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An Estimation of Intra-City Fiscal Transfers in Japan: Stealth Fiscal Transfers

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Abstract

This study aims to investigate intracity fiscal transfers from the city planning areas (CPAs) to outside the city planning areas (non-CPAs) that are not recorded on the municipal account settlement cards and to estimate the existence and amount of these transfers. The current location optimization plan in Japan attempts to realize compact cities by defining residential zones and urban function zones and by providing preferential tax treatment. Nevertheless, the location optimization plan does not cover non-CPAs, which means that the location optimization plan does not function for non-CPAs, and this is considered a social issue. Non-CPAs have low population density, and based on previous studies, the fiscal efficiency of non-CPAs is considered low. Intracity fiscal transfers are probably made from CPAs to non-CPAs, just as so-called intergovernmental fiscal transfers have a horizontal fiscal adjustment function. In this study, we refer to this intracity fiscal transfer as stealth fiscal transfer (SFT). To estimate the SFT, we estimated the average expenditure function using five-year data from FY1990 to FY2010 and we simulated the SFT for FY2005 and FY2010 using the estimated average expenditure function and mesh data. By estimating SFT, the existence and amount of SFT will be revealed, and as a policy implication, an academic basis for expanding the scope of the location optimization plan will be derived. The simulation results showed that CPAs, the payers of SFT, were estimated to have paid a national weighted average of ¥19,218 per capita in FY2005 and ¥18,360 per capita in FY2010. Conversely, non-CPA, the recipient of SFT, was estimated to have received a national weighted average of ¥164,017 per capita in FY2005 and ¥171,360 per capita in FY2010. The total value of SFT in Japan was estimated to be ¥1,104,830,463,745 in FY2005 and ¥1,062,534,779,839 in FY2010. Although the location optimization plan is a plan for CPAs, the policy implication derived from this study is that in the future, the location optimization plan is expected to cover not only CPAs but also the entire area within a municipality, including non-CPAs.

Keywords

Compact City, Stealth Fiscal Transfers, Intergovernmental Fiscal Transfers, Intra-City Fiscal Transfers, Average Cost, Municipalities' Efficiency, Japan

1. Introduction

There is a long history of attempts to improve the efficiency of municipal finances, with accumulated research and practical applications in Japan and abroad. One example is the focus on the size of a municipality, i.e., its population. The optimal city size theory and the minimum efficient city size theory are representatives of such studies, and overseas discussions include Hirsch (1959, 1965), Walzer (1972), Oates (1972), Mirrlees (1972), Dixit (1973), Richardson (1973), and Bodkin and Conklin (1971). Sekiguchi (2019) Although there are some differences, like those that derive the optimal scale for the entire city or those that specialize in the optimal scale of a particular publicly provided good or service, they generally analyze the optimal scale from the perspective of benefit maximization or cost minimization.

In Japan, many studies discussed the optimal city size from the viewpoint of cost minimization, including Nakai (1988), Yokomichi and Okino (1996), Yoshimura (1999), Nishikawa (2002), and Hayashi (2002, 2003). Hayashi (2002), in his study on the optimal city scale in Japan, uses the minimum efficient scale (MES) theory to construct a theoretical model and conduct an empirical analysis. Although the size of cities in the MES varies depending on the time of analysis, Nakai (1988) estimated 128,000 people, Yokomichi and Okino (1996) estimated 90,000 to 200,000 people, Yoshimura (1999) estimated 210,000 to 270,000 people, Nishikawa (2002) estimated 170,000 people, Hayashi (2002) estimated 310,000 to 460,000 people, and Hayashi (2003) estimated at 200,000 - 270,000 people, respectively. Based on the academic evidence accumulated through these studies, the number of municipalities in Japan has decreased from 3234 in 1997 to 1727 in 2010, about half the number of municipalities in Japan because of the so-called *Heisei no Dai Gappei*, a nationwide merger of municipalities.

If the accumulation of research on MES is taken as an ex-ante evaluation study of municipal mergers, the following studies can be cited as ex-post evaluation studies of whether mergers of municipalities contributed to efficiency gains, including expenditure reduction: Uemura and Sumi (2003), Takemoto et al. (2004), Hayashi (2013), Nakazawa (2014), and Hirota and Yunoue (2016). Uemura and Sumi (2003) estimated that mergers could reduce expenditures by up to 0.7 trillion yen in Japan as a whole. Takemoto et al. (2004) did not estimate the scale of reduction but estimated that economies of scale would work and expenditures could be reduced. Hayashi (2013) also estimated that a certain level of expenditure reduction is expected. Conversely, Nakazawa (2014) and Hirota and Yunoue (2016) estimated that there would not necessarily be an efficiency of expenditure reduction, and it is difficult to say that a consistent evaluation has been obtained as an ex-post evaluation.

Another study on the possibility of distorting the efficiency of municipalities is the inefficiency of intercity fiscal transfers or so-called soft budget constraints due to intergovernmental fiscal transfers. In Japan, studies on the allocation of local allocation tax (LAT) grants subsidies, include Kuroda (1986), Kornai (1986), Sato (2002), Yamashita et al. (2002), Kornai et al. (2003), Miyazaki (2004), and Otsuka and Goto (2014). Kuroda (1986) highlighted the institutional problems of LAT grants, Kornai (1986) was the first to point out the concept of soft budget problem, and Sato (2002) and Kornai et al. (2003) argued that fiscal transfers from central government to local governments induce unproductive public goods supply. Yamashita et al. (2002) clarified these possibilities through theoretical and empirical analysis. Miyazaki (2004) also estimated the possibility that intergovernmental fiscal transfers cause the softening of local government budget constraints using a stochastic frontier model. Otsuka and Goto (2014) estimated the loss of efficiency in total expenditure caused by the soft budget problem and found it to be approximately 23% of LAT grants. Previous studies up to this point can be viewed as studies of city size focusing on population size. In terms of improving municipal efficiency, it is important to pursue economies of scale through mergers and to solve institutional problems with intergovernmental fiscal transfers, but it will be necessary to focus not only on the size of the city as a whole but also on the city structure, including population density.

The first report of the Council for Social Infrastructure in Japan (2006) focused on the city structure, considering the existing city structure to be disorderly and diffuse, and argued for the realization of an intensive city structure, or compact city, as a review of this structure. The concept of the compact city has been incorporated into Japan's major policies, including the Second Report of the Council for Social Infrastructure Development (Council for Social Infrastructure in Japan, 2007) and the Basic Policies for Economic and Fiscal Management and Reform. Studies on the relationship between city structure and municipal finance include Carruthers and Ulfarsson (2003, 2008), Hortas-Rico and Solé-Ollé (2010), Kawasaki (2009), Morimoto (2011), Sekiguchi (2012), Wada and Ohno (2013), Kutsuzawa (2016), and others on the efficiency of compact cities. Of these, Kawasaki (2009) and Sekiguchi (2012) used population density as an index to measure city structure, whereas Kawasaki (2009) and Sekiguchi (2012) estimated the optimal compactness from the perspective of cost minimization and fiscal surplus maximization, respectively. Kutsuzawa (2016) measured the city structure using the concept of standardized standard distance and estimated the contribution of city compactness to municipal finances. Morimoto (2011) evaluated city compactness positively from both fiscal and environmental perspectives by using Utsunomiya City, Tochigi Prefecture, as a case study. Wada and Ohno (2013) focused on the area and evaluated the fiscal impact of urban compact using Nagaoka City, Niigata Prefecture, as a case study.

Various indicators measure city structure, for example, population density, area, and distance, and although there remains room for debate as to what indicator should be used to measure, the common indicator is population density. Wada and Ohno (2013), who used the area as an indicator, considered areas with high population density to be aggregation destinations, and Kutsuzawa (2016), who used distance to be an indicator, also used population density in the calculation of standardized standard distances. Conversely, in the relationship between city structure and municipal finance, the concept of city centrality can be considered, but the location of the center must also be taken into account, and the center in terms of economic activity and that in terms of administrative planning are not necessarily the same. Additionally, from the perspective of economies of scale, which is significant for efficiency, having a certain degree of population density may be more important for the efficiency of municipal finances than the concept of a city center. Hence, in this paper, the population density will be used as an indicator to measure city structure.

Although studies on city structure evaluate the compact city as a desired city structure, Japan's Urban Revitalization Special Measures Law was amended in 2014 to introduce a location optimization planning system. According to the guidebook for preparing the location optimization plan (Ministry of Land, Infrastructure, Transport and Tourism, 2022), the location optimization plan is an advanced version of the Municipal Master Plan and is intended to realize compact cities by defining residential zones and urban function zones and by providing tax incentives.

Conversely, according to the 12th edition of the Operational Guidelines for City Planning (2022), "The area of the location optimization plan must be within the city planning area, but from the perspective of looking at the entire city, it is fundamental that the entire city planning area is subject to the area of the Location optimization plan. Additionally, when there are multiple city planning areas (CPAs) within a municipality, it is fundamental to prepare a location optimization plan for all CPAs", it should be noted that the location optimization plan is a plan limited to the scope of the CPA.

Additionally, according to the guidelines, the location optimization plan allows for establishing a residential adjustment zone outside of the residential zone when it is necessary to control residential development, and a site management zone when the number of vacant lots is increasing and proper management of these lots is necessary. However, non-CPAs are outside the scope of the location optimization plan, and the fact that the location optimization plan does not work for non-CPAs is deemed a social issue.

This would not be a social issue if the entire area of a municipality were designated to be CPAs, but in the case of a rural city, only a portion of the area is designated to be a CPA. If urban downsizing is considered to increase population density through the consolidation of city structures, it should not only be limited to CPAs but should also include non-CPAs. Non-CPAs have low population densities, and based on previous studies, the fiscal efficiency of these areas is low. A study focusing on differences in efficiency allocation within the same city was conducted by Sekiguchi and Nagase (2019), who highlighted the possibility of intracity fiscal transfers from areas with high population density and high efficiency to areas with low population density and low efficiency within the same city. This intracity fiscal transfer can be considered an academic issue that has not been highlighted in previous studies.

Social issue: the location optimization plan does not cover non-CPAs.

Academic issue: most previous studies do not consider the possibility of intracity fiscal transfers.

Based on the social and academic issues, this study aims to estimate the amount of invisible fiscal transfers from CPAs to non-CPAs, which we call stealth fiscal transfers (SFTs). This estimation will reveal how much SFT is paid per capita by CPAs and how much SFT is received per capita by non-CPAs, thus revealing the existence and amount of intracity fiscal transfers, which is an academic issue. Additionally, if the existence and amount of SFTs are revealed, policy implications can be derived to expand the scope of the location optimization plan and contribute to solving social issues.

The structure of the rest of this paper is as follows: The simulation model of total expenditure per capita, followed by simulations using the estimated parameters in Section 2. The simulation results are tabulated for each prefecture in Section 3. Finally, one summary and future issues are presented in Section 4.

2. Simulation

2.1. Estimation Model

First, we specify the following model by decomposing the average cost, which is the total expenditure per capita in the municipality *i* in fiscal year t, into M_{it}, the population density as a city structure into D_{it}, and other factors of type *j*, which cannot be expressed by the city structure index, into γ_{itj} for example, population aging rate and types of municipalities as dummy variables of the ordinance-designated city, core city, special city. The types of municipalities are mainly based on population requirements and the affairs transferred from the prefectures (see **Table 1** for details).

$$M_{it} = D_{it}^{\alpha} \gamma_{itj}^{\beta_j} \tag{1}$$

Here, we transform the logarithm of Equation (1) and specify it as follows to perform panel data analysis.

$$\ln M_{it} = \alpha \ln D_{it} + \sum_{j=1} \beta_j \gamma_{itj} + \beta_0 + \varepsilon_{it} \tag{2}$$

Note that β_0 is the constant term and ε_{it} is the error term that satisfies the usual assumptions.

To obtain the average cost of a municipality, we divide its total expenditure by its population, but the total expenditure is strongly affected by natural disasters,

Table 1. Types of municipalities.

Type of municipalities	Requirements for designation	Main affairs		
Ordinance-designated cities	Designated by government ordinance from among cities with a population of 500,000 or more.	1. Affairs related to city planning 1.1 Permission for development activities within an Urbanization Promotion Area or Urbanization Control Area 2. Affairs related to environmental preservation 2.1 Acceptance of notification of establishment of general dust-generating facilities 2.2 Acceptance of notification of establishment of specified facilities that discharge sewage or liquid waste 3. Other 3.1 Recommendations and periodic inspections based on the Measurement Law	1. Affairs related to city planning 1.2 Restrictions on the installation of outdoor advertisements by ordinance 2. Affairs related to environmental preservation 2.3 Permission to install general waste disposal facilities and industrial waste disposal facilities 2.4 Acceptance of notification of installation of soot and smoke-generating facilities 4. Affairs related to welfare 4.1 Approval and supervision of establishment of nursery schools 4.2 Approval and supervision of the establishment of special nursing homes for the elderly 4.3 Designation of nursing care service providers 5. Affairs related to education 5.1 Training of prefectural-funded teachers and staff 6. Affairs related to health and sanitation 6.1 Establishment of public health center 6.2 Licensing of the restaurant business 6.3 Permission to operate inns and public bathhouses	1. Affairs related to city planning 1.3 City planning decisions regarding zoning, etc. 1.4 Management of national and prefectural roads outside the designated area 1.5 Management of first-class rivers (in part) and second-class rivers (in part) in designated areas 4. Affairs related to welfare 4.4 Establishment of Child Guidance Centers 5. Affairs related to education 5.2 Class formation of elementary and junior high schools, etc., determination of the number of teachers and staff, appointment and dismissal, and salary burden
Core cities	Designated by government ordinance upon request of a city with a population of 200,000 or more			
Special case cities	Designated by government ordinance upon request of a city with a population of 200,000 or more		Affairs of the prefectural government	
Others				

Reference: Prepared by the authors based on the Ministry of Internal Affairs and Communications website (confirmed on April 14, 2022). https://www.soumu.go.jp/main_content/000799385.pdf.

including torrential rain disasters. In this study, unbalanced panel data for FY1990 for 1737 municipalities, FY1995 for 1740 municipalities, FY2000 for 1741 municipalities, FY2005 for 1741 municipalities, and FY2010 for 1739 municipalities, which correspond to the years in which the census was conducted, are used, but using data for each year directly is problematic because it reflects large single-year fluctuations. Therefore, as shown in Table 2, the total expenditure for each fiscal year is the geometric mean (GM) of the total expenditures, including the total expenditures of the fiscal years before and after the fiscal year in which the data are used. When using actual values, the arithmetic mean (AM) is generally used, but the GM is used because the GM is equal to or less than the AM, and the GM can reduce fluctuations in a single fiscal year compared to AM.

Table 2. Adjustment for fluctuations in a single fiscal year.

	FY1990			FY1990			FY1995			FY2000			FY2005			FY2010		
Geomtric mean		¥\(A*B*C)^(1/3)bln.			¥268 bln.			…			…			…			\167 bln.	
	↗	↑	↖	↗	↑	↖	↗	↑	↖	↗	↑	↖	↗	↑	↖	↗	↑	↖
	FY1989	FY1990	FY1991	FY1989	FY1990	FY1991	…	…	…	…	…	…	…	…	…	FY2009	FY2010	FY2011
Total expenditure	¥A bln.	¥B bln.	¥C bln.	¥200 bln.	¥400 bln.	¥240 bln.	…	…	…	…	…	…	…	…	…	¥200 bln.	¥400 bln.	¥240 bln.

Let us restate here the purpose of this study. This study aims to reveal the existence and amount of SFT. In this estimation, simulation is performed based on statistical information (population by five-year age group and area data) that the so-called 1 km^2 mesh data provided by the Ministry of Land, Infrastructure, Transport and Tourism of Japan possesses, which places restrictions on the variables that can be used in Equation (2). In other words, Equation (2) is estimated by using only those variables that apply to both the statistical information compiled and publicly available for each municipality and the 1 km^2 mesh data. With this restriction, the following variables are used in this study.

Due to the statistical limitations of the 1 km^2 mesh data, the estimation model for this study is specified as follows:

$$\ln M_{it} = \alpha \ln D_{it} + \beta_A A_{it} + \beta_S S_{it} + \beta_C C_{it} + \beta_T T_{it} + \beta_0 + \varepsilon_{it} \quad (3)$$

where A_{it} is the aging rate of municipality i in the year t and S_{it} is a dummy variable, whose value is 1 if the municipality was an ordinance-designated city as of April 1 of year t and 0 otherwise. C_{it} is a dummy variable, whose value is 1 if the municipality was a core city as of April 1 of year t and 0 otherwise. T_{it} is a dummy variable, whose value is 1 if the city was a special case city as of April 1 of year t and 0 otherwise. The sign condition in Equation (3) is expected to be $\alpha < 0$ because, in accordance with previous studies, economies of scale are expected to operate as D_{it}, an indicator of the increase in city structure and an expected decrease in the average cost. $\beta_A > 0$ is expected because social security-related costs are expected to increase with a higher aging rate. Additionally, $\beta_S > 0, \beta_C > 0, \beta_T > 0$ for these cities and $\beta_S > \beta_C > \beta_T$, respectively, because of the transfer of authority from the prefectures compared with the other municipalities. The data sources and remarks are shown in **Table 3** and the descriptive statistics in **Table 4**, and the scatter plot between average cost and population density is shown in **Figure 1**. According to **Figure 1**, it is possible to specify the model as a quadratic function, but due to multicollinearity issues and the complexity of interpretation, for the sake of simplicity of discussion, the parameter estimation in this study is performed using a linear equation.

Note: Kitakami City, Iwate Prefecture; Miyake Village, Tokyo; Kofu City, Yamanashi Prefecture; Fuji-Kawaguchiko Town, Yamanashi Prefecture; Hamamatsu City, Shizuoka Prefecture; Shimabara City, Nagasaki Prefecture; Minami-Shimabara City, Nagasaki Prefecture are missing FY1990, FY2000, FY2010, FY2010, FY1990, FY1990, and FY1990 respectively.

Table 3. Data sources and/or remarks.

Data		Source and/or Remarks
Total expenditure		Account settlement by Municipality (Shichosonbetsu Kessan Joukyoutou Sirabe) for each city for each fiscal year. Ministry of Internal Affairs and Communications, Japan.
Square kilometer		National Area Survey by Prefecture and Municipality for each city for each year. Geospatial Information Authority of Japan.
Population		Census for each city for each fiscal year. Ministry of Internal Affairs and Communications, Japan.
Per capita expenditures	M_{it}	Total expenditure/Population for each city for each fiscal year.
Density	D_{it}	Population/Square kilometer for each city for each fiscal year.
Aging rate	A_{it}	Population over 65 years old/population for each city for each fiscal year.
Dummy_ordinance-designated city	S_{it}	1 if the city is an ordinance-designated city as of April 1 of each fiscal year, 0 otherwise.
Dummy_core city	C_{it}	1 if the city is a core city as of April 1 of each fiscal year, 0 otherwise.
Dummy_special case city	T_{it}	1 if the city is a special case city as of April 1 of each fiscal year, 0 otherwise.

Note: Municipal data is prepared by municipalities as of March 31, 2020.

Table 4. Simulation descriptive statistics.

Variable	Obs	Mean	Std. dev.	Min	Max
$\ln M_{it}$	8698	13.08	0.51	12.09	15.93
$\ln D_{it}$	8698	5.45	1.76	0.49	9.99
$\ln A_{it}$	8698	0.22	0.08	0.04	0.57
S_{it}	8698	0.01	0.09	0.00	1.00
C_{it}	8698	0.01	0.11	0.00	1.00
T_{it}	8698	0.01	0.10	0.00	1.00

Table 5 indicates the estimation results based on Equation (3). Regarding the validation of the fixed-effects model and the random-effects model, the results of the Hausman test yielded 60.92, the χ-square value, indicating the adoption of the fixed-effects model.

The coefficient of population density, an indicator of city structure, in the fixed and random-effects models is negative and significant indicating results that are consistent with those of previous studies including Kawasaki (2009), Sekiguchi (2012) and Sekiguchi and Nagase (2019). In other words, the results indicate that as population density increases, the average cost decreases, and an

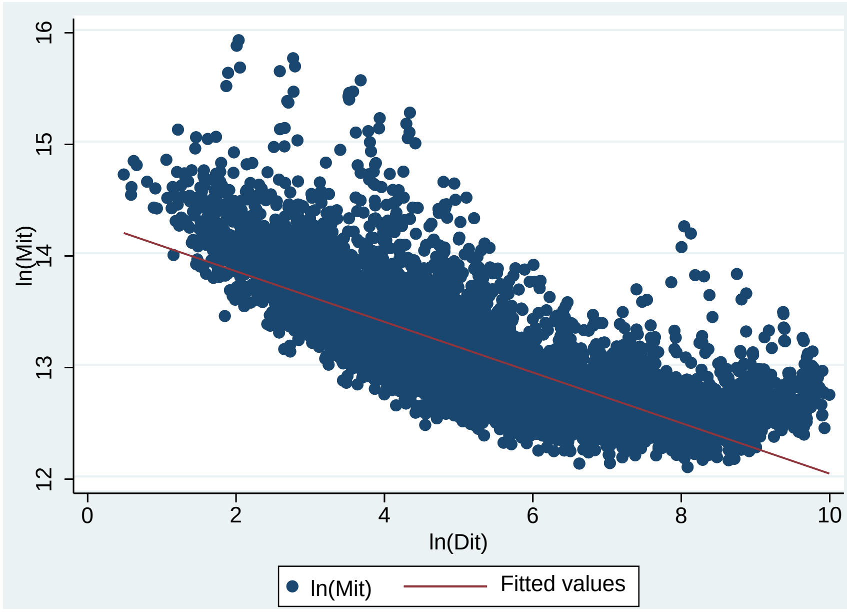

Figure 1. Scatter plots of population density and average expenditure.

Table 5. Estimation results.

	Model 1 Fixed effect			Model 2 Random effect		
	Coef.	Std. err.		Coef.	Std. err.	
$\ln D_{it}$	−0.075	(0.021)	***	−0.184	(0.021)	***
$\ln A_{it}$	1.578	(0.034)	***	1.492	(0.034)	***
S_{it}	0.075	(0.047)	+	0.199	(0.047)	***
C_{it}	0.029	(0.018)	*	0.040	(0.018)	**
T_{it}	−0.038	(0.018)	**	−0.026	(0.018)	+
constant	13.148	(0.117)	***	13.759	(0.117)	***
Number of obs.	8698			8698		
Number of groups	1741			1741		
R^2 (overall)	0.615			0.641		
Hausman test	$Chi^2(5) = 60.92$, Prob. > $Chi^2 = 0.000$					

Note: ***, **, *, and + represent significance levels of 1%, 5%, 10%, and 15%, respectively.

increase by 1% in population density results in a decrease by 0.075% in the average cost. The results are also positively significant for the aging rate and satisfy the sign condition.

The results for the ordinance-designated city dummy and the core city dummy are positive and significant, although the significance level is low, and the sign condition is satisfied, with the ordinance-designated city dummy outperforming the core city dummy. The result was consistent with prior expectations. Conversely, the result for the special case city dummy was negatively significant.

The reason why the sign condition was not met is that, although the special cities have originally received some of the powers that the core cities have, for example, the acceptance of notifications related to environmental preservation, designation of designated areas, and permission, and recommendations related to city planning, which require less administrative burden, economies of scale may have worked to reduce costs.

2.2. Simulation Procedure

The parameters estimated in the previous section will now be used to simulate the scale of the SFT. In the simulation, we estimate the total expenditure for each mesh using the population, area, and aging rate and dummy variables of the core city, government-designated city, and special case city that are included in the 1 km^2 mesh data.

The 1 km^2 mesh data are not 1 km^2 in the strict sense due to map distortion. To correct this distortion, this study used the Universal Transverse Mercator coordinate system[1] to divide Japan into six zones, from 51 to 56, and obtained the area with a scale factor accuracy of 0.9996. **Table 6** shows the area of the simulation target aggregated to prefectural units.

Procedure

1) We focused on municipalities that have both CPA and non-CPA because we estimate the SFT from CPA to non-CPA in the simulation (see **Table 6** and **Table 7**).

2) The CPA and non-CPA were fixed to the most recent FY2018 at the time of the study.

3) Calculate the total expenditure per capita for each mesh using the parameters of the estimation model and multiply by the mesh population to calculate the total expenditure per mesh.

4) The total expenditure calculated for each mesh is divided into CPA and non-CPA within a municipality and aggregated.

5) Calculate total expenditure per capita by CPA and non-CPA for each municipality.

6) Estimate the total expenditure per capita for each municipality, and the difference between this and expenditure per capita by CPA and expenditure per capita by non-CPA is per capita SFT paid by CPA and per capita SFT received by non-CPA, respectively.

7) Aggregate the estimation by municipalities to prefectural units.

[1]The Geospatial Information Authority of Japan (GSI) describes UTM as follows. "A projection method that represents the spherical Earth on a flat surface, a projection of the spherical Earth onto a cylinder lying horizontally around the Earth's equatorial plane. When a sphere is projected onto a plane, distortion occurs. The UTM method uses a width of 6 degrees of longitude, which is within the range of least distortion. This projection method is widely used worldwide, including topographic maps by GSI. The UTM cartography divides the area projected on the plane into grids in the longitude and latitude directions. For longitude, the earth is divided into 60 longitude zones every 6 degrees eastward from 180 degrees west longitude. For latitude, the earth is divided into 20 latitude zones every 8 degrees from 80 degrees south latitude to 84 degrees north latitude (the range is 12 degrees from 72 degrees north latitude to 84 degrees north latitude only)." Sources: GSI website (confirmed on April 14, 2022). https://www.gsi.go.jp/chubu/minichishiki10.html.

Table 6. Areas to be simulated.

Prefecture Code	Prefecture Name	Number of Municipalities	Square Kilometer in CPA	Square Kilometer in non-CPA	Ratio of CPA	Ratio of non-CPA
1	Hokkaido	107	7410.3	48295.5	13.30%	86.70%
2	Aomori	27	2668.4	5304.5	33.5%	66.53%
3	Iwate	25	3191.8	10042.7	24.1%	75.88%
4	Miyagi	26	2233.2	4463.7	33.3%	66.65%
5	Akita	20	2540.4	7917.2	24.3%	75.71%
6	Yamagata	31	1702.2	6646.6	20.4%	79.61%
7	Fukushima	42	3926.2	6820.0	36.5%	63.46%
8	Ibaraki	11	922.5	1530.8	37.6%	62.40%
9	Tochigi	8	1945.9	1949.0	50.0%	50.04%
10	Gunma	17	1301.5	2952.7	30.6%	69.41%
11	Saitama	11	554.9	925.5	37.5%	62.52%
12	Chiba	14	769.8	1149.7	40.1%	59.89%
13	Tokyo	4	94.6	271.3	25.8%	74.15%
14	Kanagawa	6	902.3	358.9	71.5%	28.45%
15	Niigata	21	4348.9	6960.0	38.5%	61.54%
16	Toyama	6	1174.4	1721.6	40.6%	59.45%
17	Ishikawa	17	971.2	2717.0	26.3%	73.67%
18	Fukui	13	1157.1	2317.5	33.3%	66.70%
19	Yamanashi	21	1091.4	3271.1	25.0%	74.98%
20	Nagano	47	3401.2	6114.4	35.7%	64.26%
21	Gifu	17	1316.2	6951.4	15.9%	84.08%
22	Shizuoka	23	3145.5	3340.5	48.5%	51.50%
23	Aichi	-	-	-	-	-
24	Mie	21	2182.3	2779.9	44.0%	56.02%
25	Shiga	11	1929.3	1657.2	53.8%	46.21%
26	Kyoto	16	2193.8	2227.7	49.6%	50.38%
27	Osaka	-	-	-	-	-
28	Hyogo	21	2927.6	2702.5	52.0%	48.00%
29	Nara	7	567.7	715.2	44.2%	55.75%
30	Wakayama	23	797.7	2903.3	21.6%	78.45%
31	Tottori	12	787.4	1812.5	30.3%	69.71%
32	Shimane	14	1749.9	4318.6	28.8%	71.16%
33	Okayama	20	2468.1	4250.0	36.7%	63.26%
34	Hiroshima	15	2701.6	3717.2	42.1%	57.91%
35	Yamaguchi	14	2950.2	2876.3	50.6%	49.37%

Continued

36	Tokushima	13	456.3	2383.9	16.1%	83.93%
37	Kagawa	14	848.3	917.4	48.0%	51.96%
38	Ehime	18	1721.6	3961.6	30.3%	69.71%
39	Kochi	21	1032.7	4180.0	19.8%	80.19%
40	Fukuoka	33	2617.0	1638.9	61.5%	38.51%
41	Saga	15	1182.7	979.4	54.7%	45.30%
42	Nagasaki	17	619.9	2354.9	20.8%	79.16%
43	Kumamoto	18	1401.3	3188.5	30.5%	69.47%
44	Oita	17	1317.6	4942.4	21.0%	78.95%
45	Miyazaki	19	1213.7	4606.3	20.9%	79.15%
46	Kagoshima	35	2754.7	5201.9	34.6%	65.38%
47	Okinawa	8	562.2	193.7	74.4%	25.62%
Nationwide		916	83753.7	196530.9	29.9%	70.12%

Unit: Square kilometer. Note: There was no difference in area between FY2005 and FY2010.

Table 7. Municipalities covered in this study.

	Number of municipalities	Municipalities with both CPA and non-CPA	Municipalities with only non-CPA	Municipalities with only CPA	Municipalities without both or unknown
FY2005	1741	916	502	263	60
FY2010	1741	916	502	263	60

Note: In the simulation, we included municipalities with both CPA and non-CPA. Note: The following municipalities or prefectures are excluded from the list because they do not publish CPA maps. Ebina City, Kanagawa Prefecture; Kanazawa City, Ishikawa Prefecture; all of Aichi Prefecture; Minami-Ise Town, Mie Prefecture; Hirao Town, Yamaguchi Prefecture; Nagasaki City, Nagasaki Prefecture; Sasebo City, Nagasaki Prefecture; Minami-Shimabara City, Nagasaki Prefecture; Soo City, Kagoshima Prefecture; Yushimizu Town, Kagoshima Prefecture; Nakatane Town, Kagoshima Prefecture.

3. Simulation Results

Under the above procedure, SFTs for each of the >1700 municipalities were tabulated by prefecture and are shown in **Table 8**. The simulation results showed that CPAs, the payers of SFT, were estimated to have paid a national weighted average of ¥19,218 per capita in FY2005 and ¥18,360 per capita in FY2010. Conversely, non-CPA, the recipient of SFT, was estimated to have received a national weighted average of ¥164,017 per capita in FY2005 and ¥171,360 per capita in FY2010. The total value of SFT in Japan was estimated to be ¥1,104,830,463,745 in FY2005 and ¥1,062,534,779,839 in FY2010.

When the PPMCC[2] between the amount on the payment side of the SFT and

[2]PPMCC stands for Pearson Product-Moment Correlation Coefficient.

Table 8. Simulation results.

Prefecture Code	Prefecture Name	per capita SFT paid by CPA		per capita SFT received by non-CPA		Total amount of SFT		Ratio of SFT to Expenditure	
		FY2005	FY2010	FY2005	FY2010	FY2005	FY2010	FY2005	FY2010
1	Hokkaido	13,924	13,512	178,762	188,161	66,850,203,971	63,945,358,509	3.43%	3.13%
2	Aomori	17,097	16,771	129,560	133,715	20,682,883,557	19,540,550,337	4.09%	3.76%
3	Iwate	31,925	30,499	149,275	151,588	34,912,533,838	32,430,587,844	7.23%	6.49%
4	Miyagi	22,008	20,989	135,375	140,836	38,600,136,626	36,886,354,391	5.38%	4.94%
5	Akita	28,810	28,195	106,337	109,427	25,652,137,351	24,073,333,337	6.18%	5.73%
6	Yamagata	24,467	23,064	104,422	104,092	23,670,994,261	21,689,632,441	5.51%	4.96%
7	Fukushima	17,228	16,573	144,550	148,438	30,804,801,217	28,964,331,252	3.98%	3.65%
8	Ibaraki	27,052	26,086	135,489	136,021	13,296,003,405	12,297,680,063	6.28%	5.71%
9	Tochigi	14,847	14,021	138,367	141,059	7,788,328,337	7,277,383,696	3.37%	3.07%
10	Gunma	17,663	15,927	151,868	146,120	14,074,505,089	12,475,075,514	4.24%	3.54%
11	Saitama	13,253	13,169	124,178	133,892	5,779,742,552	5,655,726,326	3.24%	3.06%
12	Chiba	31,066	21,067	100,123	175,961	15,955,214,536	26,140,806,571	7.51%	5.53%
13	Tokyo	7509	7172	253,174	266,093	1,998,907,967	2,071,075,778	2.20%	2.12%
14	Kanagawa	334	346	201,028	232,990	1,660,133,581	1,767,919,007	0.09%	0.09%
15	Niigata	16,583	15,218	174,213	172,504	35,122,826,652	31,702,763,100	3.83%	3.29%
16	Toyama	4170	4006	208,070	221,739	3,457,110,684	3,286,740,633	0.98%	0.89%
17	Ishikawa	32,784	33,343	144,692	158,172	18,249,073,802	18,369,053,402	7.65%	7.43%
18	Fukui	13,139	13,064	140,362	147,723	9,215,726,629	9,053,967,952	3.12%	2.95%
19	Yamanashi	22,671	22,187	147,567	152,599	16,828,229,873	16,194,284,355	5.52%	5.12%
20	Nagano	15,846	15,448	130,685	133,701	27,802,525,948	26,783,459,907	3.66%	3.38%
21	Gifu	43,081	43,137	115,017	122,286	21,396,951,651	21,081,845,571	9.85%	9.41%
22	Shizuoka	8124	8180	212,940	234,068	24,748,080,931	24,808,440,612	2.03%	1.90%
23	Aichi	-	-	-	-	-	-	-	-
24	Mie	15,062	14,998	145,193	155,023	23,790,362,034	23,705,624,904	3.66%	3.48%
25	Shiga	5634	5491	159,622	163,864	6,574,809,269	6,571,902,618	1.42%	1.31%
26	Kyoto	10,541	10,403	207,993	222,725	23,134,721,484	22,762,495,173	2.65%	2.51%
27	Osaka	-	-	-	-	-	-	-	-
28	Hyogo	17,116	16,908	111,784	119,013	20,799,021,996	20,246,285,051	4.00%	3.73%
29	Nara	11,583	10,795	239,384	252,205	5,302,158,730	4,859,387,583	2.92%	2.50%
30	Wakayama	31,230	30,900	134,521	138,216	14,457,463,243	13,725,317,841	6.99%	6.57%
31	Tottori	21,963	22,436	114,327	124,058	10,465,041,424	10,506,257,478	5.19%	5.07%
32	Shimane	37,930	37,287	146,536	153,495	22,045,317,357	21,234,649,936	8.17%	7.77%
33	Okayama	25,481	22,840	193,742	188,122	43,751,727,175	39,338,633,987	6.14%	5.08%
34	Hiroshima	17,141	16,899	216,005	232,043	44,160,210,383	43,647,946,605	4.25%	3.97%
35	Yamaguchi	19,487	19,589	211,127	232,160	26,860,833,089	26,447,605,495	4.49%	4.24%

Continued

36	Tokushima	44,059	43,836	58,387	60,479	9,558,854,158	9,202,964,593	9.49%	9.08%
37	Kagawa	16,341	15,665	116,087	118,359	14,017,433,908	13,315,769,938	3.89%	3.54%
38	Ehime	26,595	25,974	180,053	191,695	34,206,266,645	32,915,333,027	6.36%	5.90%
39	Kochi	32,916	32,083	197,754	206,359	20,711,216,489	19,642,128,328	7.65%	7.01%
40	Fukuoka	6270	6206	121,687	129,454	24,513,558,637	24,532,771,903	1.59%	1.51%
41	Saga	14,620	14,128	89,568	90,964	8,989,952,262	8,524,068,742	3.34%	3.12%
42	Nagasaki	45,823	47,046	75,695	82,459	18,840,944,671	18,874,580,722	10.81%	10.67%
43	Kumamoto	27,924	25,698	148,955	147,994	34,573,068,573	31,737,943,778	6.81%	5.82%
44	Oita	46,155	45,350	188,612	203,256	45,282,842,501	44,801,595,660	11.16%	10.43%
45	Miyazaki	29,279	28,839	146,068	155,375	27,917,526,884	27,465,975,301	6.94%	6.52%
46	Kagoshima	32,247	30,483	195,584	199,611	47,090,217,843	43,919,523,412	7.52%	6.84%
47	Okinawa	6401	6364	82,011	87,773	2,364,358,144	2,409,618,197	1.69%	1.65%
Nationwide		19,218	18,360	164,017	171,360	1,104,830,463,745	1,062,534,779,839	4.66%	4.23%

Unit: Japanese Yen.

the ratio of CPA to the municipal area was calculated, the PPMCC was −0.714 (p = 0.000) in FY2005 and −0.720 (p = 0.000) in FY2010, indicating a significant negative correlation. In other words, the larger the ratio of CPA to the municipal area, the more the population shares the burden, resulting in a smaller amount on the payer side of the SFT. Conversely, the PPMCC between the amount of SFT received and the non-CPA ratio was −0.082 (p = 0.591) in FY2005 and −0.129 (p = 0.397) in FY2010, which was negative but not significant. In other words, the larger the ratio of non-CPA to the municipal area, the larger and more diluted the population receiving SFT (see **Figure 2** and **Table 9**).

4. Discussion

Kuroda (1986), Kornai (1986), Sato (2002), Yamashita et al. (2002), Kornai et al. (2003), Miyazaki (2004), Otsuka and Goto (2014) pointed out the soft budget problem. That is, intergovernmental fiscal transfers, or in other words, intercity fiscal transfers may cause municipalities to spend inefficiently. In the context of this study, non-CPAs are less densely populated and therefore less efficient than CPAs; SFTs are intra-city fiscal transfers to these less efficient areas. The ratio of SFT to LAT grants (intergovernmental fiscal transfers) is shown in **Table 10**, which shows that SFT accounted for a national weighted average of 19.31% in FY2005 and 17.16% in FY2010. According to Otsuka and Goto (2014), who estimated the loss of efficiency in total expenditure caused by LAT grants, the loss is estimated to be approximately 23% for LAT grants. This suggests that 74% to 84% of the soft budget problem caused by intergovernmental fiscal transfers is likely due to SFT, whose existence is revealed in this study.

Table 9. PPMCC between the scale of SFT and the ratio of CPA.

	Between per capita SFT paid by CPA and ratio of CPA		Between per capita SFT received by non-CPA and ratio of non-CPA	
	PPMCC	*p* value	PPMCC	*p* value
FY2005	−0.714	0.000	−0.082	0.591
FY2010	−0.720	0.000	−0.129	0.397

Table 10. The ratio of SFT to LAT grants.

Prefecture Code	Prefecture Name	Ratio of SFT to LAT grants		Prefecture Code	Prefecture Name	Ratio of SFT to LAT grants	
		FY2005	FY2010			FY2005	FY2010
1	Hokkaido	10.38%	9.36%	26	Kyoto	13.52%	15.49%
2	Aomori	12.29%	10.44%	27	Osaka	-	-
3	Iwate	20.60%	16.87%	28	Hyogo	15.05%	12.90%
4	Miyagi	22.44%	20.93%	29	Nara	14.98%	12.20%
5	Akita	14.76%	12.43%	30	Wakayama	16.76%	14.02%
6	Yamagata	16.78%	13.81%	31	Tottori	15.44%	13.89%
7	Fukushima	17.90%	14.99%	32	Shimane	17.03%	14.97%
8	Ibaraki	24.83%	21.76%	33	Okayama	24.57%	21.05%
9	Tochigi	20.81%	16.17%	34	Hiroshima	24.52%	24.07%
10	Gunma	21.41%	16.50%	35	Yamaguchi	21.66%	19.17%
11	Saitama	21.01%	17.35%	36	Tokushima	16.41%	13.87%
12	Chiba	48.14%	63.39%	37	Kagawa	20.14%	16.55%
13	Tokyo	64.80%	51.05%	38	Ehime	22.44%	20.36%
14	Kanagawa	3.59%	5.19%	39	Kochi	19.50%	16.71%
15	Niigata	14.54%	12.36%	40	Fukuoka	8.98%	9.10%
16	Toyama	5.65%	5.26%	41	Saga	11.02%	9.18%
17	Ishikawa	16.12%	16.12%	42	Nagasaki	10.15%	9.34%
18	Fukui	17.31%	14.75%	43	Kumamoto	22.80%	18.75%
19	Yamanashi	20.26%	16.92%	44	Oita	35.00%	31.01%
20	Nagano	14.09%	12.47%	45	Miyazaki	22.45%	19.30%
21	Gifu	21.43%	19.39%	46	Kagoshima	20.37%	16.74%
22	Shizuoka	30.20%	27.79%	47	Okinawa	5.47%	4.68%
23	Aichi	-	-				
24	Mie	24.64%	21.35%				
25	Shiga	9.56%	8.08%				
				Nationwide		19.31%	17.16%

Unit: Japanese Yen.

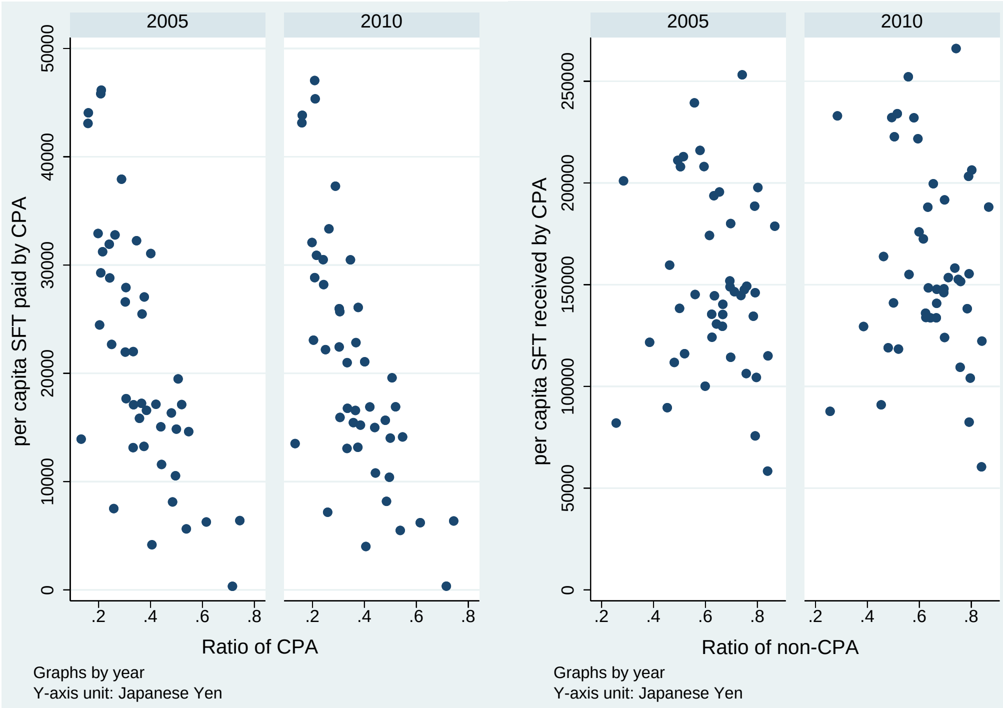

Figure 2. Scatter plots of the amount of SFT and ratio to the municipal area.

It is important to note that the above results reveal the existence and amount of SFT, as well as the desirability of expanding the scope of the location optimization plan to cover not only the CPA but also the entire area within the municipality, from the perspective of social issues.

5. Conclusion

Based on the social and academic issues, this study aims to estimate the existence and scale of intracity fiscal transfers from CPA to non-CPA that are not on the municipal account settlement card, which we call SFT. The simulation results showed that CPAs, the payers of SFT, were estimated to have paid a national weighted average of ¥19,218 per capita in FY2005 and ¥18,360 per capita in FY2010. Conversely, non-CPA, the recipient of SFT, was estimated to have received a national weighted average of ¥164,017 per capita in FY2005 and ¥171,360 per capita in FY2010. The total value of SFT in Japan was estimated to be ¥1,104,830,463,745 in FY2005 and ¥1,062,534,779,839 in FY2010. The ratio of SFT to LAT grants was 19.31% in FY2005 and 17.16% in FY2010, and this study found that SFT accounted for 74% to 84% of the loss due to LAT grants as identified by Otsuka and Goto (2014).

Although the location optimization plan is a plan for CPAs, it is important to note that the policy implication derived from this study is that in the future, the location optimization plan is expected to cover not only CPAs but also the entire area within a municipality, including non-CPAs.

Finally, we would like to address the remaining future issues for this study.

The first issue is that although population density was used in this study as an indicator to measure the city structure, the analysis will also incorporate natural conditions, like height above sea level. For the second issue, when estimating the expenditure function, some previous studies, for example, Akai and Sato (2011) and Miyazaki (2020) have conducted panel data analysis in which the variable is whether or not the municipality is allocated LAT grants. In the future, besides natural conditions such as height above sea level, we will conduct an analysis in which the allocation of the local tax is a variable. As a third issue, this study analyzed the social issue that the scope of the location adequacy plan is limited to CPAs. As a unit of the estimation of SFT, SFT from urbanized areas to other areas could be considered, which would be expected to be larger both per capita and in total. We would like to conduct such an analysis in the future.

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Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

Akai, N., & Sato, M. (2011). A Simple Dynamic Decentralized Leadership Model with Private Savings and Local Borrowing Regulation. *Journal of Urban Economics, 70,* 15-24. https://doi.org/10.1016/j.jue.2011.02.002

Bodkin, R. G., & Conklin, D. W. (1971). Scale and Other Determinants of Municipal Government Expenditures in Ontario: A Quantitative Analysis. *International Economic Review, 12,* 465-481. https://doi.org/10.2307/2525358

Carruthers, J. I., & Ulfarsson, G. F. (2003). Urban Sprawl and the Cost of Public Services. *Environment and Planning B: Planning and Design, 30,* 503-522. https://doi.org/10.1068/b12847

Carruthers, J. I., & Ulfarsson, G. F. (2008). Does Smart Growth Matter to Public Finance? Evidence from the United States. *Urban Studies, 45,* 1791-1823. https://doi.org/10.1177/0042098008093379

Council for Social Infrastructure in Japan (2006). *How Urban Planning Should Be in the New Era* (1st Report). (In Japanese)

Council for Social Infrastructure in Japan (2007). *How Urban Planning Should Be in the New Era* (2nd Report). (In Japanese)

Dixit, A. (1973). The Optimum Factory Town. *Bell Journal of Economics and Management Science, 4,* 637-651. https://doi.org/10.2307/3003057

Hayashi, M. (2002). Returns to Scale, Congestion and the Minimal Efficient Scales of the Local Public Services in Japan. *Financial Review, 61,* 59-89. (In Japanese)

Hayashi, M. (2003). Local Public Expenditure and Jurisdiction Size. *The Bulletin of Insti-*

tute for Research in Business and Economics. Meiji Gakuin University, 20, 63-83. (In Japanese)

Hayashi, R. (2013). Efficiency of Fiscal Activities through Municipal Mergers: An Empirical Analysis Considering Merger Patterns. *Government Auditing Review in Japan, 47,* 27-48. (In Japanese)

Hirota, H., & Yunoue, H. (2016). Analysis of the Calculation Structure of Base Fiscal Demand: Verification Using Prefectural Panel Data. *Government Auditing Review in Japan, 53,* 13-28. (In Japanese)

Hirsch, W. Z. (1959). Expenditure Implications of Metropolitan Growth and Consolidation. *Review of Economics and Statistics, 41,* 232-241. https://doi.org/10.2307/1927450

Hirsch, W. Z. (1965). Cost Functions of an Urban Government Service: Refuse Collection. *Review of Economics and Statistics, 47,* 87-93. https://doi.org/10.2307/1924127

Hortas-Rico, M., & Solé-Ollé, A. (2010). Does Urban Sprawl Increase the Costs of Providing Local Public Services? Evidence from Spanish Municipalities. *Urban Studies, 47,* 1513-1540. https://doi.org/10.1177/0042098009353620

Kawasaki, K. (2009). Efficiency of a Compact City. *Zaisei Kenkyu, 5,* 236-253. (In Japanese)

Kornai, J. (1986). The Soft Budget Constraint. *Kyklos, 39,* 3-30. https://doi.org/10.1111/j.1467-6435.1986.tb01252.x

Kornai, J., Eric M., & Géard R. (2003). Understanding the Soft Budget Constraint. *Journal of Economic Literature, 41,* 1095-1136. https://doi.org/10.1257/jel.41.4.1095

Kuroda, H. (1986). Theoretical Analysis of Subsidies and Tax Grants. *Financial Review, 2,* 1-11. (In Japanese)

Kutsuzawa, R. (2016). The Effect of Compact City on Cities Budget—The Analysis by Standard Distance. *Urban Housing Sciences, 95,* 142-150. (In Japanese)

Ministry of Land, Infrastructure, Transport and Tourism (2022). *The Guidebook for Preparing the Location Optimization Plan*. (In Japanese)

Mirrlees, J. A. (1972). The Optimum Town. *Swedish Journal of Economics, 74,* 114-135. https://doi.org/10.2307/3439013

Miyazaki, T. (2004). Fiscal Transfers, Public Investment, and Local Economic Efficiency. *JCER Economic Journal, 48,* 58-75. (In Japanese)

Miyazaki, T. (2020). Intergovernmental Fiscal Transfers and Tax Efforts: Regression-Discontinuity Analysis for Japanese Local Governments. *Regional Science and Urban Economics, 84,* Article 103554. https://doi.org/10.1016/j.regsciurbeco.2020.103554

Morimoto, A. (2011). The Effect of Shrinking City on Local Government Finance and Global Environment. *Journal of the City Planning Institute of Japan, 46,* 739-744. (In Japanese) https://doi.org/10.11361/journalcpij.46.739

Nakai, H. (1988). *Quantitative Analysis of Contemporary Fiscal Burden*. Yuhikaku. (In Japanese)

Nakazawa, K. (2014). Does the Method of Amalgamation Affect Cost Inefficiency of the New Municipalities? *Open Journal of Applied Sciences, 4,* 143-154. https://doi.org/10.4236/ojapps.2014.44015

Nishikawa, M. (2002). Policy Assessment of Municipal Mergers: Optimal City Size and Probability of Establishing a Merger Council. *JCER Economic Journal, 46,* 61-79 (In Japanese)

Oates, W. (1972). *Fiscal Federalism*. Harcourt Brace Jovanovich.

Otsuka, A. and Goto, M. (2014). Cost-Efficiency of Japanese Local Governments: Effects of Decentralization and Regional Integration. *Regional Studies, Regional Science, 1,* 207-220. https://doi.org/10.1080/21681376.2014.953196

Richardson, H. W. (1973). *The Economics of Urban Size*. Lexington Books.

Sato, M. (2002). Intergovernmental Transfers, Governance Structure and Fiscal Decentralization. *Japanese Economic Review, 53,* 55-76. https://doi.org/10.1111/1468-5876.00213

Sekiguchi, S. (2012). Estimation of Optimal Compact City Based on Municipal Revenue and Expenditure. *Planning and Public Management, 35,* 28-36. (In Japanese) https://doi.org/10.14985/jappm.35.3_28

Sekiguchi, S. (2019). An Analysis of the Efficiency of Local Government Expenditure and the Minimum Efficient Scale in Vietnam. *Urban Science, 3,* Article 77. https://doi.org/10.3390/urbansci3030077

Sekiguchi, S., & Nagase, H. (2019). Simulation Study on the Intra-Urban Gap in Local Government Expenditure. *Bulletin of Ishinomaki Senshu University, 30,* 33-44. (In Japanese) https://www.senshu-u.ac.jp/ishinomaki/albums/abm.php?d=1367&f=abm00013289.pdf&n=05_%E9%83%BD%E5%B8%82%E5%86%85%E6%AD%B3%E5%87%BA%E8%BC%83%E5%B7%AE%E3%81%AE%E3%82%B7%E3%83%9F%E3%83%A5%E3%83%AC%E3%83%BC%E3%82%B7%E3%83%A7%E3%83%B3%E5%88%86%E6%9E%90.pdf

Takemoto, T., Takahashi, H., & Suzuki, A. (2004). Verification of Scale Economies in Municipalities *Faculty of Literature & Social Sciences, Yamagata University Annual Research Report, 1,* 159-173. (In Japanese) https://yamagata.repo.nii.ac.jp/record/1290/files/lsar_1_01590173.pdf

Uemura, T., & Sumi, E. (2003). Establishment of Merger Councils and Local Taxation. *Government Auditing Review in Japan, 28,* 85-99. (In Japanese)

Wada, N., & Ohno, H. (2013). Evaluation of the Urban Compactization by the Cost. *Journal of Environmental Engineering, 78,* 419-425. (In Japanese) https://doi.org/10.3130/aije.78.419

Walzer, N. (1972). Economies of Scale and Municipal Police Services: The Illinois Experience. *Review of Economics and Statistics, 54,* 431-447. https://doi.org/10.2307/1924570

Yamashita, K., Akai, N., & Sato, M. (2002). The Incentive Effect of Local Allocation Tax Grants: An Empirical Test of the Soft Budget Problem by the Stochastic Frontier Cost Function. *Financial Review, 61,* 120-145. (In Japanese)

Yokomichi, K., & Okino, H. (1996). Municipal Mergers from the Perspective of Financial Efficiency. *Jichi-Kenkyu, 72,* 69-87. (In Japanese)

Yoshimura, H. (1999). Optimal City Size in Terms of Administrative Service Level and Total Expenditure. *Chiiki-Keizai-Kenkyu, 10,* 55-70. (In Japanese)