Does municipal mergers internalize spatial spillover effects? Empirical evidence from Japanese municipalities

Saito, Hitoshi and Hirota, Haruaki and Yunoue, Hideo and Miyaki, Miki

Kobe International University, Musashi University, University of Hyogo, Rikkyo University

14 February 2017

Does municipal mergers internalize spatial spillover effects?
Empirical evidence from Japanese municipalities[*]

Hitoshi Saito[a]
Haruaki Hirota[b]
Hideo Yunoue[c]
Miki Miyaki[d]

Abstract

This paper investigates whether municipal mergers could internalize spatial spillover effects by comparing mergers before and after they occur, especially focusing on local public library services in Japan. A spatial spillover effect occurs when the benefit of a local public service spreads across not only its own administrative district but also into neighboring ones. A free rider problem among municipalities might be caused when a municipality makes a policy decision regarding how much it supplies to its own local public service under a decentralization system, recognizing the existence of a spatial spillover effect. Under such circumstances, spatial spillover effects might be internalized through municipal mergers. In Japan, the boundaries of administrative districts—including those of municipalities—have been determined based on traditional or historical reasons. However, large-scale municipal mergers took place in FY2004 and FY2005 due to serious fiscal deficits and a rapidly aging population. Consequently, the number of municipalities in Japan has decreased from 3,232 to 1,820. In light of these facts, we examine whether municipal mergers internalize spatial spillover effects, focusing on Japanese local public library services, by applying cross-sectional spatial autoregressive models. As a result, we found that there are spatial spillover effects in public library services both in FY2001 (before) and in FY2008 (after). We also found that the impact of such spillovers in FY2008 is smaller than that in FY2001. The results imply that municipal mergers could at least partially internalize spatial spillover effects among municipalities.

JEL: H70, H75, H77
Keywords: spatial spillover effect, municipal mergers

Version: Feb. 13, 2017

[a] Hitoshi Saito, Assistant Professor, Faculty of Economics, Kobe International University; 9-1-6 Koyo-cho Naka, Higashinada-ku,Kobe, Hyogo, 658-0032, Japan. E-mail: saito.hit osi@gmail.com
[b] Haruaki Hirota, Associate Professor, Faculty of Economics, Musashi University; 1-26-1 Toyotama-kami, Nerima-ku, Tokyo, 176-8534, Japan. E-mail:hirota@cc.musashi.ac.jp
[c] Hideo Yunoue, Associate Professor, School of Economics, University of Hyogo; 8-2-1 Gakuen-nishi, Kobe, Hyogo, 651-2197, Japan. E-mail:yunoue@econ.u-hyogo.ac.jp
[d] Miki Miyaki, Assistant Professor, College of Business, Rikkyo University; 3-34-1 Nishi-Ikebukuro, Toshima-ku,Tokyo, 171-8501, Japan. E-mail: miyaki@rikkyo.ac.jp

1. Introduction

The spatial spillover effect [1] occurs if the benefit of a local public service spreads not only across its own administrative district but also to neighboring ones. In this situation, when a municipality makes a policy decision about how much to supply a local public service in a decentralized system, a separate local government may "free-ride" on the policies undertaken by other local governments. In Japan, there is a high likelihood that while one municipality may supply numerous public goods, the area to benefit may differ according to the type of goods, leading to spillovers and free-riding by other local governments.

Several previous studies, such as from Sweden, the United States, Spain, and Japan, confirm that local governments do free-ride on other local governments (e.g., Case et al., 1993; Figlio et al., 1999; Hanes, 2002; Finney and Yoon, 2003; Baicker, 2005; Lundberg, 2006; Solé-Ollé, 2006; Akai and Suhara, 2013).[2] These studies find significant free-riding behavior in terms of public facilities and related costs.[3] We now consider whether changes in jurisdictional areas reduce or remove this free-riding behavior.

Municipal mergers are a type of change in jurisdictional area. From 1999, Japan conducted nationwide municipal mergers to establish an administrative foundation for core local governments, which were expected to shoulder the responsibilities resulting from the regional devolution of power. In the decade between March 31, 1999 and March 31, 2010 when the mergers were largely completed, the number of municipalities decreased by around half, from 3,232 to 1,727.[4] About 80% of these mergers occurred in 2004 and 2005, with 215 and 325, respectively. The concentration of municipal mergers within this period was due to better financial support measures in the Special Municipal Mergers Law, whereby acquisitions could only take place if the mergers occurred before March 31, 2006.

Many studies investigated the effect of municipal mergers on financial affairs. First, researchers examined the effect of a decrease in annual expenditures following municipal mergers using data from Israel, Japan, and Germany (e.g., Miyazaki, 2006; Reingewertz, 2012; Hirota and Yunoue, 2013; Blesse and Baskaran, 2016). These studies differ in terms of the forms of the mergers and affected expenditure items, but there are many indications of possible decreases in expenditures due to municipal mergers. In addition, Miyazaki (2006) and Hirota and Yunoue (2013) indicated the possibility that expenditure temporarily increases in the initial stage of a merger.

Other studies examined consensus forming amongst the merging municipalities (e.g., Nishikawa, 2002; Hirota, 2007; Kawaura, 2010; Miyashita, 2011; Miyazaki, 2014; Nakazawa and Miyashita, 2014),[5] many of which confirm that the smaller the municipality's surface area, the more likely it is to choose to undergo mergers. Further, Miyazaki (2014) confirmed the

---

[1] Solé-Ollé (2006) indicated two types of spatial spillover effects: benefit spillovers and crowding spillovers. The former refers to the provision of public services that transcend areas of jurisdiction, such as radio or television broadcasting. In the latter, facilities such as art museums and parks become crowded due to commuter traffic and visitors who live in neighboring regions.

[2] Nonetheless, there are differences in the results, even for the same cultural services: Lundberg (2006) detected free-riding behavior; others, such as Murdoch et al. (1993) and Werck et al. (2008), found positive spatial correlations in expenditure competition.

[3] This behavior occurs for libraries (Finney and Yoon. 2003), recreation and cultural services (Lundberg, 2006), and cultural expenditures (Akai and Suhara, 2013). These are examples of Solé-Ollé's (2006) crowding spillovers, or from both crowding and benefit spillovers occurring together.

[4] In Japan, the fiscal year begins on April 1 and ends on March 31.

[5] Gordon and Knight (2009) also analyzed the reorganization of school districts in Iowa.

greater likelihood of agreement to municipal mergers in regions with larger spatial spillover effects.

Numerous studies in Sweden, the United States, Spain, and Japan also featured investigations into free-riding behavior amongst municipalities before and after a merger (e.g., Hinnerich, 2009; Jordahl and Liang, 2010; Hansen, 2014; Nakazawa, 2015; Hirota and Yunoue, 2016). The results showed that smaller-scale municipalities tended to issue municipal bonds and free-ride on merged municipalities.

Thus, existing research into free-riding behavior amongst merged municipalities before and after mergers found a decreasing effect of expenditure post-merger and consensus forming amongst merged municipalities. However, there are no studies on the effect of municipal mergers on free-riding behavior amongst municipalities. Yet, Solé-Ollé (2006) indicated the potential for the undersupply of a service when positive spatial spillover effect occurs. One possible solution may be to internalize the positive spatial spillover effect and thus remove or decrease the undersupply by changing jurisdictions through municipal mergers. [6]

Miyazaki (2006) and Hirota and Yunoue (2013) suggested that expenditure may temporarily increase in the initial stages of a merger, which may also indicate a temporary increase in costs in order to lessen undersupply. In particular, Miyazaki (2006) showed a rise in construction costs. This may be due to previous spatial spillover effects and undersupply of public facilities before the municipal merger, which decreased following the merger and construction costs rose to remove the undersupply.

This study focuses on public library services,[7] which are supplied mainly by a municipality and which residents of other municipalities may also use.[8]

Figure 1 shows the number of municipal mergers and the changes in the rate of increase of public libraries in Japan between 1999 and 2011. The figure shows that many new libraries were built in 2004 and 2005, when many municipal mergers took place. If were no spatial spillover effect in library services, and municipal mergers occurred in pursuit of economies of scale, then the number of libraries would likely have fallen. Yet, the number of libraries actually increased. This may be attributed to municipal mergers internalizing (or lessening) the spatial spillover effects and increasing the supply of library services, which were previously undersupplied.

[Insert Figure 1 here]

This study first examines whether free-riding behavior in library services existed amongst neighboring municipalities prior to many municipal mergers. If we observe free-riding behavior, we use data after 2005, when many municipal mergers occurred, to examine whether there were subsequent changes in free-riding behavior. Comparing the changes in municipalities' behavior in these two periods, the study investigates the effects of municipal mergers on spatial spillover effects.

Additionally, this study focuses on the Kyushu region, which is geographically independent (i.e., independent from the mainland), and shows trends similar to the Japanese national average in terms of municipal mergers in these periods (excluding Okinawa, which is geographically independent).[9]

---

[6] The creation of a higher level of government, such as subsidies from a higher government, as in Dahlby (1996), or strengthened cooperation amongst communities, as in Haughwout (1999), may be a way to internalize externalities.

[7] Here, "library" refers to the services defined in the Library Act.

[8] There is much research concerning public libraries, including cost-efficiency analysis (e.g., Vitaliano, 1997; Hammond, 2002), production function estimation (e.g., Ross, 1977), and economies-of-scale analysis (e.g., DeBoer, 1992).

[9] Between 1999 and 2005, the number of municipalities across Japan dropped by 43.7%. The

Section 2 provides the methodology and model specification. Section 3 lists the data sources and features, while Section 4 discusses the results of the analysis. Section 5 presents the conclusion.

2. Methodology and Model Specification

This study adopts methods for spatial econometrics to detect free-riding behavior in library services amongst municipalities. This analysis uses four approaches. First, we apply an ordinary least squares (OLS) model to examine whether the number of external library users affects the total number of library users. Second, we investigate the potential spillover effect among municipalities regarding public library services by applying a spatial autoregressive model (SAR), taking the number of external library users as an independent variable. Although the number of external library users could have no effect, there may be a correlation with error terms such as similarities of regional characteristics with other (external) areas. To account for this possibility, we apply a spatial error model (SEM) as the third approach. Finally, we apply a generalized spatial autoregressive model with a correlated error term (SAC model), which uses the number of external library users as an independent variable and considers the possibility of correlation with error terms such as regional similarities.

$$Y = \alpha I_N + X\beta + \varepsilon \qquad \text{(OLS)}$$
$$Y = \rho WY + \alpha I_N + X\beta + \varepsilon \qquad \text{(SAR)}$$
$$Y = \alpha I_N + X\beta + u \,; u = \lambda Wu + \varepsilon \qquad \text{(SEM)}$$
$$Y = \rho WY + \alpha I_N + X\beta + u \,; u = \lambda Wu + \varepsilon \qquad \text{(SAC)}$$

Where Y is an N × 1 vector consisting of one observation on the dependent variable for every unit in the sample (i = 1,…,N). X is an N × K matrix of exogenous explanatory variables. I_N is an N × 1 vector of ones associated with the constant term parameter α. W is an N× N matrix, usually referred to as spatial weights matrix. β, ρ, and λ are the parameters to estimate and ε is a random error term. ρ shows the endogenous interaction effects, where the decision of a spatial unit to behave depends on the decision taken by other spatial units. Wu the interaction effects among the disturbance term of the different units. λ shows the correlated effects, where similar unobserved environmental characteristics result in similar behavior.

When ρ=0 in the SAC model, we have the SEM model. When λ=0 in the SAC model, we have the SAR model, and when both ρ=0 and λ=0 in the SAC model, we have the OLS model. Thus, these models share a nested relationship, enabling us to select the most explanatory model by examining each with a Likelihood-ratio test.

Further, when calculating the above, we must assume the extent of the affected area (*W* in the previous formulae). When a spatial spillover effect exists and external users (i.e., residents of other areas) use the library services, distance is an important factor. Thus, this we define *W* as follows:

$$W_{i,j} = \frac{\frac{1}{d_{i,j}}}{\sum_j \frac{1}{d_{i,j}}} \,, i \neq j, W_{i,i} = 0 \,,$$

where $d_{i,j}$ is the distance between the local government offices of municipality$_i$ and municipality$_j$. Namely, we consider that the shorter the distance from the local government offices, the stronger the influence, and we apply the weighting accordingly.

---

number of smaller municipalities alone (*chō*, *son*) dropped to 59.3%. In the same period, the Kyushu region saw a 47% and 60.7% drop in the total number of municipalities and the number of smaller municipalities only, respectively. We may therefore consider the municipal mergers in Kyushu as reflecting tendencies comparatively similar to the Japanese national average.

We use the number of registered users as a dependent variable (*Y*) for several reasons. First, Solé-Ollé (2006) indicated that crowding spillovers may occur in public facilities such as libraries, where both local and neighboring (external) residents use the service. Under these circumstances, when any municipality similarly reduces library services, the municipality may decide to lower the level of its own library services and free-ride on those of another area. In this case, the number of local library users would decrease, and the number of library users from other areas would increase. Meanwhile, if there is no spatial spillover effect and no free-riding behavior between municipalities, there is no effect on the number of local library users relative to the number of external library users.

Second, the function of public libraries has changed since the Ministry of Education, Culture, Sports, Science and Technology (MEXT) announced a guideline for public libraries in 2000 (Desirable Standards for the Establishment and Operation of Public Libraries: Report). The guideline stipulated that public libraries should aim to provide multiple functions: public libraries should provide not only book lending services but also a lifetime learning system and a network system constructed with neighboring libraries, etc. In particular, even if users are not residents of a municipality, they can use most neighboring library services if they register.

Moreover, many municipalities built public multipurpose facilities, including public libraries, for years. In terms of new public management, some public libraries cooperate with the private sector to provide many services such as theaters, galleries, museums, restaurants, cafés, and so on.

Therefore, we believe that it is difficult to evaluate library services by the number of lent books and number of books in stock, which were used in previous studies on public libraries. However, in Japan, users must register to use public libraries. Thus, the number of registered users is a useful indicator of the number of users.

Two factors are available as independent variables: variables relating to public libraries and variables relating to municipalities. For the public library variables, we have "total floor area," "number of employees," "number of books in stock," "number of libraries," "consignment dummy," and "number of employees × consignment dummy." Note that this study focuses on municipalities' decision making and therefore uses the aggregated data per municipality in the calculations. Additionally, we use "population" and "area" as the municipality variables. The next section provides detailed definitions of the variables and their sources.

3. Data and Variables

The main subjects of observation in this study are the effects for 2004 and 2005, when many municipal mergers took place. Here, we take 2001 as the year for the pre-merger analysis, and 2008 as the year for the post-merger analysis. Nationally, large-scale mega-mergers began in Japan in 1999 in Sasayama City and by March 2002, the total number of municipalities decreased by 14. However, the Kyushu region, which is the focus of the analysis in this study, there were no municipal mergers until March 2002. We thus consider that no effect arose from municipal mergers in 2001.

We chose 2008 as the year for the post-merger analysis due to the possibility that the effects may not materialize immediately after a merger and the implementation of the Greater Independence Settlement Area Concept (GISAC) across Japan in 2009. In particular, GISAC involves mutual cooperation between core cities with populations of over 50,000 and their surrounding municipalities. Analyzing the effects in the year after this initiative was first implemented would risk the possibility of observing cooperative behavior as free-riding behavior; thus, we choose to analyze data from 2008, a year before GISAC was implemented.

Data on Japanese public libraries were obtained from *Nihon No Toshokan* [Japan's Libraries] and the Ministry of Internal Affairs and Communications *Kōkyō Shisetsu Jōkyō Chōsa* [Survey of the State of Public Facilities]. We obtained data on the number of registered users, total floor area, number of books in stock, and number of libraries from *Nihon No Toshokan.* We obtained

"consignment fee" data from *Kōkyō Shisetsu Jōkyō Chōsa*.

First, users must register to use a library, we employ the total number of registered users as "number of registered users." We use "total floor area" as a variable to indicate the size of the library facilities. We use "number of employees" as a variable to show the number of employees working at the libraries, calculated as the sum of specialist staff, emergency staff, and temporary staff. We use "number of books in stock" as an indicator of libraries' capital. We use "number of libraries" as a variable to show the number of libraries within an area. Considering that the number of libraries may not be linear, we employ both the number of libraries and its squared value.[10]

A designated administrator system was established in 2003, which allowed libraries to outsource or contract the administrative management to private firms.[11] To account for the effect of this action, we use the variables "consignment dummy" and "number of employees × consignment dummy." The "consignment dummy" is equal to 1 for municipalities that have at least one temporary employee and pay consignment fees, and 0 otherwise. The "number of employees × consignment dummy" variable is calculated as "number of employees" multiplied by the "consignment dummy."

We use a municipality's "population" and "area" as factors affecting the municipality's environment. The populations and areas for each municipality are obtained from *Chihō Zaisei Tōkei Nenpō* [Annual Statistics on Local Public Finance]. Tables 1 and 2 summarize the pre-merger statistics for 2001 and post-merger statistics for 2008, respectively.

[Insert Table 1 here]
[Insert Table 2 here]

4.   Estimation Results

Table 3 reports the results of the analysis using the 2001 data. The results of the model selection show that the SAC model is the most appropriate.

[Insert Table 3 here]

The estimation results for the SAC model in Table 3 show significant positive values for variables related to library facilities; that is, total floor area, number of employees, and number of books in stock. This shows that municipalities with better-equipped library facilities will have a higher number of registered users. Meanwhile, the "number of employees × consignment dummy" has significantly negative results. For number of libraries, both the simple and squared variables have significantly negative results. We obtained no significant results for the consignment dummy.

Municipal population has significant positive results, showing a higher number of registered users for a larger population. We also note the significantly negative results for municipality area. Because we assume the area provided when counting the number of libraries as a substitute variable for the distance from a library within a municipality, this result shows that the more distant a library, the fewer the number of users registered with it.

The endogenous interaction effect (*rho*) of the number of external library users shows significantly negative results, while the correlated effect (*lambda*) from external areas shows

---

[10] We also conduct estimations without the squared value of the number of libraries, which returned almost similar results.

[11] Traditionally, Japanese public facilities were managed and operated mainly by local governments. However, with the introduction of the designated administrator system, the private sector (NPO, corporations, or other companies) can manage and operate public libraries if permitted by the municipality.

significantly positive results. The endogenous interaction effects indicate the possibility of spatial spillover effects in library services; if a local area improves its library services, then the number of registered users will increase due to an influx of external users. However, this would also lead to a reduction in the number of registered users because the number of external users would drop. In other words, these results suggest free-riding in library services in external areas. The correlated effects show that significantly positive results for the correlated effect (*lambda*) may be because education and income levels may be similar among an area and its neighboring areas, and thus, these regions may share similar book reading and library using habits.

Next, Table 4 reports the results of the analysis using the 2008 data. The model selection indicates that the SAC model is the best, as with the 2001 data.

[Insert Table 4 here]

The estimation results for the SAC model in Table 4 show significantly positive values for variables related to library facilities, that is, number of employees and number of books in stock. This result shows that municipalities with better-equipped library facilities will have a higher number of registered users. However, total floor space becomes insignificant. The variables "number of employees × consignment dummy" and the squared value of number of libraries also show significantly negative results. The consignment dummy has a significantly positive value, meaning that municipalities with libraries that introduced consignment will have a higher number of registered users. The estimation results for the municipality variables of area and population are similar to those obtained for the 2001 data.

Furthermore, both the endogenous interaction effect (*rho*) of the external registrants and the correlated effect from external areas (*lambda*) have the same signs as in the 2001 estimation results. Comparing the estimation values for the endogenous interaction effect (*rho*) and correlated effect (*lambda*) between the 2001 and 2008 data, however, shows that because the 2001 *rho* value is -0.816 and that for 2008 is -0.297, the endogenous interaction effect reduced in absolute terms. The *lambda* values of 0.961 for 2001 and 0.894 for 2008 also show a decrease, but not to the extent of the endogenous interaction effect (*rho*). Accordingly, the fact that *rho* reduced in absolute terms suggests that the scale of post-merger free-riding is less than before the municipal mergers.

Next, the consignment dummy is not significant for 2001 and has positive significance for 2008, possibly because the effects of consignment became detectable in 2008 because introducing a designated administrator system made it easier for public facilities to begin private consignment, and private firms could handle more consignment-related work.

5. Conclusion

Most studies on municipal mergers focused on cost reduction effects, merger consensus forming, and free-riding behavior between merged municipalities. Other researchers investigated spatial spillover effects in the context of free-riding behavior between local governments. However, none of the previous research examined whether municipal mergers internalize spatial spillover effects.

Many municipal mergers took place in Japan starting in 1999, and particularly in 2004 and 2005. Changes in jurisdictional areas also accompany municipal mergers. This study examined potential free-riding behavior between neighboring municipalities in library services provided by municipalities in the Kyushu region of Japan using data from 2001, before the mergers, and from 2008, after the mergers.

Free-riding behavior may emerge between municipalities when the spatial spillover effect occurs. Meanwhile, if there are changes in jurisdictional areas due to municipal mergers, spatial spillover effects may be internalized and free-riding behavior may disappear or decrease. This study contributes to the literature by verifying this point.

The results of the analysis showed free-riding behavior between neighboring municipalities in the pre-merger period (2001). Similarly, free-riding behavior between neighboring municipalities was existed the post-merger period (2008), though at a smaller scale. This suggests that municipal mergers may have partially internalized the spatial spillover effect and partially lessened free-riding behavior.

The results further suggest that whilst private consignments did not result in user increases in library services in 2001, following the introduction of the designated administrator system in 2003, it became easier to implement private consignments, potentially resulting in an increase in the number of users.

References：
・Akai, N., & Suhara, M. (2013). Strategic interaction among local governments in Japan: An application to cultural expenditure. *Japanese Economic Review*,64(2), 232-247.
・Anselin, L., & Bera, A. K. (1998). Spatial dependence in linear regression models with an introduction to spatial econometrics. *Statistics Textbooks and Monographs*, 155, 237-290.
・Baicker, K. (2005). The spillover effects of state spending. *Journal of public economics*, 89(2), 529-544.
・Blesse, S., & Baskaran, T. (2016). Do municipal mergers reduce costs? Evidence from a German federal state. *Regional Science and Urban Economics*, 59, 54-74.
・Case, A. C., Rosen, H. S., & Hines, J. R. (1993). Budget spillovers and fiscal policy interdependence: Evidence from the states. *Journal of public economics*, 52(3), 285-307.
・Dahlby, B. (1996). Fiscal externalities and the design of intergovernmental grants. *International tax and public finance*, 3(3), 397-412.
・DeBoer, L. (1992). Economies of scale and input substitution in public libraries. *Journal of Urban Economics*, *32*(2), 257-268.
・Figlio, D. N., Kolpin, V. W., & Reid, W. E. (1999). Do states play welfare games?. *Journal of Urban economics*, 46(3), 437-454.
・Finney, M. M., & Yoon, M. J. (2003). Asymmetric interdependence in the provision of a local public good: An empirical examination. *Public Finance Review*, 31(6), 648-668.
・Gordon, N., & Knight, B. (2009). A spatial merger estimator with an application to school district consolidation. *Journal of Public Economics*, 93(5), 752-765.
・Hanes, N. (2002). Spatial spillover effects in the Swedish local rescue services. *Regional Studies*, 36(5), 531-539.
・Hansen, S. W. (2014). Common pool size and project size: an empirical test on expenditures using Danish municipal mergers. *Public choice*, 159(1-2), 3-21.
・Hammond, C. J. (2002). Efficiency in the provision of public services: a data envelopment analysis of UK public library systems. *Applied Economics*, *34*(5), 649-657.
・Haughwout, A. F. (1999). Regional fiscal cooperation in metropolitan areas: an exploration. *Journal of Policy Analysis and Management*, 18(4), 579-600.
・Hinnerich, B. T. (2009). Do merging local governments free ride on their counterparts when facing boundary reform?. *Journal of Public Economics*, *93*(5), 721-728.
・Hirota, H., 2007. Verication of municipal incorporation with discrete choice model [in Japanese]. *Planning Administration*, 30 (4), 75-81.
・Hirota, H., &Yunoue, H., 2013. Municipal mergers and local government expenditure in Japan: Panel analysis of scale effect and secular change [in Japanese]. *Studies in Regional Science* 43 (3), 325-340.
・Hirota, H., & Yunoue, H. (2016). Evaluation of the fiscal effect on municipal mergers: Quasi-experimental evidence from Japanese municipal data. *MPRA paper No.72455*
・Jordahl, H., & Liang, C. Y. (2010). Merged municipalities, higher debt: on free-riding and the common pool problem in politics. *Public Choice*, *143*(1-2), 157-172.
・Kawaura, A. (2010). Self-Serving mayors and local government consolidations in japan. *University of Hawaii Department of Economics Working Paper.*
・LeSage, J., & Pace, R. K. (2009). *Introduction to Spatial Econometrics.* CRC Press
・Lundberg, J. (2006). Spatial interaction model of spillovers from locally provided public services. *Regional Studies*, 40(6), 631-644.
・Miyashita,T.(2011). Reasons for Municipalities Not to Agree to A Merger Plan [in Japanese] . *Public Choice Review*,57,4-20
・Miyazaki, T. (2006) Effect of municipal merger on expenditure reduction - detection by merger trend variable[in Japanese]. *Policy Making in the Era of Low Birth-Rate Populations(ZaiseiKenkyu)*,2,145-160
・Miyazaki, T. (2014). Municipal consolidation and local government behavior: evidence from

Japanese voting data on merger referenda. *Economics of Governance*, *15*(4), 387-410.

・Murdoch, J. C., Rahmatian, M., & Thayer, M. A. (1993). A spatially autoregressive median voter model of recreation expenditures. *Public Finance Review*, 21(3), 334-350.

・Nakazawa, K. (2016). Amalgamation, free-rider behavior, and regulation. *International Tax and Public Finance*, 23(5) 812-833.

・Nakazawa, K.& Miyashita,T. (2014). Municipality amalgamation in Japan: an examination using event history analysis, *Economics Bulletin*, Vol.34 No.2, pp.627-633

・Nishikawa,M.(2002). Policy evaluation of merger of municipalities [in Japanese],*Nihon keizai kenkyu* ,46, 61-79.

・Reingewertz, Y. (2012). Do municipal amalgamations work? Evidence from municipalities in Israel. *Journal of Urban Economics*, *72*(2), 240-251.

・Ross, M. H. (1977). Accountability, Productivity and the Impending Crisis in the Public Library. *The Journal of Economics*, *3*, 165-68.

・Solé-Ollé, A. (2006). Expenditure spillovers and fiscal interactions: Empirical evidence from local governments in Spain. *Journal of Urban Economics*, 59(1), 32-53.

・Vitaliano, D. F. (1997). X-inefficiency in the public sector: the case of libraries. *Public Finance Review*, *25*(6), 629-643.

・Werck, K., Heyndels, B., & Geys, B. (2008). The impact of 'central places' on spatial spending patterns: evidence from Flemish local government cultural expenditures. *Journal of Cultural Economics*, 32(1), 35-58.
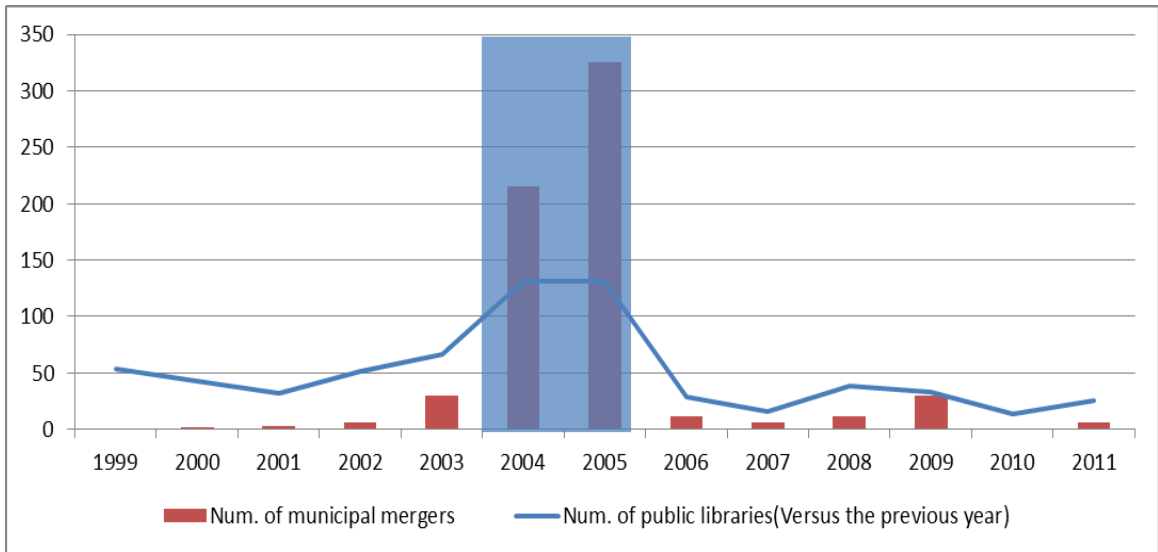
Figure 1：Trends in the number of public libraries (Versus the previous year) and municipal mergers

Table 1：Descriptive Statistics(in FY2001)

Variable	Obs	Mean	Std. Dev.	Min	Max
The number of registered users	513	6715.766	26549.67	0	428224
Total floor area	513	587.01	1717.803	0	27988.4
Num. of employees	513	3.635185	10.14674	0	143.7
Num. of employees ×Consignment Dummy	513	2.24961	5.687954	0	59.6
Num. of books in stock	513	42430.62	117805.1	0	1499940
Num. of libraries	513	0.471735	0.995929	0	17
Population	513	26134.9	88388.38	414	1302454
Consignment dummy	513	0.241715	0.428541	0	1
Area	513	81.52988	75.29211	1.31	536.2

Table 2：Descriptive Statistics(in FY2008)

Variable	Obs	Mean	Std. Dev.	Min	Max
The number of registered users	247	21026.3	54045.65	0	646225
Total floor area	247	1498.46	2719.281	0	28633.4
Num. of employees	247	10.37186	19.55929	0	210.2
Num. of employees ×Consignment dummy	247	4.058704	13.27807	0	146
Num. of books in stock	247	121069.2	208669.7	0	1815332
Num. of libraries	247	1.295547	1.895035	0	18
Population	247	53794.25	130932.5	368	1384820
Consignment dummy	247	0.198381	0.39959	0	1
Area	247	170.8089	174.1061	5.68	903.51

Table 3 : Estimation Results (in FY2001)

VARIABLES	OLS	SAR	SEM	SAC
Total floor area	2.711***	2.676***	2.710***	2.301***
	(0.499)	(0.496)	(0.495)	(0.484)
Num. of employees	543.9***	558.1***	544.3***	828.9***
	(138.6)	(138.6)	(137.6)	(141.7)
Num. of employees ×Commission Dummy	-146.6	-148.2*	-146.6	-232.6***
	(90.17)	(89.27)	(89.28)	(87.45)
Num. of books in stock	0.120***	0.120***	0.120***	0.107***
	(0.01000)	(0.00990)	(0.00994)	(0.00977)
Num. of libraries	-4,570***	-4,623***	-4,566***	-4,655***
	(808.8)	(804.0)	(806.8)	(779.5)
Squared of number of libraries	-402.4***	-401.1***	-402.6***	-406.0***
	(46.53)	(46.09)	(46.28)	(44.73)
Population	0.110***	0.110***	0.110***	0.106***
	(0.00898)	(0.00890)	(0.00892)	(0.00868)
Consignment dummy	-1,108	-1,045	-1,107	-265.1
	(1,040)	(1,033)	(1,030)	(1,005)
Area	-4.930	-5.634	-4.967	-11.53***
	(3.781)	(3.872)	(3.839)	(4.119)
Constant	-1,158***	-675.0	-1,157***	-317.5
	(415.2)	(797.5)	(414.7)	(8,532)
Rho		-0.0602		-0.816***
		(0.0851)		(0.134)
Lambda			0.0124	0.961***
			(0.277)	(0.0392)
Observations	513	513	513	513
Log likelihood	-5164	-5164	-5164	-5153
lrtest(rho=0)				22.61***
lrtest(lamdba=0)				22.11***
chi2_lr(VS OLS)		0.5	0.002	22.61***

Note: Standard errors are shown in parentheses. ***, **, and * denote p-values at the significance levels of 1%, 5%, and 10%, respectively.

Table 4 : Estimation Results (in FY2008)

VARIABLES	OLS	SAR	SEM	SAC
Total floor area	0.398	0.539	0.637	0.504
	(1.027)	(1.008)	(1.001)	(0.990)
Num. of employees	312.8	269.0	237.5	341.5*
	(192.7)	(190.8)	(191.1)	(196.5)
Num. of employees ×Commission Dummy	-991.7***	-986.2***	-989.2***	-987.1***
	(116.2)	(113.5)	(111.8)	(110.1)
Num. of books in stock	0.0557***	0.0547***	0.0554***	0.0514***
	(0.0171)	(0.0167)	(0.0165)	(0.0164)
Num. of libraries	-285.5	-174.0	81.74	-25.91
	(1,117)	(1,093)	(1,091)	(1,075)
Squared of number of libraries	-322.7***	-325.4***	-332.6***	-323.8***
	(83.78)	(81.78)	(80.92)	(79.89)
Population	0.357***	0.360***	0.361***	0.352***
	(0.0183)	(0.0181)	(0.0179)	(0.0182)
Consignment dummy	11,253***	10,967***	10,910***	11,031***
	(2,685)	(2,629)	(2,597)	(2,560)
Area	-11.43**	-10.22**	-11.08**	-12.11**
	(4.803)	(4.772)	(4.855)	(4.882)
Constant	-2,929***	-6,090**	-3,356	987.1
	(1,119)	(2,574)	(2,185)	(7,126)
Rho		0.137		-0.297**
		(0.101)		(0.145)
Lambda			0.654***	0.894***
			(0.233)	(0.106)
Observations	247	247	247	247
Log likelihood	-2644	-2643	-2641	-2639
lrtest(rho=0)				3.54*
lrtest(lamdba=0)				7.27***
chi2_lr(VS OLS)		1.828	5.558*	9.099***

Note: Standard errors are shown in parentheses. ***, **, and * denote p-values at the significance levels of 1%, 5%, and 10%, respectively.