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The impact of childcare on maternal employment

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Abstract

This paper re-examines the impact of childcare availability on maternal employment in Japan, focusing on the period when childcare centre availability increased dramatically due to government policies in the 2010s aimed at boosting women's labour participation. We use data tracking mothers' employment status after childbirth, merging administrative data on the availability of both standard and nonstandard childcare centres. This is linked to each respondent via location identifiers based on their residential city and the nearest train station. The findings first show that an increase in unlicensed/nonstandard daycare availability significantly raised the proportion of mothers who return to work by the time the child reaches the age of three, particularly in areas with limited access to licensed/standard centres. Secondly, the effects may vary depending on the services offered by the centres. The results suggest that nonstandard centres, often more conveniently located and offering varied services, better meet the needs of working mothers, leading to higher employment rates. This research emphasizes that government efforts to expand childcare options in the 2010s may play a crucial role in promoting maternal labour-force participation in Japan.

1 | INTRODUCTION

Deriving labour supply for married women is a key policy issue in many countries. This is particularly important in countries like Japan, where married women often devote extensive hours to household chores, while labour shortages persist as a serious issue in the labour market. A well-known M-shaped curve illustrates the drop in labour-force participation and employment rates among women between the ages of 25 and 39, typically coinciding with marriage and childbearing. Unlike Scandinavian countries, where this drop has largely diminished, it remains pronounced in Japan.

This paper focuses on the recovery in maternal employment following this drop. Specifically, it aims to determine whether childcare availability affects a mother's decision to return to work. Among the many determinants, the expansion of access to childcare is our primary focus. In the 2010s, the Japanese government implemented several initiatives to increase childcare availability. These measures included subsidies for establishing new childcare centres, increasing the number of available spots in existing facilities and efforts to hire more childcare workers. This study evaluates whether the expansion of childcare services contributed to increased maternal employment.

Existing empirical results on this issue are mixed. Nollenberger and Rodriguez (2015) found that a reform in Spain, which expanded full-time, publicly provided childcare for 3-year-olds in the early 1990s, led to an increase in maternal labour-force participation. Their analysis used a difference-in-differences framework based on the birth year of the youngest child, the state of residence and the year of the reform's implementation. Similarly, Carta and Rizzica (2018) demonstrated that reforms in Italy during the 2000s, which extended early access to kindergarten for 2-year-olds, raised maternal labour-force participation and employment rates through a difference-in-discontinuities analysis. Bauernschuster and Schlotter (2015) showed that a 1996 reform in Germany, which expanded childcare eligibility to 3-year-olds, increased childcare attendance and maternal employment, utilizing instrumental variables and a difference-in-differences approach based on child age cut-offs.

In contrast, other studies have shown little or no effect of childcare availability on maternal employment. Fitzpatrick (2010), using a regression discontinuity design with birthday-based eligibility cut-offs in Georgia and Oklahoma, found that while free pre-kindergarten programmes increased preschool enrollment for 4-year-olds, they had little impact on maternal labour supply. Similarly, Bettendorf et al. (2015) found that increases in childcare subsidies in the Netherlands between 2005 and 2009 had limited effects on maternal labour-force participation, based on a difference-in-differences analysis comparing mothers with children under 12 to those with older children.

Goux and Maurin (2010) showed that early childcare availability increased labour-force participation among single mothers in France, but had no significant effect on two-parent families. de Muizon (2022) found that a 2004 French reform, which increased subsidies for working mothers with preschool children, had only small effects on overall maternal employment rates, though it did boost employment among middle class, educated mothers with two children. Neuberger et al. (2022) showed that childcare expansions in Germany during the 2010s had no significant effect on maternal employment after controlling for regional differences and time trends. Dehos and Paul (2023) also found that expanding access to after-school programmes in Germany during the 2000s did not increase maternal employment.

In Japan, empirical results have been similarly inconsistent. Asai et al. (2015) found that increases in the availability of licensed childcare centres had no effect on maternal employment, using prefectural panel data from 1990 to 2010. Conversely, Kawabata (2014) showed that access to childcare for children under three significantly increased maternal employment, using detailed spatial data and a geographic information system (GIS) to calculate the potential supply and demand for childcare in the Tokyo metropolitan area. Nishitateno and Shikata (2017)

found that better access to licensed childcare centres significantly increased employment among mothers with children aged 0–5, using city-level panel data from the 2000s.

Most of these studies in Japan use aggregated data at the regional level, such as city, municipality or prefecture. However, Fukai and Kondo (2025) use administrative individual and household records, including applications for licensed childcare, childcare usage and tax payments. They found that using licensed childcare for toddlers significantly increases maternal employment and annual income among mothers living in areas with childcare shortages. Their study also uniquely addresses endogeneity in childcare use by leveraging the application process to create a valid instrument for estimating maternal employment decisions.

The importance of services provided by centres is also noted in existing research. Brewer et al. (2022) found that full-time childcare services positively impacted maternal employment in the United Kingdom, while part-time care did not always have the same effect, using a regression discontinuity design based on age eligibility for free childcare in England. In the context of Japan, Ito and Yamamoto (2022) examined the effects of a government project, the 'General Childcare-Support for Model-Municipalities' programme, launched in 2004 in Japan. Although municipalities were selected for the programme based on their proposals for improving childcare, which may introduce an endogeneity problem, their difference-in-differences analysis found that maternal employment rates were higher in the treatment municipalities.

The present paper re-examines the effect of childcare centre availability on maternal employment in Japan, using individual-level data that track maternal employment status following the birth of the first child. The analysis focuses on the period around the year of 2010, when both local and central governments implemented policies to increase the number of childcare centres. The study area is Osaka, Japan's second-largest city, which faces a significant shortage of childcare services. Our primary focus is on the availability of unlicensed childcare centres, as their expansion represents the most notable change in Osaka during this period. While licensed centres are typically the first choice for families, unlicensed centres often serve as viable alternatives for working mothers. As explained in the following section, most unlicensed centres are certified by local municipalities and maintain adequate quality. As will be explained later, we refer to these centres as 'nonstandard' daycare centres in this paper.

Using an administrative dataset that includes information on the availability of both standard and nonstandard childcare centres, combined with maternal employment data, we find that an increase in nonstandard daycare centre availability significantly raises the rate at which mothers return to employed status, particularly in areas with limited access to standard centres. In other words, as nonstandard childcare centres became more prevalent in regions with a shortage of standard centres, mothers were more likely to return to employed status earlier. Furthermore, our analysis shows that the impact of childcare availability varies depending on the specific services provided by the centres. In our sample, nonstandard centres offering homemade snacks or allergy-free meals had a particularly positive effect on maternal employment. We conclude that government policies aimed at expanding daycare availability have successfully encouraged mothers to re-enter the workforce earlier after childbirth.

Our findings on unlicensed/nonstandard daycare centres contribute to the existing body of research on childcare and maternal employment in Japan, while also providing new evidence on the role of service content in childcare globally. The results suggest that the policy to expand childcare services around 2010 encouraged mothers to return to employment within the first 3 years after childbirth. Additionally, the findings indicate that childcare services tailored to mothers' specific needs may positively impact their return to employment.

The paper is organized as follows. Section 2 covers maternal labour supply and childcare policies in early 2010s Japan, with a focus on Osaka's regional characteristics. Section 3 introduces the Discrete Mixture Hazard Model for estimating mothers' return-to-work rates. Section 4 describes the two datasets: administrative data on childcare centres and an original survey on maternal employment after the first child. Section 5 reports the results, showing a positive effect of daycare services on maternal employment, especially in areas with limited standard daycare. Section 6 concludes with a summary of the findings.

2 | THE BACKGROUND

2.1 | Maternal labour supply

Our target period is the early 2010s, when married women's employment rates began to rise rapidly, although the overall rate was still relatively low around 2010. In 2012, the labour-force participation rates for women aged 25–29, 30–34, 35–39 and 40–44 were 77.6%, 68.6%, 67.7% and 71.7%, respectively. The rate for women aged 35–39 marks the lowest point of the M-shaped curve. The employment rate for married women with at least one child under the age of 6 was 41.8% in 2010 and 49.6% in 2015, significantly lower than in other countries like Italy, France, the United Kingdom and the United States, according to the Ministry of Health, Labour and Welfare (2022). Several factors may explain these low employment and labour-force participation rates among married women. For instance, societal expectations in Japan often place the responsibility of childcare and household chores on women. Such traditional norms may discourage women from working outside the home. Additionally, the long working hours expected of men may be another contributing factor. In many workplaces, male employees are often unable to refuse overtime, and their limited time at home may result in their spouses taking on more household responsibilities.

2.2 | Childcare services

The primary caregiver during the daytime is typically the child's mother. According to the Longitudinal Survey of Newborns in the 21st Century (conducted by the Ministry of Health, Labour and Welfare and comprising around 40,500 mothers of children born in January and July of 2001), the main daytime caregiver for a 3-year-old child on a typical day can be the child's parents (57.64%), grandparents (3.62%), daycare centres or nursery schools (30.13%), kindergartens (7.90%) or others (0.21%).

When a mother is employed, daycare centres or nursery schools typically become the primary caregivers. Childcare facilities for children under the age of 3 in Japan are referred to as 'Hoiku-en' or 'Hoiku-sho', which are often translated as nursery schools but are more accurately described as daycare centres in terms of the services provided. These facilities generally do not offer educational programmes, and care hours are relatively long. In contrast, kindergartens provide educational programmes for preschool-aged children (usually aged four and above), with shorter care hours. In this paper, we refer to 'daycare centres' as childcare facilities for children aged three and under, whose mothers are the focus of our empirical study.

In Japan, daycare centres are broadly classified into two types: 'Licensed' and 'Unlicensed'. Licensed centres are regulated by the government and must strictly adhere to the standards set

forth in the Child Welfare Act. These regulations cover areas such as care hours, staff-to-child ratios, facility size, meal provision and more. Licensed centres typically offer longer care hours (up to 11 h), higher staff-to-child ratios and larger facilities, often including outdoor spaces, compared to unlicensed centres. Licensed centres also provide lunch services, whereas unlicensed centres may not. Care fees are usually lower at licensed centres, although they depend on household income. Licensed childcare centres can be either public or private, while the majority of unlicensed centres are operated by private companies. These unlicensed facilities can be subsidized after 2010 when many municipalities facing a shortage of childcare centres began providing financial support to promote the establishment and maintenance of unlicensed facilities.[1]

Although the above description may suggest that licensed centres are of higher quality, this is not always the case. Unlicensed childcare centres can be small, ranging from home-based care and small-scale care to centre-based care. Unlicensed ones, due to their flexibility, can offer a wider range of services, including longer care hours, care for sick children, educational programmes, meal services, special safety measures and more. As a result, unlicensed centres can provide high-quality care. Additionally, their smaller size allows them to be located in more convenient places for parents, such as near train stations, making them ideal for parents commuting to work.[2]

Another major difference between licensed and unlicensed centres is the application process. For licensed centres, parents must apply through the city office where they are registered, meaning only residents of the city can access its centres. The application must be submitted with ranked centre preferences (first choice, second choice, etc.) by a specific deadline, and the city office evaluates the applications based on need. For instance, single parents, those without extended family support, or those working full-time may have higher priority. The city then assigns each applicant to a specific centre. Thus, the final decision made by the city office may not necessarily match the parents' first choice. The selection process can be lengthy.

In sharp contrast, the process for unlicensed centres is much simpler. Applications are submitted directly to the unlicensed centre of the applicant's choice, and parents can choose centres located outside their registered city if they prefer. Applications are accepted at any time, providing greater flexibility.

Since unlicensed centres are not necessarily of lower quality, we refer to licensed centres as 'standard' daycare centres and unlicensed ones as 'non-standard' centres in this paper to avoid misunderstanding about the quality. Standard centres may be the first choice for some mothers, while nonstandard centres serve as a second option for them when their applications for standard centres are rejected or there are no vacancies.

To address the shortage of childcare and boost maternal employment, the government implemented several policies under the 'Acceleration Plan for Reducing Wait-listed Children', launched in 2013, and the 'New System for Children and Child-rearing', introduced in 2015. The availability of childcare centres, especially nonstandard ones, has increased dramatically since 2013, and the number of employed mothers has gradually risen during the same period.

2.3 | The situation in Osaka

Our target group consists of mothers who had their first baby between 2006 and 2013 in Osaka Prefecture. It is the second-largest prefecture in Japan, located in the western part of the country. The prefecture includes 39 cities, from a small town with about 450 children under five to

Osaka City, the capital, with over 135,000 children under five during our target period. These cities have many small- and medium-sized enterprises, offering more work opportunities than in other local prefectures. However, as the number of mothers seeking employment is also high, Osaka prefecture faced a serious shortage of daycare centres, especially around the early 2010s. The percentage of children on daycare waiting lists ranged from 0% to 29.3%, with an average of 8.75% during our target years.

To address the childcare shortage, the local government of Osaka and its municipalities have also implemented various policies to encourage the establishment of new daycare centres. Note here that the focus is on nonstandard centres, as standard ones are slow to increase in availability. As mentioned, nonstandard centres are often located near train stations, likely because major cities have well-developed railway networks. As many workers in urban areas commute by train, daycare centres near stations are particularly convenient.

Figure 1 illustrates a typical scenario in Osaka. Consider three mothers—Sarah, Emily and Jessica—who all gave birth to their first child in the same month. Sarah lives in City A, while Emily and Jessica reside in City B. They all aim to work at the same workplace (■). Sarah, who lives in City B, can access four daycare places: the standard centres S-1 and S-2, and the nonstandard centres N-1 and N-2 near train station X. In contrast, Emily, who lives in City A, can use three centres: nonstandard centres N-1 and N-2, and standard centre S-3. She cannot use S-1, because she is not a resident of City B, even though it is nearby. Lastly, Jessica can access two centres: nonstandard one N-3 near station Y, and standard one S-3. We explore how these different daycare options influence their decisions about returning to work, focusing on the emergence of nonstandard options.

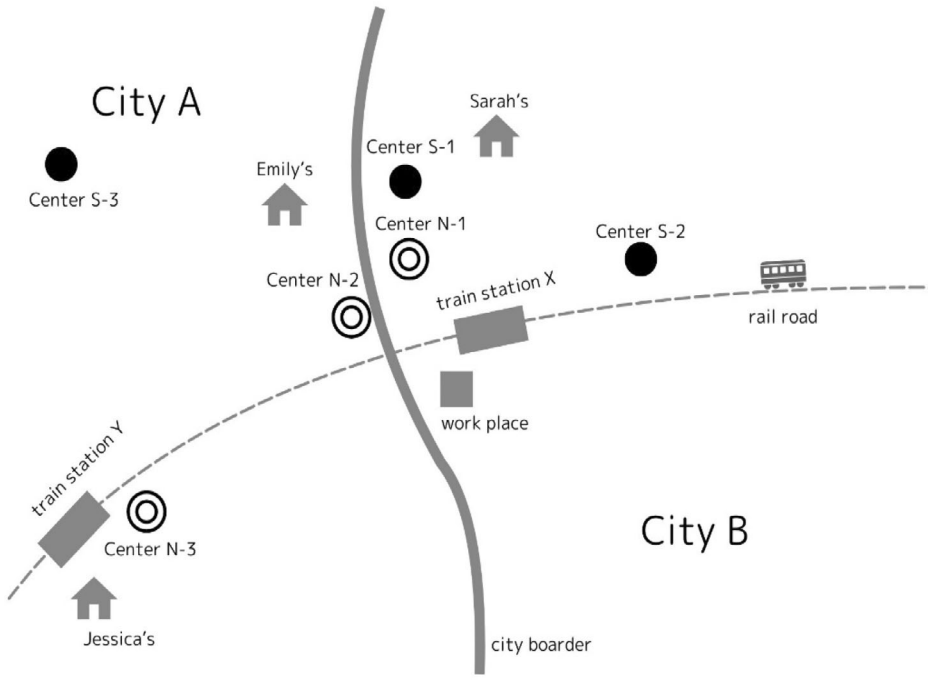

FIGURE 1 Standard and nonstandard childcare centres mothers can use.

3 | THE ESTIMATION MODEL

We estimate the return-to-work behaviour of mothers who were employed prior to childbirth. Specifically, we calculate the hazard rates of mothers returning to work after childbirth, accounting for both observed and unobserved heterogeneity. To achieve this, we use the Discrete Mixture Hazard Model by Heckman and Singer (1984). Supposing that h shows the hazard rate and that t_i is the duration of a mother i from the month of delivery, we can write the hazard function such as $h(t_i|\theta,x) = \theta_k \phi(x) \lambda(t_i)$ where $\phi(x)$ is a determinant of hazard, which is defined as the function of vector x: $\phi(x) = \exp(x\beta)$, and $\lambda(t_i)$ is a baseline hazard. θ_k is the unobserved heterogeneity, following Gamma distribution. To assess the mixing distribution, fitting the finite mixture with support at K discrete points with a probability of p_k. All the parameters are obtained by maximizing a joint likelihood.

Our analysis focuses on the period from childbirth up to 36 months, when the child reaches 3 years of age. We focus on the first 36 months because mothers who used to work before childbirth and remain in the labour force typically return to employment by the time their children turn three. In other words, mothers who do not start working before their children reach the age of three tend to remain out of the labour force for a significant period. Additionally, our analysis emphasizes the effect of daycare centres providing care for small children under the age of three, as the scarcity of such centres is a known social issue. Children over the age of three can attend kindergartens and other preschool daycare centres, whose shortage is not a major problem. In our hazard model, we consider mothers who do not return to work by the 36th month as a right-censored sample.

There is one drawback in our estimation. Although a finite mixture hazard model allows time-varying regressors, we use time-invariant information on centre availabilities either for standard or nonstandard centres, fixed at the time when a respondent's first child is 1.5 years old for simplicity of calculation. Although they are time-invariant within the same mother/child, the values are quite different since the first child's birth year and place are very different among respondents. Allowing for the time-varying centre availability remains for future study.

It is important to note that we focus on the effect of nonstandard care centres, as the availability of standard centres remains relatively stable. However, the availability of standard centres must be controlled for, as it may influence the effect of nonstandard centres. The challenge arises in controlling both availabilities simultaneously, due to the relatively strong correlation between them. In our estimated sample, the correlation rate is −0.28 and significant at the 1% level.[3] Therefore, after estimating the mixture hazard model, which includes both nonstandard and standard centre availability in the regressors, we split the sample into areas with high and low availability of standard centres. The cut-off point will be explained in the next section. We then examine the difference in the effects of nonstandard centres on hazard rates between the two areas.

Another focus is the differences in the content of care services provided by nonstandard centres. As noted in the previous section, nonstandard centres provide a wide range of services. Using the information on the services offered by each nonstandard centre included in our data, we estimate how differences in service content affect mothers' decisions to return to work. We conduct the same estimation but focus on the availability of nonstandard centres, calculated separately for those offering (a) extended-hour services, (b) temporary/short-term services, (c) lunch services, (d) homemade snack services and (e) allergy-free food services.

4 | THE DATA

We use two datasets. The first is a dataset of registered daycare centres compiled by Osaka Prefecture. This dataset includes information on the centres' addresses, availability, year of establishment and services provided. The second dataset is an original survey of mothers living in Osaka, titled 'Survey on the Impact of Social Health Care Policies and Household Investment on Children's Growth' (hereafter referred to as the 'Child Growth Survey'), conducted by the authors online in 2016. The survey was conducted over a week in early October 2016 and targeted mothers of first children aged 3–10 who were registered with a Japanese survey company. The survey asks mothers to reflect on changes in their employment status, their first child's growth, household situations, childcare use and support from (grand)parents since the birth of their first child. The first children, in our sample, were born between 2006 and 2013, and their mothers were between 19 and 45 years old at the time (93.02% were between 25 and 39 years old).

We can merge the information on standard daycare centres by 'city code' and nonstandard centres by 'station name', as collected in the 'Child Growth Survey'. The merged dataset allows us to track changes in a mother's employment status after the birth of her first child, enabling us to conduct a duration analysis on the rate of returning to work. Additionally, we can identify changes in the availability of nonstandard centres for each respondent based on the nearest station, while also tracking changes in the availability of standard centres using the respondent's residential municipality identifier. This allows us to examine the effect of nonstandard centres while controlling for standard centre availability.

Furthermore, we have detailed respondent information on possible determinants of maternal employment, as suggested by previous studies.[4] These factors include potential support from nearby or co-resident grandparents, the availability of childcare leave in the mother's previous workplace, as well as the characteristics of the mother, child(ren) and household. Although unobserved heterogeneity among mothers is accounted for in our mixture hazard model estimation, controlling for observed characteristics remains important. This detailed information helps clarify the causal impact of childcare services on maternal employment.

Our dependent variable is whether or not a mother returned to work (get out of non-employment status) each month. 'Returning to work' includes both returning to the same firm a mother worked at before giving birth and starting employment at a new firm after previously terminating her employment prior to childbirth. In our sample, when comparing the employment status 6 months before childbirth with the status one and a half years after, 30% of mothers were not employed either before or after childbirth, 40% were employed before childbirth but not after and 30% were employed both before and after. Among the latter 30%, 60% returned to the same firm, while 40% began working at a new firm.[5] Figure 2 presents Kaplan–Meier survival estimates of mothers' non-employment rates over the months following their first child's birth up to 36 months. The figure indicates that approximately 20% of mothers start working by the time their first child turns three. Specifically, the hazard rates are 4%, 11% and 19% at 12 months, 24 months and 36 months, respectively.

The most important explanatory variable is the availability of nonstandard daycare centres.[6] We counted the number of nonstandard centres located within 2 km of the respondent's nearest train station, based on a map from the year when their first child was 1.5 years old. We then averaged this figure across each residential city and calculated the ratio per 10,000 children under 5 years old in the city for that year. According to Table 1, approximately 6.6 nonstandard centres are available around the nearest station (per 10,000 children under 5 years old).[7]

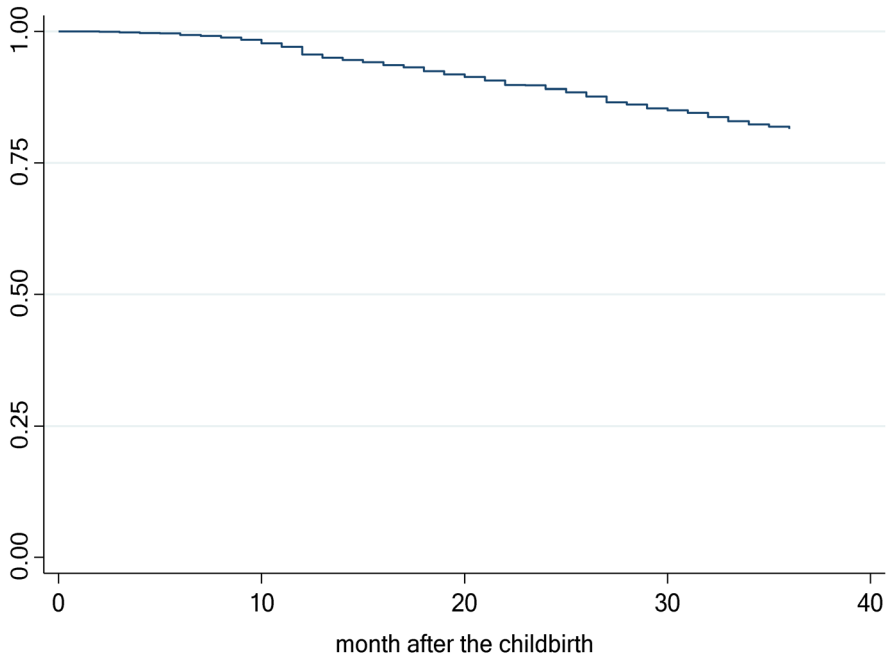

FIGURE 2 Maternal non-employment rates after the birth of the first child. The figure shows our sample's Kaplan–Meyer survival estimates of the mother's non-employment status after the first child's birth. We focus on the hazard rates up to 36 months, by the time the first child turns three. In the estimation, the right censoring at the 36th month is considered. [Color figure can be viewed at wileyonlinelibrary.com]

The availability of standard daycare centres is another important regressor. This is publicly reported as the sum of available seats in standard centres per 100 children under 5 years old in each municipality per year. We assigned this measure to each respondent based on their residential municipality in the year when their first child was 1.5 years old. According to Table 1, an average of approximately 29.9 seats (per 100 children under 5 years old) were available. Note that the effects of nonstandard and standard centres cannot be directly compared, as the method of counting availability differs between the two types.

This is a note regarding the definition of these two types of childcare centres. For standard childcare centres, we use the availability measure based on the number of available seats for children. In contrast, for nonstandard centres, we use the number of available centres, although the number of available seats would be preferable for our analysis. This is because the information on available seats is not known for all the nonstandard centres. As a result, we cannot calculate the total availability by summing the availability across the two types of centres. In our estimation, we treat the two variables separately to ensure a careful interpretation of the results.

To examine the heterogeneity in the effects of nonstandard care availability on maternal employment carefully, we split the sample into the cities depending on the availability of standard daycare centres. Specifically, we define the cities with high availability of standard ones as those where availability is greater than or equal to the median in the entire sample, while the cities with availability below the median as low availability.

TABLE 1 Definition and descriptive statistics of the variables.

		Entire sample				In the area with: (A) high availability of standard centres		(B) low availability of standard centres	
	Definition	**Mean**	**SD**	**Min**	**Max**	**Mean**	**SD**	**Mean**	**SD**
Dependent variable									
Rate of mother's return to work at every month	Mother's hazard rate of getting out of non-employment status (the ratio of mothers who started work in each month after delivery	0.0116	0.1071	0	1	0.0127	0.1119	0.0104	0.1017
	(c.f) Months from childbirth to a mother starting work	33.1795	6.9661	0	36	32.9112	7.2299	33.4603	6.6674
Independent variable									
Availability of daycare centers									
Availability of non-standard daycare centers	Number of nonstandard daycare centres within 2 km of the respondent's nearest train station when the first child is 1.5 years old (calculated as the municipality average, as a ratio of the municipality's 10,000 children under 5 years old)	6.6030	5.4906	0	34	7.5614	6.6744	5.6049	3.6327
Availability of standard daycare centers	Number of seats in standard daycare centres available in the municipality where the respondent resides when the first child is 1.5 years old (calculated as the ratio per 100 children in the years old in the municipality)	29.932	4.106	20.622	46.695	33.2069	2.0127	26.3595	2.3889
Number of non-standard daycare centers with different services									
(a) Extended hours services	Availability of nonstandard centres providing extended-hours care	1.9810	1.9730	0.5299	10.5993	1.3511	1.8415	2.6406	1.8888
(b) temporary and short-time care services	Availability of nonstandard centres providing temporary or short-time care	2.0511	2.0446	0.4184	10.1873	1.2559	1.7102	2.8836	2.0347

(Continues)

TABLE 1 (Continued)

		Entire sample				In the area with: (A) high availability of standard centres		In the area with: (B) low availability of standard centres	
	Definition	**Mean**	**SD**	**Min**	**Max**	**Mean**	**SD**	**Mean**	**SD**
(c) lunch services	Availability of nonstandard centres providing lunch services	2.2934	2.3253	0.5090	12.8251	1.4660	2.2616	3.1599	2.0606
(d) homemade snacks services	Availability of nonstandard centres providing homemade snacks	2.1619	2.2763	0.2789	13.3551	1.3419	2.2375	3.0204	1.9809
(e) allergy-free meals services	Availability of nonstandard centres providing allergy-free meals	2.0320	2.0596	0.4264	11.0233	1.2288	1.9732	2.8729	1.7957
Mother's and household characteristics									
Childcare leave at former place of employment	Workplace atmosphere before childbirth encouraging workers to take childcare leave: 1= almost none takes the leave; 2= few; 3=some; 4=many; 5=almost all	1.6790	1.1220	1	5	1.6422	1.1128	1.7174	1.1303
Motehr's age	Logarithm of mother's age at the first child's age of 1.5	3.4474	0.1527	2.9444	3.8067	3.4514	0.1493	3.4432	0.1561
Mother's marital status	A dummy variable taking 1 if a mother is married at the first child's age of 3, and 0 otherwise	0.9232	0.2662	0	1	0.9262	0.2614	0.9201	0.2711
Mother's low level of education	A dummy variable taking 1 if a mother has a middle school degree (compulsory/minimum education), and 0 otherwise	0.0349	0.1836	0	1	0.0243	0.1541	0.0460	0.2094
Household economic situation	A dummy variable taking 1 if the household economic condition relative to the other households at the first child's age of 3 is good (wealthy or relatively wealthy), and 0 otherwise (poor or relatively poor)	0.7490	0.4336	0	1	0.7458	0.4354	0.7524	0.4316
Household living with (grand) parents	A dummy variable taking 1 if a household lives with grandparents or in an area within a 10-min drive from home at the first child's age of 3, and 0 otherwise	0.4385	0.4962	0	1	0.4286	0.4949	0.4489	0.4974

TABLE 1 (Continued)

		Entire sample				In the area with: (A) high availability of standard centres		In the area with: (B) low availability of standard centres	
	Definition	**Mean**	**SD**	**Min**	**Max**	**Mean**	**SD**	**Mean**	**SD**
Two or more children	A dummy variable taking 1 if a household has two or more children at the first child's age of 3, and 0 otherwise	0.4006	0.4900	0	1	0.4101	0.4919	0.3906	0.4879
Living in the capital city	A dummy variable taking 1 if a household lives in the capital city of Osaka (Osaka-shi) at the first child's age of 3, and 0 otherwise	0.3281	0.4695	0	1	0.6414	0.4796	0	0
Regional characteristics									
Female unemployment rate in a prefecture	Female unemployment rate in Osaka prefecture at the first child's age of 1.5	4.9047	0.5939	4.1	5.9	4.8198	0.5807	4.9936	0.5947
Number of children under 5 in a city	Number of children under the age of 5 at the first child' age of 1.5 (ten thousands)	5.7362	5.6325	0.2669	13.7693	9.4181	5.7385	1.8810	1.1853

Note: The table presents descriptive statistics for the main estimation. The total number of observations is 24,493 (849 households). For areas with high and low availability of standard centres, the number of observations is 12,528 (443 households) and 11,965 (406 households), respectively. The definition of high availability of standard centres refers to areas where availability is greater than or equal to the median availability in the entire sample. Areas with availability below the median are defined as having low availability.

To further examine the effects of different services, we also measure the availability of nonstandard centres offering specific services such as (a) extended-hours services, (b) temporary and short-time care, (c) lunch services, (d) homemade snack services and (e) allergy-free meal services. The availability of nonstandard centres offering each service is calculated in the same way as the overall availability for nonstandard ones. Figure 3 shows the ratio offering each service by standard and nonstandard childcare centres in our sample. Regarding extended-hours services, more than 75% of both standard and nonstandard centres offer this service. However, other services, such as temporary and short-time care and homemade snacks, are offered significantly more frequently by nonstandard centres than by standard ones.

Control variables include the mother's age, educational attainment, marital status and the availability of childcare leave at the mother's previous workplace. The latter is particularly important for explaining the mother's decision to return to work. Here, we use the take-up rate of childcare leave at the workplace where the mother was employed before childbirth, rather than a simple indicator of childcare leave availability. The distinction is crucial because many workplaces have childcare leave policies, but they are not always utilized. The workplace atmosphere plays a key role in encouraging mothers to take childcare leave.

We also control for household economic conditions, household structure (e.g., living with grandparents or the number of children/siblings) and whether the respondent resides in a capital city. Additionally, we account for regional economic and demographic differences by including the female unemployment rate in Osaka and the number of children under 5 years old. The definitions and descriptive statistics of these variables are summarized in Table 1.

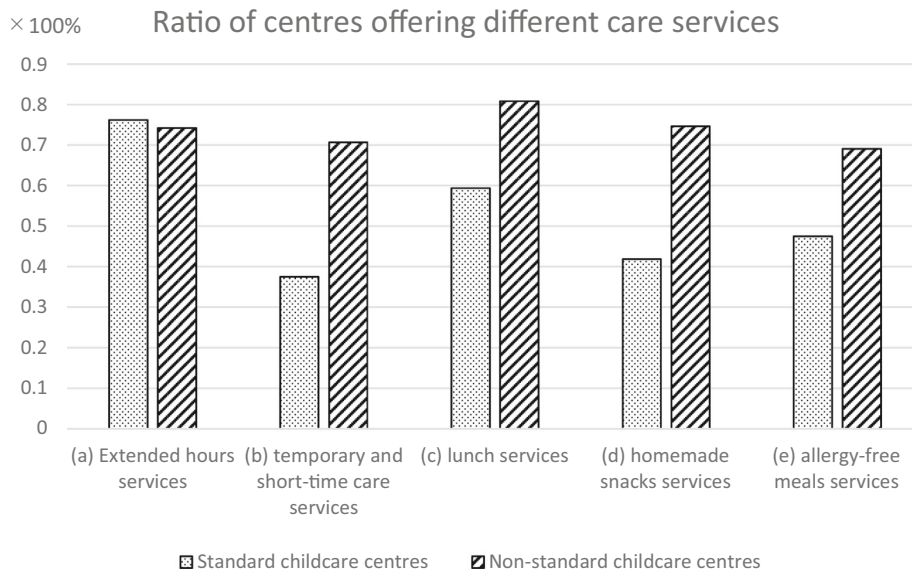

FIGURE 3 Services offered by standard and nonstandard childcare centres.

5 | RESULTS

5.1 | Does the availability of daycare affect maternal decisions regarding work?

Table 2 presents the results of the mixed hazard model estimation, allowing for maternal unobserved heterogeneity. The coefficient on available seats in nonstandard daycare centres is positive, with a *p*-value of .166. At the 10% significance level, we cannot reject the null hypothesis that nonstandard childcare availability does not affect maternal employment. The estimate and its standard error do not change dramatically even after dropping the term of the availability of standard centres, suggesting that the large standard errors do not come from a problem of multicollinearity between the standard/nonstandard service variables (the correlation rate is 0.27).

The statistically insignificant effect at conventional significance levels may suggest that the spurious correlation between daycare availability and maternal employment diminishes after controlling for the regional availability of standard centres, as well as maternal, child and household characteristics, and allowing for maternal unobservables in the hazard model on the

TABLE 2 Effects of increases in nonstandard care centres on maternal employment.

Mixed hazard estimation of maternal employment	
Availability of nonstandard daycare centres	0.0451 (0.0325)
Availability of standard daycare centres	0.0221 (0.0197)
Mother's characteristics	
Maternity leave at former place of employment	0.3292*** (0.0516)
Log of Mother's age	−0.7705* (0.4249)
Mother's marital status	−0.925*** (0.1831)
Mother's low level of education	−0.0149 (0.3407)
Household characteristics	
Household economic situation	−0.1782 (0.1403)
Household living with (grand) parents	0.0009 (0.1274)
Two or more children	−0.3076** (0.1352)
Living in the capital city	−0.8798 (0.8061)
Regional characteristics	
Female unemployment rate in a prefecture	−0.0174 (0.1098)
Number of children under 5 in a city	0.1031 (0.0715)
Constant	−2.3483 (1.7398)
Number of the observations (mothers)	24493 (849)
Log likelihood	−1503.70
Wald test (Null: all the parameters = 0)	72.61***
Likelihood Ratio Test (Null: no frailty)	0.3907

Note: Estimated by mixed hazard model allowing for frailty. The coefficients (but not hazard rates) and their standard errors are reported. ***, ** and * show that the variables are significant at the 1, 5% and 10% level, respectively. See Table 1 for the definitions of variables on the availability of daycare centres.

time taken to start working after childbirth. Indeed, a simple correlation rate between the dichotomous variable indicating maternal employment at the child's age of three and nonstandard centres' availability is positive and significant at a 1% significance level. This spurious positive correlation disappeared by our present analysis using the mixture hazard estimation.

Aside from nonstandard centre availability, parameters that are significant at least at the 10% level suggest that mothers eligible for childcare leave return to employed status earlier after childbirth. Younger mothers, single mothers and those with another child over the age of three also tend to return to work sooner, consistent with expectations.

It is important to note that the coefficient for the standard centre availability is small and insignificant at the 10% level. This remains the case even after excluding the variable for nonstandard centres, consistent with some previous studies. One might expect that the establishment of standard centres would have a positive impact in areas with fewer such centres, but this is not the case. We conducted estimations allowing for partial effects in areas with a shortage of standard daycare centres, such as including an interaction term between standard centre availability and a low-availability area dummy, and limiting the sample to a low-availability area. However, we did not find any significant effects. As prior research has suggested, Japan's childcare policies may appear inefficient when considering only standard services.

These findings are robust across different model specifications. For instance, insignificant effects on nonstandard centre availability persist even when we alter the indicator specification. This includes taking the logarithm of the availability indicators or using a dummy variable coded as one if the ratio is above the median, and zero otherwise. The insignificant effect of nonstandard centres remains unchanged even when standard centre availability is removed from the explanatory variables to avoid the multicollinearity problem. Additionally, estimating a standard proportional hazard model without allowing for the mother's unobserved heterogeneity does not change the results. Thus, the results show that an increase in daycare centres did not significantly impact mothers' rates of returning to work. Can we really find no effect of nonstandard childcare services on maternal employment? Was the government's policy of promoting nonstandard services truly ineffective in encouraging maternal labour supply? The next section will further explore heterogeneous effects in nonstandard centres.

5.2 | Does the availability of nonstandard centres not encourage maternal employment at all?

The impact of nonstandard daycare centres on maternal employment may vary across regions, depending on whether standard centres are sufficiently available. We re-estimate the maternal hazard of leaving non-employment, splitting the sample into two groups: areas with high and low availability of standard daycare centres. The threshold for high and low availability is the median number of available seats (per 100 children under 5 years old) in standard centres across the entire sample. The split improves the identification of the estimation, as the availability of standard and nonstandard centres is highly correlated. Collinearity between the two may reduce the accuracy of the estimates.[8]

Table 3 shows the results. 'High availability', shown in column (A), refers to areas where the number of available seats in standard centres exceeds the median, while 'low availability', shown in column (B), refers to areas where the number of available seats falls below the median.

TABLE 3 The difference between the areas with high and low availability of standard centres.

Mixed hazard model estimation for maternal employment	In the areas with	
	(A) high availability of standard centres	(B) low availability of standard centres
Availability of nonstandard daycare centres	−0.0029 (0.0497)	0.0896* (0.0467)
Mother's characteristics		
Maternity leave at former place of employment	0.3597*** (0.0698)	0.3126*** (0.0756)
Log of Mother's age	−1.1897** (0.6045)	−0.3969 (0.5919)
Mother's marital status	−1.1420*** (0.2516)	−0.6914** (0.2707)
Mother's low level of education	0.0384 (0.4906)	−0.0401 (0.4779)
Household characteristics		
Household economic situation	0.0009 (0.1945)	−0.3583* (0.2032)
Household living with (grand) parents	−0.0454 (0.1723)	0.1024 (0.1906)
Two or more children	−0.3106* (0.1843)	−0.3003 (0.2061)
Living in the capital city	−0.3012 (1.1670)	−3.5795 (2.2161)
Regional characteristics		
Female unemployment rate in a prefecture	−0.0835 (0.1512)	0.0189 (0.1581)
Number of children under 5 in a city	0.0433 (0.1049)	0.1505 (0.1000)
Constant	0.4264 (2.2258)	−3.5795 (2.2161)
Number of the observations (mothers)	12528 (443)	11965 (406)
Log likelihood	−824.13	−676.68
Wald test (Null: all the parameters = 0)	44.36***	31.79***
Likelihood Ratio Test (Null: no frailty)	0.2233	0.0608

Note: Estimated by mixed hazard model allowing for frailty. The coefficients (but not hazard rates) and their standard errors are reported. ***, ** and * show that the variables are significant at the 1, 5% and 10% level, respectively. Results for (A) are for mothers living in areas with high utilization of standard daycare centres and (B) are for mothers living in areas with low availability of standard daycare centres. A high availability rate is above the median availability rate of a standard daycare centre, while a low availability rate is below the median rate.

Table 3 shows a significant difference in the effect of nonstandard daycare centre availability on maternal employment between areas, depending on the availability of standard centres. The estimate for nonstandard availability is statistically significant at the 10% level (with a *p*-value of .055) in areas with low availability of standard centres, which is shown in the right panel B, unlike in areas with high availability in the left panel A. It is important to emphasize that we obtained this significantly positive impact of nonstandard centre availability after controlling for maternal unobserved heterogeneity, as well as characteristics of mothers, children and households.

The estimate for nonstandard centre availability suggests that the marginal impact on maternal hazard from non-work to work is 0.094 (which is calculated as exp. (β) − 1) where β is a coefficient shown in Table 3. This indicates that maternal employment rates would rise by 9.4 percentage points for a unit increase in the availability of nonstandard centres (a newly

established nonstandard one, per 10,000 children under the age of 5, around the nearest station). This represents a significant impact.

The results remain robust across any specifications of different forms of availability variables, different covariates or estimation models. Thus, we conclude that the availability of nonstandard centres encourages maternal employment when standard daycare centres are less available. This positive impact has not been consistently found in previous studies. The reasons for the differences in the results will be discussed later.

5.3 | Are there differences in the effects among services supplied by daycare centres?

One of the unique characteristics of nonstandard daycare centres, which distinguishes them from standard ones, is the wide variety of services they offer. Our dataset includes information on the specific services provided by each daycare centre. In this subsection, we further examine the impact of nonstandard centre availability based on the different service contents they provide.

We conduct the same estimation but analyse the increase in nonstandard centre availability separately for centres offering distinct services. The estimation results are reported in Table A1 and summarized in Figure 4. In this figure, the marginal effects of increasing the availability of nonstandard centres with different services on hazard are shown, calculated as $\exp(\beta) - 1$, where β is the coefficient obtained in Table A1. The 95% confidence intervals are also included. The left panel of the figure shows that in areas where mothers have more access to standard daycare centres, increasing the availability of nonstandard centres does not significantly raise maternal employment, regardless of the type of services offered. In contrast, the right panel shows that in areas with low availability of standard centres, the estimates for temporary and short-time care services, homemade snacks and allergy-free meals are positive and significant at the 5% level (with all the positive estimates significant at the 10% level). A unit increase in the availability of nonstandard centres offering homemade snacks or allergy-free meals results in particularly strong effects, increasing mothers' hazard rates from non-working to working by 13.25 percentage points and 14.45 percentage points, respectively.

Note that the results may reflect the importance of the overall number of available centres, rather than the importance of specific service contents, because we focus on the number of centres offering each service without considering other (and total) service availabilities. We cannot compare differences in services across similar areas in terms of centre availability because doing so would significantly reduce the sample size if we grouped areas based on both the services and quantity of nonstandard and standard centre availability. Therefore, we cannot conclude which service is effective or ineffective, or whether quality is more important than quantity. However, the results, which show varying impacts of nonstandard centre availability across different services, suggest that mothers respond differently to the availability of centres when deciding the timing of their return to employment.

Thus, we can say that certain service offerings have a greater impact on mothers returning to work after childbirth. In our sample case, attentive services related to food, such as homemade snacks and allergy-free meals, appear to have a significant effect. This suggests that mothers of young children, especially those under 3 years of age in Japan, take food quality seriously. This is probably because children in daycare often spend long hours there—from morning to evening or even into the night at daycare centres, because workers in Japan are required

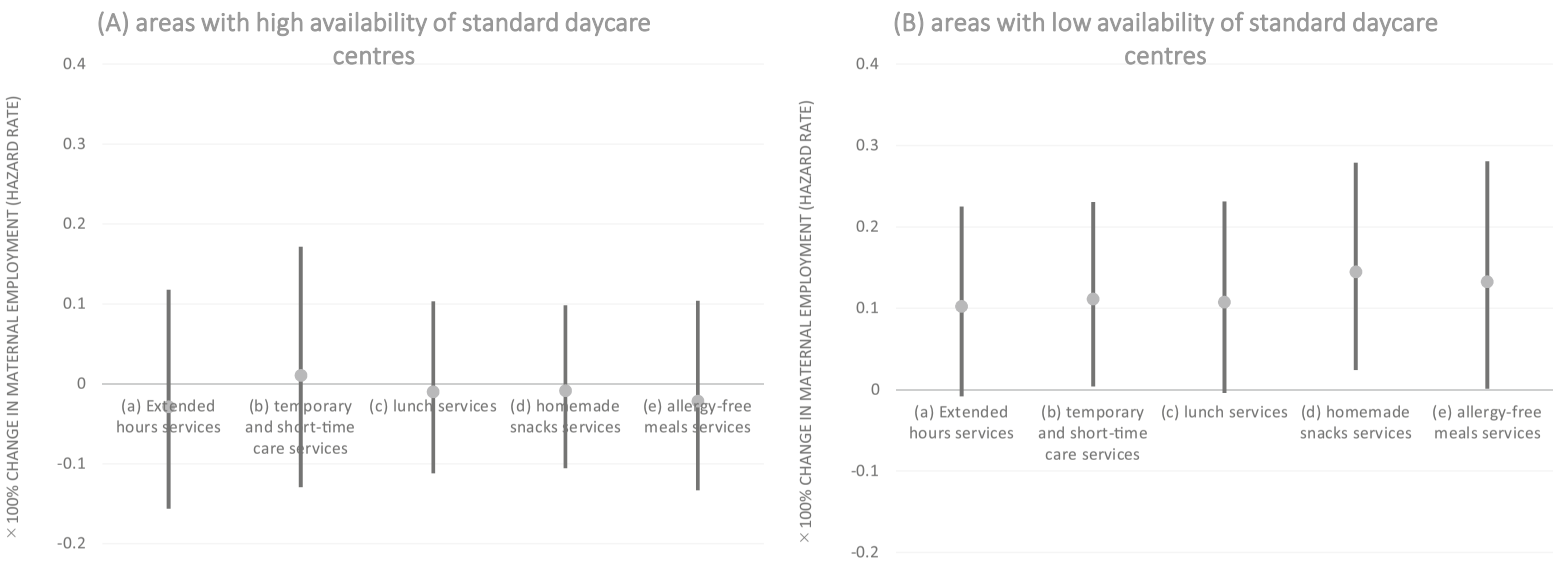

FIGURE 4 Effects of increases in the availability of nonstandard centres on maternal employment by different care services. The circle and bars show the effects on the hazard rates and their 95% confidence intervals, for different services. The effects are calculated as exp (parameter on daycare availability)-1 where its estimates are reported in Table A1. The full results are reported in Table A1.

to work for at least a certain number of hours per day. The meal services can be of great interest to mothers. These services seem to have met a critical need for working mothers in our sample period.

To summarize the overall findings, we conclude that increasing the availability of nonstandard daycare centres significantly raises maternal employment in areas with low availability of standard centres. The impact of these centres varies depending on the specific services they offer. These findings suggest that government policies aimed at expanding daycare availability for working mothers contributed to a rise in maternal employment.

Unlike many previous studies, our results show a clear positive effect of daycare centres on maternal employment. What sets our findings apart from the existing literature? First, we focus on the increase in nonstandard centres, unlike most existing literature, which has primarily examined standard centres. Nonstandard centres offer greater flexibility, allowing mothers to use them in various locations—near their homes, workplaces or along commuting routes. Standard centres, on the other hand, are restricted to local residents and are often located in remote areas, which may not be convenient for working mothers. Nonstandard centres, therefore, provide a more practical option for mothers re-entering the labour force.

Second, we use individual-level datasets that track employment status on a personal basis, rather than semi-aggregated datasets that capture changes in average employment rates for groups such as cities, prefectures or regions. The individual datasets may allow us to more precisely capture the effect of daycare availability on mothers' decisions to return to work.

Third, we analyse the hazard rates from non-employment to employment after childbirth, controlling for potentially critical factors such as childcare leave availability (based on individuals' pre-pregnancy employment status) and allowing for unobserved maternal characteristics through a mixed hazard model. As a result, we may have successfully identified the effect of nonstandard centres on maternal decisions to return to employment.

Finally, our sample covers the period around 2010, a time when the Japanese government was implementing policies to increase childcare services through the Emergency Assurance of Childcare Services and later the Accelerated Plan to Reduce Waiting Children. Since standard centres were slow to expand, nonstandard centres were established to meet the policy requirements, and the demand for childcare. In conclusion, providing nonstandard centres has significantly contributed to maternal return to work and the rise in maternal employment by compensating for the shortage of standard centres.

6 | CONCLUSION

This paper has re-examined the impact of childcare availability on maternal employment in Japan. We focused specifically on the increases in nonstandard childcare centres, which were vigorously established by government policies aimed at boosting women's labour supply in the 2010s. Our findings indicate that increasing the availability of nonstandard daycare centres significantly raises maternal employment in areas with low access to standard centres. The impact of these centres varies depending on the specific services they offer: in our sample period around 2010, the encouraging effects were more pronounced in nonstandard centres providing homemade snacks or allergy-free meals. We conclude that government policies aimed at expanding daycare availability for working mothers have contributed to mothers' earlier return to the workforce.

In contrast, standard childcare centres do not seem to affect maternal employment, a result consistent with some past studies. The key reason for this difference lies in the scarcity of standard childcare services. The availability of standard centres, which must meet high standards set by law, has been slow to increase. As a result, nonstandard centres have been utilized to compensate for the lack of standard options. From a more positive perspective, nonstandard centres, which are often located in more convenient areas for working parents and offer a wider variety of services related to childcare quality, may better meet the needs of working mothers, thus stimulating their employment decisions.

Our results suggest that government policies aimed at increasing childcare availability have a significant effect on promoting maternal labour supply. This finding is especially important in countries like Japan, where the employment rate of married women remains low. While the low employment rate itself may not be problematic, as some women may choose to focus on childcare as part of an efficient household arrangement, recent studies suggest that participation in the labour force and earning an income are crucial for women's empowerment both within and outside the household. Moreover, the imbalance in household responsibilities, where women often bear a disproportionate burden of domestic chores, is frequently criticized in many Asian countries. A slow return to employment following childbirth, or an extended period of non-employment, can ultimately lead to complete withdrawal from the labour market due to human capital depreciation and negative dependence (as hazard rates decline over time). Providing sufficient childcare options is key to promoting maternal employment.

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ENDNOTES

[1] Our focus municipality, Osaka, is no exception. It introduced a special subsidy programme to promote the implementation of small-scale childcare facilities, known as the 'Osaka-Anshin-Kodomo-Kikin-Tokubetsu-Taisaku-Jigyo-Hojokin', in line with a funding initiative by the central government, under the fund for worry-less child-rearing which started in 2009. A summary of the daycare situation in Osaka around 2010 is provided later.

[2] Unlicensed centres can be established in various locations, partly because there are fewer requirements for setting them up. As mentioned, this includes areas near train stations, near or even inside companies and similar locations. In our Osaka sample from around 2010, for example, the average walking time from the nearest station to unlicensed centres is 6 min, with 58% of them located within 5 min on foot.

[3] Furthermore, we cannot create a relative measure of the availability of nonstandard centres because we cannot sum the total availability of both standard and nonstandard care centres. This is because the units of measurement differ between the two: standard centres are counted by the number of available seats, while nonstandard centres are counted by the number of centres.

[4] Existing research suggests that extended maternity/childcare leave delays a mother's return to work (for example, Lalive and Zweimuller (2009), Lalive et al. (2014), and Carneiro et al. (2015)).

[5] These figures are comparable to national statistics. According to the *Annual Population and Social Security Surveys*, compiled by the National Institute of Population and Social Security Research between 2010 and 2014, 24% of mothers had never been employed prior to childbirth, 34% left their jobs at the time of childbirth and 38% remained employed, resuming work within 1 year after giving birth. Mothers in our sample are more likely to have left employment before childbirth and stayed unemployed after childbirth, which may reflect the generally lower employment rates among married women in Osaka.

[6] In our sample, small-scale care and home care are limited in number: 2.55% serve fewer than five children, while 77.55% serve 20 or more.

[7] We used the municipal average for the number of nonstandard daycare centres near the station because we needed to calculate the ratio relative to the number of children in the municipality. However, the implications of the results remain unchanged even if we simply use the number of nonstandard centres divided by the number of children in the respondent's residential municipality.

[8] Likewise, we can divide the areas based on the availability of nonstandard centres, setting the threshold at the median value for the entire sample. The insignificant results for standard childcare availability remain unchanged in both areas with high and low availability of nonstandard centres.

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APPENDIX A

TABLE A1 The difference of offering services in the area with high and low availability of standard daycare centres.

Mixed hazard model estimation for maternal employment										
	(a) Extended-hour services		(b) Temporary and short-time services		(c) Lunch services		(d) Homemade snacks services		(e) Allergy-free meals services	
	In the areas with:		In the areas with:		In the areas with:		In the areas with:		In the areas with:	
	(1) High availability of standard centres	(2) Low availability of standard centres	(1)Hhigh availability of standard centres	(2) Low availability of standard centres	(1) High availability of standard centres	(2) Low availability of standard centres	(1) High availability of standard centres	(2) Low availability of standard centres	(1) High availability of standard centres	(2) Low availability of standard centres
Availability of non-standard daycare centres										
Ratio of # of available seats in nonstandard centres to # of children under 5 years old with:										
(a) Extended-hour services	−0.0291	0.0975*								
	(0.0704)	(0.0528)								
(b) temporary/ short-time services			0.0103	0.1056**						
			(0.0745)	(0.0508)						
(c) lunch services					−0.0101	0.1021**				
					(0.0541)	(0.0530)				
(d) homemade snack services							−0.0088	0.135***		
							(0.0510)	(0.0556)		
(e) allergy-free food services									−0.0218	0.1244**
									(0.0604)	(0.0618)
Mother's characteristics										
Maternity leave at former place of employment	0.3605***	0.3071***	0.3594***	0.3052***	0.3599***	0.314***	0.3598***	0.3115***	0.3597***	0.3188***
	(0.0698)	(0.0756)	(0.0697)	(0.0754)	(0.0697)	(0.0746)	(0.0697)	(0.0743)	(0.0695)	(0.0752)

TABLE A1 (Continued)

Mixed hazard model estimation for maternal employment

	(a) Extended-hour services		(b) Temporary and short-time services		(c) Lunch services		(d) Homemade snacks services		(e) Allergy-free meals services	
	In the areas with:		In the areas with:		In the areas with:		In the areas with:		In the areas with:	
	(1) High availability of standard centres	(2) Low availability of standard centres	(1)Hhigh availability of standard centres	(2) Low availability of standard centres	(1) High availability of standard centres	(2) Low availability of standard centres	(1) High availability of standard centres	(2) Low availability of standard centres	(1) High availability of standard centres	(2) Low availability of standard centres
Log of Mother's age	−1.1823*	−0.3266	−1.1955**	−0.3393	−1.1865**	−0.3993	−1.1863**	−0.3838	−1.1841**	−0.3967
	(0.6049)	(0.5749)	(0.6048)	(0.5802)	(0.6044)	(0.5849)	(0.6047)	(0.5809)	(0.6039)	(0.5896)
Mother's marital status	−1.1488***	−0.7185***	−1.1394***	−0.7048***	−1.1435***	−0.7138***	−1.1444***	−0.717***	−1.1456***	−0.6901**
	(0.2534)	(0.2654)	(0.2512)	(0.2655)	(0.2520)	(0.2683)	(0.2524)	(0.2647)	(0.2523)	(0.2681)
Mother's low level of education	0.0368	−0.0715	0.0396	−0.0515	0.0378	−0.0312	0.0382	−0.0157	0.0379	−0.0039
	(0.4913)	(0.4678)	(0.4907)	(0.4720)	(0.4907)	(0.4744)	(0.4908)	(0.4734)	(0.4902)	(0.4776)
Household characteristics										
Household economic situation	−0.0025	−0.3324*	0.0017	−0.3314*	−0.0001	−0.3392*	0.0004	−0.3332*	0.0002	−0.3363*
	(0.1949)	(0.1983)	(0.1944)	(0.1998)	(0.1945)	(0.2014)	(0.1945)	(0.2002)	(0.1943)	(0.2026)
Household living with (grand) parents	−0.0341	0.0900	−0.0515	0.0835	−0.0414	0.1074	−0.0419	0.1093	−0.0343	0.1241
	(0.1721)	(0.1856)	(0.1722)	(0.1880)	(0.1722)	(0.1881)	(0.1721)	(0.1868)	(0.1727)	(0.1887)
Two or more children	−0.3056*	−0.2942	−0.313*	−0.2981	−0.309*	−0.2997	−0.3092*	−0.2942	−0.3078*	−0.3029
	(0.1845)	(0.2029)	(0.1842)	(0.2052)	(0.1842)	(0.2046)	(0.1842)	(0.2037)	(0.1839)	(0.2048)
Living in the capital city	−0.1563		−0.3915		−0.2489		−0.2641		−0.1835	
	(1.1347)		(1.1485)		(1.1420)		(1.1231)		(1.1285)	

(Continues)

TABLE A1 (Continued)

Mixed hazard model estimation for maternal employment

	(a) Extended-hour services		(b) Temporary and short-time services		(c) Lunch services		(d) Homemade snacks services		(e) Allergy-free meals services	
	In the areas with:		In the areas with:		In the areas with:		In the areas with:		In the areas with:	
	(1) High availability of standard centres	(2) Low availability of standard centres	(1)Hhigh availability of standard centres	(2) Low availability of standard centres	(1) High availability of standard centres	(2) Low availability of standard centres	(1) High availability of standard centres	(2) Low availability of standard centres	(1) High availability of standard centres	(2) Low availability of standard centres
Regional characteristics										
Female unemployment rate in a prefecture	−0.0858	0.0202	−0.0821	0.0074	−0.0839	0.0110	−0.0841	0.0113	−0.0849	0.0089
	(0.1512)	(0.1538)	(0.1512)	(0.1553)	(0.1510)	(0.1566)	(0.1511)	(0.1547)	(0.1509)	(0.1580)
Number of children under 5 in a city	0.0263	0.1176	0.0537	0.1442	0.0374	0.1394	0.0391	0.173*	0.0300	0.1463
	(0.1009)	(0.0890)	(0.1034)	(0.0934)	(0.1013)	(0.0959)	(0.0985)	(0.0977)	(0.0994)	(0.0977)
Constant	0.5146	−3.6761*	0.3814	−3.6679*	0.4481	−3.4922	0.4397	−3.7106*	0.4825	−3.5743
	(2.2287)	(2.1659)	(2.2238)	(2.1775)	(2.2207)	(2.1892)	(2.2184)	(2.1781)	(2.2191)	(2.2103)
Number of the observations (mothers)	12528 (443)	11965 (406)	12528 (443)	11965 (406)	12528 (443)	11965 (406)	12528 (443)	11965 (406)	12528 (443)	11965 (406)
Log likelihood	−824.0439	−676.9035	−824.1231	−676.4164	−824.1148	−676.6495	−824.1174	−675.4989	−824.0659	−676.4025
Wald test (Null: all the parameters = 0)	44.19***	29.90***	44.47***	30.41***	44.31***	31.26***	44.32***	32.23***	44.42***	31.25***
Likelihood Ratio Test (Null: no frailty)	0.2380	0.0001	0.2229	0.0079	0.2253	0.0246	0.2269	0.0129	0.2179	0.0497

Note: Estimated using a mixed hazards model with frailty. Coefficients (but not hazard rates) are reported in the table. Figures in parentheses are standard errors. ***, ** and * show that the variables are significant at the 1, 5% and 10% level, respectively.