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Has Improved Daycare Accessibility Increased Japan's Maternal Employment Rate? Municipal Evidence from 2000-2010

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Abstract: Over the past decades, female labor force participation in Japan has continued to expand, accompanied by an improvement in daycare accessibility. This paper quantifies the daycare effects on employment of mothers with preschool children, analyzing newly constructed municipality-level data covering 1,758 municipalities for 2000, 2005, and 2010. The results suggest that 5%-11% of the increase in maternal employment rate during 2000 to 2010 was attributable to the improvement in daycare accessibility. However, the daycare effects on maternal employment are quite limited compared with those on enrollments at licensed daycare centers. Our new evidence suggests that such discrepancy could emanate from the fact that better access to licensed daycare centers encouraged working mothers to switch from kindergartens.

Keywords: Maternal employment, female labor market, daycare centers, kindergartens, Japan

JEL Codes: J13, J18, J21

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1. Introduction

Enlarging the contribution of females to the labor force has become a key policy issue, particularly in developed economies with rapidly aging and shrinking populations (Thevenon, 2013). Greater female labor participation (FLP) could underpin economic growth by increasing the labor supply on the supply side and by strengthening consumption through an increase in household income on the demand side. Though it has seen an uptrend over time, FLP in Japan remains lower than the OECD average (Kinoshita and Guo, 2015). This paper explores the implications of how improved daycare center accessibility may help tap into the ample supply of the underutilized female labor force in Japan, particularly focusing on mothers with children aged 0-5 years.

The shortage of childcare capacity has been a serious problem in Japan, causing a large number of wait-listed children (Zhou and Oishi, 2005). A child is wait-listed when an enrollment at a licensed daycare center is not possible, mainly owing to lack of vacancies. The number of wait-listed children reached 23,167 in 2015, mostly concentrated in the metropolitan areas. The fundamental problem with such wait-listing is that mothers at home could be deprived of reinstatement and reemployment. To eliminate wait-listing and thereby increase maternal employment, successive governments have mobilized large subsidy amounts to boost the supply of daycare capacity since the early 2000s. In accordance with expectations, the maternal employment rate rose by 9.4 percentage points during the 2000s, accompanied by an

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improvement in daycare accessibility (Table 2).

The objective of the present paper is to quantify the extent to which the improved daycare accessibility contributed to an increase in maternal employment rate. In doing so, we construct a fresh data set at the municipal level, covering 1,758 municipalities for 2000, 2005, and 2010, and analyze the same. Our method involves estimating mothers' labor supply function with a fixed effects model. To identify the population average partial effect, we employ the weight least squares (WLS) method in this study. Daycare accessibility is measured using the quota of licensed daycare centers relative to the population aged 0-5 years. Maternal employment rate is defined as the number of married and employed females with at least one child aged 0-5 years relative to the total number of married females with at least one child aged 0-5 years.

The results suggest that 5%-11% of the increase in maternal employment rate during the period 2000 to 2010 may be attributed to the improvement in daycare accessibility. However, the daycare effects on maternal employment are smaller compared with those on enrollments at licensed daycare centers. We find evidence that such discrepancy could emanate from the fact that better access to licensed daycare centers encouraged some working mothers to substitute these centers for kindergartens, resulting in some children being merely reallocated and yielding little change in maternal employment. Our estimates suggest that 125,931 enrollments at kindergartens were eliminated as a result of the improved daycare accessibility during the period 2000 to 2010. Assuming that they all were reallocated to licensed daycare centers, about half of newly expanded quotas of licensed daycare centers were filled by them. A growing demand for full-time working mothers with children aged 3-5 years makes kindergartens unsuitable owing to their short operating hours and long vacations.

An important contribution of the current paper is that it provides evidence of crowding out between formal childcare arrangements (i.e., licensed daycare centers and kindergartens). The significance of the crowding out hypothesis has been well recognized in explaining nil or weak daycare effects on maternal employment (Asai et al., 2015; Fitzpatrick, 2010; Havnes and Mogstad, 2011). However, empirical analysis in this area is limited; Baker et al. (2008) alone examine the crowding out between informal care (e.g., grandparents) and formal care (e.g.,

subsidized childcare) in Canada.[1] In many OECD countries, multiple early childhood education and care services are provided in an overlapping manner for the same age groups (OECD, 2015). Thus, our finding plays an important role in deepening the understanding of the daycare effects on maternal employment, for not only Japan but also other developed nations.

The present paper also adds to the literature measuring daycare effects on maternal employment, particularly in the context of Japan. To the best of our knowledge, this is the first paper to show municipal evidence in this context. This examination is crucial as the results provide policy implications, because local governments in each municipality are the delegated authority. In addition, analyzing the municipality-level data provides the opportunity to reduce aggregation biases and improve estimation efficiency owing to the increased number of observations. Abe (2013), Asai et al. (2015), and Lee and Lee (2014) analyze national, regional, or prefectural data. The other contribution is that the current study is the first attempt to analyze heterogeneous daycare effects by child age. Thus far, previous empirical evidence on determinants of daycare effects on maternal employment in Japan has been limited to mothers' education, age, and household structure.

Our best estimate of daycare effects on maternal employment is +0.11 (Column 4, Table 3). Havnes and Mogstad (2011) obtain an estimate similar to ours (+0.06), analyzing individual-level panel data from 1976 to 1979 for Norway. On the other hand, our estimate differs from those of many other studies concluding that the daycare effects on maternal employment are considerable, such as Berlinski and Galiani (2007) (+14.2 for Argentina), Baker et al. (2008) and Lefebvre and Merrigan (2008) (+6.5-14.5 for Canada), and Brilli et al. (2013) (+13.0 for Italy). In the Japanese context, our result contrasts sharply from that of Asai et al. (2015), who conclude that the estimated daycare effect on maternal employment is not statistically different from zero. We argue that this dissimilarity in results could emanate from the differences in the unit of observation: Asai et al. (2015) employ prefecture-level data, whereas the current study uses municipality-level data. Notably, the use of municipality-level data increases the sample

[1] Baker et al. (2008) show that roughly one-third of the 14.6-percentage point rise in childcare use induced by the Quebec Family Policy reform in Canada might emanate from the shift from informal care to formal care.

size, lowering the standard errors.[2]

The rest of this paper is structured as follows. Section 2 begins by describing the early childhood education and care systems in Japan with an emphasis on licensed daycare centers, followed by an overview of daycare policies. Section 3 presents the empirical model, data, and measurement of variables, and discusses the estimation methods. Section 4 reports the estimation results. Section 5 explores the crowding out hypothesis. Section 6 concludes.

2. Background

2.1. Early childhood education and care (ECEC) systems

The mainstream ECEC settings in Japan's context are licensed daycare centers and kindergartens.[3] Based upon the Child Welfare Act, licensed daycare centers are supervised by the Ministry of Health, Labour and Welfare (hereafter, MHLW). Licensed daycare centers provide full-day center-based care with lunch for all children aged 0-5 years, operating 8 hours per day. Normally, the users of licensed daycare centers are mothers working full-time. Kindergartens are educational institutions for preschool children aged 3-5 years, operating 4 hours per day without meals. Unlike licensed daycare centers, kindergartens have long summer and spring vacations. Thus, generally, stay-at-home wives and mothers working part-time utilize kindergartens. Under the supervision of the Ministry of Education, Culture, Sports, Science and Technology (hereafter, MEXT), kindergartens are governed by the School Education Law.

Table 1 shows the utilization of licensed daycare centers and kindergartens. As of 2010, around 58% of the population under 5 years (3.7 million) was cared for at either one of these arrangements (Panel A). It is noticeable that enrollment rates vary substantially depending on the children's ages. The enrollment rate for children aged 0-2 years is 26%, indicating that most infants are still cared for at home, whereas the enrollment rate for children aged 3-5 years is 89%.[4] Overall, mothers utilize licensed daycare centers more than kindergartens (Panel B).

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[2] The heteroskedasticity-robust standard error for daycare accessibility for our study (0.02) is much smaller than that (0.11) for Asai et al. (2015).

[3] Unlike other OECD countries such as Germany, the United Kingdom, and France, home-based family daycare plays a minor role in Japan.

[4] According to the OECD Family Database, as of 2010, Japan's enrollment rate for children aged 0-2

However, kindergartens play a more important role for children aged 3-5 years (Panel C).

In terms of the changes over time, Table 1 demonstrates that the demand for licensed daycare centers continues to grow in contrast to that for kindergartens. The table indicates that the share of daycare enrollments in the population aged 0-2 years has increased by 15.5 percentage points over the past three decades (Panel A). The data for children aged 3-5 years warrants more attention. For children aged 3 years, the share of kindergarten enrollments has risen faster than that of daycare enrollments, mainly emanating from the growing interest in early education (Panel C). The share of daycare enrollments rose by 8.7 percentage points from 1990 to 2010 for children aged 4 years and 5 years. In contrast, enrollments for kindergartens dropped by 5.2 percentage points and 7.5 percentage points, respectively.

years is below the OECD average (33%) and close to the rates for Germany (23%), Italy (24%), and Finland (28%). The enrollment rate for children aged 3-5 years is above the OECD average (82%) and similar to that of Portugal (84%) and the United Kingdom (93%).

TABLE 1
Utilization of Licensed Daycare Centers and Kindergartens in Japan

	1980	1985	1990	1995	2000	2005	2010	Changes 1980-1990	Changes 1990-2000	Changes 2000-2010
Panel A:										
Share of enrollments at either licensed daycare centers or kindergartens in the population aged (%):										
0-5 years	42.2	43.2	47.1	48.3	51.7	57.0	57.6	4.9	4.7	5.9
0-2 years	10.4	11.8	14.1	15.5	19.2	24.1	25.9	3.7	5.2	6.7
3-5 years	70.6	73.2	77.0	80.4	83.8	87.8	89.1	6.5	6.8	5.3
Panel B:										
Share of enrollments in the population aged 0-5 years at (%):										
Licensed daycare centers	19.1	20.4	21.7	23.2	25.2	29.5	32.7	2.6	3.5	7.5
Kindergartens	23.1	22.8	25.3	25.0	25.0	25.7	25.3	2.3	-0.4	0.3
Panel C:										
Share of enrollments in the population aged 3 years at (%):										
Licensed daycare centers	22.1	23.3	23.6	26.8	30.4	35.4	36.6	1.5	6.8	6.1
Kindergartens	10.0	14.0	20.5	28.3	31.1	36.6	40.7	10.5	10.6	9.6
Share of enrollments in the population aged 4 years at (%):										
Licensed daycare centers	29.7	31.4	31.5	33.3	36.6	40.0	40.2	1.8	5.1	3.6
Kindergartens	51.5	53.8	57.9	57.0	55.4	54.7	52.7	6.4	-2.4	-2.7
Share of enrollments in the population aged 5 years at (%):										
Licensed daycare centers	28.7	30.8	30.9	32.3	35.7	38.9	39.6	2.2	4.9	3.8
Kindergartens	66.8	64.9	65.2	63.1	62.0	57.6	57.7	-1.6	-3.2	-4.3

Sources: Ministry of Health, Labour and Welfare (MHLW), Ministry of Education, Culture, Sports, Science and Technology (MEXT), and Ministry of Internal Affairs and Communications (MIAC).

2.2.Licensed daycare centers

Daycare centers are classified as "licensed" or "unlicensed." The license is granted when the strict standards of establishment prescribed by the Child Welfare Act are fully satisfied. These conditions relate to the facility (e.g., area, equipment, and playground), personnel allocation (e.g., student-to-teacher ratio), opening hours, and type of program. The service providers have an incentive to obtain a license, as higher subsidies are provided to make up the operating costs incurred by licensed establishments. The enrollment at licensed daycare centers in Japan, accounting for 92% of total daycare centers, was around 2 million in 2010.

Licensed daycare centers are operated by public or private entities. Around two-thirds are private, and most of them are operated by social welfare service corporations (hereafter, SWSCs), which are nonprofit organizations conducting social work.[5] SWSCs are treated favorably via tax exemption that private enterprises do not enjoy. Owing to this favorable treatment and the persistent resistance against commercializing daycare services, the operation of commercial enterprises has been quite limited even though the legal restriction to establish such centers by commercial enterprises was removed in 2000. The public licensed daycare centers are operated by local governments in each municipality.

To utilize the daycare services provided by licensed daycare centers, the applicant submits the needed documents to her own local government. The applicant confronts two hurdles before enrollment: whether the child needs care on a regular basis and whether a vacancy is open. The key criterion to meet the first condition is parents' employment status. If both parents are full-time workers, this criterion is satisfied. Then, their child is allowed to enroll as long as a vacancy is available. Without a vacancy though, the local government would decline the application even if both parents work full-time. In addition, the applicant might decline the offer when the slot allocated is not desirable because of the location and/or program of the daycare center. In both cases, parents would have to make other daycare arrangements, such as unlicensed daycare centers and kindergartens, if both of them wish to continue working.

[5] As of 2014, 12,673 SWSCs have been established, accounting for 86% of private licensed daycare centers.

Once a child is enrolled, parents pay the requisite fee to the local government in exchange for the services provided by the daycare center. The important features here are that (i) daycare fees are fixed based upon the standards prescribed by the MHLW, and (ii) they substantially differ by parents' income levels owing to the pro-poor subsidy policy.[6] The daycare fees are much lower than actual operating costs incurred, and the difference is subsidized. The monthly daycare cost per child is US$1,290, US$769, US$367, and US$316 for children aged less than 12 months, 1-2 years, 3 years, and 4-5 years. The daycare fees for children aged 1-2 years, for example, are US$166 for the poorest household (excluding one on welfare) and US$683 for the richest household. Thus, subsidies worth US$603 are indirectly given to the poorest, whereas the richest receive a subsidy of only US$86.

2.3. "Zero wait-listed children" policies

The large number of wait-listed children is the central issue plaguing Japan's daycare sector. The government interventions described in section 2.2 constitute the underlying causes for the considerable number of wait-listed children. The government's price ceiling is much lower than the equilibrium price, causing excess demand for the daycare market. This excess demand could be exacerbated by the strict regulations addressing the market imperfection emanating from the lack of information to parents about the quality of care (Blau, 2001). The licensing system intends to ensure that all centers offer the minimum quality of care and to eliminate providers offering poor quality.

Prime Minister Junichiro Koizumi announced the "Zero Wait-Listed Children" Policy in 2001.[7] One target of this policy was to establish additional daycare capacity for 15,000 children over 4 years. To do so, a large amount of subsidies was utilized. In 2002, for example, subsidies worth ¥52.5 billion (US$469 million) were provided for establishing new daycare centers and covering the additional operation costs incurred by increased enrollments. Subsequently, ¥41.7 billion

[6] Daycare fees parents pay also differ by municipality and number of siblings. Many municipalities charge less than the national standard to lessen the financial burden on the users. Daycare fees for the second and third child are discounted by up to 50% in most municipalities.

[7] This policy was in line with the "Angel Plan" and the "New Angel Plan" unveiled in 1994 and 1999, respectively, which were initiated as measures against the declines in the population and birthrate.

(US$372 million) of subsidies were mobilized in 2003. The “New Zero Wait-Listed Children” Policy was unveiled in 2008 by Prime Minister, Yasuo Fukuda. The new policy targeted increases in overall daycare enrollments by one million and the enrollment rate for children aged 0-2 years from 20% to 38% over the next 10 years.

The “(New) Zero Wait-Listed Children” Policy aims to liberalize the daycare sector by privatization and deregulation. It was thought that the daycare sector was too regulated and rigid, and thus, unable to meet the various user demands. In 2001, the government amended the Child Welfare Act, making local governments in each municipality responsible for introducing efficiency and flexibility into their respective daycare sectors by utilizing private entities. Coinciding with the need to reduce the financial burden imposed by the daycare services, local governments began giving priority to private entities looking to establish new daycare centers and also started outsourcing operations of existing public daycare centers to private entities.

The most influential deregulation allows licensed daycare centers to enroll children exceeding the quota prescribed by the Child Welfare Act, as long as the required standards imposed on the establishments are satisfied. The overcapacity is limited to 15-25% in the first half of the year, but this cap does not apply thereafter. As of 2011, 15,242 licensed daycare centers, accounting for 65% of the total, enrolled children exceeding their quotas (Ministry of Health, Labour and Welfare, 2011). The other important deregulations include removing the restriction on part-time nursery teachers in order to deal with the shortage of workers and lowering the standards concerning the presence of playgrounds and the minimum number of students required.

Table 2 suggests that a series of policies contributed to improving daycare accessibility in the 2000s. During the period 2000 to 2010, 868 licensed daycare centers were newly established, and the quotas expanded by 234,000, leading daycare accessibility to increase by 7 percentage points. The table also shows the increased privatization of licensed daycare centers. The improvement in daycare accessibility enabled 291,000 children to enroll at licensed daycare centers, increasing the daycare enrollment rate by 7.5 percentage points. Likewise, the maternal employment rate increased by 9.4 percentage points, implying that better access to licensed daycare centers gives mothers at home opportunities to realize a work–life balance. The next section examines the extent to which the labor participation of mothers with preschool children was encouraged by

better access to licensed daycare centers.

TABLE 2
Daycare Accessibility, Daycare Enrollment Rate, and Maternal Employment Rate

	1995	2000	2005	2010	Changes (2000-2010)
Establishments	22,488	22,200	22,570	23,068	868
Quotas (thousands)	1,922	1,923	2,052	2,157	234
Enrollments (thousands)	1,678	1,788	1,993	2,080	291
Daycare accessibility (%)	26.6	27.1	30.4	34.0	7.1
Daycare enrollment rate (%)	23.2	25.2	29.5	32.7	7.5
Privatization (%)	41.3	43.2	48.6	54.3	11.1
Maternal employment rate (%)	32.9	33.5	37.7	42.9	9.4

Note: See Appendix A for measurements of the variables.

3. Empirical Analyses

3.1. The model and data

We estimate the augmented version of the standard female labor supply equation as follows:

$$M_{m,t} = \beta_0 + \beta_1 D_{m,t} + \beta_2 \ln I_{m,t} + \beta_3 \ln W_{m,t} + \beta_4 U_{m,t} + \beta_5 T_{m,t} + \delta \boldsymbol{X}_{m,t} + \varepsilon_{m,t} \quad (1)$$

where subscript *m* stands for the municipality: *m* = 1, …, 1758, and *t* stands for the year: *t* = 2000, 2005, and 2010. The dependent variable (*M*) is maternal employment rate, which is a measure of a municipality's average probability that mothers residing in that municipality choose to work. *D* is daycare accessibility, which captures the access to licensed daycare centers. *I* and *W* are householder's income and the minimum wage, respectively. *U* is the unemployment rate to capture the labor market conditions. *T* is the share of three-generation households, which is a measure of informal childcare arrangements. ***X*** is a vector of addition determinants discussed later. ε is an error term. The term "ln" before the variables denotes the natural logarithm.

In this paper, the daycare effects on maternal employment (β_1) are examined in various ways. First, following Baker et al. (2008), Berlinski and Galiani (2007), and Fitzpatrick (2010), we examine daycare enrollment rate (*E*) as a dependent variable to gauge the extent of difference due to the daycare effects between enrollment and maternal employment. A large difference might be an indication of the crowding out of other daycare arrangements. Second, equation (1) is estimated in terms of child age and household structure to investigate the heterogeneity of the daycare effects. Third, we also examine regional heterogeneity of the daycare effects.

The measurements and data sources of the variables are listed in Appendix A. Note that maternal employment includes not just full-time but also part-time workers, parental leave acquirers, self-employed persons, and family employees. Single mothers are excluded from the sample. Daycare accessibility is measured in the same manner as in Asai et al. (2015), Brilli et al. (2013), and Shigeno and Okusa (1999), essentially capturing the opportunities wherein mothers with children aged 0-5 years can leave their children at licensed daycare centers when needed. The municipality's average householder income is assumed to be identical within the same prefecture owing to data limitations. Minimum wage is determined at the prefectural level, and thus, the same wage rate is applied to all municipalities within the same prefecture.

It is important to note that the change in daycare accessibility is affected by not only quotas of licensed daycare centers but also the population aged 0-5 years. Overall, daycare accessibility improved in both rural and metropolitan municipalities during the period 2000 to 2010. The improvement in metropolitan municipalities was mainly attributed to increased quotas of licensed daycare centers, even though some were offset by the growth of the population aged 0-5 years. On the other hand, the main cause of improved daycare accessibility for rural municipalities was depopulation combined with the difficulties in downsizing the capacity of licensed daycare centers owing to the minimum number of students (60). To examine the effects of daycare capacity and population separately, we also estimate the specification where daycare accessibility is decomposed into quotas of licensed daycare centers and the population aged 0-5 years.

A potential concern relating to the use of municipality-level data is migration across municipalities for seeking a better childcare environment, causing an estimation bias (Asai et al., 2015). However, the Employment Status Surveys show that such inter-municipality migration is small (Ministry of Internal Affairs and Communications, 2012). According to the survey, around 877,000 females migrated to seek a better childcare and education environment over the past five years, and 36% of them (approximately 315,720) migrated across municipalities. Assuming that they all are married mothers with preschool children, the inter-municipality migration accounts for 7.4% of the population of married mothers with preschool children (i.e., 4,251,909, as of 2010). Note that this estimated number should be far lower, as single mothers and married mothers with children aged above 5 years are included in the count of females who migrated

across municipalities for better childcare and education environments. We also took into account the inter-municipality migration and confirmed that the estimation bias would not affect our conclusions.[8]

Careful attention should be paid in estimating equation (1) as the mothers' labor supply function, owing to the assumption that all explanatory variables, except for W, would be independent of labor demand. In particular, there is a concern that *D* might be associated with labor demand. For example, in a region with poor daycare accessibility, companies might hesitate to hire mothers with a small baby because they may face a time constraint for their job. We investigated this concern carefully and confirmed that the positive association between *D* and labor demand is almost perfectly controlled in the fixed effects model employed in this study.[9]

3.2. Estimation method

Our primary interest is to identify β_1 with municipality-level panel data. The key identification issue is that *D* might be correlated with unobserved time-invariant factors (θ_m) in ε in equation (1). One such variable may be the local government's view of childcare. Some municipalities impose requirements that are more stringent than national standards on licensed daycare centers, preventing service providers from entering daycare sectors and incumbents from expanding their capacity.[10] On the other hand, the stringent regulations could be a signal for the quality of

[8] The endogeneity concern is that the inter-municipality migration might bias β_1 upward (Asai et al., 2015). To examine this, we estimate the same specification as in equation (1) using prefecture-level data and find that the estimated daycare effect on maternal employment is *larger* than that estimated using the municipality-level data. The results are available on request.

[9] Supposing that *D* is positively associated with labor demand in ε in equation (1), we examine whether β_1 is biased upward. To do so, we construct the variable "share of female labor-intensive sectors" at the municipality-level as a proxy for labor demand. Estimates without controlling for the year and municipality fixed effects suggest that β_1 is 3.6% biased upward unless labor demand is not taken into account. However, such bias is no longer observable when the year and municipality fixed effects are controlled for. The results are available on request.

[10] For example, Kyoto city requires licensed daycare centers to observe the following student-to-teacher ratio (the numbers in brackets denote the national standard): 3 (3) for children aged less than 12 months, 5 (6) for one-year-olds, 6 (6) for children aged 2 years, 15 (20) for children aged 3 years, 20 (30) for children aged 4 years, and 25 (30) for those aged 5 years.

daycare centers, increasing demand for daycare services, and thus, the possibility that mothers choose to work. In addition, municipality-specific traditional family values and women's preference for work could simultaneously influence mothers' decision to work and daycare accessibility (Abe, 2013). Unless this issue is taken into account, the ordinary least squares (OLS) estimator could be biased and inconsistent.

To address the potential endogeneity, the current paper employs the fixed effects model. The advantage of this approach is to sweep away θ_m by the within transformation. In addition, the use of panel data enables us to control unobserved events that could influence all mothers' choice of work (φ_t) in ε. For example, φ_t includes a nation-wide secular rise in female wages and changes in parental leave and other labor legislation mandated by the national government (Asai et al., 2015). Defining the new error term as $\mu_{m,t} = \varepsilon_{m,t} - \theta_m - \varphi_t$, β_1 could be identified under the assumption that $\mu_{m,t}$ is not correlated with any explanatory variables.

However, the validity of the zero conditional mean assumption remains debatable, as time-variant factors that could influence *D* are potentially included in $\mu_{m,t}$. The extent of privatization in the daycare market (*P*) matters, because new entrants tend to enter the privatized sector as it is subject to fewer regulations. In addition, private entities respond to mothers' demands more flexibly, encouraging their participation in the labor force. Kindergarten accessibility (*K*) should be controlled for owing to the substitution relationship between daycare centers and kindergartens for children aged 3-5 years. Potentially, land price (*L*) is an important omitted variable. *L* is positively correlated with the labor supply of married women with a housing purchase plan, because it is easier for two-earner couples to access mortgage (Yoshikawa and Ohtake, 1989). On the other hand, *L* works as a supply constraint for daycare capacity under the stringent area regulations imposed on licensed daycare centers. Total fertility rate (*F*) relates to the number of preschool children for a mother, which influences mothers' choice of work (Oishi, 2003; Shigeno and Okusa, 1999). Inter-municipality commuting (*C*) should be taken into account owing to the fact that married women, particularly in metropolitan areas, may commute across municipalities for their jobs. *C* is negatively associated with *M*, because a longer commuting time could discourage mothers from participating in the labor force. Female workers commuting across municipalities tend to be young, and thus, the municipalities they reside in have more preschool children. In order to mitigate the omitted variable biases to the extent possible, we

consider all the above-mentioned factors.

To address the potential endogeneity problem, prior research, such as Fitzpatrick (2010) and Havnes and Mogstad (2011), employs the difference-in-difference (DID) approach. It seems that the DID approach can be applicable to the current study in terms of the introduction of the "Zero Wait-Listed Children" Policy. However, using this approach is challenging, because it is hard to define a control group with characteristics indifferent to those of the treatment group. The other way to overcome the endogeneity problem is to employ an instrumental variable (IV) approach (Gelbach, 2002). However, we do not take this approach because of the difficulties in finding an instrument that is correlated with daycare accessibility and meets exclusion restrictions.

The other estimation concern is the potential heterogeneity of daycare effects on maternal employment across municipalities, making it difficult to identify the population average partial effect (Solon et al., 2015). Most wait-listed children are concentrated in metropolitan areas, whereas licensed daycare centers in rural areas tend to fall short of their quotas. Thus, estimating equation (1) by the OLS might result in the underestimation of β_1. To address this issue, the WLS method is employed in this study. The municipality's population share for mothers with at least one child aged 0-5 years is used as the weight. Standard errors are always robust to heteroskedasticity and clustered at the municipality level.

The summary statistics are presented in Appendix B. The weighted mean daycare enrollment rate and weighted mean maternal employment rate are 29% and 37%, respectively. Maternal employment rates vary according to household structure and age of the youngest child. The weighted average daycare accessibility is 29%. The appendix also shows that the changes in weighted means of daycare enrollment rate and maternal employment rate are +6.6 and +9.3 percentage points during the period 2000 to 2010, respectively. The rise in labor participation of mothers in nuclear households is larger than that for mothers in three-generation households. In addition, the rise in labor participation of mothers with children aged 0-2 years is larger than that for mothers with children aged 3-5 years. The change in weighted mean daycare accessibility is +6.1 percentage points.

4. Results

4.1. Main specifications

Table 3 reports the results for the main specifications. The panel data cover 1,758-1,892 municipalities for 2000, 2005, and 2010, amounting to 3,297-5,197 observations. The overall goodness-of-fit of the regressions is sufficient to conduct an econometric analysis. Columns 1 and 2 report daycare effects on enrollments at licensed daycare centers. Column 1 presents pooled WLS estimates controlling year fixed effects. The coefficient of daycare accessibility is positive and statistically significant at the 1% level, predicting that, overall, a one-percentage point improvement in access to licensed daycare centers leads to an increase of 0.84 percentage points in daycare enrollment rate. Column 2 shows WLS estimates controlling municipality fixed effects and additional factors, indicating that the point estimate of daycare accessibility of daycare enrollment rate (+0.73) remains high. The 95% confidence interval ranges from 0.66-0.80. The simple calculation using the estimate indicates that 63%-76% of the increase in daycare enrollment rate during the period 2000 to 2010 can be attributed to the improvement in daycare accessibility.

Columns 3 and 4 of Table 3 present the results of daycare effects on maternal employment. Column 3 shows pooled WLS estimates, indicating that holding other factors constant, a one-percentage point improvement in access to licensed daycare centers leads to an increase of 0.28 percentage points in maternal employment rate. Column 4 shows that the point estimate of daycare accessibility of maternal employment rate (+0.11) is relatively small when municipality fixed effects and additional factors are controlled for. The 95% confidence interval is between 0.07 and 0.14, suggesting that 5%-11% of the increase in maternal employment rate during the period 2000 to 2010 can be attributed to the improvement in daycare accessibility.

TABLE 3
Results for Main Specifications

Dependent variables:	Daycare enrollment rate (%)		Maternal employment rate (%)	
Estimator: WLS	(1)	(2)	(3)	(4)
Daycare accessibility (%)	0.84***	0.73***	0.28***	0.11***
	(0.01)	(0.04)	-0.01	(0.02)
Ln householder's income	-1.90***	0.18	2.62**	2.97***
	(0.67)	(0.81)	-1.34	(0.93)
Ln minimum wage	-14.11***	1.37	-45.79***	17.84***
	(1.64)	(3.66)	-3.17	(5.20)
Unemployment rate (%)	0.19*	0.11	-0.04*	-0.47***
	(0.07)	(0.09)	-0.1	(0.10)
Three-generation households (%)	-0.01	0.16	0.63***	0.71***
	(0.02)	(0.11)	-0.03	(0.10)
Privatization (%)		0.04***		0.01
		(0.01)		(0.01)
Kindergarten accessibility (%)		1.38		0.38
		(1.26)		(1.04)
Ln land price		-1.26**		-0.80
		(0.64)		(0.87)
Total fertility rate		1.00		1.63
		(1.37)		(1.38)
Inter-municipality commuting (%)		-0.02		0.10**
		(0.03)		(0.05)
Year fixed effects	Yes	Yes	Yes	Yes
Municipality fixed effects	No	Yes	No	Yes
R^2	0.93	0.99	0.80	0.99
Hausman test *p* value	-	0.00	-	0.00
Observations	5,197	3,297	5,197	3,297
Municipalities	1,892	1,758	1,892	1,758
95% confidence interval for coefficients on daycare accessibility	0.82 -0.86	0.66 -0.80	0.26 -0.3	0.07 -0.14

Notes: All specifications cover 2000, 2005, and 2010. WLS stands for weighted least squares. The municipality's population share for mothers with at least one child aged 0-5 years is used as the weight. See Appendix A for details on the measurements and data sources of variables. Standard errors are robust to heteroskedasticity and clustered at the municipality level. The null hypothesis that the unobserved time-invariant municipality-specific factor is uncorrelated with each explanatory variable is rejected if the Hausman test *p* value is below 0.1.

***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

Table 4 reports the additional results for the daycare effects. Columns 1 and 4 report the specifications that add a quadratic term of daycare accessibility to examine the non-linearity of the daycare effects. The results show that the relationships between daycare accessibility and both daycare enrollment rate and maternal employment rate have a concave form, suggesting that the effect of a one-percentage point change in daycare accessibility is larger when the daycare services are scarce. However, note that the degree of concavity is not very high, and thus warrants little attention.

TABLE 4
Additional Results

Dependent variables:	Daycare enrollment rate (%)			Maternal employment rate (%)		
Estimator: WLS	(1)	(2)	(3)	(4)	(5)	(6)
Daycare accessibility	0.99***	0.75***		0.15***	0.13***	
	(0.08)	(0.04)		(0.03)	(0.02)	
(Daycare accessibility)^2	-0.003***			-0.001*		
	(0.00)			(0.00)		
Ln quotas of licensed daycare centers			17.72***			2.88***
			(0.87)			(0.59)
Ln population aged 0-5 years			-23.86***			-3.42***
			(1.40)			(1.26)
Control variables included?	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	No	Yes	Yes	No	Yes
Municipality fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Municipality-specific time trends	No	Yes	No	No	Yes	No
R^2	0.99	0.99	0.99	0.99	0.99	0.99
Observations	3,297	3,297	3,297	3,297	3,297	3,297
Municipalities	1,758	1,758	1,758	1,758	1,758	1,758

Notes: Columns 1-3 show the results for the same specification as in Column 2 of Table 3. Columns 4-6 show the results for the same specification as in Column 4 of Table 3. Coefficients on other variables (householder's income, minimum wage, unemployment rate, three-generation households, privatization, kindergarten accessibility, land price, total fertility rate, inter-municipality commuting, year fixed effects, and municipality fixed effects) are controlled but not reported.
***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

Columns 2 and 5 report the specification that includes municipality-specific time trends, instead of year dummies, to control for heterogeneous time trends of population among municipalities. Rural municipalities have experienced continuous depopulation emanating from aging and outflows of population for quite a while now. On the other hand, municipalities in metropolitan areas tend to be experiencing an uptrend in population mainly due to population inflows. It is important to note that population trends vary among municipalities even within the same prefecture (Ministry of Internal Affairs and Communications, 2000, 2010). The results indicate that the daycare effects on both enrollments at licensed daycare centers and employment of mothers with preschool children remain almost unchanged even when heterogeneous time trends of population among municipalities are controlled for.

Columns 3 and 6 report the specifications that include quotas of licensed daycare centers and population aged 0-5 years, instead of daycare accessibility, to examine the effects of expanded capacity of licensed daycare centers. The result suggests that a one-percentage increase in quotas of licensed daycare centers leads to an increase of 0.18 percentage points and 0.03 percentage

points in the daycare enrollment rate and maternal employment rate, respectively. This means that 29.3% of the growth of daycare enrollment rate and 3.9% of the growth of maternal employment rate during the period 2000 to 2010 can be attributed to the expanded capacity of licensed daycare centers.

4.2. Do child age and household structure matter?

Table 5 reports the estimation results for the same specification as in Column 4 of Table 3, by age of the youngest child and household structure. The upper part of the table shows that the daycare effects on employment of mothers having at least one child aged below 5 years are prevalent regardless of the age of their child. However, mothers having children aged less than 12 months are exceptions, probably emanating from the facts that maternal employment includes mothers availing maternity leave, and that most mothers prefer to look after their children at home when they are aged less than 12 months.[11] We find no evidence that mothers with children aged 6-9 years are encouraged by an improvement in daycare accessibility.[12] The lower part of the table shows that for a mother living with her parents or parents-in-law, the daycare effect might be limited, probably because a child could be left with the mother's parents or parents-in-law while the mother works.

[11] The share of mothers in Japan who do not want to work outside the home when their child is aged less than 12 months is 79% (Benesse Educational Research and Development Institute, 2009).

[12] This result could enhance the credibility of our estimates, as it implies that municipality-level policy changes and other shocks common to mothers with young and old children are not correlated with the change in daycare accessibility (Asai et al., 2015).

TABLE 5
Daycare Effects on Maternal Employment by Child Age and Household Structure

Dependent Variable: Maternal Employment Rate (%). Estimator: WLS.				
	Coefficients on daycare accessibility	S.E.	R^2	Obs.
By age of the youngest child (years)				
Less than 12 months	0.02	(0.03)	0.97	3,296
1	0.11***	(0.03)	0.98	3,296
2	0.12***	(0.03)	0.98	3,296
3	0.11***	(0.04)	0.98	3,296
4	0.08**	(0.04)	0.98	3,295
5	0.11***	(0.04)	0.98	3,292
6	0.06	(0.04)	0.97	3,295
7	0.04	(0.04)	0.97	3,295
8	0.03	(0.04)	0.96	3,295
9	0	(0.04)	0.96	3,291
By household structure				
Nuclear	0.12***	(0.02)	0.99	3,296
Three-generation	0.05*	(0.03)	0.97	3,295

Notes: All specifications cover 2000, 2005, and 2010 and are estimated by weighted least squares (WLS). Standard errors (S.E.) are robust to heteroskedasticity and clustered at the municipality level. The table shows the results for the same specification as in Column 4 of Table 3 (by age of the youngest child and household structure).
***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

4.3. Regional heterogeneity

Table 6 reports the extent to which the effects of improved daycare accessibility on maternal employment for municipalities with wait-listed children, or municipalities in Tokyo metropolitan area, where the shortage of daycare accessibility is more serious, differ from the overall average. To allow for regional heterogeneity, we add wait-listed children dummy or Tokyo metropolitan dummy and its interaction term with daycare accessibility to the same specification as in Column 4 of Table 3 without controlling municipality fixed effects. The wait-listed children dummy takes one if a municipality has any wait-listed children, whereas the Tokyo metropolitan dummy takes one if a municipality is located in Tokyo, Kanagawa, Chiba, or Saitama. In the table, we report only the coefficient of the interaction term and its ratio relative to the coefficient of daycare accessibility in percentage.

The baseline result predicts that the daycare effect on maternal employment for municipalities with wait-listed children is 0.09 percentage points (35%) larger compared with that for all municipalities. The heterogeneity is larger for mothers having a child aged 3-5 years and residing in three-generation households. The result also suggests that the daycare effect on maternal

employment for municipalities in Tokyo metropolitan area is 0.17 percentage points (64%) larger compared with that for all municipalities. In particular, the heterogeneity is salient for mothers with a child aged less than 12 months and those with a 1-year-old child.

TABLE 6
Regional Heterogeneity of Daycare Effects on Maternal Employment

Comparison with the overall average for:				
	Municipalities with wait-listed children		Municipalities in Tokyo metropolitan area	
	Point estimate	Ratio	Point estimate	Ratio
Baseline	0.09***	35%	0.17***	64%
By age of the youngest child (years)				
Less than 12 months	0.00	-1%	0.16***	131%
1	0.06*	24%	0.21***	99%
2	0.08***	26%	0.16***	52%
3	0.16***	49%	0.18***	50%
4	0.21***	63%	0.17***	46%
5	0.22***	74%	0.16***	45%
By household structure				
Nuclear	0.06**	16%	0.17***	48%
Three-generation	0.12***	61%	0.14***	73%

Notes: The dependent variable is maternal employment rate (%). All specifications cover 2000, 2005, and 2010, and are estimated by weighted least squares (WLS). The table shows the results for the same specification as in Column 4 of Table 3, together with wait-listed children dummy (or Tokyo metropolitan dummy) and its interaction term with daycare accessibility. We report only the coefficient of the interaction terms. The ratio is calculated by the coefficient of the interaction term relative to the coefficient of daycare accessibility in percentage.

***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

5. Examination of Crowding Out

The key finding obtained through the empirical analyses in Section 4.1 was that the estimated daycare effects on maternal employment are much smaller than those on enrollment at licensed daycare centers (Tables 3 and 4). Baker et al. (2008), Berlinski and Galiani (2007), and Fitzpatrick (2010) observe the same discrepancy. Such discrepancy suggests that the improved access to licensed daycare centers encouraged mostly working mothers, rather than full-time housewives, to enroll their children at licensed daycare centers, switching from other ECEC institutions such as kindergartens and unlicensed daycare centers. In this section, we directly examine whether better access to licensed daycare centers reduces the possibility that mothers utilize kindergartens.

Attention is paid to kindergartens for two reasons. One is data availability. We have access to

municipality-level data on kindergarten enrollments but not on children cared for in unlicensed daycare centers. More importantly, the focus on kindergartens is motivated by a growing demand for full-time work by mothers with children aged 3-5 years. Data from the Employment Status Surveys (Ministry of Internal Affairs and Communications, 2002, 2012) show that the share of full-time female workers with children aged 4 years in the population of mothers with children of the same age increased from 14.6% in 2002 to 19.1% in 2012. Likewise, the counterpart for mothers with children aged 5 years rose from 14.4% to 17.6% during the same period. Thus, it is anticipated that some working mothers might substitute licensed daycare centers for kindergartens.[13]

In order to examine whether the expansion of licensed daycare centers crowded out kindergartens, the following specification is estimated by WLS:

$$G_{m,t} = \alpha_0 + \alpha_1 D_{m,t} + \alpha_2 \ln V_{m,t} + \omega \boldsymbol{Z}_{m,t} + \rho_m + \gamma_t + \tau_{m,t} \quad (2)$$

where subscript *m* stands for the municipality: *m* = 1,…, 1592, and *t* stands for the year: *t* = 2000, 2005, and 2010. The dependent variable (*G*) is kindergarten enrollment rate defined as enrollments at kindergartens divided by the population aged 3-5 years. *D* is daycare accessibility, and *V* refers to the number of established kindergartens. $\boldsymbol{Z}$ is a vector of the same control variables as those employed in equation (1), including householder's income, minimum wage, unemployment rate, and three-generation households. ρ_m and γ_t are municipality fixed effects and year fixed effects, respectively. The municipality's population share for mothers with at least one child aged 3-5 years is used as the weight. We are interested in the sign and magnitude of α_1: a negative sign would support the crowding out between licensed daycare centers and kindergartens.

Table 7 reports the results. Column 1 shows that the point estimate of daycare accessibility of the kindergarten enrollment rate is -0.10 and statistically significant, suggesting that holding other factors constant, the improvement in daycare accessibility during the period 2000 to 2010 leads

[13] The contrasting trends of daycare enrollment rate and kindergarten enrollment rate for children aged 4 years and 5 years from 1990 to 2010 support our argument (Panel C, Table 1).

to a decrease of 0.71 percentage points in the kindergarten enrollment rate. Column 2 reports the specification where the absolute term of kindergarten enrollments is used as the dependent variable controlling the population aged 3-5 years. The coefficient of daycare accessibility is negative and statistically significant at the 1% level, predicting that, overall, a one-percentage point improvement in access to licensed daycare centers leads to a 1% decrease in enrollments at kindergartens. This result suggests that the improved daycare accessibility during the period 2000 to 2010 reduced enrollments at kindergartens by 125,931, accounting for 75% of the total decrease in enrollments at kindergartens, and more importantly, 54% of the newly expanded capacity of licensed daycare centers.

TABLE 7
Examination of Crowding Out

Dependent variables:	Kindergarten enrollment rate (%)	Ln kindergarten enrollments
	(1)	(2)
Daycare accessibility (%)	-0.10**	-0.01***
	(0.04)	(0.00)
Ln establishments of kindergartens	5.26***	0.19**
	(1.88)	(0.08)
Ln population aged 3-5 years		0.77***
		(0.05)
Control variables included?	Yes	Yes
Year fixed effects	Yes	Yes
Municipality fixed effects	Yes	Yes
R^2	0.97	1.00
Hausman test *p* value	0.00	0.00
Observations	4,161	4,138
Municipalities	1,592	1,586
95% confidence interval for coefficients on daycare accessibility	-0.18- -0.02	-0.01- -0.004

Notes: All specifications refer to data from 2000, 2005, and 2010, and are estimated by weighted least squares (WLS). The municipality's population share for mothers with at least one child aged 3-5 years is used as the weight. Standard errors are robust to heteroskedasticity and clustered at the municipality level. Coefficients on other variables (householder's income, minimum wage, unemployment rate, three-generation households, year fixed effects, and municipality fixed effects) are not reported.
***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

6. Conclusion

In this paper, we explored whether improved daycare center accessibility may help tap into the ample supply of the underutilized female labor force in Japan. Our results suggest that an improvement in access to licensed daycare centers has positive effects on mothers' choice of work, and the effects are large for municipalities with wait-listed children or municipalities

located in Tokyo metropolitan area. Our results also suggest that the utilization of licensed daycare centers is not necessarily concurrent with the labor participation of mothers. This is because the improved access to licensed daycare centers could encourage working mothers to switch from other ECEC institutions. In this paper, we showed evidence that licensed daycare centers crowd out kindergartens.

The current paper focused solely on the role of childcare arrangements in determining mothers' choice of work. The results obtained in this study, however, indicates that the recent increase in female labor participation in Japan can not be explained only by an improvement in daycare accessibility. It is interesting to investigate the implications of diffusing maternity leaves and various types of employment. In addition, we limited the examination of crowding out to kindergartens owing to data limitation. It is worthwhile to explore the crowding out between licensed and unlicensed daycare centers with a fine dataset, particularly in the context of Japan. Finally, there is a need to undertake a welfare analysis for the daycare market. We find evidence that most of the increase in the daycare enrollment rate during the period 2000 to 2010 can be attributed to the improvement in daycare accessibility. However, this result does not necessarily mean that social welfare was enhanced, as the increases in consumers' (and providers') surpluses are realized at a price, namely, paying more taxes.

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APPENDIX A
Measurements and Data Sources of Variables

Variables	Definitions	Data sources
Daycare enrollment rate	(Enrollments at licensed daycare centers/population aged 0-5 years) × 100, %	Survey of Social Welfare Institutions by the Ministry of Health, Labour and Welfare (MHLW)
Maternal employment rate	(Number of married and employed females with at least one child aged 0-5 years old/total number of married females with at least one child aged 0-5 years) × 100, %	Population Census by the Ministry of Internal Affairs and Communications (MIAC)
Daycare accessibility	(Quotas of licensed daycare centers/population aged 0-5 years) × 100, %	Survey of Social Welfare Institutions by the MHLW
Householder's income	Monthly householder's income, yen	Family Income and Expenditure Survey by the MIAC
Minimum wage	Hourly minimum wage, yen	Survey of Regional Minimum Wage by the MHLW
Unemployment rate	(Number of unemployed workers/total labor force) × 100, %	Labor Force Survey by the MIAC
Three-generation household	(Number of three-generation households/total number of households) × 100, %	Population Census by the MIAC
Privatization	(Licensed daycare centers operated by private entities/total licensed daycare centers) × 100, %	Survey of Social Welfare Institutions by the MHLW
Kindergarten accessibility	(Establishments of kindergartens/population aged 3-5 years) × 100, %	School Basic Survey by the Ministry of Education, Culture, Sports, Science and Technology (MEXT)
Land price	Average land price for all uses per square meter, hundred yen	Survey of Prefectural Land Price by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT)
Total fertility rate	Number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with age-specific fertility rates of the specified year	Vital Statistics by the MHLW
Inter-municipality commuting	(Number of employed female workers commuting across municipalities/total number of employed female workers) × 100, %	Population Census by the MIAC
Kindergarten enrollment rate	(Enrollments at kindergartens/population aged 3-5 years) × 100, %	School Basic Survey by the MEXT

APPENDIX B
Summary Statistics

Variables	Obs.	Mean	Standard deviation	Min	Max	Changes in the means		
						2000-2005	2005-2010	2000-2010
Daycare enrollment rate (%)	5,197	29	13	0	124	5.2	1.4	6.6
Maternal employment rate (%)	7,779	37	10	0	100	3.5	5.8	9.3
By household structure								
Nuclear household	7,778	34	9	0	100	4.4	6.7	11.2
Three-generation household	7,749	50	12	0	100	2.2	3.0	5.2
By age of the youngest child (years)								
Less than 12 months	7,776	23	8	0	100	2.2	8.2	10.4
1	7,774	31	10	0	100	3.1	7.0	10.0
2	7,770	37	11	0	100	3.6	6.3	9.8
3	7,763	43	12	0	100	3.7	5.2	8.9
4	7,765	48	13	0	100	3.1	4.5	7.6
5	7,755	51	13	0	100	2.8	4.1	6.9
6	7,760	54	13	0	100	2.5	3.5	6.0
7	7,760	57	12	0	100	2.3	2.8	5.1
8	7,754	61	11	0	100	2.5	2.3	4.8
9	7,757	63	11	0	100	2.5	2.0	4.4
Daycare accessibility (%)	5,197	29	14	0	450	4.3	1.8	6.1
Householder's income (thousand yen/monthly)	5,200	445	54	280	574	-34.0	-0.7	-35.0
Minimum wage (yen/hourly)	5,200	688	54	600	821	8.4	62.2	70.6
Unemployment rate (%)	5,200	6	2	0	23	1.1	0.4	1.5
Three-generation households (%)	5,200	8	6	0	56	-0.7	-1.3	-2.0
Privatization (%)	5,009	50	26	0	100	4.8	7.3	12.1
Kindergarten accessibility (%)	5,017	0.39	0.24	0	14.28	0.00	0.03	0.03
Land price (hundred yen/square meter)	4,811	2,183	2,921	15	37,182	-926.5	41.4	-885.1
Total fertility rate	3,575	1.33	0.21	0.74	3.14	-0.02	-0.02	-0.04
Inter-municipality commuting	4,761	40	18	0	80	-3.4	1.1	-2.3
Kindergarten enrollment rate	5,006	51	17	0	177	-0.9	0.4	-0.5

Notes: Summary statistics cover 2000, 2005, and 2010 and are weighted by the municipality's population share for mothers with at least one child aged 0-5 years.

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