Interactions among Local Governments over the Provision of Nursery Facilities: A Quasi-Experimental Approach*

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Abstract: The development policy for nursery facilities has become an important issue in Japan in recent years. We thus examine the existence of a strategic interaction among local governments over the provisioning policies for nursery facilities by estimating their reaction function. To this end, we employ a quasi-experimental framework to validate the strategic interaction and evaluate the spatial autocorrelation coefficient changes between the Kanto and Kansai regions using the institutional and informational changes in the development policy in the 2010s. The estimation results show that the "blog frenzy" of 2016 increased media coverage in the Kansai urban area and significantly raised the spatial autocorrelation coefficients on the public and total provision rates compared to similar local governments in the Kansai region. By contrast, the "Zero Children on Waiting Lists Declaration" by the City of Yokohama in 2013, which marked a turning point in the development policy of the Kanto region, had no region-specific effect on spatial autocorrelation. This result may be due to the regional nature of the event and the regional and temporal differences in local governments' responses.

Keywords*:* nursery school provision, spatial autocorrelation, strategic interaction, experimental paradigm
JEL classification*:* H72, H77, R53

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1. Introduction

The provisioning policy concerning nursery facilities (hereafter, provisioning policy) has been a crucial policy issue in Japan since the 2010s. A proper provisioning policy is expected to improve women's work–life balance and alleviate the chronically low fertility rate in the country. In recent years, the government has made nursery facilities a main pillar of its measures to combat the declining birthrate, such as starting free preschool education and childcare in 2019 financed by an increase in the consumption tax.

It is highly significant to consider the existence of strategic behaviors when analyzing the provisioning policies of local governments, given that competition among local governments for the supply of high-quality nursery services and the interregional migration of child-rearing households are observed extensively. Suppose such a strategic characteristic is present in provisioning policies. In this case, developing nursery facilities in one municipality may induce other cities to develop similar facilities. Concurrently, municipalities may withdraw from development based on the fact that surrounding municipalities have sufficient nursery facilities. In coping with the severe shortage of nursery facilities in urban areas, examining this strategic change and its forms is worthwhile.

Such strategic behaviors have been a significant subject of study in public economics. For example, the existence of strategic relationships in local governments' taxation of mobile elements was noted early on by Zodrow and Mieszkowski (1986). Theoretical studies on such instances of tax competition have since been developed under various municipal actions (Wilson, 1999) and due to the strategic competition for municipal public goods and services. This study applies this discussion of local governments' strategic behaviors to whether competition based on strategic behaviors exists in the provisioning policies of local governments.

There are also many empirical studies on strategic behaviors, most using spatial econometric models for estimation. However, recent studies highlight identification problems stemming from the regional correlations of explanatory and missing variables; how to deal with these problems is thus still controversial. In this study, we focus on the existence of institutional and informational changes in the provisioning policies of the Kanto and Kansai regions, including urban areas where the "children-on-waiting-lists" problem is critical, and the fact that the impact of these changes is heterogeneous among the two regions. We also use these facts to evaluate the spatial correlation in provisioning policies under a quasi-experimental framework and obtain policy implications.

Our estimation results show that the 2016 "blog frenzy" increased media coverage in the urban Kansai region and significantly raised the spatial autocorrelation coefficients on public and total provision rates among similar municipalities in the Kansai region. This result indicates the existence of strategic behavior in the provisioning policy and that this upward shock enhanced either the resource-flow competition or yardstick competition. The "Zero Children on Waiting Lists Declaration" by the City of Yokohama in 2013 did not have a correlated regional effect. This ambiguity may be due to the regional nature of this event and the regional and temporal differences in local governments' responses.

The contributions of this study to the literature are twofold. First, it analyzes a notable policy variable, namely, the policy of providing nursery facilities, and obtains significant results. Second, in examining strategic behaviors, the study employs a quasi-experimental framework, which Gibbons and Overman (2012) have pointed out is of little concern for identification problems and has been gaining increasing attention in recent years.

The remainder of this paper is organized as follows. Section 2 describes the evolution of nursery facilities as an analysis background in the context of strategic behaviors to derive hypothesis testing. It also outlines the theories of strategic behavior, the identification problem of the spatial econometric model, and the quasi-experimental framework used for estimation. Section 3 explains the estimation model and the corresponding strategy for estimation, while Section 4 describes the data. Section 5 presents the estimation results and their interpretation, followed by an event study regression for robustness. Section 6 concludes the paper.

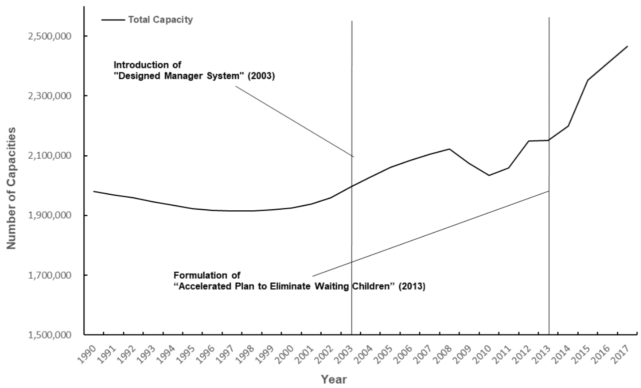
2. Background

2.1. Development of nursery facilities in urban areas in Japan

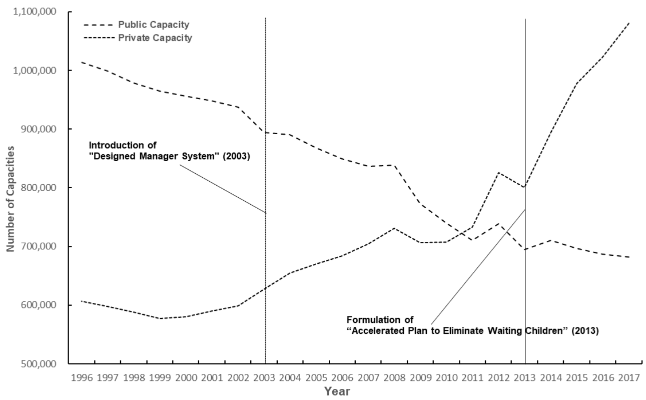
Fig. 1 shows the capacity of public and private nursery facilities and their total nationwide number from 1990 to 2017, according to the "Survey of Social Welfare Facilities" (Ministry of Health, Labour and Welfare, 1990–2017). The capacity decreased slowly in the 2000s before beginning to increase. The introduction of the "Designated Manager System" during 2003–2004, the shift of facility maintenance costs to general funds, and the "Accelerated Plan to Eliminate Waiting Children" in 2013 are some of the factors that contributed to this trend.

With the introduction of the "Designed Manager System," the municipalities that assessed the supply of nursery facilities as a burden promoted the approval of private facilities instead of setting up public ones; further, some public facilities were outsourced to the private sector. Meanwhile, the expansion of private facilities has proceeded rapidly since the "Accelerated Plan to Eliminate Waiting Children" in April 2013. This decision stipulates that nursery quotas should be established nationwide and that municipalities need to set targets for reducing the number of children waiting for nursery services and the development of nursery facilities.[1]

According to these system changes, the period under analysis (2010–2018) can be divided into two parts: 2010–2012 and 2013–2018. The changes made in 2013 were designed to encourage municipalities to set targets for developing childcare centers, reduce the number of children on waiting lists, and facilitate procedures for establishing nursery facilities. As such, a comparison between the post-implementation (2013–2018) and pre-implementation periods (2010–2012) is expected to verify the impact of institutional changes in these policies.



(a) Total provision



(b) Public and private provision

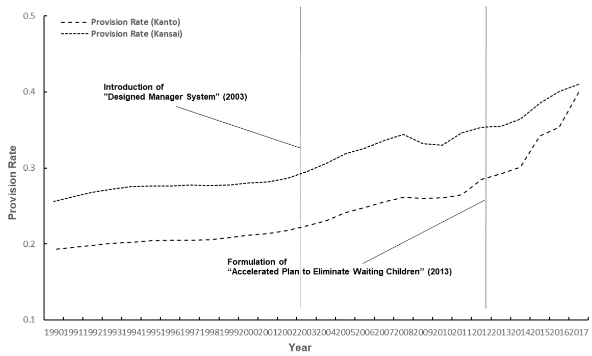
Fig. 1. Capacity of Nursery Facilities at the National Level (Total, Public, and Private)

Source: Ministry of Health, Labour and Welfare (1990–2017).

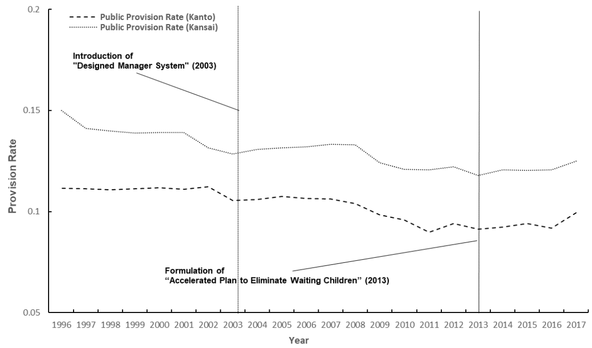
We focus our analysis on the prefectures referred to in the "Accelerated Plan to Eliminate Waiting Children" as "Urban Areas with Serious Waiting Lists." These prefectures can be divided into the Kanto and Kansai regions: Saitama, Chiba, Tokyo, and Kanagawa in the Kanto region and Kyoto, Osaka, and Hyogo in the Kansai region. The capacity ratio to population aged 0–5 years is defined as the "provision rate" and is used to indicate how much of the capacity is supplied to the population compared to potential demand.

[1] The additional program for this plan is the "New System for Supporting Children and Child Rearing," which came into effect in 2015, and its impact can be observed in the "Local Government Finance Plan" (Ministry of Internal Affairs and Communications). In FY2014 and FY2015, 316.0 and 518.9 billion yen were appropriated as public funds for measures to cope with the declining birthrate under the item "Enhancement of Social Security." The effect of the subsidy may be nationwide, which is why we use the fiscal explanatory variables in the "quasi-experimental" approach and "event study" analyses to examine its asymmetric effects.

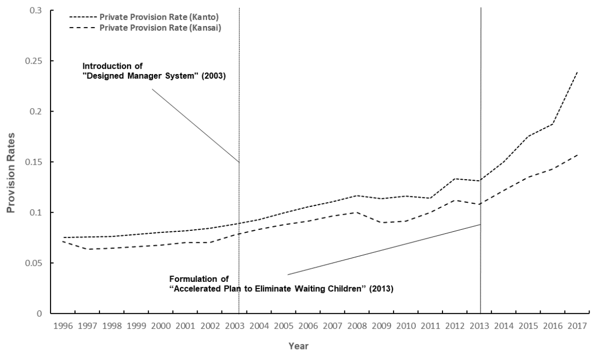
A comparison of the total, public, and private provision rates between the Kanto and Kansai regions from 1990 to 2017 is shown in **Fig. 2**. The total provision rate in the Kanto region was consistently lower than that in the Kansai region until around 2010, but Kanto's rate rose sharply after 2010 and reached almost the same level as Kansai's. Contrarily, the public provision rate in the Kanto region is approximately 10%, compared to 14% in the Kansai region, with the Kansai region consistently outpacing the Kanto one. The private provision rate has been slightly higher in the Kanto region, but since the "Accelerated Plan to Eliminate Waiting Children," the rate has increased in both regions, with a cumulative increase of approximately 10% in the Kanto region.



(a) Total provision rate (Kanto and Kansai)



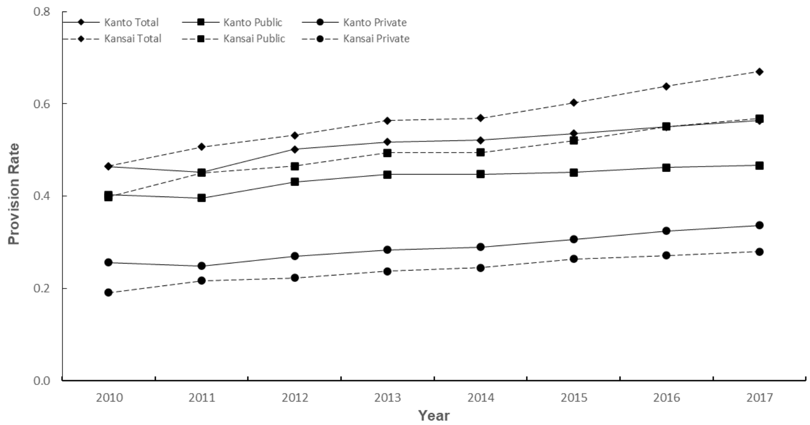
(b) Public provision rate (Kanto and Kansai)



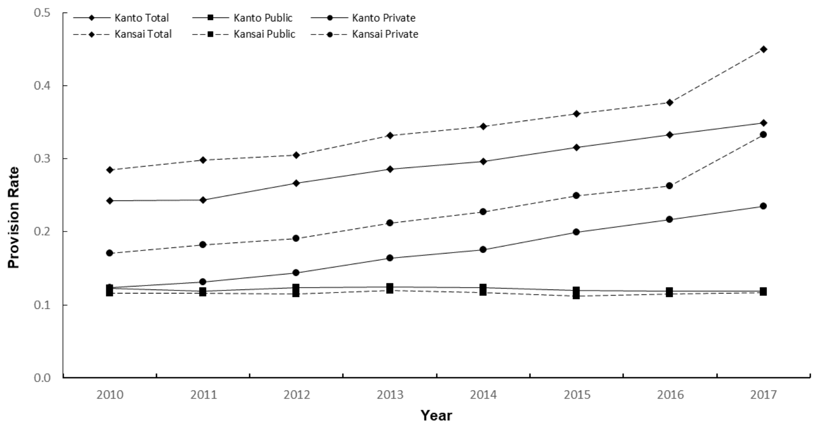
(c) Private provision rate (Kanto and Kansai)

Fig. 2. Provision Rate of Nursery Facilities in Kanto and Kansai (Total, Public, and Private)
Sources: Ministry of Health, Labour and Welfare (1996–2017) and Statistics Bureau, Ministry of Internal Affairs and Communications (1996–2017).

The size of the municipality should also be considered, since it is assumed that the supply of nursery facilities is insufficient compared to the demand for nursery services in large cities. By contrast, the excess demand for services is relatively low in smaller cities at the periphery. The nursery facility provision rates are shown for small municipalities in **Fig. 3**. While the rate of large municipalities is higher than that of small municipalities, the number of children on waiting lists tends to be higher in all regions. It can thus be inferred that there are different circumstances according to the size of the municipalities and estimating the number of children waiting for admission by size is necessary.



(a) Provision rates (small)



(b) Provision rates (large)

Fig. 3. Provision Rates by Scale in Kanto and Kansai (Total, Public, Private)

Sources: Ministry of Health, Labour and Welfare (2010–2017), and Statistics Bureau, Ministry of Internal Affairs and Communications (2010–2017).

From the figures and discussions above, we can deduce several facts concerning the provisioning policies of nursery schools in the Kanto and Kansai Regions.

(Fact 1) The chronological trend of the provisioning policy for nursery schools changed significantly in the 2010s. The change depends on the operation, size of the municipality, and region.

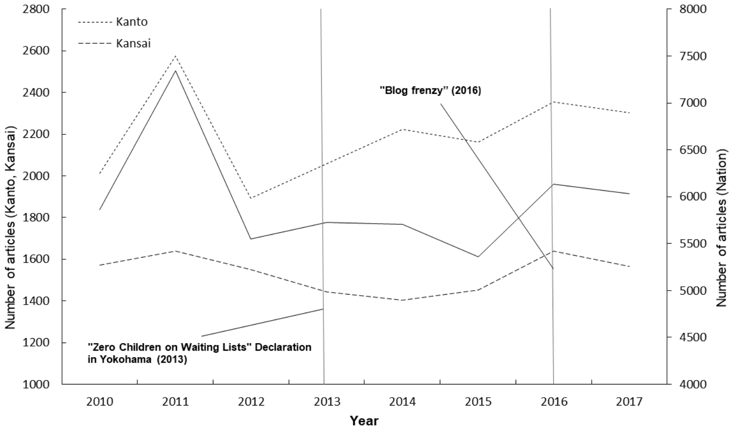
(Fact 2) At the beginning of the 2010s, the provision rates of nursery schools in the Kanto and Kansai regions differed. Furthermore, the introduction of the "Accelerated Plan to Eliminate Waiting Children" in April 2013 had different effects on the two regions.

Moreover, we focus on the possibility that the changes in the private sector's information on nursery facilities may have caused changes in the related strategic relationships. This view is because yardstick competition—a form of strategic interaction described by Besley and Case (1995)—stems from information asymmetries and spillovers regarding public goods. Following Unayama and Yamamoto (2015), we consider newspaper coverage a proxy for information.

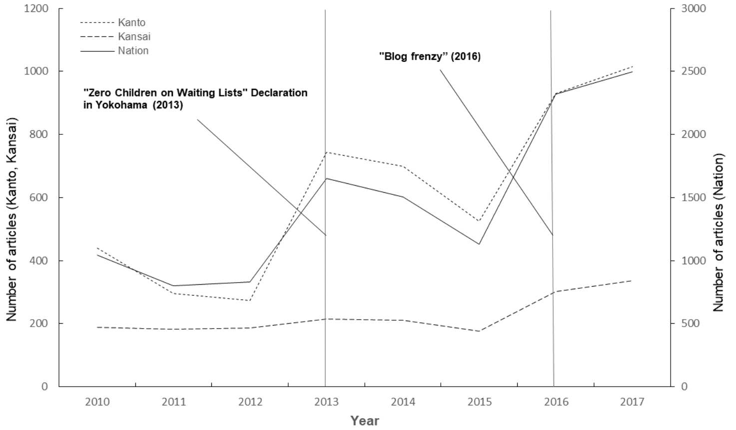
Among the major news reports, two events that might affect the above information asymmetry are the "Zero Children on Waiting Lists Declaration" in Yokohama City in 2013 and the "blog frenzy" of 2016. The "Zero Children on Waiting Lists Declaration" was announced by the City of Yokohama in April 2013, while the "blog frenzy" was triggered by an article[2] written by a parent who was unsuccessful in the selection process and had such an impact that the Prime Minister mentioned it in the House of Representatives. We examined whether the word "children on waiting lists" is included in the Asahi, Mainichi, and Yomiuri

[2] https://anond.hatelabo.jp/20160215171759, viewed May 2018.

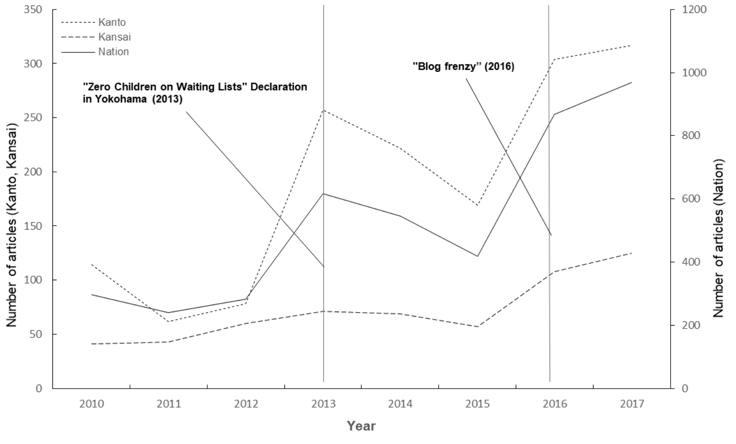
Shimbun articles.[3] The frequencies of articles with “children on waiting lists” in the text or headline were used as indicators. We also used the number of articles where “children on waiting lists” and “Yokohama” appear at least once in the headline and text to evaluate local impact. These indicators are illustrated for 2010–2017 in **Fig. 4**.



(a) News reports including the words “waiting children” in the text or headline



(b) News reports including the words “waiting children” in the headline



(c) News reports including the words “waiting children” and “Yokohama

Fig. 4. Number of Reports Related to the Provision of Nursery Facilities

Sources: Asahi Shimbun (2018), Mainichi Shimbun (2018), The Yomiuri Shimbun (2018).

[3] Asahi Shimbun articles are extracted from the main newspaper and regional editions according to handling by the Nation and the branches of Tokyo and Osaka. The Mainichi Shimbun’s head office editions and regional editions are aggregated for the Nation, Kanto, and Kansai regions. The Yomiuri Shimbun’s national and regional editions are aggregated for the Nation, Kanto, and Kansai regions. The Asahi Shimbun and the Mainichi Shimbun use “headline + text” and “headline” searches, while the Yomiuri Shimbun uses a “keyword search.”

These figures show that the “Zero Declaration” and “blog frenzy” had different impacts on the Kanto and Kansai regions. In 2013, after the “Zero Declaration,” the number of reports almost doubled nationwide and tripled in the Kanto region, with no noticeable impact in the Kansai region. By contrast, the “blog frenzy” doubled the amount of media coverage in all regions. Therefore, we can hypothesize that the “Zero Waiting Children Declaration” only affected the information of residents in the Kanto region, which is geographically close to Yokohama City.

By contrast, the “blog frenzy” affected the information of residents in both regions. We use this information to derive the hypotheses. From **Fig. 4(b),** it can be inferred that the 2013 “Zero Declaration” had a regional effect. In **Fig. 4(c)**, the media reports indicate that the “Zero Declaration” affected only the Kanto region. In the Kansai region, the maximum number of reports was only 17 in 2013, and we can conclude that only the “blog frenzy” affected the Kansai region.

From the perspective of beneficiaries’ information, we divide the period of analysis, 2010–2017, into two periods: 2010–2012 and 2013–2015, and 2013–2015 and 2016–2017. For the former, we consider only the changes in information in the Kanto region. However, for the latter, although the changes coincided in the Kanto and Kansai regions, we consider only the Kansai region to have been affected, which can be interpreted as a transition from the absence to the presence of information related to the provision of nursery facilities in this region.[4] From **Fig. 4** and the discussion above, we can also point out two facts concerning the provisioning policies of nursery schools in the Kanto and Kansai Regions.

(Fact 3) The “Zero Children on Waiting Lists Declaration” announced by Yokohama City in April 2013 only affected the information of residents in the Kanto region, which is geographically close to Yokohama City.

(Fact 4) The “blog frenzy” of 2016 affected the information of residents in both the Kanto and Kansai regions. It might be that first-time residents in the Kansai region were informed about the provisioning policy of nursery facilities.

2.2. Theories and hypotheses on strategic interaction and hypothesis

Nursery facilities are part of welfare policies implemented by local governments. There is a strategic nature of the welfare policies by local governments due to various factors, called welfare competition, which states that benefits are lower when the local governments implement public assistance than when the national government implements benefits uniformly due to the population mobility of recipients (Fiva and Rattsø, 2006; Saavedra, 2000; Wheaton, 2000).

In welfare competition,[5] the local government in jurisdiction i maximizes utility u_i of the median voter with income y_i, which depends on consumption level c_i, social expenditure level s_i, and local characteristics x_i. Denoting by t_i and r_i the tax rate and recipiency ratio, respectively, the budget constraint of the government can be expressed as $t_i y_i = r_i s_i$. Moreover, since recipients are assumed to move between regions if local government i increases the benefit level s_i relative to levels in other jurisdictions, s_{-i}, recipients will flow into the region and r_i will increase. Hence, the maximization problem of the government can be formulated as follows:

$$\max_{s_i} u_i = u\big((1 - t_i)y_i, s_i; x_i\big) \quad \text{s.t.} \quad t_i y_i = r_i(s_i, s_{-i})s_i.$$

In this case, u_i will decrease if the government must increase t_i or decrease s_i to balance its budget. Therefore, the welfare policy depends on its tax rate t_i and policies in other jurisdictions s_{-i} and is strategic. Under the Nash equilibrium, benefit level s_i is lower than the efficient level. In addition, since s_i and r_i are determined simultaneously, benefit level s_i under the strategic interaction is defined by the following reaction function:[6]

$$s_i = s_i(s_{-i}, t_i; y_i, x_i). \tag{1}$$

[4] In Kanto, the interpretation is that there continues to be information about nursery facilities after 2016.

[5] The “resource flow” part of the discussion is based on Revelli (2005) and Wildasin (1988, 1989).

[6] To concentrate on the empirical and policy implications of strategic interactions, we treat tax rate t_i and income y_i as exogenous. This can be done by assuming that the tax is imposed on the income of individuals representing a sufficiently large population relative to the beneficiaries.

In our examination of the strategic nature of provisioning policies for nursery facilities, benefit level s_i is the provision rate and beneficiary population $r_i N_i$ (N_i: total population in i) includes the mothers or children who use the facilities.

When studying the provisioning policies by local governments, it must also be considered that the central governments bear a significant burden and the beneficiaries are larger than those of welfare policies in previous studies.[7] From these factors, local governments might not be engaged in welfare competition in terms of tax rates as the policy variable but rather in "expenditure competition" with the amount of public expenditure as the policy variable. Studies dealing with this expenditure competition include Wildasin (1988, 1989), who shows that strategic behavior exists in expenditure competition. The following brief model outlines this expenditure competition:

$$\max_{S_i} u_i = u\big[\big(1 - t_i(S_i, S_{-i})\big)y_i, S_i; x_i\big] \quad \text{s.t.} \quad t_i(S_i, S_{-i})y_i = S_i.$$

Here, social expenditure S_i is defined as median voter's income y_i multiplied by tax rate t_i, which represents total expenditure to beneficiaries within municipality i. Tax rates for each region are determined to meet these expenditure levels according to the tax base of the region. As in the welfare competition case, beneficiaries move to the region with a higher benefit level, so tax rates are determined simultaneously to meet the budget constraints of all regions. Hence, social expenditure S_i is strategically determined and can be described in the form of a reaction function:[8]

$$S_i = S_i(S_{-i}; y_i, x_i). \tag{2}$$

In our situation, social expenditure level S_i is the welfare expenditure for nursery facilities, which we have discussed in detail in the previous section.

The yardstick competition described by Besley and Case (1995) might also induce a strategic interaction over provisioning policies. Under yardstick competition,[9] voters in region i refer to public services s_{-i} and taxes t_{-i} in other regions and judge whether their region's government is wasting resources through inefficiency or rent. Due to information asymmetry, voters cannot observe the wasteful use of resources, but it is possible to create some indicators using the relationship between taxes and public services in a region.

Let us assume that voters set a minimum level of public supply relative to taxes, for which policymakers in region i are elected. Under these circumstances, utility u_i of the median voter in jurisdiction i can be defined as follows:

$$u_i = u[y_i, \{(s_i/t_i) - \pi(s_{-i}/t_{-i})\}; x_i]. \tag{3}$$

Function $\pi(\cdot)$ is the policy evaluation function, which is increasing in the average service level of the referenced municipality. As its value depends on the observed public good supply relative to taxes in other municipalities, s_{-i}/t_{-i}, if policymakers in other regions increase their public goods supply, s_{-i}, the concerned region's level, s_i, will also increase through elections or other evaluation systems. If local government i maximizes utility u_i of a median voter, but without migration of beneficiaries, the optimization problem can be stated[10] as follows:

$$\max_{s_i} u_i = u\big(y_i, s_i, s_{-i}; x_i, t_i, t_{-i}, \pi(\cdot)\big) \quad \text{s.t.} \quad (1 - t_i)y_i = r_i s_i.$$

By the same discussion as in the resource-flow case, we can conclude that policy s_i depends on policies in other jurisdictions, s_{-i}, and is strategic. The reaction function can also be defined as:

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[7] All previous studies on welfare competition have focused on the poor, especially the Aid to Families with Dependent Children (AFDC).

[8] According to Wildasin (1988), strategic behavior has been verified in expenditure competition as well as tax competition under standard assumptions, but their equilibrium values vary.

[9] The "yardstick" part of the discussion is based on Allers and Elhorst (2011).

[10] To concentrate on the empirical and policy implications of strategic interactions, we treat tax rate t_i and income y_i as exogenous. See footnote 6 for details.

$$s_i = s_i\big(s_{-i},; y_i, t_i, t_{-i}, x_i, \pi(\cdot)\big). \tag{4}$$

In equation (4), if the policymakers in other regions increase benefit levels s_{-i}, a region's level, s_i, will also increase through some evaluation systems. When it comes to provisioning policy s_i, the evaluation might represent a comparison between the provision rates for a set of jurisdictions.

The previous discussions indicate that if either of the two forms of competition—resource-flow (welfare competition or expenditure competition) or yardstick competition—exists in the social welfare policies of municipalities, including the provisioning policies of nursery facilities, policy s_i in municipality i can be described by reaction function (5), where x_i is explanatory variable representing the characteristics[11] of region i:

$$s_i = s_i(s_1, \cdots, s_{i-1}, s_{i+1}, \cdots, s_I; x_i). \tag{5}$$

3. Empirical Strategy

3.1. A "quasi-experimental" paradigm

There are many empirical studies on strategic behavior. The primary method is spatial econometrics, a field that introduces spatial autocorrelation and heterogeneity into the estimation and analyzes the spatial nature of the economy (Anselin, 1988). Spatial econometric models, which estimate spatial correlation, have been extensively used in strategic behavior studies. In these studies, reaction functions of the policies, such as equation (5), are derived and estimated.

Strategic interaction in taxation has been examined by Allers and Elhorst (2005) and Devereux and Loretz (2013), among others. Further, Besley and Case (1995) consider state taxes and Bordignon et al. (2003), Brueckner and Saavedra (2001), and Solé Ollé (2003) municipal local property taxes. Additionally, Saavedra (2000) and Fiva and Rattsø (2006) provide evidence of strategic interactions based on spatial econometrics. Many empirical studies on welfare competition in Japan also use spatial econometric models, including Nakazawa (2007) for the supply of home help services, Bessho and Miyamoto (2012), and Adachi and Saito (2016a) for the public cost of antenatal health checkups, and Adachi and Saito (2016b) for subsidies on infant medical expenses. Furthermore, Adachi and Uemura (2016) examine the strategic nature of the quantitative expansion of nursery facilities using data on the number of nursery schools in municipalities. The results report the strategic interactions regarding the total number of nursery schools and the number of private nursery schools.

Most of these studies use spatial autocorrelation (SAR) models. However, estimating spatial correlations using a SAR model has two statistical problems: endogeneity due to the simultaneous determination of policies and heteroscedasticity due to correlations in the error terms. All these problems cause bias and inefficiency in the least-squares estimates (see Appendix A 1).

Another issue is posed by the regional correlations of explanatory variables.[12] Gibbons and Overman (2012) report that it is difficult to distinguish between spatial explanatory variable correlation (SLX) models and SAR models that deal with regional correlations of explained variables. They claim that endogeneity and identification problems remain even if the statistical problems stated above are solved, which is why an "experimental paradigm" is recommended for estimation. An experimental paradigm is a method for replicating an experimental situation in which explanatory variables are randomly assigned to each municipality and identifying and extracting factors that cause changes in the explanatory variables are assumed to be exogenous.

Lyytikäinen (2012) uses this quasi-experimental framework to demonstrate strategic interaction. Specifically, it considers the revised lower limit of local property tax rates in Finland to test strategic interaction in property taxation. Since Lyytikäinen (2012), several studies have applied a quasi-experimental framework to identify strategic interactions, most notably Baskaran (2014) and Isen (2014). They critically examined existing studies on strategic interaction and noted that strategic interaction tends to be over-detected through estimation using spatial econometric models; the quasi-experimental framework of Gibbons and Overman (2012) is thus recommended. Other studies are using administrative boundaries, such as Agrawal (2015), who derives the strategic nature of municipal sales tax setting based on the cross-border nature of purchasing and business location behavior, while Eugster and Parchet (2019) and Parchet (2019)

[11] Nevertheless, the composition of the characteristics differs slightly between the two theories.

[12] For further discussions, see Appendix A.1.

find cantonal boundaries in Switzerland and broader cultural boundaries to discuss the strategic behavior in local taxation.

These studies share a commonality: they use exogenous institutional changes to reconcile the various challenges presented by Gibbons and Overman (2012). Following this line of research, this study examines whether institutional and informational changes affect the spatial autocorrelation of provision rates of nursery facilities for the municipalities in the Kanto and Kansai regions, which are urban areas with similar regional characteristics. The following hypotheses consider the four facts in the evolution of nursery facilities' provision in the previous section. We discuss the existence or nonexistence of behaviors in provisioning policy and its form by testing the following two hypotheses.

(Hypothesis 1) The strategic behavior in the nursery facility provisioning policy led to an asymmetric change in the spatial autocorrelation of provision rates for the municipalities in Kanto and Kansai during the 2012–2013 institutional change.

(Hypothesis 2) The strategic behavior in the nursery facility provisioning policy led to an asymmetric change in the spatial autocorrelations of its provision rates for municipalities in Kanto and Kansai during the informational change in 2015–2016, thus causing an asymmetric consequence.

The institutional change refers to **Fact 2**. By contrast, the informational change refers to **Facts 3** and **4**. In light of the discussion, we do not rule out the possibility of an impact on Kansai in 2013. However, we assume that asymmetric changes occurred in Kanto based on trends in the provision rate of private facilities (**Fact 1**). In 2013, institutional changes were likely to have occurred uniformly. Nevertheless, informational changes were likely to have had asymmetric effects. In 2016, as discussed in Section 2.1, the "blog frenzy" brought national attention to the provision of nursery facilities, and the beneficiaries in the Kansai region became more attentive to the efficiency of maintenance policies.

There are two possible scenarios under which the spatial autocorrelation term may be affected. One is a case in which the beneficiaries become more active in comparing the provisioning policies of local governments, strengthening the resource-flow competition. Another scenario is a case in which the attention paid to the efficiency of provisioning policies increases among policymakers and beneficiaries, strengthening yardstick competition.

3.2. Estimation equations

This section formulates the estimating equations corresponding to our hypotheses under a quasi-experimental framework. **Hypothesis 1** assumes institutional and informational changes during 2012–2013 and **Hypothesis 2** during 2015–2016. We formulate a basic estimation equation (6) to capture the regional and chronological heterogeneities corresponding to each hypothesis:

$$\begin{aligned} y_{it} = {} & \lambda_1 \left\{ \sum_{j \in R_i} w_{ij}^{R_i} y_{jt} \right\} + \beta_1 time + \lambda_2 time \times \left\{ \sum_{j \in R_i} w_{ij}^{R_i} y_{jt} \right\} + \lambda_3 Kanto \times \left\{ \sum_{j \in R_i} w_{ij}^{R_i} y_{jt} \right\} \\ & + \lambda_4 time \times Kanto \times \left\{ \sum_{j \in R_i} w_{ij}^{R_i} y_{jt} \right\} + \boldsymbol{x'}_{it} \boldsymbol{\beta} + \mu_i + \eta_t + const. + \varepsilon_{it}, \end{aligned} \tag{6}$$

where y_{it} is the explained variable (provision rate of nursery facilities), μ_i is the fixed effect, η_i is the year fixed effect, ε_{it} is the error term, $\boldsymbol{x'}_{it}$ denotes explanatory variables, $Kanto$ is a dummy that takes one if the municipality belongs to the Kanto region, and $time$ is a dummy that takes one after 2013 **(Hypothesis 1)** and after 2016 **(Hypothesis 2)**, indicating the institutional and informational changes. The estimation equation also includes average provision rate $\left\{ \sum_{j \in R_i} w_{ij}^{R_i} y_{jt} \right\}$ for the municipality that serves as reference. Coefficient λ_3 of the interaction term with the Kanto dummy corresponds to the strategic behavior between two regions, while λ_4 is the coefficient of the interaction term with the change and dummy, which is significant if the asymmetry of each change affects strategic behaviors differently in the both regions.

The reference number of municipalities was not excessively large relative to the sample, which is why we could address the identification problem of spatial lag terms and time-fixed effects as per Devereux et al. (2008) (see below). In addition, based on Stock and Watson (2008), errors are clustered by municipalities to address the underestimation of standard errors derived from time-series correlations.

The difference-in-difference estimation method supporting this estimation equation has a typical trend assumption as a prerequisite for identification (Angrist and Pischke, 2008), which is of concern. Specifically, if the asymmetry of the observed regional effects originates from heterogeneity before the changes, the significance of the estimation results cannot be guaranteed. Accordingly, we perform the estimation based on the approach of Li et al. (2016), which allows the treatment and control groups to have different trends to check the robustness of the estimation results to the success or failure of the standard trend assumption. Following Kodama and Yokoyama (2018), the estimation model adds an interaction term with trend function $f(t)$ and its Kanto region dummy to the basic estimation model (equation (6)). The trend function $f(t)$ is assumed to be linear or quadratic. Other settings follow equation (6):

$$
\begin{aligned}
y_{it} = {} & \beta_1 time + \lambda_1 \left\{ \sum_{j \in R_i} w_{ij}^{R_i} y_{jt} \right\} + \lambda_2 time \cdot \left\{ \sum_{j \in R_i} w_{ij}^{R_i} y_{jt} \right\} + \lambda_3 Kanto \cdot \left\{ \sum_{j \in R_i} w_{ij}^{R_i} y_{jt} \right\} \\
& + \lambda_4 time \cdot Kanto \cdot \left\{ \sum_{j \in R_i} w_{ij}^{R_i} y_{jt} \right\} + \boldsymbol{x'}_{it} \boldsymbol{\beta} + \mu_i + \eta_t \qquad (7) \\
& + \boldsymbol{f(t)} + \boldsymbol{f(t)} \cdot Kanto + const. + \varepsilon_{it}, \\
& where \quad \boldsymbol{f(t)} = \gamma t \quad or \quad \boldsymbol{f(t)} = \gamma_1 t + \gamma_2 t^2.
\end{aligned}
$$

4. Data Description

In analyzing the strategic behavior of municipalities, we first establish a spatial weighting matrix corresponding to the policy variables of the municipalities to be referenced. The following spatial weighted matrices were set up, considering the administrative characteristics of provisioning policies following previous studies.[13] The "neighboring group matrix" is a matrix that assigns weights to governments adjacent to municipality i if they are located in the same prefecture as i, and spatial weight matrix $w_{ij}^A \in \boldsymbol{W}^A$ is established. Set A_i represents "governments adjacent to i in the prefecture":

$$
w_{ij}^A = \begin{cases} 1/\#A_i & if \ \ j \in A_i, \\ 0 & if \ \ j \notin A_i. \end{cases} \qquad (8)
$$

The "similar group matrix" is a matrix using "similar groups," as in Adachi and Saito (2016a) and Hayashi and Yamamoto (2017). Here, we assign weights to the municipalities that belong to the same local classification as the municipality in question and are in the same category in the "Fiscal Index Table by Similar Municipality Group" (Ministry of Internal Affairs and Communications, 2015). In other words, set C_i is defined as "municipalities that belong to the same region as i and belong to the same group as i," and spatial weight matrix $w_{ij}^C \in \boldsymbol{W}^C$ is set as follows:

$$
w_{ij}^C = \begin{cases} 1/\#C_i & if \ \ j \in C_i, \\ 0 & if \ \ j \notin C_i. \end{cases} \qquad (9)
$$

Appendix A.2 lists the descriptive statistics. **Table A.1** shows statistics for the entire country and the Kanto and Kansai regions. Descriptive statistics for each reference level of the rates (**Table A.2**) and statistics by municipality size (**Table A.3**) are also provided.

Table A.1 shows that the public and private provision rates are smaller in the Kanto and Kansai regions than nationwide. Comparing Kanto and Kansai, the public rate is lower in Kanto, whereas the private rate is lower in Kansai. The total rate is lower in the Kanto than in the Kansai region, as reflected in the number of children on waiting lists in the Kanto region. As for the explanatory variables, regional population characteristics do not differ significantly between the Kansai and Kanto regions. However, the variables

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[13] The concept of distance is included in spatial-weighting matrices, which are often used in studies of the identification of strategic behavior. However, this study did not introduce this concept because it uses the difference-in-differences-like estimation method from the standpoint that it is difficult to identify the correlation between the explained and explanatory variables and the error terms. The relationship between the location of each municipality and spatial autocorrelation is pseudo-treated in the event study in Section 5.2.

related to beneficiary characteristics reflect that the "nuclear family rate" and "maternal employment rate" are higher in the Kansai region. Municipalities in the Kanto region show the highest performance in terms of financial characteristics.

As for the reference level in **Table A.2**, while the mean is more significant for the neighboring reference than for the category group reference, the inverse relationship is observed for variance, but the characteristics of the policy variable statistics generally show no differences. **Table A.3** shows the descriptive statistics corresponding to each municipality's size, following **Fact 1**. As in the case of all municipality sizes, each provision rate tends to be lower. However, there are differences in the regional nature of their public or private compositions.

5. Results

5.1. Evidence of strategic interaction over the provision of nursery facilities

We present the estimation results assuming institutional and informational changes in 2013 **(Hypothesis 1)** and an informational change in 2016 **(Hypothesis 2)**, using six different combinations of variables. In result (1), basic equation (6) is estimated using standard explanatory variables. Result (2) is the result of equation (7) with standard explanatory variables, including the linear trend term and its interaction term with the Kanto dummy. The estimation equation in result (3) includes the quadratic term of trend and its interaction term with the Kanto dummy. We also show the results of estimation equation (7) with the first set of additional explanatory variables (budget constraints) in result (4) and with the second set of additional explanatory variables (population trend) in result (5). Result (6) shows the estimation results with two-period lagged changes to conduct a placebo test, which is typical in this difference-in-differences-like framework.

Table 1 shows the primary estimation results for municipalities referencing those in the same category and large municipalities' public and private provision rates by referencing neighboring municipalities in **Hypothesis 1.**[14] For the public rates of similar municipalities, the reference level (coefficient: 0.0409–0.0803) and an interaction term for the level and the Kanto dummy (coefficient: -0.2359–-0.1629) are consistently significant in all cases. We conclude that there is a negative spatial autocorrelation in the Kanto region and a positive spatial autocorrelation in the Kansai region. Furthermore, the institutional and informational changes in 2013 did not affect these autocorrelations as there is no significant interaction term with the time dummy.

Next, we consider the case of large municipalities. The reference level (coefficient: 0.0673–0.0707) and the interaction term between the reference level and the institutional and information change (coefficient: 0.0205–0.0215) are significant for the public provision rate of adjacent municipalities. Therefore, it can be concluded that there is a weak spatial autocorrelation for the public rate in large municipalities nationwide and that institutional change slightly strengthened this correlation. Regarding the private provision rate, the coefficients on the reference level and Kanto dummy (0.1932–0.5312) are significant, indicating that the change caused a more substantial spatial autocorrelation for the private rate in large municipalities only in the Kanto region.

Concerning **Hypothesis 1**, we did not find any asymmetric effects of the 2013 institutional change ("Accelerated Plan to Eliminate Waiting Children") and informational change ("Zero Declaration") on the spatial autocorrelation term. However, the sharp increase in the rate of private nursery facility development in the Kanto region in **Fig. 2** can be interpreted as an amplification of the effect of the institutional change that encouraged local governments to develop nursery facilities if the confirmed spatial autocorrelation of the rate of private facilities is due to strategic behavior.

[14] In this study, the basic estimation equation was solved for each combination of maintenance rates (total, public, or private operation), referents (adjacent or similar municipalities), and municipality sizes (all municipalities, small municipalities, large municipalities). Due to space limitations, Table 1 shows only the results for which the reference level is significant, suggesting some strategic behavior. The other results are available upon request.

	Public Category						Public-Adjacent Large						Private-Adjacent Large					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
Reference Level	0.0471**	0.0478**	0.0475**	0.0409**	0.0484**	0.0803***	0.0707**	0.0697**	0.0690**	0.0673**	0.0694**	0.0514	0.0117	-0.1549	-0.2028	-0.1892	-0.2326	-0.1723
	(0.0206)	(0.0208)	(0.0208)	(0.0185)	(0.0205)	(0.0309)	(0.0341)	(0.0349)	(0.0339)	(0.0337)	(0.0337)	(0.0518)	(0.1244)	(0.1452)	(0.1496)	(0.1515)	(0.1515)	(0.1380)
Time	0.0222	0.0009	-0.0163	-0.0342	-0.0177	-0.0074	-0.0703***	0.0241***	-0.0299**	-0.0311**	-0.0333**	-0.0287**	0.0778**	-0.0285***	0.0686***	0.0737***	0.0560***	0.0694***
	(0.0725)	(0.0255)	(0.0330)	(0.0338)	(0.0354)	(0.0333)	(0.0249)	(0.0089)	(0.0137)	(0.0139)	(0.0148)	(0.0123)	(0.0391)	(0.0109)	(0.0208)	(0.0211)	(0.0212)	(0.0199)
Reference × Kanto	-0.2303**	-0.2359**	-0.2351**	-0.2289**	-0.2316**	-0.1629*	-0.0994*	-0.0937	-0.0890	-0.0947*	-0.0907	-0.0250	0.1932*	0.4659**	0.5300***	0.4962**	0.5312***	0.4972***
	(0.0997)	(0.1034)	(0.1034)	(0.1058)	(0.1030)	(0.0840)	(0.0575)	(0.0574)	(0.0564)	(0.0548)	(0.0562)	(0.0626)	(0.1147)	(0.1868)	(0.1916)	(0.1912)	(0.1876)	(0.1822)
Reference × Time	0.0441*	0.0415	0.0416	0.0463*	0.0389	-0.0099	0.0178	0.0205*	0.0211*	0.0215*	0.0207*	0.0321	0.0520*	0.0386	0.0363	0.0354	0.0372	0.0246
	(0.0257)	(0.0258)	(0.0258)	(0.0252)	(0.0250)	(0.0270)	(0.0110)	(0.0117)	(0.0114)	(0.0112)	(0.0117)	(0.0242)	(0.0286)	(0.0267)	(0.0265)	(0.0269)	(0.0267)	(0.0283)
Reference × Kanto × Time	0.0364	0.0438	0.0437	0.0410	0.0418	0.0298	0.0432**	0.0350	0.0337	0.0345	0.0352	-0.0012	-0.0388	-0.0193	-0.0176	-0.0153	-0.0141	-0.0103
	(0.0441)	(0.0516)	(0.0516)	(0.0509)	(0.0512)	(0.0510)	(0.0189)	(0.0226)	(0.0225)	(0.0220)	(0.0230)	(0.0281)	(0.0269)	(0.0254)	(0.0251)	(0.0254)	(0.0254)	(0.0289)
Trend		0.0052	0.0233	0.0334	0.0258	0.0317		-0.0197***	0.0382**	0.0366**	0.0416**	0.0369*		0.0236**	-0.0799***	-0.0771***	-0.0665***	-0.0812***
		(0.0178)	(0.0413)	(0.0404)	(0.0436)	(0.0421)		(0.0064)	(0.0174)	(0.0177)	(0.0187)	(0.0188)		(0.0092)	(0.0242)	(0.0246)	(0.0244)	(0.0255)
Trend × Kanto		-0.0011	-0.0043	-0.0041	-0.0087	-0.0107		0.0007	-0.0105**	-0.0103**	-0.0113**	-0.0087		-0.0057**	0.0137*	0.0140*	0.0145*	0.0165
		(0.0020)	(0.0109)	(0.0113)	(0.0117)	(0.0163)		(0.0011)	(0.0052)	(0.0052)	(0.0053)	(0.0087)		(0.0028)	(0.0076)	(0.0076)	(0.0079)	(0.0105)
$Trend^2$			-0.0010	-0.0016	-0.0011	-0.0010			-0.0032***	-0.0031***	-0.0033***	-0.0031***			0.0057***	0.0054***	0.0051***	0.0059***
			(0.0027)	(0.0027)	(0.0028)	(0.0028)			(0.0011)	(0.0011)	(0.0011)	(0.0011)			(0.0013)	(0.0013)	(0.0013)	(0.0014)
$Trend^2$ × Kanto			0.0002	0.0002	0.0005	0.0006			0.0007**	0.0007**	0.0008**	0.0007			-0.0014***	-0.0013***	-0.0014***	-0.0016**
			(0.0007)	(0.0007)	(0.0007)	(0.0010)			(0.0003)	(0.0003)	(0.0004)	(0.0006)			(0.0005)	(0.0005)	(0.0005)	(0.0007)
Population of Mothers	-7.1448***	-7.0419***	-7.0512***	-6.7759***	-7.0121***	-6.3906***	-2.9800***	-3.0985***	-3.2027***	-3.0963***	-3.2286***	-3.1457***	2.5572*	2.1356	2.1993*	2.2543*	2.1044*	2.1681*
	(1.6473)	(1.6493)	(1.6487)	(1.6522)	(1.6443)	(1.6786)	(1.0408)	(1.0223)	(1.0281)	(1.0155)	(1.0287)	(1.1007)	(1.3278)	(1.3033)	(1.2957)	(1.3031)	(1.2596)	(1.2930)
Population Density (log)	-0.0000	-0.0000	-0.0000	-0.0000	0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000*	0.0000	0.0000	0.0000*	0.0000	0.0000*	0.0000*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Total Fertility Rate	-0.0719***	-0.0723***	-0.0725***	-0.0667**	-0.0722**	-0.0807***	-0.0351**	-0.0344**	-0.0350**	-0.0344**	-0.0341**	-0.0346**	-0.0433**	-0.0420**	-0.0403*	-0.0413*	-0.0378*	-0.0404*
	(0.0273)	(0.0272)	(0.0272)	(0.0259)	(0.0280)	(0.0258)	(0.0162)	(0.0160)	(0.0160)	(0.0159)	(0.0156)	(0.0156)	(0.0212)	(0.0212)	(0.0214)	(0.0213)	(0.0204)	(0.0218)
Nuclear Family Share	0.1582	0.1527	0.1535	0.1510	0.1612	0.1887	0.0135	0.0165	0.0198	0.0125	0.0151	0.0507	-0.2032	-0.1744	-0.1732	-0.1693	-0.2011	-0.1822
	(0.3038)	(0.3020)	(0.3022)	(0.2914)	(0.3346)	(0.3111)	(0.1283)	(0.1279)	(0.1275)	(0.1262)	(0.1270)	(0.1370)	(0.2260)	(0.2247)	(0.2230)	(0.2169)	(0.2263)	(0.2245)
Share of Families with children	0.5367	0.5669	0.5700	0.5736	0.5580	0.8076	0.3677	0.3536	0.3809	0.3882	0.3735	0.4221	-0.6785	-0.5555	-0.5873	-0.6162	-0.6072	-0.5936
	(0.4637)	(0.4572)	(0.4575)	(0.4503)	(0.4576)	(0.5054)	(0.3675)	(0.3698)	(0.3722)	(0.3692)	(0.3696)	(0.3956)	(0.5723)	(0.5689)	(0.5709)	(0.5750)	(0.5585)	(0.5724)
Co-employment Rate	-0.0733	-0.0742	-0.0734	-0.0660	-0.0811	-0.1306	0.1037***	0.1064***	0.1112***	0.1108***	0.1066***	0.1050***	-0.0587	-0.0450	-0.0502	-0.0351	-0.0613	-0.0651
	(0.1186)	(0.1185)	(0.1192)	(0.1171)	(0.1209)	(0.1188)	(0.0375)	(0.0379)	(0.0379)	(0.0393)	(0.0388)	(0.0352)	(0.0537)	(0.0541)	(0.0543)	(0.0534)	(0.0522)	(0.0543)
Taxable Income (log)	0.0983	0.0967	0.0974	0.1172	0.0922	0.0722	-0.0425	-0.0410	-0.0406	-0.0494	-0.0380	-0.0491	0.1859**	0.1862**	0.1876**	0.1882**	0.1873**	0.1825**
	(0.0877)	(0.0868)	(0.0866)	(0.0810)	(0.0876)	(0.0837)	(0.0491)	(0.0491)	(0.0494)	(0.0484)	(0.0496)	(0.0503)	(0.0768)	(0.0743)	(0.0743)	(0.0741)	(0.0748)	(0.0745)
Financial Strength Index	-0.0441	-0.0506	-0.0529	-0.0281	-0.0657	-0.0521	-0.0030	0.0009	-0.0096	0.0019	-0.0127	-0.0131	0.0428	0.0244	0.0423	0.0434	0.0449	0.0447
	(0.0491)	(0.0522)	(0.0543)	(0.0569)	(0.0539)	(0.0571)	(0.0312)	(0.0336)	(0.0341)	(0.0331)	(0.0340)	(0.0345)	(0.0411)	(0.0428)	(0.0451)	(0.0459)	(0.0460)	(0.0454)
Bond Expenditure Ratio	0.0068	0.0100	0.0089	-0.0864	-0.0138	-0.0303	-0.1402*	-0.1378*	-0.1442*	-0.1396*	-0.1453*	-0.1226	-0.0331	-0.0317	-0.0203	-0.0362	-0.0168	-0.0204
	(0.1508)	(0.1495)	(0.1493)	(0.1341)	(0.1408)	(0.1501)	(0.0762)	(0.0749)	(0.0747)	(0.0752)	(0.0748)	(0.0760)	(0.1069)	(0.1052)	(0.1037)	(0.1068)	(0.1041)	(0.1054)
Residential Land Prices				0.0113						0.0149						0.0159		
				(0.0288)						(0.0129)						(0.0215)		
Land Prices for All Uses				-0.0432						-0.0069						-0.0219		
				(0.0401)						(0.0129)						(0.0224)		
Local Consumption Tax				0.2545						0.0046						-0.0008		
				(0.2004)						(0.0729)						(0.0694)		
General Subsidy Tax				-2.6349						-1.2437						2.2676		
				(2.5756)						(1.1726)						(1.5374)		
Population Outflow Rate					-0.7835						-0.2786						-0.3396	
					(0.4794)						(0.2699)						(0.3932)	
Population Inflow Rate					0.9426						0.0581						-0.9136*	
					(0.6405)						(0.3428)						(0.5143)	
Constant	0.0513	0.0341	-0.0284	0.0755	-0.0066	0.0943	0.6562*	0.7461**	0.5705	0.5479	0.5484	0.6191*	-1.2143**	-1.3100**	-1.0094*	-0.9581*	-0.9953*	-0.9659*
	(0.6454)	(0.6125)	(0.6680)	(0.7613)	(0.6854)	(0.6432)	(0.3718)	(0.3686)	(0.3663)	(0.3567)	(0.3691)	(0.3732)	(0.6007)	(0.5792)	(0.5617)	(0.5585)	(0.5613)	(0.5640)
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Explanatory Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional Variables 1	No	No	No	Yes	No	No	No	No	No	Yes	No	No	No	No	No	Yes	No	No
Additional Variables 1	No	No	No	No	Yes	No	No	No	No	No	Yes	No	No	No	No	No	Yes	No
Placebo Change (2year lagged)	No	No	No	No	No	Yes	No	No	No	No	No	Yes	No	No	No	No	No	Yes
Observations	1590	1590	1590	1590	1590	1590	1021	1021	1021	1021	1021	1021	1031	1031	1031	1031	1031	1031
Coefficient of Determination (R^2)	0.1560	0.1563	0.1563	0.1676	0.1595	0.1403	0.1425	0.1433	0.1475	0.1527	0.1496	0.1350	0.7261	0.7284	0.7306	0.7320	0.7344	0.7300
F-value (χ^2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hausman	95.65	96.33	106.52	86.33	120.49	122.91	64.60	65.40	94.85	107.17	96.59	92.67	68.69	67.93	87.10	111.16	91.46	59.47
Breusch-Pagan	2935.22	2930.17	2931.14	2958.87	2879.35	2905.00	2094.24	2078.34	2076.19	2060.95	2048.80	2071.72	2012.56	1992.71	2002.19	1826.59	1984.61	2008.89

Table 1. Primary Estimation Results (2012–2013 Change)

Note: ***, **, and * indicate significance at the 10%, 5%, and 1% levels, respectively. This table examines the public and private provision results based on Hypothesis 1. In "Adjacent references," each municipality refers to adjacent municipalities within the same prefecture and in "Category references," each municipality refers to the same municipalities in the same category within the same locality. The estimates use a fixed effects model that includes time-specific fixed effects. In Hypothesis 1, the institutional and information changes are assumed to have occurred between 2012 and 2013. (1) uses standard explanatory variables in the basic estimation; (2) includes the first-order term of the trend and the interaction term with the Kanto dummy; (3) includes the first-order and second-order terms of the trend and the interaction terms with the Kanto dummy; (4) includes the explanatory variables for the trend and the budget constraint for provision; (5) includes the explanatory variables for the trend and population trend; and (6) shows the results of the placebo estimation, which estimates the two-period lag of change in the basic estimation.

	Public Category						Total Category					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
Reference Level	-0.1930	-0.2289	-0.2294	-0.2267	-0.2288	0.0872	-0.1135	-0.1166	-0.1167	-0.1166	-0.1166	0.0123
	(0.1793)	(0.1954)	(0.1952)	(0.1952)	(0.1933)	(0.0627)	(0.0971)	(0.1027)	(0.1026)	(0.1021)	(0.1010)	(0.0744)
Time	0.0080	-0.0169	0.0091	0.0036	0.0097	0.0188	0.1024	0.0048	-0.1675	-0.1750	-0.1668	-0.1428
	(0.0649)	(0.0291)	(0.0448)	(0.0451)	(0.0455)	(0.0437)	(0.0666)	(0.0522)	(0.1694)	(0.1775)	(0.1721)	(0.1709)
Reference × Kanto	-0.1010	-0.0819	-0.0797	-0.0905	-0.0829	-0.3719**	0.3100**	0.2910**	0.2853**	0.2874**	0.2854**	0.1770
	(0.2388)	(0.2422)	(0.2414)	(0.2469)	(0.2388)	(0.1675)	(0.1573)	(0.1333)	(0.1316)	(0.1341)	(0.1299)	(0.1192)
Reference × Time	0.1638*	0.1819*	0.1820*	0.1811*	0.1813*	0.0911	0.1215*	0.1260*	0.1261*	0.1257*	0.1261*	0.0614
	(0.0911)	(0.1004)	(0.1004)	(0.1005)	(0.0990)	(0.0787)	(0.0672)	(0.0756)	(0.0756)	(0.0753)	(0.0746)	(0.0701)
Reference × Kanto × Time	-0.1407*	-0.1846*	-0.1847*	-0.1840*	-0.1842*	-0.0888	-0.1050**	-0.1156*	-0.1161*	-0.1159*	-0.1160*	-0.0577
	(0.0827)	(0.1064)	(0.1064)	(0.1074)	(0.1048)	(0.0839)	(0.0470)	(0.0643)	(0.0646)	(0.0647)	(0.0634)	(0.0642)
Trend		-0.0010	-0.0372	-0.0197	-0.0374	-0.0574		0.0177	0.2455	0.2677	0.2446	0.1956
		(0.0166)	(0.0770)	(0.0755)	(0.0794)	(0.0756)		(0.0144)	(0.2735)	(0.2966)	(0.2776)	(0.2832)
Trend × Kanto			0.0015	0.0006	0.0015	0.0026			-0.0092	-0.0103	-0.0092	-0.0067
			(0.0035)	(0.0034)	(0.0036)	(0.0035)			(0.0110)	(0.0121)	(0.0112)	(0.0115)
Trend^2		0.0071	0.0131	0.0163	0.0124	0.0405		0.0024	-0.0171	-0.0139	-0.0173	0.0244
		(0.0048)	(0.0224)	(0.0224)	(0.0225)	(0.0353)		(0.0062)	(0.0235)	(0.0230)	(0.0236)	(0.0527)
Trend^2 × Kanto			-0.0003	-0.0004	-0.0003	-0.0019			0.0009	0.0008	0.0009	-0.0014
			(0.0011)	(0.0011)	(0.0012)	(0.0017)			(0.0012)	(0.0012)	(0.0012)	(0.0024)
Population of Mothers	-6.7297***	-6.8914***	-6.9047***	-7.1069***	-6.9611***	-7.8383***	-6.2322***	-6.2422***	-6.2003***	-6.4771***	-6.2142***	-6.6003***
	(2.1483)	(2.1271)	(2.1467)	(2.1154)	(2.1065)	(1.8712)	(1.8376)	(1.8222)	(1.8421)	(1.9191)	(1.8044)	(1.7360)
Population Density (log)	0.0000	-0.0000	-0.0000	-0.0000	-0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Total Fertility Rate	-0.1469***	-0.1463***	-0.1464***	-0.1477***	-0.1463***	-0.1289***	-0.1180***	-0.1183***	-0.1182***	-0.1191***	-0.1183***	-0.1031**
	(0.0499)	(0.0494)	(0.0493)	(0.0500)	(0.0492)	(0.0493)	(0.0441)	(0.0447)	(0.0447)	(0.0453)	(0.0447)	(0.0410)
Nuclear Family Share	-0.0717	0.0229	0.0181	0.0348	0.0065	0.2378	-0.0195	-0.0034	0.0055	0.0229	0.0036	0.2377
	(0.5217)	(0.5586)	(0.5695)	(0.5921)	(0.5485)	(0.6698)	(0.4819)	(0.4978)	(0.5050)	(0.5419)	(0.4893)	(0.6104)
Share of Families with children	1.9032**	1.7029*	1.6992*	1.6446*	1.7311*	1.9671*	0.6646	0.6180	0.6281	0.5754	0.6266	0.6391
	(0.9333)	(0.9566)	(0.9588)	(0.9740)	(0.9447)	(1.1342)	(1.1871)	(1.1722)	(1.1681)	(1.1921)	(1.1635)	(1.2543)
Co-employment Rate	0.0051	0.0093	0.0082	0.0118	0.0056	0.0097	-0.0861	-0.0837	-0.0811	-0.0796	-0.0813	-0.0967
	(0.1028)	(0.1008)	(0.1012)	(0.1029)	(0.1046)	(0.1207)	(0.1169)	(0.1164)	(0.1155)	(0.1159)	(0.1168)	(0.1264)
Taxable Income (log)	-0.0759	-0.0630	-0.0634	-0.0657	-0.0619	-0.0270	-0.0491	-0.0479	-0.0466	-0.0454	-0.0459	-0.0244
	(0.1005)	(0.0967)	(0.0971)	(0.0927)	(0.0937)	(0.0926)	(0.0968)	(0.0959)	(0.0966)	(0.0944)	(0.0927)	(0.0923)
Financial Strength Index	0.0544	0.0196	0.0195	0.0226	0.0195	0.0347	0.1613	0.1541	0.1541	0.1741	0.1546	0.1513
	(0.1642)	(0.1720)	(0.1718)	(0.1668)	(0.1694)	(0.1802)	(0.1662)	(0.1677)	(0.1677)	(0.1586)	(0.1685)	(0.1685)
Bond Expenditure Ratio	-0.3849	-0.4417	-0.4405	-0.4465	-0.4334	-0.5190	-0.2416	-0.2512	-0.2549	-0.2936	-0.2543	-0.3269
	(0.3165)	(0.3386)	(0.3402)	(0.3855)	(0.3278)	(0.4509)	(0.3339)	(0.3512)	(0.3529)	(0.3863)	(0.3404)	(0.4446)
Residential Land Prices				-0.0156						-0.0002		
				(0.0763)						(0.0744)		
Land Prices for All Uses				0.0008						-0.0168		
				(0.0647)						(0.0592)		
Local Consumption Tax				-0.0636						0.0042		
				(0.1338)						(0.1274)		
General Subsidy Tax				10.4030						11.8299		
				(9.5184)						(14.3203)		
Population Outflow Rate					0.3242						0.0109	
					(0.8026)						(0.7947)	
Population Inflow Rate					-0.2706						-0.0496	
					(0.9164)						(0.8397)	
Constant	1.3577	1.2988*	1.4834	1.5770	1.4882	1.0214	1.1286	0.9788	-0.2122	-0.1611	-0.2080	-0.4205
	(0.8654)	(0.7690)	(1.0197)	(1.0167)	(1.0362)	(1.0728)	(0.8184)	(0.7461)	(1.6937)	(1.7793)	(1.7198)	(1.6908)
Time Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Explanatory Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional Variables 1	No	No	No	Yes	No	No	No	No	No	Yes	No	No
Additional Variables 1	No	No	No	No	Yes	No	No	No	No	No	Yes	No
Placebo Change (2year lagged)	No	No	No	No	No	Yes	No	No	No	No	No	Yes
Observations	1585	1585	1585	1585	1585	1585	1766	1766	1766	1766	1766	1766
Coeff. of Determination (R^2)	0.2307	0.2372	0.2372	0.2387	0.2375	0.1769	0.1701	0.1702	0.1710	0.1704	0.1569	0.1569
F-value (χ^2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hausman	107.91	116.72	116.86	126.78	121.38	70.52	96.83	98.02	105.68	87.36	105.51	102.02
Breusch-Pagan	3059.10	3054.81	3060.13	3009.59	3035.18	3062.06	2135.26	2119.62	2119.72	2028.61	2119.67	2119.67

Table 2. Primary Estimation Results (2015–2016 Change)

Note: ***, **, and * indicate significance at the 10%, 5%, and 1% levels, respectively. This table examines the public and total provision results based on Hypothesis 2. In "Category references," each municipality refers to the same municipalities in the same category within the same locality. The estimates use a fixed effects model that includes time-fixed effects. In Hypothesis 2, the institutional and information changes are assumed to have occurred between 2015 and 2016. (1) uses standard explanatory variables in the basic estimation; (2) includes the first-order term of the trend and the interaction term with the Kanto dummy; (3) includes the first-order and second-order terms of the trend and the interaction terms with the Kanto dummy; (4) includes the explanatory variables for the trend and the budget constraint for provision; (5) includes the explanatory variables for the trend and population trend; and (6) shows the results of the placebo estimation, which estimates the two-period lag of change in the basic estimation.

Table 2 shows the primary estimation results of the public and total provision rates for similar municipalities in **Hypothesis 2**. Consistent public rates results are obtained for the reference level and informational change (coefficient: 0.1638–0.1820) and the interaction terms between the reference level, Kanto dummy, and informational change (coefficient: -0.1847–-0.1407). The interpretation is that informational changes only affected Kansai's spatial autocorrelation for the public rate. For the total rate, consistent significance is found for the interaction term between the reference level and the Kanto dummy (coefficient: 0.2853–0.3100); the interaction between the reference level and institutional change (coefficient: 0.1215–0.1261); and the interaction between the reference level, Kanto dummy, and institutional change (coefficient: -0.1161–-0.1050). Accordingly, we can conclude that a solid spatial autocorrelation existed in the total rate for similar groups in Kanto at the beginning and that the informational change caused a spatial autocorrelation in the total rate in Kansai.

For the estimation of **Hypothesis 2**, the inference that there is strategic behavior in provisioning policies due to the regionally asymmetric change exerting regionally asymmetric effects on spatial autocorrelation is strongly supported. The 2016 "blog frenzy" spilled throughout the country and may have changed information about the beneficiaries of childcare services in the Kansai region, leading to more frequent regional migration under the comparison of nursery services or to more stringent assessments of efficiency by beneficiaries and policymakers. In other words, the results in **Table 2** suggest strongly that the strategic behavior of local governments has become stronger through resource-flow competition due to the more frequent movement of beneficiaries or yardstick competition due to the more stringent evaluation of efficiency by beneficiaries and policymakers.

5.2. Robustness tests using event study regression

During the primary estimation in the previous section, we detected three forms of spatial autocorrelation corresponding to **Hypothesis 1** and two forms of autocorrelation corresponding to **Hypothesis 2**. To confirm the robustness of these results, we perform additional estimation in these cases under an event study design of the same setting. The estimation method here is shown by equation (10) below:

$$y_{it} = \sum_{\boldsymbol{k} \geq -\boldsymbol{\ell}}^{\boldsymbol{\ell}} \lambda_k \boldsymbol{D_{t+k}} \cdot \left\{ \sum_{j \in R_i} w_{ij}^{R_i} y_{jt} \right\} + \boldsymbol{x'_{it}\beta} + \mu_i + \eta_t + const. + \varepsilon_{it}. \tag{10}$$

For **Hypothesis 1**, the additional effects on the spatial autocorrelation for the six years around 2013 are derived ($\ell = 3$), and for **Hypothesis 2**, the additional effect for the four years around 2016 ($\ell = 2$).[17] Due to the confirmed robustness of the results to the choice of explanatory variables, we use standard explanatory variables. We also continue to introduce year-fixed effects and fixed effects.

Fig. A.1 in Appendix A.3 shows the additional effects on spatial autocorrelation for each year before and after the changes in the estimation results of equation (10). The results presented here are restricted to the sample of municipalities in (1) all of Japan, (2) Kansai, (3) Kanto excluding Kanagawa Prefecture, and (4) Kanagawa Prefecture excluding the city of Yokohama. We excluded Yokohama City (Kanagawa Prefecture) from the samples because the city is the source of the information change in **Hypothesis 1**, while the Kansai region is considered to be affected by the information change in **Hypothesis 2**. If the asymmetric trend is observed in the year-by-year additional effects on spatial autocorrelation in these samples, it could show robustness to the primary results and provide further evidence of strategic behaviors.

Hypothesis 1 should be discussed for comprehensiveness, although no asymmetric effect was found. Regarding (a) the public rate of similar municipalities, the interaction term has a strong positive effect with the three-period lead and the reference level for Japan and Kansai. Further, the additional effects tend to increase after the change in the Kansai region, except for Kanagawa Prefecture, while the effects consistently decrease in Kanagawa. The public rate's adverse effects on spatial autocorrelation in Kanto and the positive effects in Kansai may capture this trend.

Next, we examine the spatial autocorrelation among large municipalities neighboring each other in (b) and (c). In the case of the public rate, the additional effect is small in the Kansai region, while additional solid effects exist in Kanto in the year of the change. By contrast, only Kanagawa Prefecture shows a significant additional effect on the private rate after the change. The change in the spatial autocorrelation of the public and private rates may be affected by system changes.

Conversely, the primary estimation results of **Hypothesis 2** indicate that informational changes affected the strategic behavior in the public rate and total rate among similar municipalities in the Kansai region. Consistent with the primary results, an additional yearly effect on the spatial autocorrelation term for similar municipalities' public and total rates is significantly observed in Kansai. These results confirm that the "blog frenzy" of 2016 brought information to the Kansai region, resulting in enhanced strategic behaviors.

However, the primary estimation for Kanto did not confirm the effect of the "Zero Declaration" in 2013, as can be inferred from the number of media reports in **Fig. 4**. Nevertheless, we observed the differences in the responses of the municipalities in Kanagawa Prefecture located in the vicinity of Yokohama City and those in the rest of the Kanto region. The time difference between regions might stem from some geographical policy lags and be the possible cause of the non-significant results in the primary estimation.

The primary estimation results and the event study design in this section are consistent, especially the asymmetric effect of informational changes on the spatial autocorrelation term in **Hypothesis 2**, which supports the existence of strategic behaviors in the provisioning policy.

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[17] We limited the period of estimation and number of year dummies to ensure compatibility with **Hypothesis 2.** Due to the collinearity with the original year fixed effects and the baseline term of spatial autocorrelation, we also limited the number of the interaction terms (terms of additional effects).

6. Conclusions

In this study, we examined the spatial autocorrelation among municipalities regarding the provision rate of nursery facilities under the "quasi-experimental framework" proposed by Gibbons and Overman (2012) to determine whether strategic behaviors exist in the policy. Specifically, we used asymmetric trends in information (newspaper reports) held by beneficiaries by region, considering any changes in the institutional arrangements of nursery facilities and testing whether these have an asymmetric effect on spatial autocorrelation. Estimates under an event study design for the spatial autocorrelation term and its interaction with year effects were also conducted to confirm the robustness of the result and provide additional insights.

The policy implications of strategic behaviors in the provisioning policy include the following. As the government attempted to eliminate children on the waiting list in urban areas through the "Accelerated Plan to Eliminate Waiting Children" in 2013 and the implementation of the "New Child Care Support System" in 2015, it may be possible that the government's policy effects on local governments were amplified in urban areas due to strategic behaviors. Specifically, such relationships and the setting of numerical targets may have been behind the rapid increase in the provision rate. However, amid the rapid changes in the demographic structure going forward, it may be problematic to balance the supply of and need for nursery services if the policy in a municipality is determined by reference to the actions of other municipalities.

Nonetheless, this study does not identify which factors may be responsible for such strategic behaviors regarding the provision of nursery schools, which is a potential limitation. In particular, the form of competition depends on whether the information obtained by residents of the Kansai region since 2016 has facilitated their choice of municipalities or made them more rigorous in evaluating policymakers. Identifying the form is important because the policy implications would differ accordingly. Significantly, resource-flow competition enhanced by the provision of information amplifies the problem of development that may occur in the future, causing more significant gaps between the demand and supply of facilities on a regional basis.

Therefore, future work will identify whether the effects of institutional and information changes are due to resource-flow fiscal or yardstick competition. In doing so, it will be necessary to estimate the relationship between beneficiary transfers and policy variables for resource-flow-type fiscal competition and the one between information and policy variables for yardstick competition; in other words, supplementary estimates of the source factors that lead to the competition will be necessary.

Declarations of interest: none

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Appendix

A.1 Summary of the identification problems in spatial econometrics

The main text states that most empirical studies use the spatial autocorrelation (SAR) model. However, estimating the coefficients on spatial lags in the SAR has statistical problems, as endogeneity and incomplete identification due to regional correlations in the error terms lead to bias and inefficiency in the least-squares estimates.

Endogeneity arises from the simultaneous determination of policy variables, usually in the situation of interest. The policy variables in other municipalities under the strategic interaction determine one municipality's policy variable. The incomplete identification problem happens if the referenced neighborhoods are geographically and culturally similar (Brueckner, 2003). In this case, the geographical similarities, usually omitted in economic models, trigger the identification problem. If this spatial error correlation is not included, but only the dependent variable is formulated, there is a risk that the significance of the autocorrelation will be wrongly detected even when there is no autocorrelation.

Let us discuss these issues using spatial econometric models. The reaction functions are estimated using the SAR model:

$$\boldsymbol{y} = \boldsymbol{\lambda W y} + \boldsymbol{X\beta} + \boldsymbol{u}. \qquad \text{(A. 1)}$$

Here, coefficient $\boldsymbol{\lambda}$ corresponds to the strength of strategic interactions. If we estimate λ using standard OLS, the estimate might be biased and inefficient since terms $\boldsymbol{\lambda W y}$ and $\boldsymbol{y}$ are simultaneously determined. If the geographical and cultural similarities are omitted in the model, the error term u can be formulated as follows:

$$\boldsymbol{u} = \boldsymbol{\rho M u} + \boldsymbol{\varepsilon}. \qquad \text{(A. 2)}$$

$\boldsymbol{u}$ is the error term in the SAR model and $\boldsymbol{\varepsilon}$ is the "true" disturbance term. The error terms correlate if the similarities are unobservable and omitted from the model. In this case, the problem of heteroscedasticity arises and the OLS estimates are inefficient, although unbiased. For this reason, Anselin (1988, 2001) and Brueckner (2003) recommend using maximum likelihood or instrumental variable methods to estimate equations (A.1) and (A.2) simultaneously.

Another issue is that of regional correlations of explanatory variables. Gibbons and Overman (2012) report that it is difficult to distinguish between spatial explanatory variable correlation (SLX) models and SAR models that deal with regional correlations of explained variables. The SLX model is expressed as follows:

$$\boldsymbol{y} = \boldsymbol{\theta X \beta} + \boldsymbol{u}. \qquad \text{(A. 3)}$$

Here, the explanatory variables (regional characteristics) are spatially correlated instead of the explained variables (policy variables). To clarify this point, we rewrite SAR model estimation equation (A.1) as reduced form (A.4):

$$\boldsymbol{y} = (\boldsymbol{I} - \boldsymbol{\lambda W})^{-\mathbf{1}}\boldsymbol{X\beta} + \boldsymbol{u}. \qquad \text{(A. 4)}$$

Under weak conditions,[18] which are often satisfied in practice, the SAR and SLX are hard to distinguish because their reduced forms are almost identical. Gibbons and Overman (2012) intuitively explain the background of this identification problem with the "reflection problem" noted by Manski (1993). The reflection problem states that only the total effects of one's behavior from a neighbor can be identified, not whether they are from the neighbor's behavior or characteristics.

The above discussion explains why explanatory variables' endogeneity and identification problems in spatial econometric models remain and an "experimental paradigm" is recommended for estimation. The "experimental paradigm," such as natural experiments and institutional changes, provides an exogenous variation needed to distinguish between the effects of the behavior and the characteristics of neighbors (the referenced municipalities).

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[18] This condition depends on the high-order spatial lags of the explanatory variables and can easily be satisfied in practice. For a detailed discussion, see Gibbons and Overman (2012).

A.2 Descriptive statistics and reference levels

	Nation				Kanto				Kansai			
	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.
Public Provision Rate	0.3628	0.3317	5.0000	0.0051	0.2168	0.2365	2.2222	0.0140	0.2619	0.3603	3.7500	0.0063
Private Provision Rate	0.2936	0.2089	3.7984	0.0064	0.1933	0.1497	1.4286	0.0062	0.2189	0.1512	3.7984	0.0106
Total Provision Rate	0.5268	0.2832	5.0000	0.0152	0.3615	0.2175	2.2222	0.0152	0.4282	0.3246	3.8789	0.0929
Children on Waiting List	10.5118	58.2428	1552	0.0000	48.0833	119.745	1552	0.0000	18.7583	74.0119	744	0.0000
Population of Mothers	0.0600	0.0119	0.1175	0.0018	0.0598	0.0097	0.1053	0.0233	0.0646	0.0101	0.0905	0.0219
Population Density (log)	5.3965	1.8252	10.0027	0.3865	7.7743	1.2870	10.0027	3.7859	7.5936	1.1276	9.3936	5.0445
Total Fertility Rate	1.9056	0.3320	3.5853	-0.9958	1.9628	0.2896	3.5853	0.1143	1.9733	0.2905	2.5647	-0.3876
Nuclear Family Share	0.5190	0.0700	0.8635	0.0000	0.5777	0.0869	0.7530	0.2603	0.6170	0.0660	0.7796	0.4423
Share of N.F. with children	0.0991	0.0332	0.3169	0.0210	0.1078	0.0338	0.3194	0.0244	0.1070	0.0310	0.1897	0.0204
Co-employment Rate among N.F with Children	0.7063	0.2262	1.0000	0.2313	0.6879	0.3561	1.9420	0.2429	0.7047	0.3811	1.9083	0.2243
Taxable Income (log)	7.0062	0.2768	8.8358	5.8440	7.3415	0.2756	8.8358	6.7826	7.1435	0.1898	8.0174	6.5795
Financial Strength Index	0.5146	0.3012	2.8900	0.0500	0.8115	0.2703	1.7200	0.1100	0.6578	0.2260	1.7800	0.1100
Bond Expenditure Ratio	0.1158	0.0446	0.4013	0.0001	0.0822	0.0320	0.2226	0.0023	0.1222	0.0412	0.3494	0.0108
Residential Land Prices	10.0392	1.0478	14.8646	7.3132	11.2898	1.1960	14.8646	8.7323	11.0334	0.8823	12.6520	7.9725
Land Prices for All Uses	10.1888	1.0397	15.6090	7.3132	11.4309	1.2912	15.6090	8.9092	11.1053	0.8569	13.5593	7.9725
Local Consumption Tax Share	0.2977	0.1745	0.7786	0.0000	0.1136	0.1249	0.6270	0.0000	0.2066	0.1446	0.6458	0.0005
General Subsidy Tax Share	0.0020	0.0019	0.0202	0.0000	0.0041	0.0041	0.0465	0.0000	0.0034	0.0031	0.0254	0.0000
Population Outflow Rate	0.0609	0.0237	0.1802	0.0111	0.0492	0.0238	0.2061	0.0092	0.0338	0.0142	0.1872	0.0096
Population Inflow Rate	0.0569	0.0186	0.1397	0.0129	0.0476	0.0210	0.2890	0.0204	0.0365	0.0112	0.1805	0.0196

Table A.1. Descriptive Statistics

Source*:* Prepared by the author based on various statistics.
Note: Each statistic is based on the values for each municipality for the 2007–2018 fiscal years. "St. Dev.," "Max.," and "Min." stand for standard deviation, maximum, and minimum, respectively. "N.F." stands for nuclear families.

	Nation				Kanto				Kansai			
	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.
All Municipalities (n = 1742)												
Public												
Adjacent	0.2822	0.2265	2.7083	0.0000	0.1632	0.1341	0.9005	0.0000	0.2199	0.2558	2.7083	0.0000
Category	0.2768	0.2424	3.7500	0.0000	0.1777	0.1650	0.9332	0.0000	0.2313	0.3200	3.7500	0.0000
Private												
Adjacent	0.2069	0.1578	1.1679	0.0000	0.1594	0.1126	0.7059	0.0000	0.1934	0.0919	1.0215	0.0000
Category	0.1816	0.1660	1.5320	0.0000	0.1495	0.1046	0.8540	0.0000	0.1736	0.1181	1.5320	0.0000
Total												
Adjacent	0.4891	0.2176	2.7083	0.0000	0.3226	0.1501	0.9292	0.0000	0.4132	0.2372	2.7083	0.0730
Category	0.4584	0.2484	3.7500	0.0000	0.3272	0.1770	1.3385	0.0000	0.4048	0.3067	3.7500	0.0000
Small Municipalities (Kanto and Kansai): (n = 126)												
Public												
Adjacent	0.3152	0.2411	2.7083	0.0000	0.2139	0.1878	0.9005	0.0000	0.2901	0.3185	2.7083	0.0000
Category	0.3111	0.2535	3.7500	0.0000	0.2841	0.2296	0.9332	0.0000	0.3255	0.4082	3.7500	0.0000
Private												
Adjacent	0.2070	0.1676	1.1679	0.0000	0.1552	0.1303	0.7059	0.0000	0.1977	0.1106	1.0215	0.0000
Category	0.1812	0.1794	1.3741	0.0000	0.1337	0.1344	0.8540	0.0000	0.1545	0.1188	0.6977	0.0000
Total												
Adjacent	0.5222	0.2268	2.7083	0.0000	0.3691	0.2017	0.9292	0.0000	0.4878	0.2876	2.7083	0.1508
Category	0.4922	0.2571	3.7500	0.0000	0.4178	0.2451	1.3385	0.0000	0.4800	0.3844	3.7500	0.0000
Large Municipalities (Kanto and Kansai): (n = 196)												
Public												
Adjacent	0.2139	0.1750	1.7745	0.0000	0.1342	0.0762	0.4945	0.0054	0.1635	0.1715	1.6334	0.0329
Category	0.2053	0.1980	1.8072	0.0000	0.1170	0.0509	0.2393	0.0000	0.1556	0.1951	1.5467	0.0000
Private												
Adjacent	0.2054	0.1339	1.0310	0.0000	0.1618	0.1010	0.6690	0.0110	0.1898	0.0734	0.5337	0.0279
Category	0.1813	0.1320	1.5320	0.0000	0.1585	0.0815	0.6383	0.0000	0.1889	0.1153	1.5320	0.0000
Total												
Adjacent	0.4194	0.1788	1.8368	0.0000	0.2961	0.1012	0.6745	0.1233	0.3533	0.1644	1.6770	0.0730
Category	0.3866	0.2107	1.8072	0.0000	0.2755	0.0871	0.6383	0.0000	0.3445	0.2070	1.6498	0.0000

Table A.2. Reference Levels by Operational Form and Reference Source

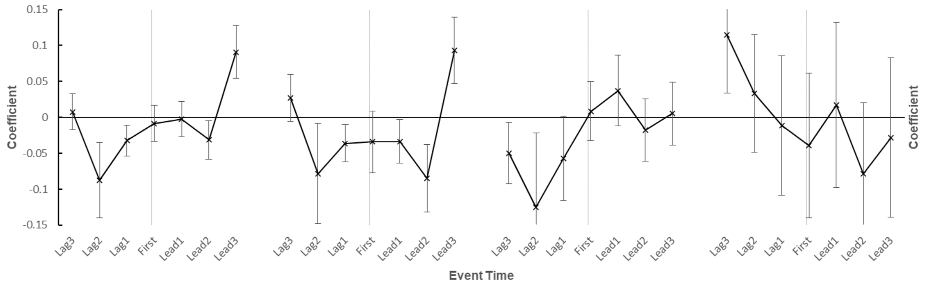
Source*:* Prepared by the author based on various statistics.
Note*:* Each variable corresponds to the following variables in the text. Here, "public" is the provision rate of public nursery facilities, "private" is the provision rate of private nursery facilities, and "total provision rate" is the total provision rate of nursery facilities. See the text for the definitions of "adjacent" municipalities and municipalities in the same "category. "St. Dev.," "Max.," and "Min." stand for standard deviation, maximum, and minimum, respectively.

	Nation				Kanto				Kansai			
A. Small Municipalities ($n = 126$)												
	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.
Public Provision Rate	0.4793	0.3577	5.0000	0.0105	0.4338	0.3321	2.2222	0.0391	0.4724	0.4801	3.7500	0.0451
Private Provision Rate	0.3524	0.2363	2.1053	0.0094	0.2825	0.2147	1.4286	0.0359	0.2317	0.1416	0.6977	0.0339
Total Provision Rate	0.6005	0.3023	5.0000	0.0221	0.5052	0.2883	2.2222	0.0488	0.5499	0.4142	3.7500	0.0929
Children on Waiting List	0.5615	7.4074	206	0.0000	0.1418	3.0656	73	0.0000	0.0986	2.3919	58	0.0000
Population of Mothers	0.0575	0.0125	0.1175	0.0018	0.0557	0.0118	0.1053	0.0233	0.0603	0.0124	0.0905	0.0219
Population Density (log)	4.6745	1.5248	8.5353	0.3865	6.5796	0.8889	8.3840	3.7859	6.7034	0.7859	8.4112	5.0445
Total Fertility Rate	1.8206	0.3510	3.5853	-0.9958	1.7555	0.3432	3.5853	0.1143	1.8183	0.3530	2.5647	-0.3876
Nuclear Family Share	0.5035	0.0691	0.7071	0.0000	0.5785	0.0854	0.7330	0.2603	0.6002	0.0725	0.7796	0.4551
Share of N.F. with children	0.0904	0.0331	0.3169	0.0210	0.0888	0.0403	0.3194	0.0244	0.0943	0.0331	0.1897	0.0204
Co-employment Rate among N.F with Children	0.7279	0.2163	1.0000	0.2333	0.7412	0.3464	1.8393	0.2562	0.7360	0.3635	1.9083	0.2390
Taxable income (log)	6.9106	0.2354	8.2780	5.8440	7.1583	0.1870	7.8679	6.7826	7.0418	0.1586	7.6024	6.5795
Financial Strength Index	0.4095	0.2686	2.8900	0.0500	0.6355	0.2790	1.6200	0.1100	0.5362	0.2462	1.7800	0.1100
Bond Expenditure Ratio	0.1215	0.0477	0.4011	0.0001	0.0881	0.0316	0.2226	0.0023	0.1340	0.0458	0.3019	0.0108
Residential Land Prices	9.6203	0.8074	12.0125	7.3132	10.2657	0.8877	12.0125	8.7323	10.3878	0.7110	11.9829	7.9725
Land Prices for All Uses	9.7680	0.7679	12.0119	7.3132	10.3370	0.8355	12.0119	8.9092	10.4613	0.6283	11.8699	7.9725
Local Consumption Tax Share	0.3674	0.1526	0.7786	0.0000	0.2194	0.1315	0.6270	0.0000	0.3027	0.1436	0.6458	0.0005
General Subsidy Tax Share	0.0016	0.0016	0.0202	0.0000	0.0031	0.0033	0.0300	0.0000	0.0027	0.0025	0.0151	0.0000
Population Outflow Rate	0.0339	0.0175	0.3952	0.0029	0.0402	0.0244	0.2061	0.0092	0.0544	0.0218	0.1559	0.0164
Population Inflow Rate	0.0388	0.0163	0.2890	0.0074	0.0424	0.0250	0.2890	0.0204	0.0505	0.0177	0.1245	0.0215
B. Large Municipalities ($n = 196$)												
	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.	Mean	St. Dev.	Max.	Min.
Public Provision Rate	0.1656	0.1305	0.8892	0.0051	0.1240	0.0633	0.4189	0.0140	0.1186	0.1037	0.8892	0.0063
Private Provision Rate	0.2210	0.1388	3.7984	0.0064	0.1627	0.1031	0.6047	0.0062	0.2123	0.1557	3.7984	0.0106
Total Provision Rate	0.3777	0.1549	3.8789	0.0152	0.2826	0.1002	0.7194	0.0152	0.3306	0.1761	3.8789	0.1085
Children on Waiting List	30.9306	98.0892	1552	0.0000	75.4278	143.0285	1552	0.0000	33.7473	96.8210	744	0.0000
Population of Mother	0.0654	0.0081	0.0999	0.0411	0.0622	0.0074	0.0828	0.0411	0.0680	0.0060	0.0834	0.0516
Population Density (log)	6.9003	1.4227	10.0027	3.7126	8.4557	0.9338	10.0027	5.9153	8.3086	0.8056	9.3936	6.1281
Total Fertility Rate	2.0855	0.1857	2.7775	1.2908	2.0804	0.1627	2.6301	1.3729	2.0976	0.1324	2.4747	1.6948
Nuclear Family Share	0.5518	0.0592	0.8635	0.2978	0.5772	0.0877	0.7530	0.3063	0.6305	0.0569	0.7419	0.4423
Share of N.F. with children	0.1168	0.0256	0.2360	0.0489	0.1184	0.0237	0.2049	0.0472	0.1173	0.0249	0.1828	0.0565
Co-employment Rate among N.F with Children	0.6552	0.2384	0.9915	0.2313	0.6583	0.3580	1.9420	0.2429	0.6796	0.3931	1.7372	0.2243
Taxable Income (log)	7.2066	0.2467	8.8358	6.4848	7.4461	0.2632	8.8358	6.9607	7.2252	0.1726	8.0174	6.7504
Financial Strength Index	0.7480	0.2305	1.9400	0.2300	0.9336	0.1827	1.7200	0.4900	0.7555	0.1485	1.2200	0.3000
Bond Expenditure Ratio	0.1049	0.0343	0.3494	0.0027	0.0789	0.0318	0.2117	0.0027	0.1127	0.0344	0.3494	0.0401
Residential Land Prices	10.9030	0.9437	14.8646	8.6482	11.8519	0.9442	14.8646	9.4804	11.5519	0.6277	12.6520	9.3759
Land Prices for All Uses	11.0539	0.9780	15.6090	8.7796	12.0305	1.0878	15.6090	9.4727	11.6226	0.6374	13.5593	9.7050
Local Consumption Tax Share	0.1521	0.1175	0.5250	0.0000	0.0533	0.0681	0.4106	0.0000	0.1293	0.0879	0.4624	0.0006
General Subsidy Tax Share	0.0030	0.0020	0.0121	0.0000	0.0046	0.0043	0.0465	0.0001	0.0041	0.0033	0.0254	0.0004
Population Outflow Rate	0.0396	0.0167	0.1559	0.0123	0.0291	0.0164	0.1872	0.0096	0.0376	0.0106	0.0734	0.0146
Population Inflow Rate	0.0394	0.0134	0.1245	0.0172	0.0337	0.0131	0.1805	0.0196	0.0388	0.0087	0.0675	0.0208

Table A.3. Descriptive Statistics By Scale of Municipality

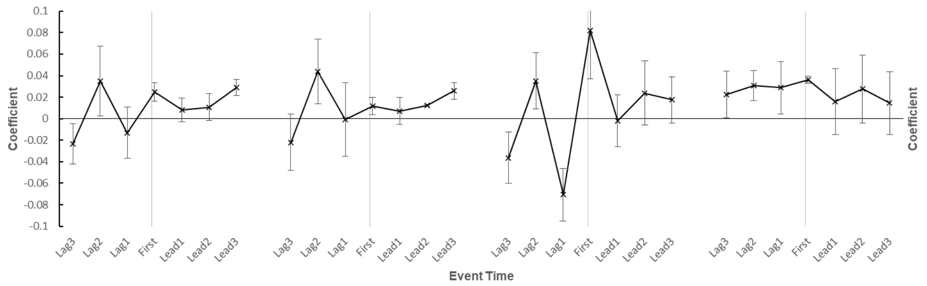
Source*:* Prepared by the author based on various statistics.
Note: Each statistic is calculated for each municipality for the 2007–2018 fiscal years in each region. Small municipalities have populations of 50,000 or fewer, and large municipalities have populations of 50,000 or more. “St. Dev.,” “Max.,” and “Min.” stand for standard deviation, maximum, and minimum, respectively. “N.F.” stands for nuclear families.

A.3 Results of the robustness tests



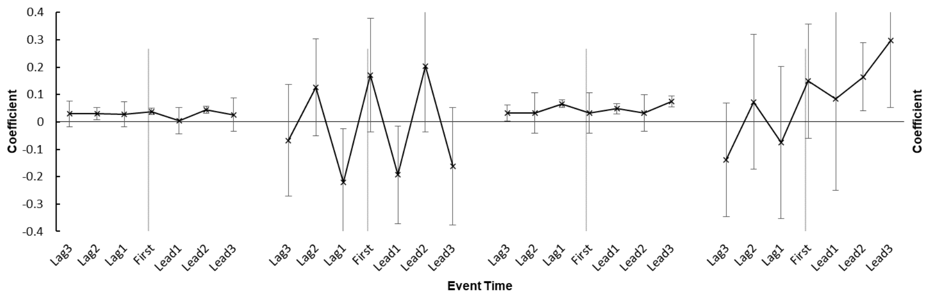
Nationwide Kansai Kanto Kanagawa

(a) 2012–2013 Public Category



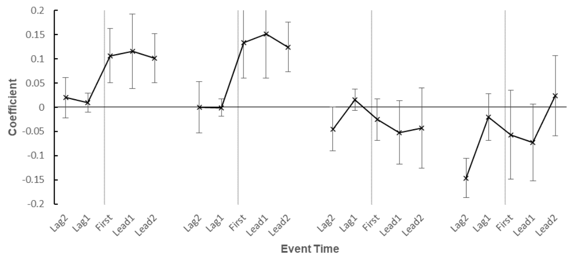
Nationwide Kansai Kanto Kanagawa

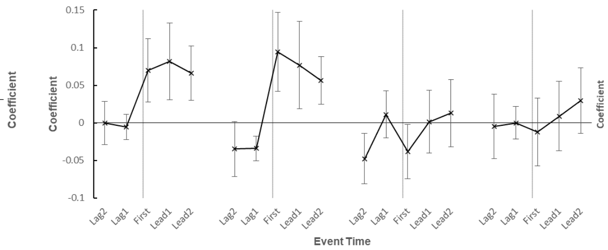
(b) 2012–2013 Public Adjacent Large



Nationwide Kansai Kanto Kanagawa

(c) 2012–2013 Private Adjacent Large





Nationwide Kansai Kanto Kanagawa Nationwide Kansai Kanto Kanagawa

(d) 2015–2016 Public Category (e) 2015–2016 Total Category

Fig. A.1. Additional Validation through Event Studies

Note: We present the additional effect of years on the spatial autocorrelation coefficients obtained from estimation equation (10) of the event study model for each of the scenarios listed in Tables 1 and 2 (standard errors are appended). Due to the robustness of the results, we used a standard combination of explanatory variables. "First" represents the institutional and information changes during 2012–2013, and "Second" the institutional and information changes during 2015–2016 due to the nature of the event study. "First" shows the results for the three years before and after the event. "Second" shows the results for the two years before and after. To examine the nature of the institutional and information changes, from left to right, the results of "Nationwide," "Kansai Region," "Kanto Region (excluding Kanagawa Prefecture)," and "Kanagawa Prefecture (excluding Yokohama City)" are shown.