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Do municipal mergers reduce public expenditure? Evidence from the MTE approach

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Abstract

This study investigates whether local government mergers reduce public expenditure by examining the marginal treatment effect (MTE) using data from Japan during FY2006-2018. Existing papers in the literature have paid little attention to self-selection bias or heterogeneity in treatment effects and preferences for mergers. Corresponding to these issues, we use the instrumental variables used in Miyazaki(2018) [Applied Economics, 50(10), pages 1366-1376] and estimate the MTE of the mergers. From the estimated MTEs, we construct several estimands corresponding to the heterogeneity and show that municipal mergers increased public spending on average. Moreover, we confirm that the local average treatment effect (LATE) was quite large from FY2006 to FY2015, although it decreased suddenly in FY2016 around which some incentives that promoted the mergers ended. This implies that the incentives offered by the national government negated the expenditure reductions resulting from municipal mergers.

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1 Introduction

Over the past 50 years, many countries have merged their local governments in order to reap the benefits associated with economies of scale. However, when mergers are voluntary, measuring the efficiency of mergers is difficult because mergers may be self-selected, reflecting unobserved heterogeneity in the net gains from consolidation, which leads to estimation bias. (Blesse and Baskaran, 2016; Tricaud, 2021) This heterogeneity may lead to diverse results of previous analyses in the literature on public expenditure and mergers (Table 1).[1] Moreover, the analyses are also different in their method and estimands, so the comparison of results may be difficult.

(1) Author(s)	(2) Data	(3) Method of analysis	(4) Voluntary or Compulsory	(5) (Total) Expenditure
Reingewertz(2012)	1999–2007 data of Israel	DID	Voluntary	Reduced
Blom-Hansen et al. (2014)	2005-2011 data of Denmark	DID	Voluntary	Reduced ※ 1
Allers and Geertsema(2016)	2002-2013 data of Netherlands	DID	Voluntary	Unchanged ※ 2
Blesse and Baskaran(2016)	1995–2010 data of Brandenburg state in Germany	DID	Voluntary Compulsory	Unchanged Unchanged ※ 3
Miyazaki(2018)	2000, 2005 and 2010 data of Japan	FE-IV	Voluntary	Increased
Drew et al. (2021)	2014-2020 data of New South Wales state in Australia	DID	Compulsory	Increased

Table 1: Empirical studies on public expenditure and government consolidation

Source: Author's own synopsis. *1 The authors call their outcome variable as "administrative costs". *2 The authors also report that mergers reduce administrative expenditure. *3 The authors also report that compulsory mergers reduce administrative expenditure.

In this paper, we examine municipal mergers as an effective policy for reducing public expenditure and try to overcome the self-selection issue, estimating several different estimands using the estimation of the marginal treatment effect (MTE). We focus on Japan's mergers in the 2000s, which were voluntary but were induced by the central government's carrot-and-stick policies. We utilize one of the policies, the reduction in unconditional grants for the municipalities with small populations in FY2002, as instrumental variables (IV) following Miyazaki (2018).

This paper has two main findings. First, the estimated average treatment effect (ATE), ATE on the untreated (ATUT) and ATE on the treated (ATT) show that the consolidation increased the expenditure of municipalities by between 0% and 18%, while the corresponding figure in terms of the Local ATE (LATE), which captures the effect for incentivised municipalities that would not have merged without incentives for mergers to do so, is very high at 20%. Different from the existing papers such as Miyazaki (2018), this finding suggests, for the first time, that there was considerable heterogeneity in the expenditure of incentivised municipalities, represented by small merged municipalities that benefited from mergers and other municipalities. Moreover, this result also confirms that small merged municipalities increased their spending after their mergers, whereas studies such as Goto and Yamamoto (2023) show that they did so before their mergers in Japan.

Second, we find that LATE was quite large from FY2006 to FY2015, although it decreased suddenly in FY2016 around which some incentives that promoted the mergers

[1] Gomez-Reino, Lago-Penas, and Martinez-Vazquez (2023) reviews the literature and conducts a meta-analysis, implicitly assuming public expenditure as the cost of public services and cost minimization as the governments' objective. Our paper differs from theirs in not relying on these assumptions.

ended. This result suggests that the decade of benefits to merging municipalities by the central government amplified public spending substantially.

To derive the MTE, we use the framework for the generalized Roy model developed in Heckman and Vytlacil (1999, 2005, 2007). Different from existing papers in the public expenditure and merger literature, such as Miyazaki (2018), this model allows us to account for the heterogeneity as well as the self-selection problem. In this framework, we can derive several estimands from MTE following Mogstad, Santos, and Torgovitsky (2018) and can examine whether consolidation reduces public expenditure. Compared to the common methods such as 2SLS, the novel features of this framework are that the estimation allows for self-selection into treatment and that we can infer several estimands corresponding to the heterogeneity. We contribute to the literature on municipal mergers by deriving several estimands using the MTE framework.

The remainder of the paper consists of five sections. Section 2 provides background information on Japanese municipal mergers in the 2000s. The analytical method and framework are discussed in Section 3. Section 4 explains the data and presents the findings of the empirical analysis. Finally, Section 5 concludes.

2 Background

2.1 Local governments in Japan and their revenue sources

In Japan, municipalities provide basic public services such as primary education and sanitation. The municipal revenue consists mainly of taxes, grants, and bonds. Local tax and grants from the national government respectively account for about 30% of the local government's revenue.[2] The main national grants are an unconditional grant named the local allocation tax (LAT)[3] and an earmarked subsidy named national treasury disbursements (NTD). Finally, bond issuance accounts for about 10% of the revenue.

2.2 Municipal mergers in Japan

In Japan, municipal mergers are voluntary. Although the national government has promoted mergers to encourage greater efficiency among municipalities, the number of municipalities decreased by only 5% from FY1965 (3392 municipalities) to FY1999 (3229 municipalities). In FY1999, the national government started "carrot-and-stick" policies by enacting a law that prescribed the distribution of the incentives for mergers from FY1999 to FY2005.

Regarding the carrots, the national government offered the LAT incentive. Because the national government tends to distribute LAT more to small and rural municipalities in the sense of per capita amount, expecting the reduction of LAT, municipalities were reluctant to merge before FY1999. However, the national government guaranteed the same LAT amount for at least 10 years after the merger and promised to take transitional measures from 10 to 15 years after the merger. (Figure 1)

[2]Note that the number here is based on FY2012 data (Ministry of Internal affairs and Communications, 2012), while the corresponding number in other years of our samples is broadly similar. Please refer to the relevant year's White Paper for details.

[3]This confusing name, the local allocation tax, is coming from the fact that it shows an allocation to local governments from taxes collected by the central government.

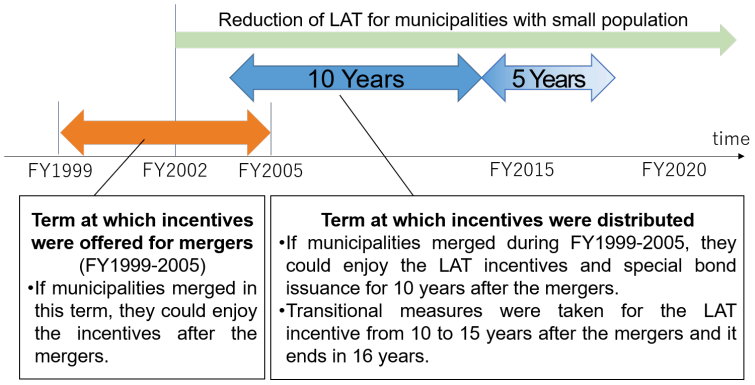

Figure 1: Timeline of "carrot-and-stick" policies

Source: Ministry of Internal affairs and Communications (2016)

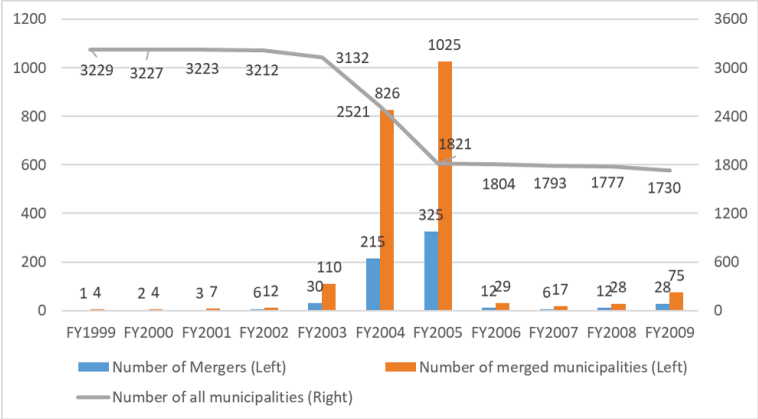

Figure 2: Changes in the number of municipalities.

Source: Data from Ministry of Internal affairs and Communications (2016)

Another incentive was the special-bond issuance. In FY1999, the national government allowed merged municipalities to issue bonds that could be used to finance up to 95% of the expenditures for consolidation for 10 years after the mergers, and 70% of the repayment costs were paid by the national government. These incentives were available to municipalities that merged between FY1999 and FY2005, but many of them were not offered after FY2006. Figure 2 shows that many municipalities consolidated between FY1999 and FY2005, and the peak of mergers was in FY2005. Then, for the most of merged municipalities, represented by those merged in FY2005, the incentives to merge were reduced by FY2015.

Regarding the sticks, LAT for small municipalities ("*Dankai-hosei*" in Japanese) was reduced from FY2002. Since the larger per capita amount of LAT was reduced for municipalities with a smaller population (Table 2), they had a stronger incentive to merge.

Through these policies, municipalities had the incentive to merge to secure their LAT revenue. In particular, such an incentive should have been effective for municipalities with small populations since their LAT revenue would be reduced if they did not merge

Population	Reduction in LAT (yen)	Reduction in LAT per capita (yen)	IV
1000	8,000,000	8,000	category A
4000	18,000,000	4,500	category B
8000	17,000,000	2,125	category C
12,000	17,000,000	1,416.7	category C
20,000	17,000,000	850	category C
30,000	10,000,000	333	category D

Table 2: Reduction in LAT

Source: Ministry of Internal affairs and Communications (2002)

but would be secured if they did merge. (Weese, 2015; Miyazaki, 2018)

2.3 Empirical issue of voluntary mergers

The institutional background implies that municipalities might select consolidation based on their gains from the consolidation and that consolidation would be an endogenous treatment.

To address this issue, Miyazaki (2018) utilizes *Dankai-hosei* as IVs. He creates categorical dummy variables that equal one for non-merged municipalities depending on their populations in FY2002 and uses them as IVs for the non-merged municipalities. For the merged municipalities, he employs the share of merging municipalities in each category as IVs: for example, if a category A municipality and a category B municipality merged, the variables for categories A and B each equal 0.5 for the merged municipality. By controlling for the current population, these categorical variables should not be correlated with the total expenditure per capita after the mergers. Therefore, we adopt this approach.

However, a two-stage least squares (2SLS) regression captures LATE, which represents the treatment effect only on subjects who change their behavior depending on the value of IV (i.e., compilers), and 2SLS is not suitable to evaluate the overall policy effect. To overcome this shortfall, we conduct the MTE analysis and derive several estimands, addressing the self-selection issue.

3 Estimation Framework

In this section, we provide a brief sketch of the estimation framework by omitting the subscript i, which indicates the individual sample. Please refer to the web appendix for the details and underlying assumptions.[4]

Define a binary variable $D \in \{0, 1\}$ equals one if consolidation is chosen. Consider municipalities' gain from consolidation is shown as $\nu(\boldsymbol{W}) - V$, which consists of a function of observables $\boldsymbol{W}(= \{\boldsymbol{X}, \boldsymbol{Z}\})$ and unobserved disutility for consolidation V whose distribution is normalized to a uniform distribution on the unit interval. $\boldsymbol{X}$ and $\boldsymbol{Z}$ are respectively the set of covariates, which affect both the treatment (consolidation) and the outcome (the logged expenditure per capita in this paper), and IVs, which affect the treatment but not the outcome if $\boldsymbol{X}$ is conditioned. If $\nu(\boldsymbol{W}) - V$ is positive, municipalities select into consolidation, i.e. $D = \mathbb{I}(\nu(\boldsymbol{W}) > V)$. Therefore, $\nu(\boldsymbol{W})$ can be interpreted as a propensity score of consolidation. Denoting p as a value of $\nu(\boldsymbol{W})$, $V = p$ means

[4]The web appendix is available as 'Supplemental Material' in this journal.

Estimand	Expression	$\omega_1(\boldsymbol{w}, p)$
ATE	$E[G_1 - G_0]$	1
ATT	$E[G_1 - G_0 \mid D = 1]$	$\frac{\mathbb{I}(p \leq \nu(\boldsymbol{w}))}{P(D=1)}$
ATUT	$E[G_1 - G_0 \mid D = 0]$	$\frac{\mathbb{I}(p \geq \nu(\boldsymbol{w}))}{P(D=0)}$
LATE for $U \in (\underline{p}, \bar{p})$	$E[G_{i,1} - G_{i,0} \mid U \in (\underline{p}, \bar{p}))$	$\frac{\mathbb{I}(p \in (\underline{p}, \bar{p}))}{\bar{p} - \underline{p}}$

Table 3: Estimands and weighting functions

Source: Mogstad, Santos, and Torgovitsky (2018).
Note: We can derive an estimand by substituting $\omega_1(\boldsymbol{w}, p)$ into eq. (1). Since LATE is the average treatment effect for those who are shifted into treatment when the instruments are shifted from $\boldsymbol{z}$ to $\boldsymbol{z}'$, $\underline{p}$ and $\bar{p}$ are defined as $\underline{p} = \nu(\boldsymbol{x}, \boldsymbol{z})$ and $\bar{p} = \nu(\boldsymbol{x}, \boldsymbol{z}')$, respectively, for LATE for $U \in (\underline{p}, \bar{p})$.

that a municipality with p is on the margin of the indifference between consolidation and non-consolidation.

Under this setting, define MTE at $(\boldsymbol{x}, p)$ as $MTE(\boldsymbol{x}, p) = E(G_1 - G_0 | \boldsymbol{X} = \boldsymbol{x}, V = p)$, where G_1 (G_0) is the potential outcome of municipality i when it is (not) consolidated. Using this, we can derive several estimands β^* from

$$\beta^* = \int_0^1 MTE(\boldsymbol{X}, p)\omega_1(\boldsymbol{w}, p)dp, \tag{1}$$

where $\omega_1(\boldsymbol{w}, p)$ is a weight function. By changing $\omega_1(\boldsymbol{w}, p)$ according to Table 3, we can derive various estimands.

Following Brinch, Mogstad, and Wiswall (2017), assume that $MTE(\boldsymbol{x}, p)$ is separable between $\boldsymbol{x}$ and p, i.e. $MTE(\boldsymbol{x}, p) = \mu(\boldsymbol{x}) + k(p)$, where $\mu(\cdot)$ and $k(\cdot)$ are respectively the function of $\boldsymbol{x}$ and p. By specifying $\mu(\cdot)$ as linear and $k(\cdot)$ as cubic, $MTE(\boldsymbol{x}, p)$ can be expressed as

$$MTE(\boldsymbol{x}, p) = \boldsymbol{x}(\boldsymbol{\beta}_1 - \boldsymbol{\beta}_0) + \{\sum_{l=1}^{3} \pi_{1l}(p^l - \frac{1}{l+1}) - \sum_{l=1}^{3} \pi_{0l}(p^l - \frac{1}{l+1})\}, \tag{2}$$

where $\boldsymbol{\beta}_j$ is the coefficients of $\boldsymbol{x}$ and π_{jl} is the coefficient of the lth order of p for $j \in \{0, 1\}$. Since the variation in $\boldsymbol{Z}$ creates many values for $P(\boldsymbol{W}) = p$ and the sample size is enough to make normal equations, we can estimate $\{\boldsymbol{\beta}_0, \boldsymbol{\beta}_1, \{\pi_{0l}, \pi_{1l}\}_{l=1}^3\}$. In the estimation, we limit the range of p to cover the common support for $P(\boldsymbol{W}|D = 0)$ and $P(\boldsymbol{W}|D = 1)$.

4 Data and analysis

4.1 Data

In this study, we employ data on Japanese municipalities from FY2006 to FY2018 since the series of mergers ended in FY2005, and due to the data availability. The data sources, units, and summary statistics for the variables are shown in Tables 4 and 5.

We set the outcome as log-valued total expenditure per capita. As covariates, we use population, average income, the population of elderly, young, and foreign people, and land area. We use logged values for all of these covariates following Miyazaki (2018).

VARIABLES	Source	Unit
Exp per capita	The Survey of Local Public Finance	Thousand yen
Pop	Population survey based on Basic Resident Register	People
Young pop	Population survey based on Basic Resident Register	People
Elderly pop	Population survey based on Basic Resident Register	People
Foreign pop	Population survey based on Basic Resident Register	People
Area	Land area of municipality	Hectare
Income	The Survey of Municipal Residential Tax	Thousand yen
City	The Survey of Local Public Finance	Dummy
Special city	The Survey of Local Public Finance	Dummy
Core city	The Survey of Local Public Finance	Dummy
Designated city	The Survey of Local Public Finance	Dummy

Table 4: Variables and data sources

	Merged municipalities			Nonmerged municipalities		
VARIABLES	N	Mean	SD	N	Mean	SD
Exp per capita	6,461	556.3	250.0	13,567	699.4	668.5
Pop	7,547	210,288	508,607	15,819	59,419	216,013
Young pop	7,547	27,697	70,961	15,819	7,857	28,053
Elderly pop	7,547	54,623	118,614	15,819	14,017	47,204
Foreign pop	7,547	842.3	2,307	15,819	760.6	4,035
Area	6,461	113,094	186,100	13,569	14,526	19,727
Income	6,461	1,078	231.5	13,567	1,147	326.3
City	7,547	0.629	0.483	15,827	0.285	0.452
Special city	7,547	0.0256	0.158	15,827	0.0161	0.126
Core city	7,547	0.0368	0.188	15,827	0.0142	0.118
Designated city	7,547	0.00742	0.0858	15,827	0.00885	0.0936

Table 5: Summary statistics

As a robustness check, we also add dummy variables that show the category of the municipalities, such as cities or villages.[5]

As IV, we create four categorical dummy variables that equal one depending on the population in FY2002: these are variables that indicate municipalities with populations less than 1000 (hereafter, category A), 1000-4000 (category B), 4000-8000 (category C), and 8000-30000 (category D) (See Table 2). Following Miyazaki (2018), while we directly use these variables for non-merged municipalities, we employ the share of merging municipalities in each category as IVs. Since, by controlling for the current population, these categorical variables should not be correlated with the total expenditure per capita after the merger, these variables should satisfy the exclusion restriction. Moreover, considering that the LAT reduction was larger for smaller municipalities (Table 2) and the smaller municipalities should have been more willing to merge, our IV satisfies the monotonicity. We also check the weakness of IV by using a probit regression in the first-stage analysis, and find that they are not weak.[6]

Before the analysis, we check the trends of outcomes using the data. Figure 3 shows the average trend of outcome for merged and non-merged municipalities. At a glance, they seem to be parallel, and the growth of expenditure in merged municipalities is slightly less than the other. However, the causal effect of mergers cannot be seen here. Therefore, we examine it as follows.

[5]These consist of four dummy variables: a city dummy, special city dummy, core city dummy, and designated city dummy. In Japan, administrative responsibilities are different for these categories.

[6]See the web appendix.

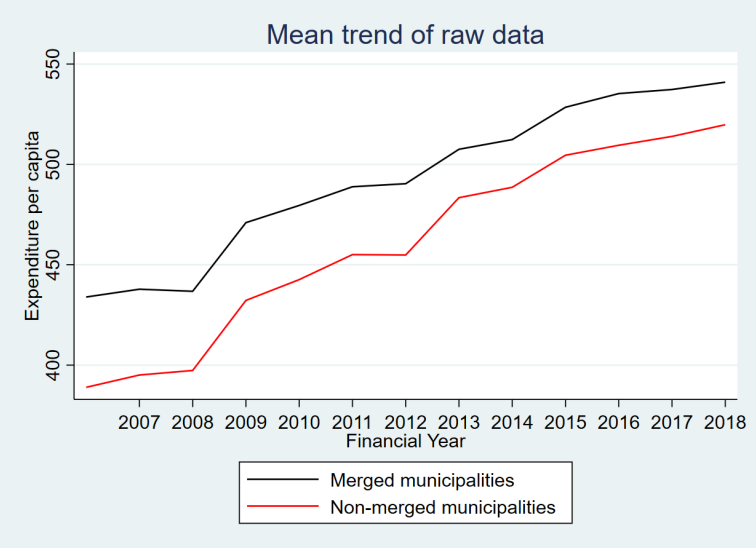

Figure 3: Trend in total expenditure per capita

Note: The average trend in total expenditure per capita for merged (non-merged) municipalities is shown as a black (red) line, respectively. Merged municipalities here are municipalities that merged during FY1999-2005, and non-merged municipalities are all other municipalities. We did not control for any variables here.

4.2 Analysis results

We conduct the cross-sectional MTE analysis year by year. In doing so, we derive annual treatment effects. We show the annual transition of estimands in this section.[7]

Figures 4, 5, 6, and 7 show the estimated ATE, ATT, ATUT, and LATE, respectively, for each year. The left panel of each figure shows the results when we use the covariates in the baseline analysis. The right panel shows the results when city dummies are added to the covariates in the baseline analysis. Since the shapes of both graphs seem similar, the baseline analysis results are robust because the trends in the estimands do not vary with the addition of covariates.

The estimated ATE range from 0 to 0.12, which indicates that, if all municipalities merged, total expenditure per capita would increase by 2%∼12% on average. Figure 4 shows that the magnitude of ATE tends to be high before 2010 or 2015. This may reflect the fact that the initial cost to launch their new municipalities was required shortly after the consolidations, or that the LAT incentive has ended for many municipalities by 2015.[8] Given that the ATE of mergers on public expenditure could not be derived in the existing studies (at least in the Japanese context), this result shows firstly that municipal mergers in Japan increase public expenditure on average. The magnitudes of ATT range from 0 to 0.18, indicating that the merged municipalities increased the spending per capita by 0%∼18% after merging. Considering that the estimand of DID is ATT, this result differs

[7]Note that we do not use panel data analysis or time series analysis, but the MTE analysis is based on the framework of cross-sectional data. See the web appendix for estimation results of parameters, $\{\boldsymbol{\beta}_0, \boldsymbol{\beta}_1, \{\pi_{0l}, \pi_{1l}\}_{l=1}^{3}\}$, for each year.

[8]Note that the wave of mergers peaked around FY2004 and FY2005 and the the 10-year incentives to merge for the mass of merged municipalities should have been reduced by FY2015. See Figure 1 and 2.

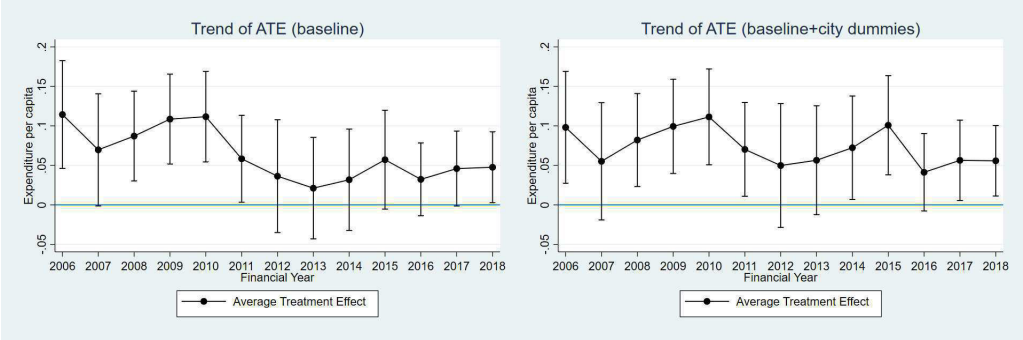

Figure 4: The estimated ATEs for each year

Note: The estimated ATE for each year is shown. The left (right) panel shows the results of the baseline analysis (the analysis with city dummies). 95% confidence intervals based on standard errors clustered at the municipality level are also shown.

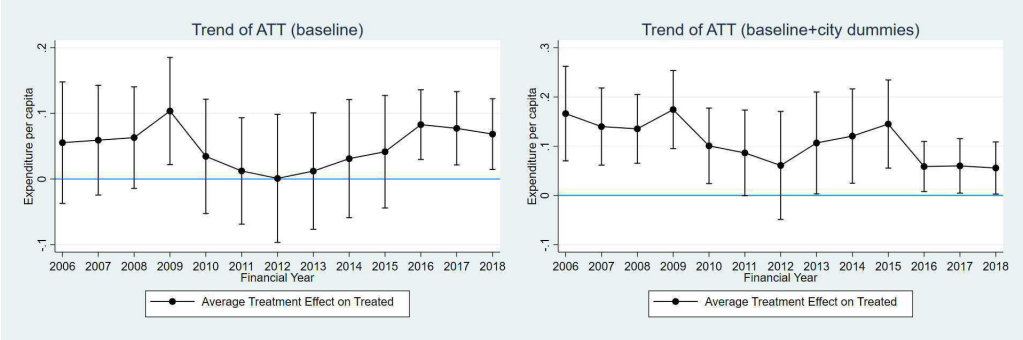

Figure 5: The estimated ATT for each year

Note: The estimated ATT for each year is shown. The left (right) panel shows the results of the baseline analysis (the analysis with city dummies). 95% confidence intervals based on standard errors clustered at the municipality level are also shown.

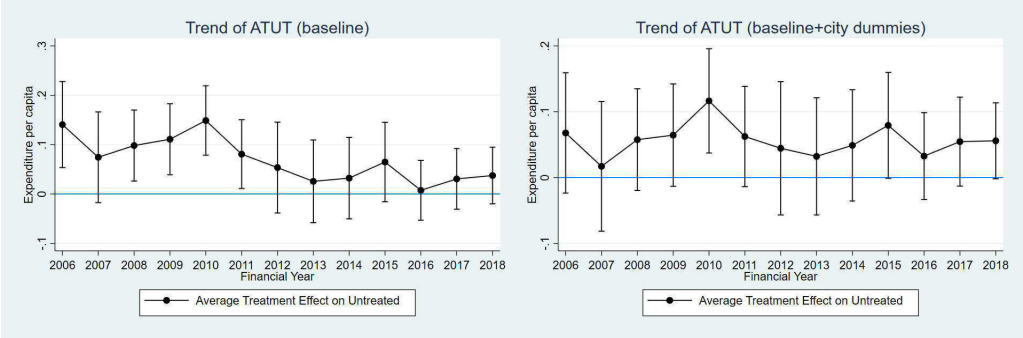

Figure 6: The estimated ATUT for each year

Note: The estimated ATUT for each year is shown. The left (right) panel shows the results of the baseline analysis (the analysis with city dummies). 95% confidence intervals based on standard errors clustered at the municipality level are also shown.

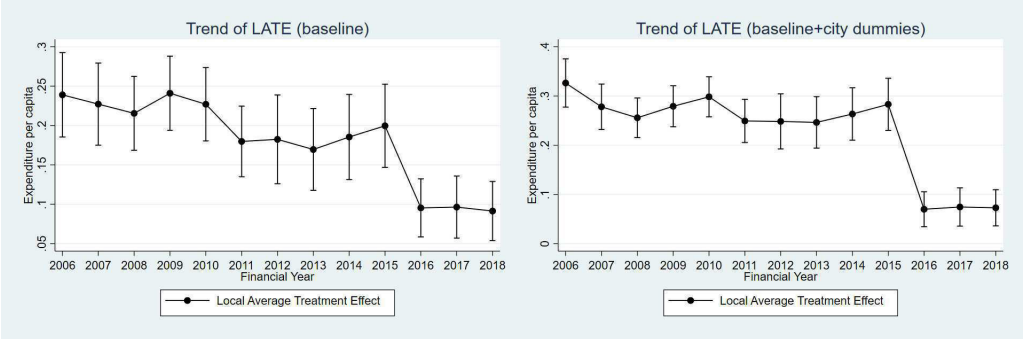

Figure 7: The estimated LATE for each year

Note: The estimated LATE for each year is shown. The left (right) panel shows the results of the baseline analysis (the analysis with city dummies). 95% confidence intervals based on standard errors clustered at the municipality level are also shown.

from the results in many extant papers in that expenditure increased in our result. The magnitudes of ATUT range from 0.02 to 0.15, showing that the non-merged municipalities would have increased their total expenditure per capita by 2%∼15% if they had merged. We can roughly observe that these estimates from FY2006 to FY2010 are large, while they become small after FY2011. This may be because the merged municipalities paid the initial cost to launch their new municipalities just after their mergers.

Comparing the estimates for ATE, ATT, and ATUT, the magnitudes are not significantly different in most years. This implies that the heterogeneity in the treatment effects on the most of merged and non-merged municipalities is not very large.

However, the estimates for LATE in Figure 7 show clearly different results. The values are extensive, ranging from approximately 0.2 from FY2006 to FY2015 in the baseline analysis and suddenly decreasing to about 0.1 from FY2016 to FY2018. Since LATE shows the treatment effect on the compliers, i.e., the treatment subjects that would not have chosen to be treated without the policy used as an IV, the results mean that those municipalities induced to merge by the reduction in the LAT increased their expenditure by approximately 20% from FY2006 to FY2015 due to their mergers.

Although LATE seem to be pretty large compared to the other estimands, they are in line with the results of an extant paper, Miyazaki (2018) since he reports that the increase in the current expenditure estimated using the fixed-effects IV (FE-IV) approach is approximately 0.2. Considering that the FE-IV approach estimates LATE (Chabe-Ferret, 2022), our results capture the same effect as Miyazaki (2018). Moreover, Miyazaki (2018) reports a gradual reduction in the treatment effect using data up to FY2010, and we observe a similar trend in our estimation results.

Considering that LATE captures the treatment effect on the municipalities induced to merge by the reduction of LAT, these municipalities were likely to be affected by the carrot-and-stick policies implemented. In other words, they may select consolidation based on the gains from the incentives, and they enjoyed those incentives more than the other municipalities. In addition, considering that the national government guaranteed that merged municipalities would receive the same LAT payment for at least ten years after their merger, the sudden reduction of LATE in FY2016 is natural because FY2016 is precisely 11 years after FY2005, the deadline to receive the incentives.

The results in this subsection imply that the municipalities selected into consolidation

based on their gains or losses and that the increase in public expenditure was caused by the incentives to merge offered by the national government.

5 Conclusion

This study examines whether municipal mergers reduce public expenditure using the MTE of municipal mergers. Extant papers in the literature have paid little attention to bias from the self-selection into municipal mergers or to the heterogeneity in the treatment effects of the mergers. Corresponding to these issues, we use the IVs used in Miyazaki (2018), estimate the MTEs of the mergers, and show that the total expenditure per capita increased by 2%∼12% after the mergers according to the ATE.

Our results suggest that there is considerable heterogeneity in expenditure across municipalities and that merged municipalities increased their expenditure because of the incentives for mergers provided by central government. However, our results may only capture the short-term adjustment costs of mergers. Considering this, the long-term impact of consolidation on public expenditure should be examined using longer-term data in the future. To obtain further insights into municipal mergers, more research is needed.

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