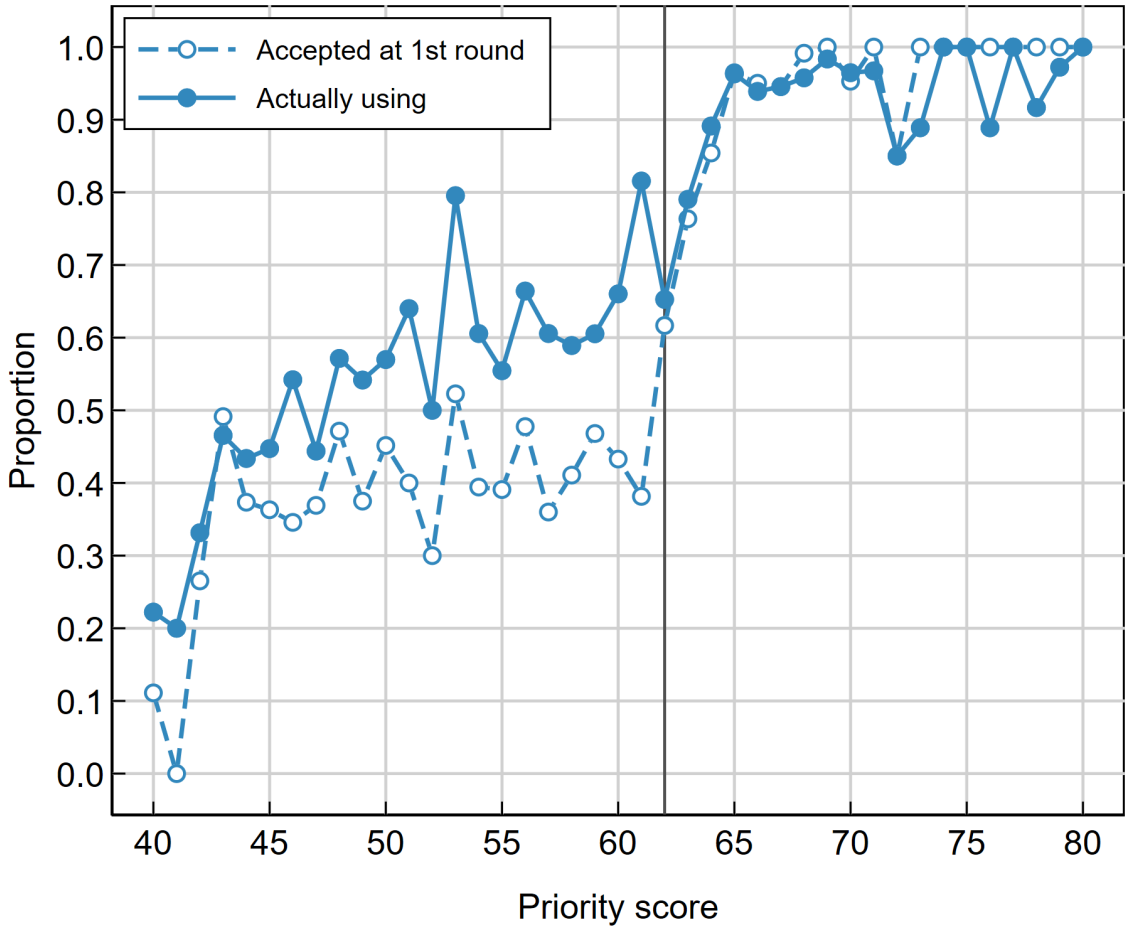
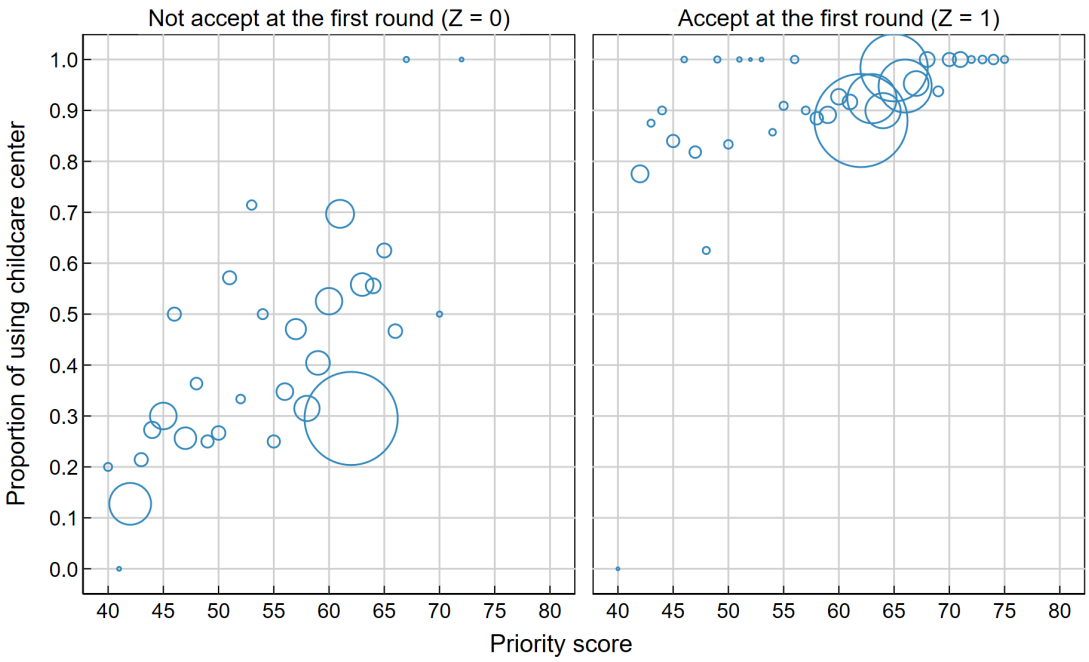
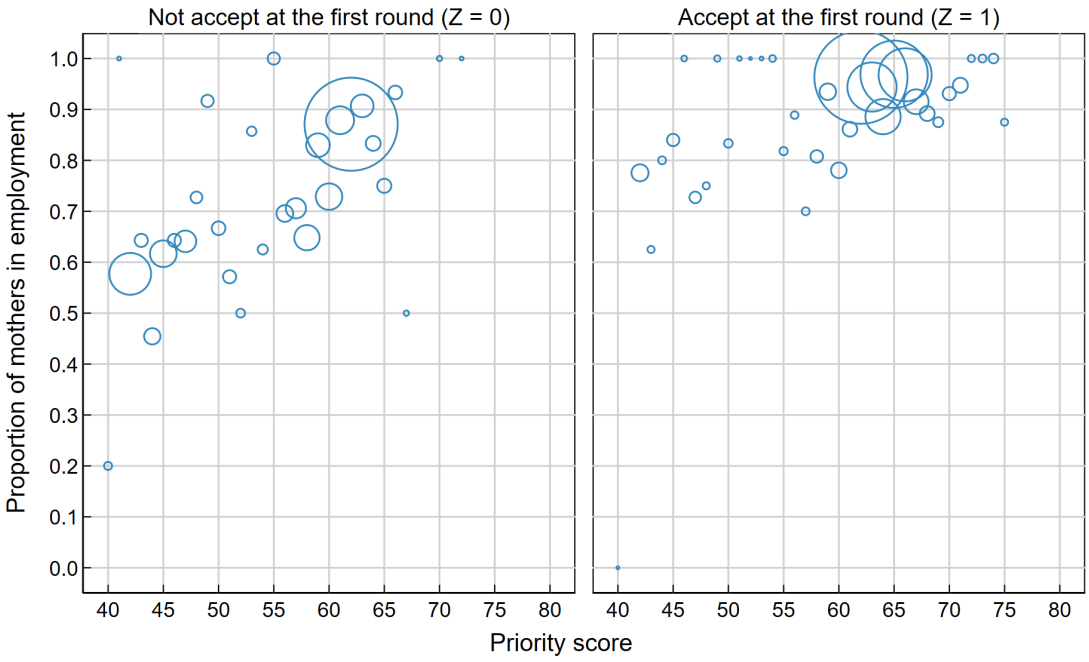


Figure 1: Priority score and proportion of accepted/using childcare centers

Note: This figure shows the proportion of households with first round acceptances (dotted line) and the proportion of households actually using the accredited child- care center (actual battle) by the priority score in the first round of screening. The sample used for the figure is households with a 0-year-old child in 2016-2017 or households with a 1-year-old child in 2017 that applied for accredited childcare centers.



(a) Childcare use



(b) Mothers in employment

Figure 2: Priority score and proportion of childcare use / mothers in employment

Note: This figure shows the proportion of households using accredited childcare centers (panel (a)) and mothers in employment (panel (b)) as a result of the first round screening. The size of each point indicates the number of households for each priority score. The sample used for the figure is households with a 0-year-old child in 2016-2017 or households with a 1-year-old child in 2017 that applied for accredited childcare centers.

List of Tables

1 Summary statistics 26
2 Summary statistics (cont.) 27
3 OLS coefficients of childcare use on parental labor market outcome: Child age = 0 28
4 OLS coefficients of childcare use on parental labor market outcome: Child age = 1 29
5 First stage estimation results: Coefficients on childcare use 29
6 IV estimates: Child's age = 0 & Priority score = 62 30
7 IV estimates: Child's age = 1 & Priority score = 62 30

Table 1: Summary statistics

	Child's age = 0			
	(1)	(2)	(3)	(4)
% 2016 cohort	50.9	53.8	49.9	51.9
	[50.0]	[49.9]	[50.0]	[50.0]
% accepted in the 1st round			80.3	76.3
			[39.8]	[42.5]
% using the childcare center	20.3	22.2	80.5	72.1
	[40.2]	[41.6]	[39.6]	[44.9]
Previous year's city income tax (10k JPY)		13.2	18.8	20.5
		[19.5]	[14.3]	[11.8]
Mother's characteristics				
Age (as of April 1 in the outcome year)	32.7	33.2	33.5	32.8
	[4.7]	[4.5]	[4.3]	[4.3]
Salary income before birth (10k JPY)		172.2	311.5	412.5
		[208.3]	[207.0]	[166.5]
% non-zero salary income before birth		63.5	91.9	98.4
		[48.2]	[27.4]	[12.6]
Salary income in the outcome year (10k JPY)	58.5	61.1	179.9	185.8
	[124.1]	[129.0]	[143.6]	[124.0]
% non-zero salary income in the outcome year	45.9	46.6	90.0	93.1
	[49.8]	[49.9]	[30.0]	[25.3]
Father's characteristics				
Age (as of April 1 in the outcome year)	34.6	35.1	35.1	34.4
	[5.6]	[5.4]	[5.2]	5.2]
Salary income before birth (10k JPY)		514.6	515.3	513.3
		[316.0]	[232.5]	[199.8]
% non-zero salary income before birth		90.7	96.4	97.7
		[29.1]	[18.6]	[15.0]
Salary income in the outcome year (10k JPY)	584.4	591.5	561.6	562.3
	[348.4]	[355.9]	[252.8]	[217.5]
% non-zero salary income in the outcome year	95.0	95.1	96.5	97.3
	[21.8]	[21.5]	[18.3]	[16.1]
Sample restriction				
Salary income before birth		Y	Y	Y
Priority score			Y	Y
Priority score = 62				Y
N	19,193	15,097	2,579	1,048

Note: This table presents descriptive statistics for households in which the youngest child was 0 years old in 2016-2017. Standard deviations are in parentheses.

Table 2: Summary statistics (cont.)

	Child's age = 1			
	(1)	(2)	(3)	(4)
% accepted in the 1st round			68.0	57.6
			[46.6]	[49.4]
% using the childcare center	31.3	32.6	74.6	65.5
	[46.4]	[46.9]	[43.5]	[47.6]
Previous year's city income tax		11.0	16.3	17.5
		[20.4]	[34.1]	[11.0]
Mother's characteristics				
Age (as of April 1 in the outcome year)	33.8	34.3	34.1	33.4
	[4.7]	[4.5]	[4.2]	[4.2]
Salary income before birth (10k JPY)		182.6	302.2	410.0
		[211.2]	[206.7]	[156.0]
% non-zero salary income before birth		66.4	89.7	98.4
		[47.2]	[30.5]	[12.5]
Salary income in the outcome year (10k JPY)	120.1	125.6	222.5	207.3
	[183.3]	[187.7]	[170.7]	[128.8]
% non-zero salary income in the outcome year	51.1	52.1	90.2	93.2
	[50.0]	[50.0]	[29.7]	[25.2]
Father's characteristics				
Age (as of April 1 in the outcome year)	35.6	36.2	36.0	35.3
	[5.5]	[5.4]	[5.3]	[5.2]
Salary income before birth (10k JPY)		541.1	519.4	524.3
		[308.2]	[233.1]	[220.8]
% non-zero salary income before birth		95.2	95.6	97.6
		[21.3]	[20.6]	[15.2]
Salary income in the outcome year (10k JPY)	613.2	619.7	591.0	601.1
	[417.3]	[437.6]	[274.1]	[238.5]
% non-zero salary income in the outcome year	94.8	94.8	95.2	97.5
	[22.3]	[22.1]	[21.4]	[15.7]
Sample restriction				
Salary income before birth		Y	Y	Y
Priority score			Y	Y
Priority score = 62				Y
N	9,837	7,541	1,934	634

Note: This table presents descriptive statistics for households in which the youngest child was 1 years old in 2017. Standard deviations are in parentheses.

Table 3: OLS coefficients of childcare use on parental labor market outcome: Child age = 0

Outcome variables	(1)	(2)	(3)	(4)	(5)	(6)
Mothers in employment	0.527***	0.526***	0.341***	0.245***	0.260***	0.259***
	(0.007)	(0.007)	(0.008)	(0.021)	(0.020)	(0.022)
Mother's salary income (10k JPY)	115.448***	112.136***	89.476***	77.911***	114.630***	93.924***
	(2.495)	(2.704)	(2.452)	(7.361)	(5.921)	(6.409)
Fathers in employment	0.003	0.002	0.008**	-0.024***	0.003	0.001
	(0.004)	(0.004)	(0.004)	(0.007)	(0.007)	(0.008)
Father's salary income (10k JPY)	-62.954***	-60.518***	-34.089***	-105.367***	-9.391	-6.036
	(5.315)	(5.948)	(3.200)	(12.470)	(5.864)	(6.678)
Past income						
observed		X	X	X	X	X
observed and control			X		X	X
Priority score						
observed				X	X	X
observed and control						X
Observations	19,193	15,097	15,097	2,579	2,579	2,579

Note:This table shows the results of a regression analysis of childcare use regressed on various outcomes such as maternal employment. Heteroskedasticity robust standard errors are in parentheses. In each analysis, the age of the parents are controlled for in a flexible functional form of cubic functions. In regressions controlling for priority score, we controlled for the priority score in saturated way. Also, the regression controlling for past income uses a flexible functional form of cubic functions. $*p < 0.10$, $**p < 0.05$ and $***p < 0.01$

Table 4: OLS coefficients of childcare use on parental labor market outcome: Child age = 1

Outcome variables	(1)	(2)	(3)	(4)	(5)	(6)
Mothers in employment	0.636***	0.634***	0.377***	0.226***	0.218***	0.173***
	(0.007)	(0.008)	(0.011)	(0.021)	(0.020)	(0.020)
Mother's salary income (10k JPY)	204.094***	209.723***	119.576***	95.222***	106.821***	64.984***
	(3.665)	(4.186)	(4.179)	(8.560)	(6.801)	(7.410)
Fathers in employment	0.004	0.001	0.025**	-0.014	0.000	0.002
	(0.005)	(0.005)	(0.006)	(0.010)	(0.009)	(0.010)
Father's salary income (10k JPY)	-80.533***	-76.862***	-32.807***	-45.022***	-14.131**	-11.339***
	(7.348)	(8.728)	(5.631)	(14.230)	(6.945)	(7.278)
Past income						
observed		X	X	X	X	X
observed and control			X		X	X
Priority score						
observed				X	X	X
observed and control						X
Observations	9,837	7,541	7,541	1,934	1,934	1,934

Note: Heteroskedasticity-robust standard errors are in parenthesis. This table shows the results of a regression analysis of childcare use regressed on various outcomes such as maternal employment. Heteroskedasticity robust standard errors are in parentheses. In each analysis, the age of the parents are controlled for in a flexible functional form of cubic functions. In regressions controlling for priority score, we controlled for the priority score in a saturated way. Further, the regression controlling for past income uses a flexible functional form of cubic functions. $*p < 0.10$, $**p < 0.05$ and $***p < 0.01$

Table 5: First stage estimation results: Coefficients on childcare use

	Child' age = 0		Child's age = 1	
Priority score	[40, 100]	62	[40, 100]	62
	(1)	(2)	(3)	(4)
Accept in the 1st round	0.533***	0.540***	0.460***	0.524***
	(0.025)	(0.035)	(0.027)	(0.036)
F-statistics	468.4	239.0	286.3	208.6
Observations	2,555	1,048	1,894	634

Note: This table shows the results of the first stage regression described in Equation (6). Heteroskedasticity robust standard errors are in parentheses. In each analysis, the age of the parents, the previous year's income tax at the time of application and the salary income of the fathers and mothers before childbirth are controlled in a flexible functional form of cubic functions. $*p < 0.10$, $**p < 0.05$ and $***p < 0.01$

Table 6: IV estimates: Child's age = 0 & Priority score = 62

Dependent variables	Mother's emp (1)	Mother's income (2)	Father's emp (3)	Father's income (4)
OLS				
Childcare use	0.236***	104.908***	0.004	3.594
	(0.027)	(8.065)	(0.007)	(7.744)
Reduced form				
Accept in the 1st round	0.139***	64.846***	0.004	-7.564
	(0.027)	(9.056)	(0.009)	(8.081)
TSLS				
Childcare use	0.258***	120.009***	0.007	-13.999
	(0.048)	(15.014)	(0.017)	(14.883)
Observations	1,048	1,048	1,048	1,048

Note: This table shows the results of the second stage regression described in Equation (5) along with OLS and reduced form coefficients. Heteroskedasticity robust standard errors are in parentheses. In each analysis, the age of the parents, the previous year's income tax at the time of application and the salary income of the fathers and mothers before childbirth are controlled in a flexible functional form of cubic functions. $*p < 0.10$, $**p < 0.05$ and $***p < 0.01$

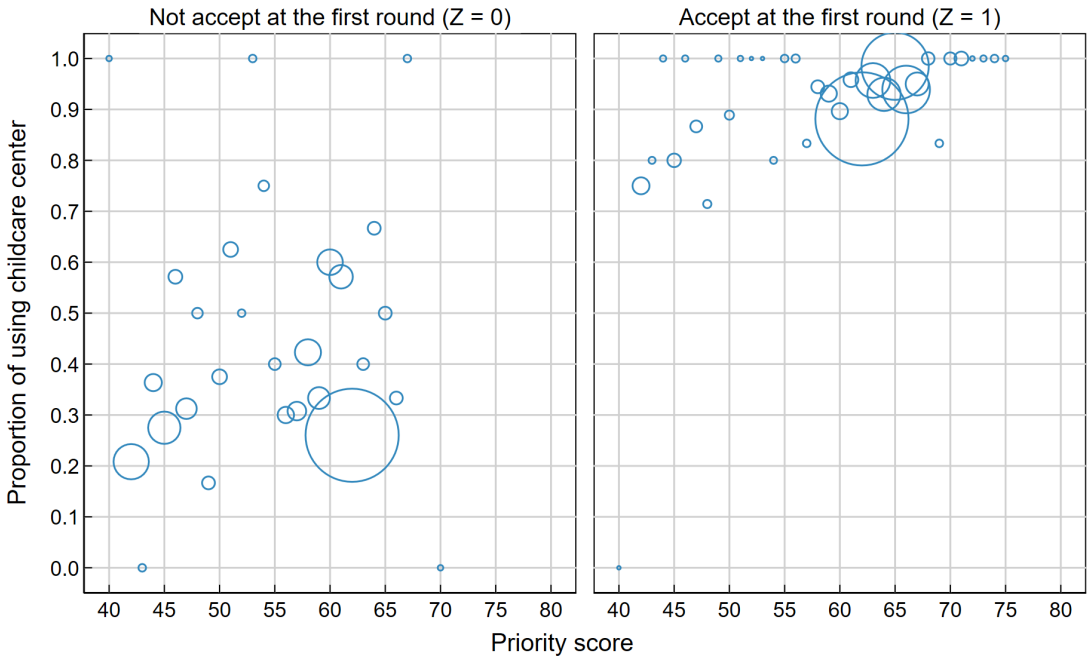
Table 7: IV estimates: Child's age = 1 & Priority score = 62

Dependent variables	Mother's emp (1)	Mother's income (2)	Father's emp (3)	Father's income (4)
OLS				
Childcare use	0.174***	72.419***	0.017*	-3.853
	(0.027)	(9.638)	(0.008)	(9.930)
Reduced form				
Accept in the 1st round	0.114***	33.580***	0.006	2.941
	(0.023)	(8.893)	(0.012)	(9.588)
TSLS				
Childcare use	0.217***	64.9134***	0.012	5.617
	(0.043)	(16.054)	(0.022)	(18.074)
Observations	634	634	634	634

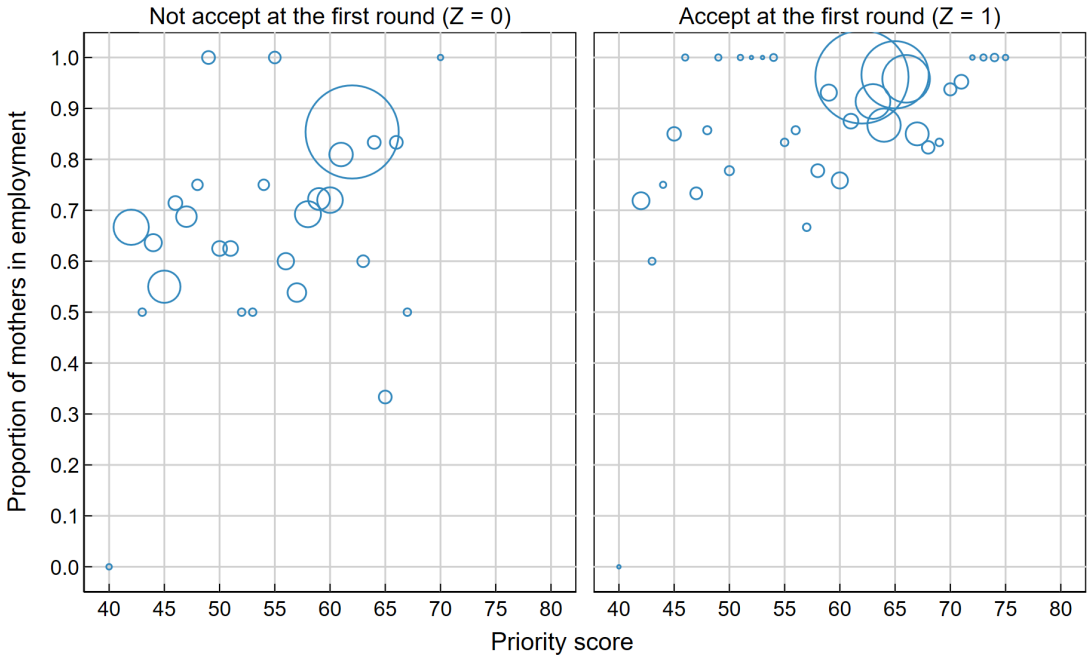
Note: This table shows the results of the second stage regression described in Equation (5) along with OLS and reduced form coefficients. Heteroskedasticity robust standard errors are in parentheses. In each analysis, the age of the parents, the previous year's income tax at the time of application and the salary income of the fathers and mothers before childbirth are controlled in a flexible functional form of cubic functions. $*p < 0.10$, $**p < 0.05$ and $***p < 0.01$

Appendix

A Figures



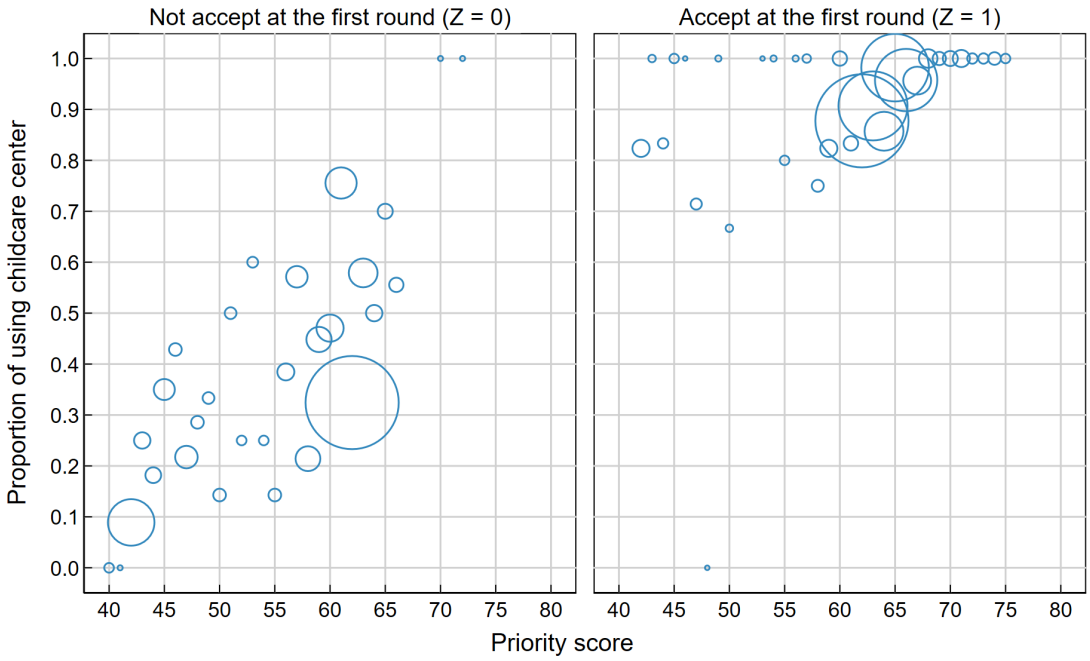
(a) Childcare use



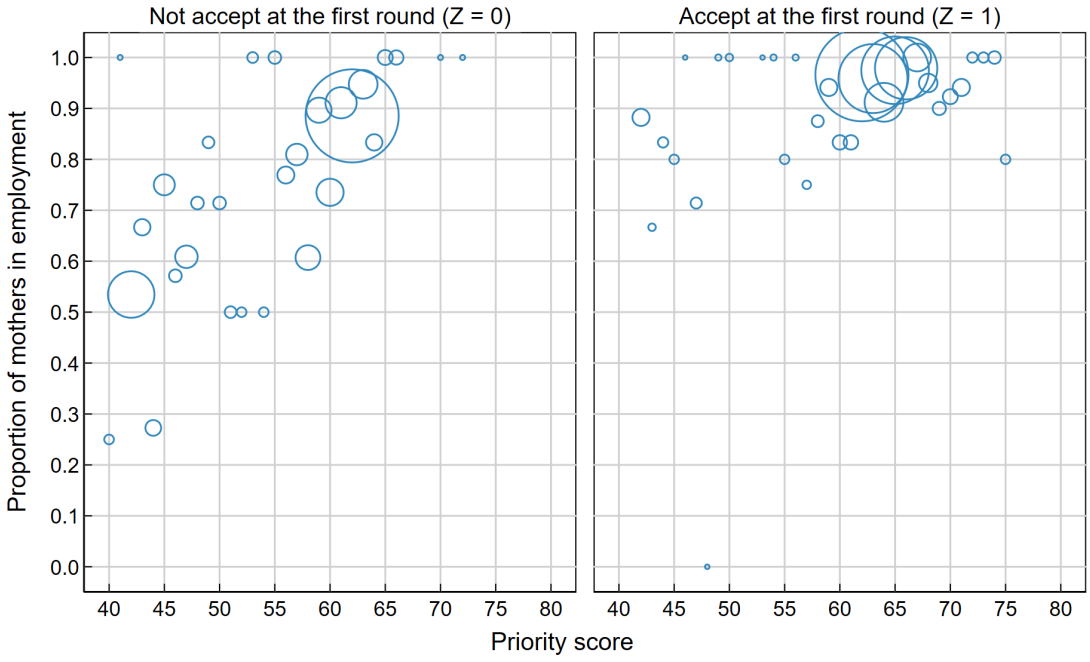
(b) Mothers in employment

Figure A1: Priority score and proportion of childcare use / mothers in employment: Child's age = 0

Note: This figure shows the proportion of using accredited childcare centers (panel (a)) and mothers in employment (panel (b)) as a result of the first round screening. The size of each point indicates the number of households for each priority score. The sample used for the figure is households with a 0-year-old child in 2016-2017 that applied for accredited childcare centers.



(a) Childcare use



(b) Mothers in employment

Figure A2: Priority score and proportion of childcare use / mothers in employment: Child's age = 1

Note: This figure shows the proportion of using accredited childcare centers (panel (a)) and mothers in employment (panel (b)) as a result of the first round screening. The size of each point indicates the number of households for each priority score. The sample used for the figure is households with a 1-year-old child in 2017 that applied for accredited childcare centers.

B Tables

Table B1: Percentage of Parents Who Lived in the City in the Past Three Years by Age of Child

		Percentage by year		
Age of child in April 2018	Obs.	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

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.

Table B2: IV estimates: Child's age = 0 & Priority score = [40, 100]

Dependent variables	Mother's emp (1)	Mother's income (2)	Father's emp (3)	Father's income (4)
OLS				
Childcare use	0.260***	94.664***	0.001	-6.045
	(0.022)	(6.382)	(0.008)	(6.377)
Reduced form				
Accept at the 1st round	0.154***	71.315***	-0.005	-12.422*
	(0.022)	(6.771)	(0.009)	(6.511)
TSLS				
Childcare use	0.289***	133.678***	-0.010	-23.286*
	(0.039)	(12.106)	(0.017)	(12.126)
Observations	2,555	2,555	2,555	2,555

Note: This table shows the results of the second stage regression described in Equation (5) along with OLS and reduced form coefficients. Heteroskedasticity robust standard errors are in parentheses. In each analysis, the age of the parents, the previous year's income tax at the time of application and the salary income of the fathers and mothers before childbirth are controlled in a flexible functional form of cubic functions. $*p < 0.10$, $**p < 0.05$ and $***p < 0.01$

Table B3: IV estimates: Child's age = 1 & Priority score = [40, 100]

Dependent variables	Mother's emp (1)	Mother's income (2)	Father's emp (3)	Father's income (4)
OLS				
Childcare use	0.173***	65.423***	0.002	-11.584
	(0.020)	(7.418)	(0.010)	(7.274)
Reduced form				
Accept at the 1st round	0.104***	34.005***	0.016	3.141
	(0.018)	(7.127)	(0.011)	(7.939)
TSLS				
Childcare use	0.225***	73.848***	0.035	6.821
	(0.034)	(14.836)	(0.025)	(17.009)
Observations	1,894	1,894	1,894	1,894

Note: This table shows the results of the second stage regression described in Equation (5) along with OLS and reduced form coefficients. Heteroskedasticity robust standard errors are in parentheses. In each analysis, the age of the parents, the previous year's income tax at the time of application, and the salary income of the fathers and mothers before childbirth are controlled for in a flexible functional form of cubic functions. $*p < 0.10$, $**p < 0.05$ and $***p < 0.01$

C Calculation of Priority Score

The priority score is a sum of the following points.

1. Each parent's status (separate points for mother and father)
   (a) Employed: sum of basic points based on working hours and bonus points
      - Basic points based on working hours per day: 20points if 8h or more, 19 if 7-8h, 18 if 6-7h, 17 if 5-6h, 16 if 4-5h, 15 if less than 4h, 15 if expected to be employed, 16 if piece work done at home.
      - Bonus points: 3 if works 5 or more days per week, 1 if works 5 or more days per week and 8 or more hours per day, 2 if working out of home

   (b) Unemployed searching for a job or preparing for own business
      - Basic points: 10
      - Bonus points: 5 if involuntary job loss, 3 if bread earner

   (c) Expecting mother: 33
   (d) Disease
      - Basic points: 20
      - Bonus points: 13 if hospitalized, 13 if designated intractable disease or bedridden, 6 others

   (e) Disability
      - Basic points: 20
      - Bonus points: 13 if physical disability rank 1 or 2, 10 if physical disability rank 3, 6 if other physical disability, 13 if mental disability rank 1, 10 if mental disability rank 2, 6 if mental disability rank 6, 13 if intellectual disability A or B, 10 if intellectual disability C

   (f) Caregiving for a sick person
      - Basic points: 20
      - Bonus points: 10 if caring for a bedridden relative, 10 if taking the person to hospital for five or more days per week, 8 if four days, 4 others

   (g) Caregiving for elderly
      - Basic points: 20 (18 if using service covered by Long-term Care Insurance three days or more per week)
      - Bonus points: 10 if nursing care level 3-5, 8 if nursing care level 2, 4 if nursing care level 1

   (h) Victims of natural disaster: 50
   (i) Student
      - Basic points: 18 if already in school, 11 if planning to go to school
      - Bous points 4 if undergoing vocational training

   (j) Not living in the same house: 24, bonus point 20 if in process of divorce or in detention
   (k) Non-existing (divorced or dead): 60

2. Additional points depending on who is taking care of the child now
   - Other accredited childcare centers 5
   - Kindergarten, baby sitters or privately operated childcare service, or nursery room operated by the employer: 7
   - Orphanage etc.: 15

- By parents, at home: 2
- By parents, out of home: 3
- A parent is on parental leave: 6
- Older siblings who withdrawn from accredited childcare centers because the mother takes maternity leave: 11
- By grandparents or other relatives: 3
- By friends or other non-relatives: 4
- At workplace: 5

3. Additional bonus points
    - Users of a certain kind of childcare service for children younger than three who must leave because of the age limit: 5
    - Moving because of relocation, switching to the same center as other siblings, etc.: 2
    - Welfare recipient: 5
    - One of the parents is living apart temporarily due to job transfer: 4
    - Siblings bonus
        - disabled: 3
        - preschool: 3 if applying for the same center, 2 if not
        - no preschool siblings, but at least one sibling in 1st-4th grade of elementary school: 1
        - 1 point per additional siblings exceeding 3
    - For each grandparent, 1 if unavailable due to work or not living together

Example: The father is working full-time, the mother is on maternal leave and returning to full-time work from April, an only child in the family, and no grandparent lives with them.

1. Each parent's status (separate points for mother and father): 52
    - Father's points: 26
        - basic points based on working hours per day: 20 points,
        - Bonus points: 3 if works 5 or more days per week, +1 if works 5 or more days per week and 8 or more hours per day, +2 if working out of home
    - Mother's points: 26
        - basic points based on working hours per day 20pt,
        - Bonus points: 3 if works 5 or more days per week, +1 if works 5 or more days per week and 8 or more hours per day, +2 if working out of home
2. Additional points depending on who is taking care of the child now: 6
    - A parent is on parental leave 6
3. Additional bonus points: 4
    - For each grandparent, +1 if unavailable due to work or not living together * 4

⇒ **Total 62 points (= 52 + 6 + 4)**