Evaluation of the fiscal effect on municipal mergers: Quasi-experimental evidence from Japanese municipal data

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Evaluation of the fiscal effect on municipal mergers: Quasi-experimental evidence from Japanese municipal data *

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Abstract

The purpose of this paper is to evaluate a fiscal common pool problem in Japanese municipal mergers. Specifically, we investigated whether the merged municipalities rapidly their increase expenditures and bond just before mergers. Because the likelihood of Japanese municipal mergers depends on a municipality's characteristics such as population size, area, and fiscal conditions, municipal mergers are a non-voluntary and non-random phenomenon in Japan. Therefore, identify causal effects by applying propensity score matching within a differences-in-differences framework to address the problems of endogeneity bias and sample selection bias. In particular, we focus on the subordinate merger partner in absorption-type merger. Our results show that the subordinate merger partner suffers from adverse fiscal conditions and creates the fiscal common pool problem in public projects just before mergers.

JEL Classification: H72, H73, H74, H77

Keywords: fiscal common pool problem, municipal mergers, propensity score matching with differences-in-differences, average treatment effect on treated, subordinate merger partner

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1 Introduction

Do municipal mergers create a fiscal common pool problem? Recently, numerous studies have attempted to resolve this question in local public finance. The fiscal common pool problem in fiscal policy is related to the free rider problem, pork-barrel spending, and the law of $1/n$– which are all very similar phenomena. For example, consider the situation in which only some municipalities receive most of the marginal benefits from a public project while the marginal costs of the project are paid by the new municipality after a merger. Municipal mergers give a municipal government the incentive to increase bond and expenditures before mergers because the people in the new municipality will share the cost.

Previous studies have identified the fiscal common pool problem in municipal mergers in countries such as Canada, Denmark, Germany, Israel, Finland, Sweden, Switzerland, and Japan (e.g., Baqir, 2002; Bradbury and Stephenson, 2003; Hinnerich, 2009; Blom-Hansen, 2010; Jordahl and Liang, 2010; Hansen, 2014; Hirota and Yunoue, 2014a, b; Flitz and Feld, 2015; Nakazawa, 2015; Saarimaa and Tukiainen, 2015)[1]. Most of these studies examined voluntary municipal mergers and reported a positive effect on bond after municipal mergers using the differences-in-differences (DID) method. Few studies have examined the fiscal effect of bond just before mergers using the DID method. For instance, Hinnerich (2009), Jordahl and Liang (2010) and Nakazawa (2015) found that the merged municipalities increased bond just before mergers because they can share the additional financial burden after mergers using the DID method.

To evaluate the fiscal common pool problem in Japan, this paper focuses on municipal governmental expenditures and bond just before mergers using quasi-experimental evidence. Since Japan's municipal mergers have some tendencies, it is inadequate to apply the DID method to Japanese municipal mergers as was done in previous studies.

For example, aside from the evaluation of the fiscal common pool problem, Kauder (2014) applied the propensity score matching (PSM) method to address the sample selection bais between the treatment and control groups on the German municipal mergers. Kauder (2014) studied the difference of influence between large municipalities and small municipalities. The results showed the merger's effects of the population of the small mergerd municipalities is larger than small non-merged municiplities while there are no differences between large merged municipalities and large non-merged municiplities.

We are skeptical that municipal mergers are truly voluntary and random because local public finance is like a centralization system in Japan.

[1] A related studies shows the fiscal effects after mergers, for example Reingewerts (2012), Bless and Baskaran (2016).

The Japanese central government encouraged municipalities to merge from FY1998 to FY2005 using the Special Municipal Mergers Law of the Ministry of Internal Affairs and Communications (MIC)[2]. The Special Municipal Mergers Law, a so-called carrot and stick policy, was temporary legislation in force until FY2005[3].

As a result of this merger policy, the number of municipalities in Japan decreased from 3,232 in FY1998 to 1,820 in FY2005. Most of these mergers occurred in rapid succession in FY2004 and FY2005. In other words, the central government induced municipalities to merge as a national policy. The national movement was called "Heisei era big municipal mergers". As the fiscal conditions of the central and local governments declined rapidly following the collapse of the bubble economy in the 1990s, this merger policy was intended to strengthen municipalities and decrease public expenditure.

In Japan, recent research indicates that small municipalities in poor financial condition chose municipal mergers (e.g., Nishikawa, 2002; Hirota, 2007; Kawaura, 2009; Nakazawa and Miyashita, 2014; Miyazaki, 2014; Hirota and Yunoue, 2014a; Hirota and Yunoue, 2014b; Weese, 2015)[4]. These studies reported that the factors driving municipal mergers are poor fiscal conditions, population decline, and small municipality size[5]. In other words, Japanese municipal mergers are the result of a national merger policy intended to address serious fiscal problems. Because we consider assignment to the merged municipality group to be non-voluntary and non-random, we cannot apply the DID method in this case. We devote attention to addressing sample selection bias and obtaining proper counterfactual data.

In this paper, we especially focus on the subordinate partners in mergers as the treatment group to examine the heterogeneity of treatment effects. We do so because previous studies created treatment groups based on whether the municipalities chose to merge. However, we believe that the fiscal effects on the subordinate and dominant merger partner differ. Although a subordinate merger partner with a small size and difficult fiscal conditions may increase bond before a merger, a dominant merger partner with a large size and sound fiscal condition may reduce additional bond. There are also

[2]MIC plays an important role in local administration and public finance as an appropriate authorities and decieds such as an amount of some grants to local governments

[3]The Japanese fiscal year is from April to March. The deadline of the Special Municipal Mergers Law is 31 March, 2006

[4]Weingast et al. (1981) formalized the fiscal common pool problem. See Weingast et al., Persson and Tabellini (1999) and Acemoglu (2003)

[5]Sørensen (2006) examined political factors in merger decisions and the expected efficiency gains and found that generous grants compensated for the effect of dis-economies of scale on municipal mergers. Because small municipalities could receive higher levels of grants from the central government in the absence of a merger, they did not regard a merger as necessary. In addition, although the central government promised to maintain the level of grants to small municipalities, some small municipalities chose not to engage in municipal mergers because of the lack of credibility of the central government.

two types of mergers, an absorption-type merger and an equal-type merger. In the case of an equal-type merger, it is considerably more difficult to defect as such mergers entail mutual surveillance.

Thus, if we were to create treatment groups following the approach of previous studies, our results might capture effects of the dominant merger partner and equal-type mergers. However, in reality, we could observe so many absorption-type mergers in Japan. Therefore, we focus primarily on the subordinate merger partner in absorption-type mergers.

We also deal with total expenditure, investment expenses and bond in terms of the fiscal common pool problem. Previous studies examined only the change of debt stock. If the merged municipalities increase investment expenses and bond just before mergers, we can call the phenomena the fiscal common pool problem on municipal mergers. This is the reason debt stock includes interest of debt which municipalities borrowed long bofore.

In this paper, we estimate the fiscal effect of municipal mergers using average treatment effect on the treated (ATET) estimation based on the propensity score matching with differences-in-differences (PSM-DID) method to evaluate the causal effect.

The remainder of the paper is organized as follows. The next section explains Japanese intergovernmental transfers and the special law regarding municipal mergers. Section 3 describes the empirical framework. Section 4 explains the selection of the subordinate merger partners as the treatment group. Section 5 describes the dataset. Section 6 presents the estimation results. Section 7 concludes.

2 Japanese intergovernmental transfers and Special Municipal Mergers Law

In Japanese local public finance, local governments receive Local Allocation Tax grants of approximately 16 - 20 trillion Japanese yen annually, financed by the central government (through the system of Local Allocation Tax grants, abbreviated LAT grants)[6]. The LAT grants system means that there is an intergovernmental transfers system in Japan. For example, the amount of the LAT grants for FY1998 was approximately 16 trillion yen, while the central government's general accounting budget for FY1998 was approximately 80 trillion yen.

The LAT grants represent 30 percent of local government revenue. A municipality can use the LAT grants as unconditional lump-sum grants. For some municipalities, the LAT grants account for over 70 percent of total revenue. Local tax revenue accounts for approximately 30 percent of total revenue. Unfortunately, Japanese local public finance is sometimes described

[6]This section follows Hirota and Yunoue (2014a). For further information on the LAT grants system, see Ihori (2009) and Saito and Yunoue (2009).

as local governments having "thirty-percent autonomy" [7]. Thus, the fiscal condition of a local government is substantially dependent on the central government. The LAT grants system has been in place for over 60 years.

The LAT grants system is very uncommon system from a global perspective. The amount of the LAT grants provided to each municipality is determined based on the municipality's fiscal shortage according to the central government. In other words, the MIC determines the amount of the LAT grants allocated to each municipality on the basis of the fiscal gap. Because the LAT grants are unconditional lump-sum grants, most municipalities prefer LAT grants to conditional grants. For example, the number of municipalities that received LAT grants in FY1998 is 3114 out of a total of 3232. Over 90 percent of municipalities receive LAT grants every year.

However, the central government's fiscal condition has been chronically deteriorating since the 1990s. The long-term debt stock of the central and local government exceeded approximately 130 percent of GDP at the end of FY1998 and has since continued to increase[8]. In this context, the central government has been promoting fiscal decentralization, including through its municipal mergers policy.

The Special Municipal Mergers Law, called the carrot and stick policy, was temporary legislation passed by the central government and in place from FY1999 to FY2005 to improve fiscal conditions. The carrot and stick policy is focused on the LAT grants, specific grants and bond.

The stick policy is for the non-merged municipalities[9]. The central government announced that if municipalities did not chose to merge, they would receive a reduced amount of LAT and specific grants until FY2005. The stick policy of the LAT grants is also called "the LAT grants shock". Most municipalities suffered severely from the decrease in LAT grants of approximately 5.2 trillion yen over the FY1999 to FY 2005 period.

The carrot policy is for the merged municipalities. The central government announced that if municipalities chose to merge, the merged municipalities would be allowed to receive the LAT grants for 10 years as they had prior to the merger. Similarly, the merged municipalities were permitted to issue special bond after merging. In addition, if the merged municipalities issued this special bond after mergers, the central government promised to repay 70 percent of the fiscal burden of the new public project. The carrot policy affected not only the subordinate merger partner but also the domi-

[7]Typically, LAT grants, specific grants and bond jointly represent 70 percent of local government revenue. Because tax revenue accounts for only approximately 30 percent of the total, Japanese local governments are said to have "thirty-percent autonomy". This shows that the local governments depend on the central government

[8]The long-term debt stock is expected to reach approximately 200 percent of GDP at the end of FY2015.

[9]The stick policy is related to the "Triple Reform" implemented by the Koizumi Cabinet. For further details, see Ihori (2009), Saito and Yunoue (2009), Hirota and Yunoue (2014a) and Weese (2015)

nante merger partner through the LAT grants and special bond. Thus, the dominant merger partner also had some incentives to merge.

In addition, if municipalities applied to merge under the Special Municipal Mergers Law, the central government required the municipalities to discuss the merger for at least one or two years. To apply under the special law, they were not allowed to immediately change their the merger partners.

As mentioned above, the central government made a substantial effort to encourage municipal mergers. That is, municipal mergers are not voluntary or random phenomena.

3 Empirical framework

This paper analyzes the fiscal common pool problem in the context of Japanese municipal mergers. Our identification strategy is based on the propensity score matching method (e.g., Rosenbaum and Rubin, 1983; Heckman et al., 1997; Abadie et al., 2004, 2008, 2012; Imbens, 2014)[10].

Recent research has studied small municipalities and those with poor financial conditions that chose municipal mergers in Japan using a discrete choice model, survival analysis and synthetic control methods (e.g., Nishikawa, 2002; Hirota, 2007; Kawaura, 2009; Hirota and Yunoue, 2014a, b; Nakazawa and Miyashita, 2014). Because we consider assignment to the merged municipality to be nonrandom, we cannot employ DID estimation. For exmaple, Kauder (2014) studied the relationship between municipal mergers and population growth using propensity score mathing method in Germany to address sample selection biases. We devote attention to sample selection bias, endogeneity bias and obtaining proper counterfactual data.

However, by applying PSM to the problem of municipal mergers, we can consider pseudo-randomization by creating treatment and control groups that will be similar. Therefore, the treatment and control groups can be on average observationally identical.

Moreover, when we use PSM in combination with the DID method, we can eliminated time-consistent unobserved effects. We ultimately calculate the ATET of municipal mergers using the PSM-DID method to consider causal effects.

3.1 Propensity score matching

First, the ATET is the difference between the outcomes of treated observations and the outcomes of the treated observations if they had not been

[10]In this section, we referred to Becker and Ichino (2002) and Abadie et al. (2004)

treated.

$$\begin{aligned} ATET &= E(Y_1 - Y_0|T = 1) \\ &= E(Y_1|T = 1) - E(Y_0|T = 1) \end{aligned} \tag{1}$$

In equation (1), Y_i is total expenditure, investment expenses or local bond. Y_1 denotes a merged municipality and Y_0 denotes a non-merged municipality. T represents the municipal merger choice. If a municipality merged, T equals 1 and denotes a member of the treatment group. If a municipality did not merge, T equals 0 and denotes a member of the control group. Because we cannot actually observe $E(Y_0|T = 1)$, we calculate the ATET using $E(Y_0|T = 0)$ as a substitute for $E(Y_0|T = 1)$. The ATET is reflected in equation (2).

$$\begin{aligned} ATET &= E(Y_1 - Y_0|T = 1) \\ &= E(Y_1|T = 1) - E(Y_0|T = 0) \\ &\quad + (E(Y_0|T = 0) - E(Y_0|T = 1)) \end{aligned} \tag{2}$$

If $(E(Y_0|T = 0) - E(Y_0|T = 1))$ does not equal zero, the ATET has some bias. The ATET is based on two assumptions that must be satisfied for the estimate to be unbiased. Equation (3) is the unconfoundedness assumption, meaning that the outcomes are independent of treatment, conditional on x_i.

$$Y_0 \perp T|X \tag{3}$$

Equation (3) shows that the assignment to municipal merger and Y_0 are independent. The treatment variable needs to be exogenous.

$$\begin{aligned} Pr(T = 1|X) < 1 \\ for\ all\ X \end{aligned} \tag{4}$$

Equation (4) reflects the common support assumption. There is a matched control observation with similar X for each treated observation. When equation (3) and (4) exist, we calculate the ATET without some biases by removing $(E(Y_0|T = 0) - E(Y_0|T = 1))$ in equation (2).

Even if observation variables are comparable to a similar group, unobserved variables might cause sample selection biases. The curse of dimensionality makes it too difficult to match a large number of covariates using cross-sectional matching methods. The PSM method can overcome the problem or at least mitigate the problems associated with the curse of dimensionality.

Second, the PSM method is a statistical matching method that attempts to estimate the effect of a treatment by accounting for the covariates that predict assignment to treatment. Regardless of whether municipalities are

actually chose to engage in municipal mergers, the method can assign them randomly into a control group of non-merged municipalities and a treated group of merged municipalities using a predicted probability. This predicted probability is based on a probit or logit model to create a counterfactual group. Furthermore, we can be seen as randomly assigning observations to either group to match the same or similar propensity score.

We estimate the factors affecting the municipal merger decision using the empirical model defined in equation(5):

$$P(X) = Pr(T = 1|X) = E(T|X) \tag{5}$$

The propensity score is a probit model with T as the outcome variable and X as covariates. The propensity score is the conditional predicted probability of receiving treatment given pre-treatment characteristics X.

Third, we match observations from treatment and control groups based on their propensity scores. the PSM method matches a similar predicted probability given equation (3). The ATET of PSM is reflected by equation (6).

$$\begin{aligned} ATET &= E(Y_1 - Y_0|T = 1) \\ &= E|_{P(X)|T=1}(E(Y_1|T = 1, P(X)) - E(Y_0|T = 1, P(X)) \\ &= E|_{P(X)|T=1}(E(Y_1|T = 1, P(X)) - E(Y_0|T = 0, P(X)) \end{aligned} \tag{6}$$

We calculate a consistent estimator of the ATET using equation (7):

$$\hat{ATET} = \frac{1}{N_1}\sum_{i=1}^{N_1}[Y_{1i} - \sum_{j=1}^{N_0} W(i,j)Y_{0j}] \tag{7}$$

N_1 indicates the size of the merged municipality sample and N_0 indicates the size of the non-merged municipality sample. $W(i,j)$ is a weight assigned to a non-merged municipality based on the propensity score and $\sum_j W(i,j) = 1$.

We applied the common support assumption from Becker and Ichino (2002). If some observations cannot be matched to a similar comparison group, they need to be dropped from our data. Moreover, an assignment to treatment is independent of the X characteristics given the same propensity score. We have to verify that the samples are balanced on covariates.

3.2 Propensity score matching with differences in differences

In this section, we explain the ATET of the PSM-DID method. Equation (7) showed the ATET, which can eliminate sample selection bias by matching the merged municipalities with similar non-merged municipalities. It should be noted that the ATET of the PSM might capture time-consistent unobserved effects. If that is the case, equation (7) cannot be consistent.

Heckman et al. (1997) introduced the PSM-DID method to consider unobserved effects. Equation (8) describes the ATET of the PSM-DID method.

$$\begin{aligned} \hat{ATET} = & \frac{1}{N_{1t}} \sum_{i=1}^{N_{1t}} [Y_{1ti} - \sum_{j=1}^{N_{0t}} W(i,j) Y_{0tj}] \\ & - \frac{1}{N_{1s}} \sum_{i=1}^{N_{1s}} [Y_{1si} - \sum_{j=1}^{N_{0s}} W(i,j) Y_{0sj}] \end{aligned} \tag{8}$$

where t and s index the pre-treatment period and the end of the pre-treatment period. N_{1t} and N_{1s} indicate the number of municipalities at each point in time.

In this case, unconfoundedness assumption is described by the following equation (9):

$$E(Y_{0t} - Y_{0s}|T = 1, P(X)) = E(Y_{0t} - Y_{0s}|T = 0, P(X)) \tag{9}$$

Equation (9) shows that there is no correlation between differences in the outcome variable and assignment to merger status. In other words, there is no difference between the average value of the merged municipalities and the average value of the non-merged municipalities.

3.3 Matching methods

Recent studies have proposed different matching methods: nearest neighbor matching, radius matching, and kernel matching.

Nearest neighbor matching is described by equation (10).

$$min_j ||P_i - P_j|| \tag{10}$$

For each treated observation i, select a control observation j that has the closet X. We select merged municipalities and find the non-merged municipalities with closest propensity score.

Radius matching is described by equation (11).

$$(P_j | \, ||P_i - P_j|| < r) \tag{11}$$

Each treated observation i is matched with control observation j that falls within r.

In kernel matching, each treated observations i is matched with several control observations, with weights inversely proportional to the distance between the treatment and control observations. The weights are defined as:

$$W(i,j) = \frac{K(\frac{P_j - P_i}{h})}{\sum_{j=1}^{N_0} K(\frac{P_j - Pi}{h})} \tag{12}$$

h is the bandwidth parameter.

4 Subordinate merger partner as the treatment group

In considering a probit model of Japanese municipal mergers in equation (5), we follow the findings of Nishikawa (2002), Hirota (2007), Kawaura (2009) and Hirota and Yunoue (2014a). These studies reported that small and poor municipalities chose to engage in municipal mergers.

We also apply a population criterion to identify the fiscal common pool problems that lead to the decision to be a subordinate merger partner. There are cases in which merger partners can be classified as the dominant or subordinate merger partner. If a small municipality is absorbed by a large neighboring municipality as a dominant partner, the resulting merged municipality may increase the number of new public projects. These projects are accompanied by additional investment expenses. The subordinate merger partner will borrow more to cover its expenses, which will increase the public bond. However, the subordinate merger partner prefers to externalize the expenses on public projects financed by bond while it receives most of the marginal benefits from a public project.

According to the law of $1/n$, merger partners have an incentive to free ride that depends on their population size over that of the new municipality (e.g., Hinnerich, 2009; Jordahl and Liang, 2010; Blom-Hansen, 2010; Hansen, 2014; Nakazawa, 2015; Saarimaa and Tukiainen, 2015). Specifically, Hinnerich (2009) defined the $1 - pop_i/pop_{new}$ as the free-rider treatment group when pop_i is the population size of municipality i and pop_{new} is the population size of the new municipality.

In this paper, the treatment group T refers to the following three patterns of subordinate partners.

Equation (13) is called the basic model if the population size of a merger partner is smaller than half the population size of the new municipality; in that case, T equals 1 and zero otherwise.

$$\begin{aligned} T_B = 1 \, , if \; pop_i < \frac{pop_{new}}{2} \\ T_B = 0 \, , \; otherwise \end{aligned} \tag{13}$$

where pop_i is the population size of a municipality and pop_{new} is the population size of the new municipality. This model is similar to Hinnerich's (2009) free-rider model.

However, the model may introduce some bias (underestimating or overestimating) because equation (13) includes equal-type mergers and the dominant merger partners.

In addition, the dominant partner does not choose to incur additional

bond from new public projects because it must repay this bond itself after a merger. The subordinate merger partner may prefer reducing funding to incurring new bond. Therefore, we focus on the subordinate merger partner in equations (14) and (15).

Equation (14) is called the subordinate partner model (A) if the population size of a subordinate merger partner is smaller than the population size of the dominant merger partner; in that case, T equals 1 and zero otherwise.

$$\begin{aligned} T_{SA} = 1 \, , if \; pop_i < pop_d \\ T_{SA} = 0 \, , \; otherwise \end{aligned} \tag{14}$$

where pop_d is the population size of the dominate merger partner.

Equation (15) is called the subordinate partner model (B) if the population size of the subordinate merger partner is smaller than half of the population size of the dominant merger partner; in that case, T equals 1 and zero otherwise.

$$\begin{aligned} T_{SB} = 1 \, , if \; pop_i < \frac{pop_d}{2} \\ T_{SB} = 0 \, , \; otherwise \end{aligned} \tag{15}$$

These population sizes are measured from pre-merger data on each municipality. Only pop_{new} is measured using post-merger data.

5 Data

In the probit model, we use a Japanese municipality's data for FY1998. This means that the Special Municipal Mergers Law is enforced for 7 years, from FY1999 to FY2005. The first municipal merger involved four towns in FY1999. However, most of municipal mergers are concentrated in FY2004 and FY2005. We assume that there is a period of consultation period lasting a few years. Therefore, we employ the data for FY1998, just before the special law came into effect, to estimate probit model. Furthermore, we attempt to match similar propensity scores using various matching methods.

The number of municipalities that chose to merge in FY2004 is 831. The number of treatment observations is as follows: equation (13), 675; equation (14), 614; and equation (15), 497. In other words, there were many absorption-type mergers in Japan.

To estimate the predicted probability using the probit model, we use these following covariates: population, area, share of population over 65, share of population under 15, share of primary industry, share of tertiary industry, share of LAT grants, share of the specific grants and share of bond stock. The shares of LAT grants and specific grants are as a proportion of total municipal revenue. A municipality that is financially dependent on

transfers may choose to merge because it suffers from difficulties resulting from fiscal problems. The bond stock is per capita accumulated bond. We use period t-1 for the financial data such as LAT grants, specific grants and bond stock.

In the PSM and PSM-DID model, we employ the pre-merger fiscal data to calculate the ATET. We use expenditure and bond information for FY2003 as outcome variables for mergers conducted in FY2004. For example, if a subordinate merger partner engaged in a municipal merger in FY2004, we use total expenditure, investment expenses (non-subsidized public works expenses) and bond in FY2003 as outcome variables.

Data on municipal governments are derived primarily from the Shi Tyo Son Kessan Card (Statistics of the Final Accounts of Municipal Governments) and the Gappei Digital Archive (Digital Archive of Municipal Mergers).

Summary statistics are reported in Table 1. The mean of population size is 36,635. The maximum population size is approximately 3.3 million people, and the minimum population size is 204. The data on area also exhibit a wide range. Regarding the share of LAT grants, many municipalities receive them from the central government. Surprisingly, some municipalities received considerable LAT grants that accounted for 70 percent of total revenue, and there are few municipalities that do not depend on LAT grants.

6 Empirical results

6.1 DID results

In this section, similar to previous research, we estimate the ATET by the DID method. A descriptive comparison of the effect of a municipal merger on the merged municipalities is given in Fig. 1 from the basic model in equation (13). As the figure indicates, there is a substantial difference between the merged and non-merged municipalities. The per capita total expenditures of the merged municipalities equal approximately 800 thousand yen, while the per capita total expenditures of the non-merged municipalities equal approximately 600 thousand yen. In addition, per capita merged municipal expenditures exhibit an increase in FY2003. Nevertheless, per capita non-merged municipal expenditures exhibit a decreasing trend. We are also able to observe a clear distinction between the merged and non-merged groups beginning in FY2001.

Fig. 2 depicts the results for the subordinate merger partners. This figure depicts a similar tendency to that in Fig. 1. In terms of the per capita investment expenses and bond, the difference between two groups increased from FY2001 to FY2003. From this, we can see that the merged municipalities implicitly increase their bond for investment expenses just prior to mergers.

Moreover, estimated the average difference between the merged and non-merged municipalities using the DID method. Table 2 presents the results of the DID estimation. According to the basic model, it is evident that the findings for merged municipalities are statistically significant and that they increase expenditures and bond before mergers. The ATET for investment expenses equals approximately 24 thousand yen in FY2003 and that for bond is approximately 19 thousand yen in FY2003. Thus, most financial resources for new public projects are obtained via new bond. As subordinate merger partner models (A) and (B) show, small municipalities that are absorbed by larger municipalities exhibit marked increases in investment expenses and new bond. In subordinate merger partner model (B), investment expenses increase by approximately 22 thousand yen and bond increases by approximately 17 thousand yen. Thus, this might reflect the fiscal common pool problem.

However, note that these results are obtained using the DID method. To employ DID estimation in this case, it is necessary to satisfy the parallel trends assumption. When we use the DID method, both the treatment and control groups must be very similar during the pre-treatment period. In Figs. 1 and 2, we can see the different trends exhibited by the merged and non-merged municipalities. In other words, this raises concerns of sample selection bias. The merged municipalities may have a "propensity" that depends on certain conditions, and hence municipalities suffering from financial difficulties might choose to merge. In this case, we cannot obtain an unbiased estimator using the DID method.

6.2 PS estimation results

In this section, the empirical results concern the probit estimation used to calculate the propensity score. Table 3 reports the probit estimation results.

In the basic model, the coefficients for population and area are negative and statistically significant. The LAT grants and bond stock coefficients are positive and significant, while specific grants have a negative and significant coefficient. In subordinate merger models (A) and (B), the coefficients for population and area are negative and statistically significant. A small municipality is more likely to choose to be a subordinate merger partner. A small municipality facing an aging population is also likely to choose to be subordinate merger partner. This implies that a smaller municipality, in terms of size and area, is more likely to be a subordinate merger partner. Moreover, small municipalities that are dependent on LAT grants are more likely to choose to merge with larger municipalities because of the former's poor fiscal conditions. The coefficient of the specific grant is negative and significant.

The reason for this result concerns national policy. Since the collapse of the Japanese bubble economy in FY1991, specific grants and public projects

have been on the decline. Because municipalities can receive LAT grants due to a fiscal shortage, small municipalities tend to prefer the LAT grants to specific grants and bond for covering a fiscal deficit.

With the considerable mergers during the Heisei period, the central government decided to cut LAT grants for all municipalities because it faced a larger fiscal deficit than those faced by local governments. However, the merged municipalities were permitted to receive LAT grants from the central government for 10 years just as they had before merging under the Special Municipal Mergers Law.

Similarly, the merged municipalities are permitted to issue special bond after mergers under the special law. If the merged municipalities use this special bond after mergers, the central government promises to repay 70 percent of the fiscal burden of a new public project.

Therefore, we consider that these municipalities chose to engage in mergers during the period when the special law was applicable. It should be emphasized that, under the special law, the special bond is not authorized before mergers. That is, before merging, municipalities were required to pay their own bond.

Thus, we examined whether Japanese municipal mergers were more likely depending on municipal characteristics such as population size, area, and fiscal conditions. The effects of these characteristics mean that the number of absorption-type mergers is larger than the number of equal-type mergers. In other words, because small Japanese municipalities in poor fiscal condition chose to pursue municipal mergers, we need to assume that assignment to the merged municipality group is nonrandom. We were able to confirm the presence of sample selection bias in the DID estimation. Therefore, we cannot use DID estimation to calculate the ATET for Japanese municipal mergers. The PSM method is very helpful in addressing this issue.

Fig. 3 depicts the balanced propensity scores after the PSM method using the probit estimation results. Because we imposed the common support assumption, the score of control group indicates whether inference is off support or on support.

Fig. 4 and Table 4 report the results of a balancing test before and after the PSM. The results of the balancing test after matching cannot reject the approach of matching the data on each covariate. Importantly, the PSM reduces the bias from before to after the matching, while there is a substantial difference between unmatched and matched data on variables such as population, area, share of population over 65 and share of LAT grants.

In the basic model, the average population of control group municipalities shifts from 44,103 to 8341 after matching. Both the treatment and control groups have nearly identical population sizes after matching. The population of matched observations is approximately 8,400. The average area of control group municipalities shifts from 125 to 79 and the bias im-

proved from -42 to -1.5 after matching. Similarly, comparing before and after matching, the PSM method substantially improved the average of other covariates such as the LAT grants, specific grants and debt stock. This method enabled us to reduce the substantial bias induced by the imbalance between the treatment and control groups.

In subordinate merger models (A) and (B), matching reduces the bias of many covariates is by approximately 40 percent. Moreover, the bias in estimates of the share of the population over 65 and LAT grants is improved by attenuated by 70 percent. Because some large municipalities did not need to merge are included in the control group before matching, the results of the DID method exhibit substantial bias.

Thus, the PSM method makes it possible to compare very similar municipalities to one another. In other words, we were able to attenuate the sample selection bias presented by the context of municipal mergers.

6.3 PSM results

Next, we report the results of the PSM in Table 5. The results clearly indicate reduced bias compared with the DID method in Table 2. We estimated the ATET on expenditures and bond using nearest neighbor, radius and kernel matching. Most of the results for FY2003 are statistically significant at the 1 or 5 percent level, whereas the results for FY2002 are not statistically significant. Interestingly, the results are different from those obtained from the DID method.

In the basic model, per capita total expenditures increase by between 58 and 67 thousand yen and per capita investment expenses increase by approximately 27 thousand yen in FY2003 relative to non-merged municipalities. Per capita bond was approximately 21 thousand yen in FY2003. This result is larger than that in the DID results.

In subordinate merger model (A), there is a difference in the results for per capita total expenditure. The result from the nearest neighbor matching is not statistically significant, while radius and kernel matching are significant. The reason is that this model included relatively large municipalities in the treatment group that are not subordinate partners. Thus, these results may be affected by the effects of equal-type mergers. The results for per capita investment expenses are between 22 and 27 thousand yen, while the results for per capita bond are between 17 and 22 thousand yen. Even in this case, the merged municipalities covered the cost of public projects using new bond.

In subordinate merger model (B), we can clearly see that small municipalities that chose to be a subordinate merger partner increased their expenditures and bond for public projects. Per capita total expenditures increase by between 70 and 80 thousand yen more than in other cases. Per capita investment expenses are statistically significant at the 1 percent level.

The subordinate merger partner increases investment expenses by, on average, approximately 25 thousand yen in FY2003 when we used nearest neighbor matching. Similarly, the results of radius and kernel matching are positive and significant, indicating an increase of approximately 30 thousand yen. Comparing FY2003 to FY2002, the ATET of investment expenses in FY2003 is larger than that in FY2002. Because subordinate merger partners expected dominant merger partners to carry the financial burden, they increase investment expenses considerably just before mergers. Per capita bond is positive and statistically significant at the 1 percent level in FY2003. The subordinate merger partner increases per capita bond on average by 25 thousand yen in FY2003 using nearest neighbor matching. Both radius and kernel matching yield roughly the same ATET. Moreover, the ATET of bond in FY2003 was large compared with the results for FY2002. The subordinate merger partner also increases its bond by the end of the pre-merger year.

6.4 PSM with DID results

In the preceding section, we obtained our results using the PSM method that allowed us to address the sample selection bias in municipal mergers. In attempt to identify the fiscal effect of municipal mergers, we also consider time-consistent unobserved effects. For this reason, we employ the PSM-DID method in this section.

Table 6 reports the results of the PSM-DID method. All results exhibit substantially reduced bias compared with the previous results and are statistically significant at the 1 percent level. After considering both sample selection bias and time-consistent unobserved effects, the amount of total expenditure, investment expenses and bond increases rapidly by the end of pre-merger year. In particular, we are able to attenuate the bias in subordinate merger models (A) and (B) relative to the DID and PSM methods.

In the basic model, per capita total expenditures increase by between 43 and 48 thousand yen and per capita investment expenses increase by between 24 and 29 thousand yen in FY2003. Moreover, per capita bond is between 15 and 16 thousand yen in FY2003. These results lower than the corresponding PSM results.

In subordinate merger model (A), we were are able to attenuate bias relative to the results in Table 2 and 5. Per capita total expenditures are between 43 and 48 thousand yen in FY2003. Similarly, per capita investment expenses increase by between 24 and 29 thousand yen in FY2003. However, the per capita bond is between 12 and 17 thousand yen.

In subordinate merger model (B), we are able to identify a fiscal common pool problem involving the smaller subordinate merger partner. The smaller subordinate merger partners rapidly increase their per capita total expenditures by between 44 and 47 thousand yen. Simultaneously, they in-

crease investment expenses by approximately 24 thousand yen in FY2003 and slightly increase them by approximately 12 thousand yen in FY2002. Most investment expenses are covered by new bond because the per capita bond increases by between 15 and 19 thousand yet.

This is why the central government required a consultation period of one or two years as a condition for applying for the Special Municipal Mergers Law. The subordinate merger partners, which have a higher merger probability, began to plan their new public projects two years prior to their mergers.

An important point is that the merged municipalities create a fiscal common pool problem just before mergers and then depend on the dominant merger partner.

6.5 Robustness checks

To check of the robustness of our results, Table 7 reports results using placebo treatment periods. We calculated the ATET for the pre-treatment years. If we cannot reject the null hypothesis that the placebo ATET is zero, then there are no average differences between the merged and non-merged municipalities in pre-merged years.

As mentioned above, the merged municipalities decided to merge at least one or two years prior to the merger, and we cannot expect to observe a fiscal common pool effect over the 3 years prior to the merger. Municipalities might not increase their expenditures and bond in the pre-merger years because they had not yet selected their merger partners. Thus, we calculated the data for FY2000 and FY2001 in Table 7.

No results in Table 7 are statistically significant. There are no differences between the merged and non-merged municipalities in this period. Thus, the merged municipalities began to increase new public projects and bond immediately after beginning the merger consultation.

Moreover, Tables A.1 - A.4 report results for mergers in the year 2005. These results exhibit the same tendency as for mergers in the year 2004. In particular, as indicated in Table A.4, the merged municipalities increase their expenditures and bond just before mergers. One reason for this is that most of the merged municipalities in FY2005 selected merger partners before the deadline specified in the special law. Because the mergers needed to have been successfully completed by the end of FY2005, they increased expenditures and bond only one year prior.

We also checked the dominant partner model in Tables B.1 -B.3. We set if the population size of the dominant merger partner is the largest in the merged municiplities, T equals 1 and zero otherwise. Table B.1 shows the results of probit estimation in the dominat partner model. In the dominant partner model, the coefficients for LAT grants and debt stock are negative, while specific grants is positive and statstically significant. The result was

contrary to the results of the subordinate partner model. The dominant partner has low dependence on the LAT grants as an unconditional grants. But they are dependent on specific grants and facing an aging population. Their specific grants would has been redueced by stick policy of Special Municipal Mergers Law after mergers if they had not choosen to merge. Therefore, they chose to be a dominant partner because they expected to receive more grants after mergers. Table B.2 shows the result of a balancing test before and after the PSM. We succeeded to match with each same propensity score. Table B.3 report the results of the PSM-DID methiod in the dominant partner model. What should be noted is that there are no differencese between the dominant partner and the non-merged municipalities. In other words, only the subordinate merger partner rapidly increase thier investment expenses and bond just before mergers. The results show the fiscal common pool problem on Japanese municipal mergers.

7 Concluding remarks

In this paper, we analyzed the fiscal common pool problem in Japan's municipal mergers in the context of a national policy, the Special Municipal Mergers Law. Considering the heterogeneity of the treatment effects, we mainly focued on expenditures and bond of the subordinate merger partner just before mergers.

First, we found that Japanese municipal mergers have a certain likelihood depending on municipal characteristics such as population size, area, and fiscal conditions using a probit model. In particular, small municipalities that are dependent on the LAT grants are more likely to choose to merge with larger municipalities under the Special Municipal Mergers Law because of the their poor fiscal conditions. The subordinate merger partner was worried the stick policy, which they would have been greatly reduced the LAT grants by the central government if they had not chosen to merge during the period. Thus, Japanese municipal mergers are non-voluntary and non-random. In other words, the central government induced municipal mergers. Japanese municipal mergers are "not" randomly assigned.

Second, we revealed a fiscal common pool problem consistent with the law of $1/n$ using the PSM-DID method. Especially, we found the difference of fiscal effects between the subordinate and the dominant merger partner. Based on the results for investment expenses and local bond, we observed fiscal common pool effects in Japanese municipal mergers. Because the subordinate merger partner faced severe fiscal conditions, it elected to merge with a dominant merger partner. Subordinate merger partners increased their investment expenses and local bond in an effort to offset their additional costs by shifting the burden to the dominant merger partner. On the contrary, the dominant merger partner didn't increase their investment

expenses and bond. The fiscal common pool problem in Japanese municipal mergers is mainly due to the subordinate merger partner. That is to say, the dominant merger partner didn't lead to additional fiscal burden just before mergers because they would be most likely to pay their own burden.

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Table 1: Summary statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
Pop.	3220	36635.32	122303.90	204.00	3351612.00
Area	3220	115.15	135.83	1.27	1408.10
Pop. 65	3220	0.21	0.07	0.06	0.49
Pop. 15	3220	0.16	0.02	0.03	0.25
Primary ind	3220	16.82	11.94	0.10	79.40
Ttertiary ind	3220	49.51	10.87	19.70	88.80
LAT grants	3220	0.30	0.13	0.00	0.70
Specific grants	3220	0.08	0.04	0.01	0.42
Debt (stock)	3220	672.32	543.27	59.04	5534.37
Total expenditure 2004 (per capita)	2256	567.69	368.11	220.04	3800.06
Total expenditure 2003 (per captia)	3077	614.26	416.40	196.15	4924.69
Total expenditure 2002 (per captia)	3188	619.13	425.70	219.21	6355.17
Investment expenses 2004 (per capita)	2256	65.82	75.62	0.47	1043.36
Investment expenses 2003 (per capita)	3077	81.32	92.09	1.43	1101.35
Investment expenses 2002 (per capita)	3182	87.29	99.67	2.75	1955.18
Bond 2004 (per capita)	2250	68.64	63.79	0.60	954.03
Bond 2003 (per capita)	3072	92.91	83.75	0.47	1289.11
Bond 2002 (per capita)	3188	83.29	89.74	0.00	1762.94

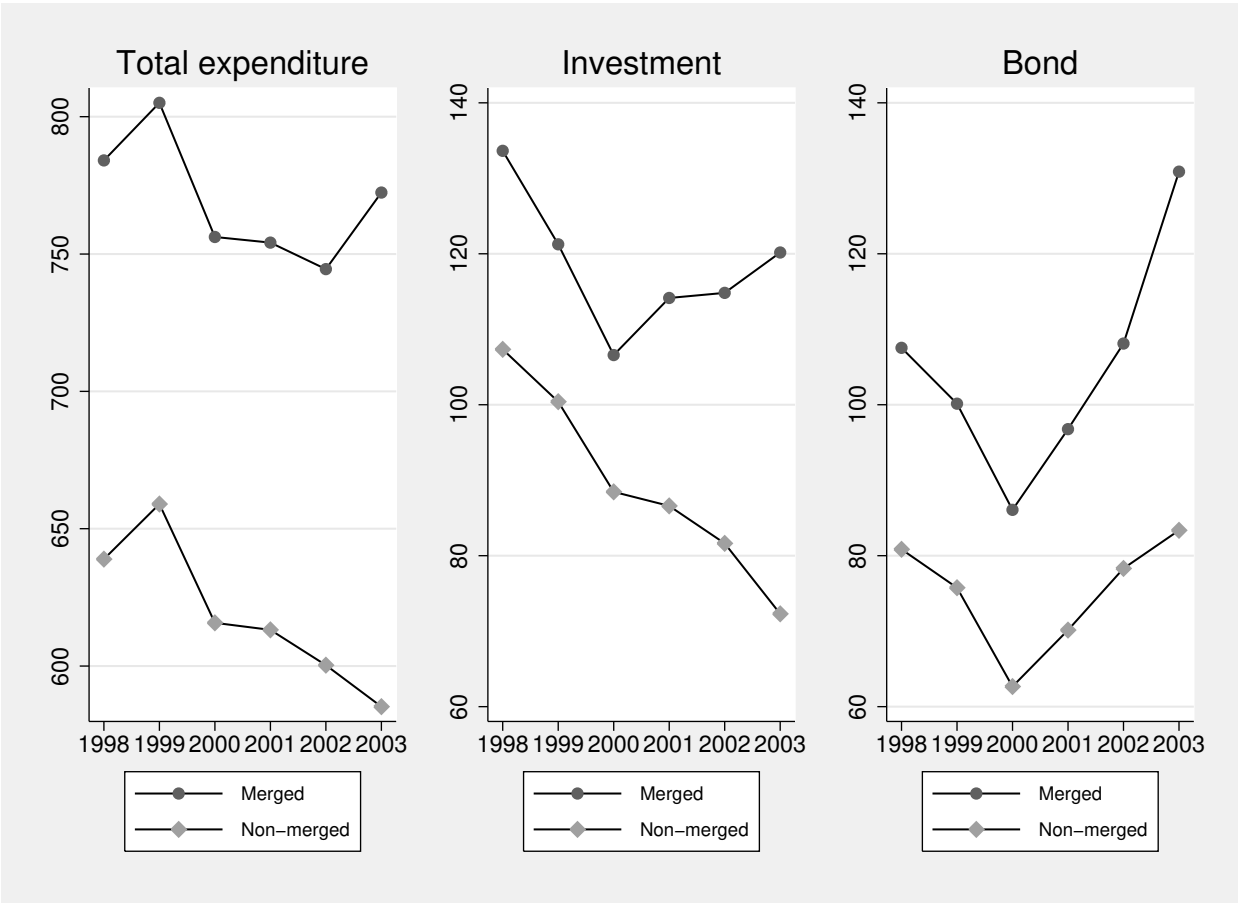

Figure 1: Basic model.

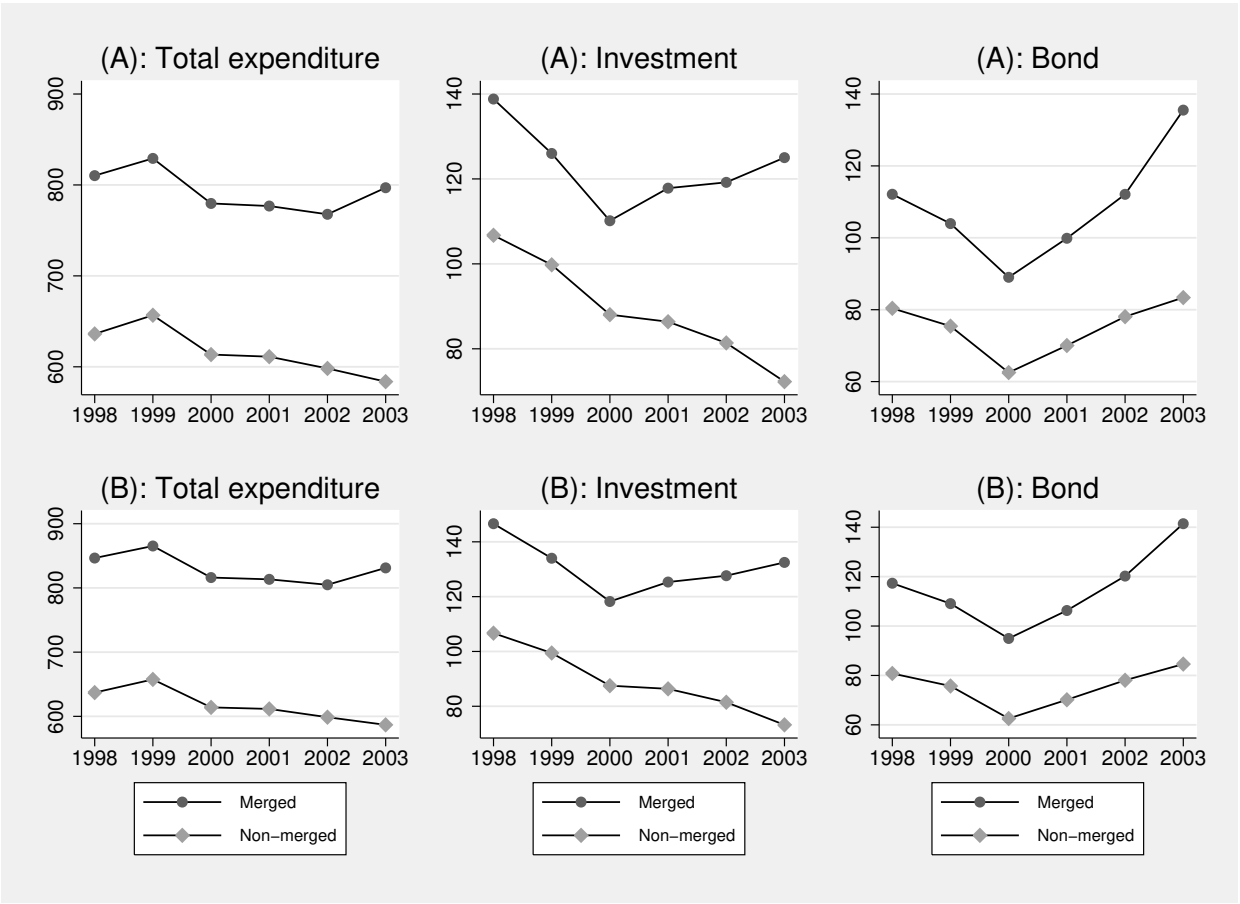

Figure 2: Subordinate merger model.

Table 2: Results of DID estimation.

	Total expenditure		Investment		Bond	
	2003	2002	2003	2002	2003	2002
Basic model						
ATET	42.318***	5.396	23.565***	9.462**	19.327***	3.370
	(8.031)	(7.714)	(4.929)	(4.768)	(3.972)	(3.974)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Obs	3,077	3,188	3,077	3,182	3,068	3,181
R-squared	0.023	0.017	0.015	0.007	0.016	0.004
Subordinate merger (A)						
ATET	33.432***	-4.964	20.817***	6.629	17.675***	1.748
	(8.415)	(8.158)	(5.125)	(4.964)	(4.276)	(4.337)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Obs	3,077	3,188	3,077	3,182	3,068	3,181
R-squared	0.008	0.003	0.011	0.006	0.017	0.001
Subordinate merger (B)						
ATET	35.055***	4.542	22.054***	9.798*	17.244***	5.606
	(9.562)	(9.440)	(5.996)	(5.798)	(4.802)	(4.912)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Obs	3,077	3,188	3,077	3,182	3,068	3,181
R-squared	0.018	0.018	0.013	0.01	0.018	0.005

Notes: ***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively. Standard errors are reported in brackets. The per capita total expenditure, investment expenses and debt are thousands of Japanese yen.

Table 3: Results of propensity score using probit model.

Variables	Basic model (T=675)	Subordinate merger (A) (T=614)	Subordinate merger (B) (T=497)
Pop.	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)
Area	-0.003***	-0.003***	-0.003***
	(0.000)	(0.000)	(0.000)
Pop. 65		2.367***	0.651
		(0.799)	(0.866)
Pop.15		-1.662	-4.956***
		(1.733)	(1.866)
Primary ind	-0.007**		-0.007**
	(0.003)		(0.004)
Ttertiary ind	-0.017***		-0.020***
	(0.004)		(0.005)
LAT grants	0.964***	0.747**	0.759**
	(0.340)	(0.349)	(0.385)
Specific grants	-1.699**	-2.465***	-1.698*
	(0.864)	(0.893)	(0.980)
Debt (stock)	0.000***	0.000	0.000**
	(0.000)	(0.000)	(0.000)
Constant	0.485*	-0.519	1.126**
	(0.263)	(0.398)	(0.528)
Obs	3220	3220	3220
Log likelihood	-1392.8679	-1296.2931	-1143.1596

Notes: ***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively. Standard errors are reported in brackets.

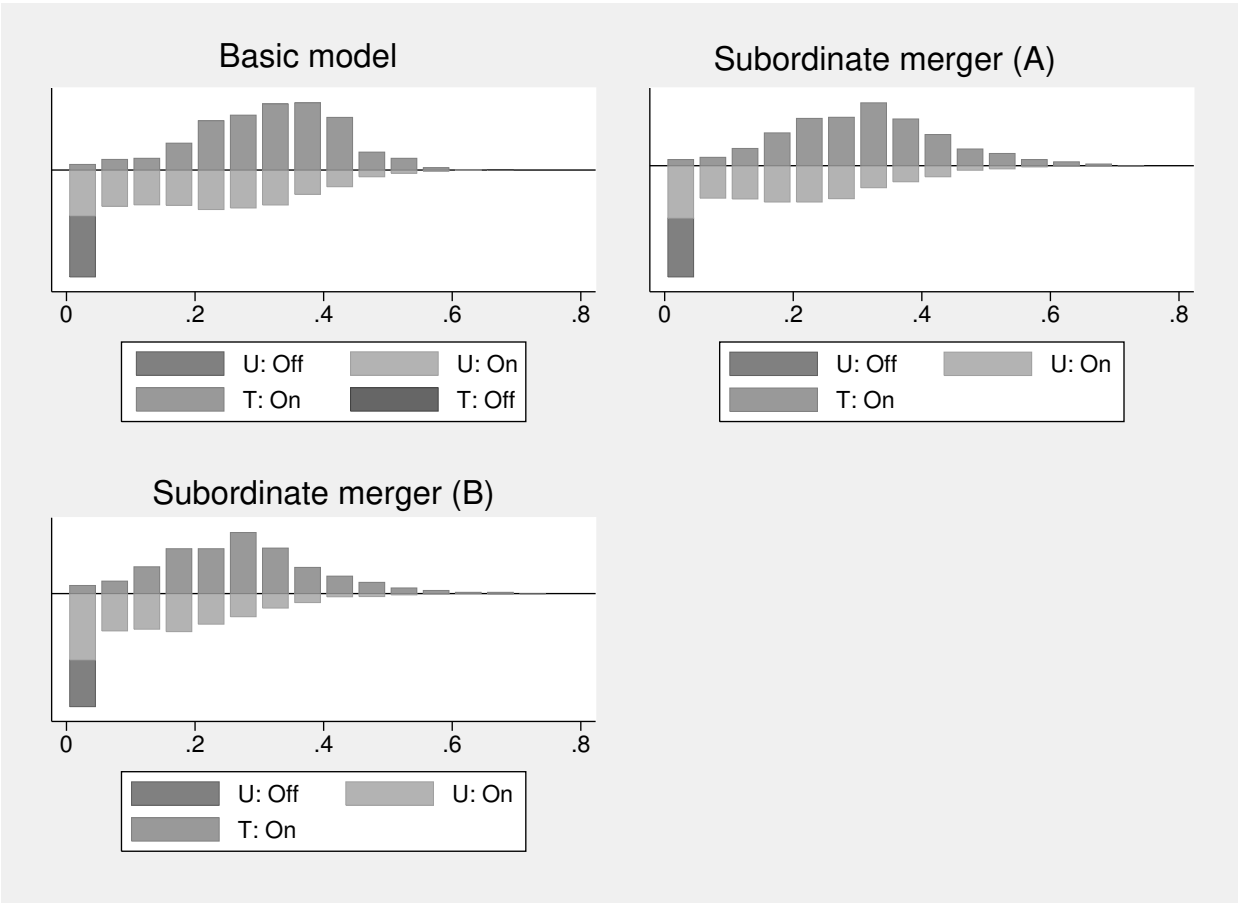

Figure 3: Balanced propensity score.
Notes: U shows the unmatched data, and M shows the matched data. Off shows the off-support data, and On shows the on-support data.

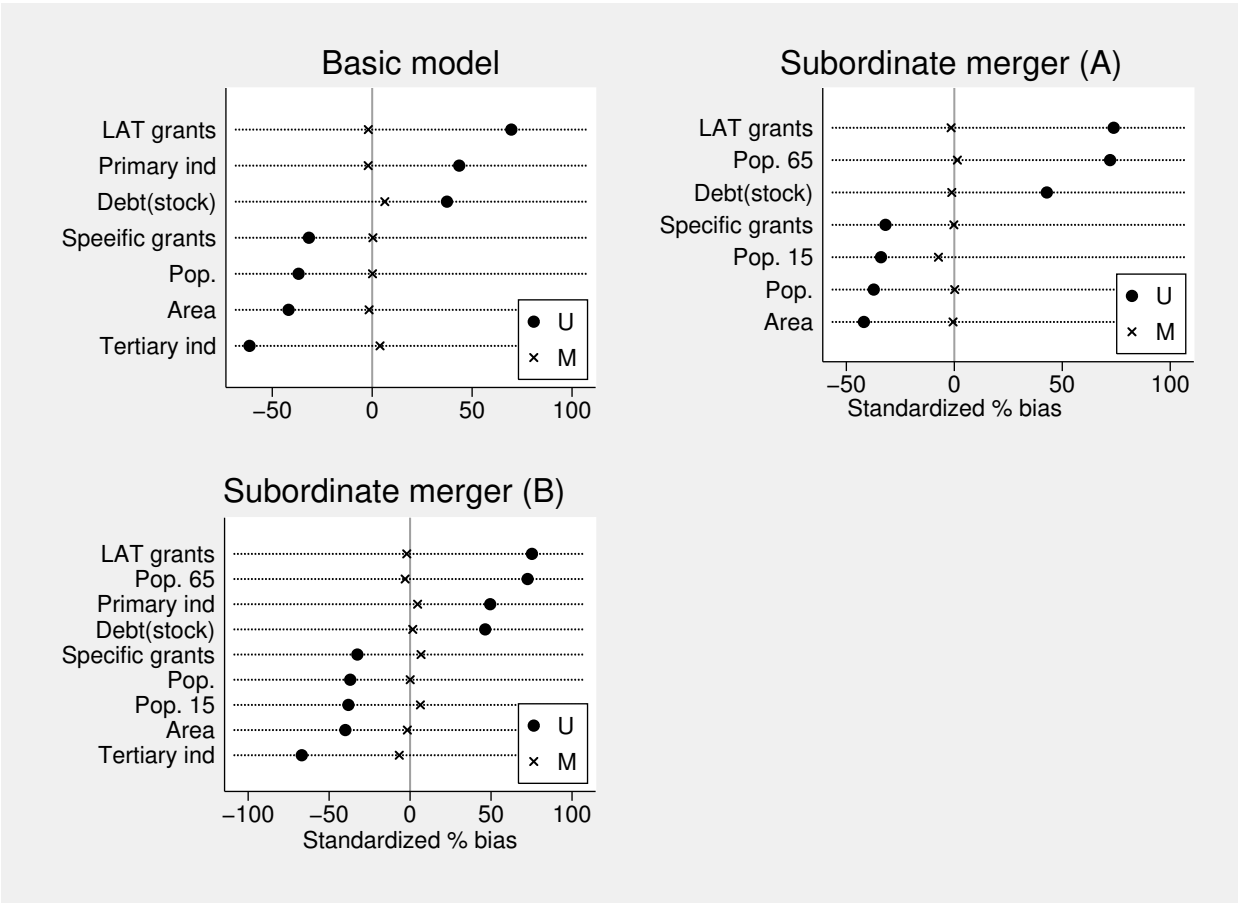

Figure 4: Standardized differences bias across covariates.
Notes: U shows the unmatched data, and M shows the matched data.

Table 4: Results of balancing test.

Variables		Treated	Control	bias	t
Basic model					
Pop.	U	8481	44103	-36.80	-6.77***
	M	8493	8341	0.20	0.38
Area	U	77.53	125.13	-41.90	-8.18***
	M	77.62	79.38	-1.50	-0.46
Primary ind	U	20.81	15.76	43.50	9.93***
	M	20.82	21.06	-2.00	-0.36
Ttertiary ind	U	44.75	50.77	-61.40	-13.12***
	M	44.73	44.35	3.90	0.85
LAT grants	U	0.36	0.28	69.60	14.52***
	M	0.36	0.37	-1.90	-0.44
Specific grants	U	0.07	0.08	-31.70	-6.98***
	M	0.07	0.07	0.40	0.07
Debt (stock)	U	839.72	627.92	37.40	9.12***
	M	832.75	796.95	6.30	1.13
Subordinate merger (A)					
Pop.	U	7769	43437	-37.30	-6.54***
	M	7769	7598	0.20	0.46
Area	U	76.82	124.18	-41.90	-7.85***
	M	76.82	77.50	-0.60	-0.18
Pop. 65	U	0.24	0.20	72.10	16.02***
	M	0.24	0.24	1.40	0.25
Pop.15	U	0.16	0.16	-34.00	-7.63***
	M	0.16	0.16	-7.30	-1.20
LAT grants	U	0.37	0.28	73.80	14.73***
	M	0.37	0.37	-1.50	-0.32
Specific grants	U	0.07	0.08	-31.90	-6.81***
	M	0.07	0.07	-0.20	-0.04
Debt (stock)	U	871.04	625.49	42.80	10.24***
	M	871.04	877.81	-1.20	-0.18
Subordinate merger (B)					
Pop.	U	7349	41981	-37.000	-5.83***
	M	7349	7289	0.10	0.15
Area	U	77.33	122.06	-40.00	-6.8***
	M	77.33	79.23	-1.70	-0.44
Pop. 65	U	0.25	0.20	72.50	14.79***
	M	0.25	0.25	-3.10	-0.48
Pop.15	U	0.15	0.16	-38.10	-7.91***
	M	0.15	0.15	6.40	0.95
Primary ind	U	21.70	15.93	49.50	10.06***
	M	21.70	21.15	4.60	0.74
Ttertiary ind	U	43.99	50.52	-66.90	-12.61***
	M	43.99	44.64	-6.70	-1.21
LAT grants	U	0.37	0.29	75.20	13.59***
	M	0.37	0.38	-2.10	-0.39
Specific grants	U	0.07	0.08	-32.60	-6.37***
	M	0.07	0.07	6.80	1.15
Debt (stock)	U	904.84	629.88	46.40	10.55***
	M	904.84	895.05	1.70	0.23

Notes: ***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively. U shows the unmatched data, and M shows the matched data after propensity score matching.

Table 5: Results of PSM.

	Total expenditure		Investment		Bond	
	2003	2002	2003	2002	2003	2002
Basic model						
Nearest Neighbor Matching	58.182**	-8.490	31.211***	6.368	21.276***	-0.469
	(28.253)	(30.880)	(6.356)	(8.009)	(5.822)	(7.307)
On support: Treated	674	674	674	672	674	674
On support: Control	2,015	2,118	2,015	2,114	2,006	2,111
Radius Matching	62.066***	21.810	27.329***	11.287**	19.831***	6.923
	(22.246)	(22.468)	(5.222)	(5.758)	(4.504)	(4.825)
On support: Treated	673	673	673	671	673	673
On support: Control	2,010	2,113	2,010	2,109	2,001	2,106
Kernel Matching	67.420***	26.439	26.923***	11.597**	21.090***	8.165*
	(22.075)	(22.255)	(5.192)	(5.715)	(4.472)	(4.772)
On support: Treated	674	674	674	672	674	674
On support: Control	2015	2118	2015	2114	2006	2111
Subordinate merger (A)						
Nearest Neighbor Matching	34.761	-13.565	25.567***	9.812	19.678***	5.837
	(31.750)	(33.685)	(7.297)	(8.426)	(5.806)	(7.531)
On support: Treated	614	614	614	612	614	614
On support: Control	2,039	2,142	2,039	2,138	2,030	2,135
Radius Matching	72.719***	32.468	27.453***	11.736*	22.277***	9.354*
	(23.506)	(23.691)	(5.482)	(6.091)	(4.751)	(5.058)
On support: Treated	614	614	614	612	614	614
On support: Control	2,039	2,142	2,039	2,138	2,030	2,135
Kernel Matching	47.135**	10.168	22.225***	7.108	17.851***	5.460
	(23.828)	(23.959)	(5.546)	(6.144)	(4.814)	(5.116)
On support: Treated	614	614	614	612	614	614
On support: Control	2,039	2,142	2,039	2,138	2,030	2,135
Subordinate merger (B)						
Nearest Neighbor Matching	80.538**	45.414	25.752***	8.902	25.124***	16.737**
	(36.924)	(35.790)	(9.232)	(9.985)	(7.680)	(7.653)
On support: Treated	497	497	497	495	497	497
On support: Control	2,190	2,293	2,190	2,290	2,181	2,286
Radius Matching	69.323**	33.343	30.360***	16.588**	21.268***	12.105**
	(27.077)	(27.520)	(6.453)	(7.266)	(5.471)	(5.945)
On support: Treated	493	493	493	491	493	493
On support: Control	2,189	2,291	2,189	2,288	2,180	2,284
Kernel Matching	75.617***	32.570	30.777***	14.997**	21.864***	12.598**
	(26.816)	(27.272)	(6.393)	(7.191)	(5.408)	(5.871)
On support: Treated	495	496	495	494	495	496
On support: Control	2,190	2,293	2,190	2,290	2,181	2,286

Notes: ***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively. Standard errors are reported in brackets. The r for the radius matching is 0.01, and the bandwidth for the kernel matching is 0.06.

Table 6: Results of PSM with DID.

	Total expenditure		Investment		Bond	
	2003	2002	2003	2002	2003	2002
Basic model						
Nearest Neighbor Matching	42.921***	-13.597	29.490***	5.203	16.000***	-6.289
	(11.142)	(13.320)	(6.582)	(6.934)	(7.302)	(6.673)
On support: Treated	674	674	674	672	674	674
On support: Control	2,015	2,118	2,015	2,114	2,006	2,111
Radius Matching	47.508***	8.723	25.885***	10.460**	15.475***	2.250
	(8.618)	(8.296)	(5.249)	(5.104)	(4.342)	(4.301)
On support: Treated	673	673	673	671	673	673
On support: Control	2,010	2,113	2,010	2,109	2,001	2,106
Kernel Matching	46.875***	7.460	24.171***	9.398*	15.149***	1.983
	(8.534)	(8.185)	(5.210)	(5.056)	(4.307)	(4.253)
On support: Treated	674	674	674	672	674	674
On support: Control	2,015	2,118	2,015	2,114	2,006	2,111
Subordinate merger (A)						
Nearest Neighbor Matching	48.070***	-0.524	29.979***	12.267	17.880***	4.099
	(12.351)	(15.509)	(7.480)	(8.515)	(6.074)	(7.367)
On support: Treated	614	614	614	612	614	614
On support: Control	2,039	2,142	2,039	2,138	2,030	2,135
Radius Matching	43.084***	4.580	24.410***	9.562*	14.012***	0.628
	(9.062)	(8.675)	(5.518)	(5.365)	(4.597)	(4.524)
On support: Treated	614	614	614	612	614	614
On support: Control	2,039	2,142	2,039	2,138	2,030	2,135
Kernel Matching	43.345***	4.525	24.588***	9.763*	12.669***	-0.295
	(9.185)	(8.793)	(5.583)	(5.056)	(4.649)	(4.572)
On support: Treated	614	614	614	612	614	614
On support: Control	2,039	2,142	2,039	2,138	2,030	2,135
Subordinate merger (B)						
Nearest Neighbor Matching	47.467***	11.350	24.733***	12.768	19.366***	7.085
	(14.058)	(13.978)	(8.566)	(7.987)	(7.302)	(6.938)
On support: Treated	497	497	497	495	497	497
On support: Control	2,190	2,293	2,190	2,290	2,181	2,286
Radius Matching	46.613***	12.953	24.975***	12.500**	15.175***	5.427
	(10.366)	(10.020)	(6.482)	(6.329)	(5.310)	(5.245)
On support: Treated	493	493	493	491	93	493
On support: Control	2,189	2,291	2,189	2,288	2,180	2,284
Kernel Matching	44.123***	15.749	24.960***	13.759**	15.107***	6.272
	(10.301)	(9.892)	(6.410)	(6.254)	(5.261)	(5.185)
On support: Treated	495	496	495	494	495	496
On support: Control	2,190	2,293	2,190	2,290	2,181	2,286

Notes: ***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively. Standard errors are reported in brackets. The r for the radius matching is 0.01, and the bandwidth for the kernel matching is 0.06.

Table 7: Results of placebo treatments.

	Total expenditure		Investment		Bond	
	2001	2000	2001	2000	2001	2000
Basic model						
Nearest Neighbor Matching	-13.721	-7.975	2.304	-7.309	-6.887	-5.345
	(11.670)	(10.487)	(6.377)	(6.536)	(5.829)	(5.342)
On support: Treated	674	674	674	674	674	674
On support: Control	2,132	2,136	2,132	2,136	2,122	2,126
Radius Matching	2.496	-0.627	4.076	-2.738	0.501	-0.540
	(8.170)	(7.505)	(4.723)	(4.548)	(4.236)	(3.948)
On support: Treated	673	673	673	673	673	673
On support: Control	2,127	2,131	2,127	2,131	2,117	2,121
Kernel Matching	2.865	-1.809	3.931	-3.628	0.475	-1.129
	(8.072)	(7.412)	(4.667)	(4.510)	(4.195)	(3.909)
On support: Treated	674	674	674	674	674	674
On support: Control	2,132	2,136	2,132	2,136	2,122	2,126
Subordinate merger (A)						
Nearest Neighbor Matching	-6.667	-12.634	11.850	0.814	3.972	0.708
	(13.197)	(12.417)	(7.357)	(6.254)	(6.132)	(5.673)
On support: Treated	614	614	614	614	614	614
On support: Control	2,156	2,160	2,156	2,160	2,146	2,150
Radius Matching	-1.750	-2.908	2.770	-3.760	-1.674	-2.112
	(8.574)	(7.842)	(4.923)	(4.766)	(4.476)	(4.160)
On support: Treated	614	614	614	614	614	614
On support: Control	2,156	2,160	2,156	2,160	2,146	2,150
Kernel Matching	-3.023	-2.596	2.050	-3.091	-3.014	-1.840
	(8.666)	(7.943)	(4.978)	(4.814)	(4.513)	(4.200)
On support: Treated	614	614	614	614	614	614
On support: Control	2,156	2,160	2,156	2,160	2,146	2,150
Subordinate merger (B)						
Nearest Neighbor Matching	-0.070	6.052	-2.526	2.794	-3.548	5.550
	(13.911)	(12.790)	(8.076)	(7.054)	(6.923)	(6.361)
On support: Treated	497	497	497	497	497	497
On support: Control	2,307	2,311	2,307	2,311	2,297	2,301
Radius Matching	3.356	3.969	4.538	-0.284	1.850	2.478
	(9.967)	(9.144)	(5.782)	(5.637)	(5.188)	(4.817)
On support: Treated	493	493	493	493	493	493
On support: Control	2,305	2,309	2,305	2,309	2,295	2,299
Kernel Matching	6.239	4.681	4.481	-0.327	0.925	1.358
	(9.850)	(9.025)	(5.715)	(5.568)	(5.147)	(4.773)
On support: Treated	496	496	496	496	496	496
On support: Control	2,307	2,311	2,307	2,311	2,297	2,301

Notes: ***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively. Standard errors are reported in brackets. The r for the radius matching is 0.01, and the bandwidth for the kernel matching is 0.06.

A Additional results in merged year 2005

A.1 Differences in Differences

Table A.1: DID estimation in FY2005.

	Total expenditure		Investment		Bond	
	2004	2003	2004	2003	2004	2003
Basic model						
ATET	38.217***	-5.445	24.889***	2.902	14.594***	4.500
	(7.830)	(6.435)	(4.090)	(3.918)	(3.103)	(3.226)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Obs	2,256	3,077	2,256	3,077	2,247	3,068
R-squared	0.038	0.011	0.025	0.004	0.019	0.005
Subordinate merger (A)						
ATET	34.241***	-5.531	24.134***	3.691	15.070***	6.240*
	(8.034)	(6.714)	(4.272)	(4.111)	(3.286)	(3.367)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Obs	2,256	3,077	2,256	3,077	2,247	3,068
R-squared	0.035	0.011	0.024	0.004	0.019	0.006
Subordinate merger (B)						
ATET	25.438***	-13.027*	16.874***	-4.320	12.678***	3.720
	(9.033)	(7.727)	(4.831)	(4.487)	(3.795)	(3.876)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Obs	2,256	3,077	2,256	3,077	2,247	3,068
R-squared	0.017	0.001	0.024	0.003	0.014	0.009

Notes: ***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively. Standard errors are reported in brackets. The per capita total expenditure, investment expenses and debt are in thousands of Japanese yen.

A.2 Propensity score using probit model

Table A.2: Propensity score using probit model in FY2005.

Variables	Basic model (T=754)	Subordinate merger (A) (T=696)	Subordinate merger (B) (T=546)
Pop.	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)
Pop.2			0.000***
			(0.000)
Area	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)
Area2		0.000	
		(0.000)	
Pop. 65			-0.462
			(0.717)
Pop. 15			-0.844
			(1.685)
Primary ind	-0.006*	-0.006*	
	(0.003)	(0.003)	
Ttertiary ind	-0.007**	-0.010***	
	(0.004)	(0.004)	
LAT grants	0.746**	0.737**	1.060***
	(0.310)	(0.320)	(0.342)
Specific grants	-0.875	-1.362*	-2.231**
	(0.786)	(0.815)	(0.875)
Debt (stock)			
Constant	-0.025	0.121	-0.464
	(0.236)	(0.246)	(0.380)
Obs	3220	3220	3220
Log likelihood	-1596.8188	-1511.0845	-1320.8029

Notes: ***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively. Standard errors are reported in brackets.

A.3 Balancing test

Table A.3: Balancing test in FY2005

Variables		Treated	Control	bias	t
Basic model					
Pop.	U	10679	44599	-34.50	-6.72***
	M	10679	10321	0.40	0.71
Area	U	91.74	122.33	-24.70	-5.44***
	M	91.74	96.33	-3.70	-0.94
Primary ind	U	19.64	15.95	31.50	7.5***
	M	19.64	19.69	-0.40	-0.08
Ttertiary ind	U	46.14	50.54	-43.00	-9.89***
	M	46.14	46.24	-1.00	-0.20
LAT grants	U	0.35	0.28	53.70	12.05***
	M	0.35	0.35	-0.90	-0.20
Specific grants	U	0.07	0.08	-25.10	-5.86***
	M	0.07	0.07	-3.00	-0.57
Subordinate merger (A)					
Pop.	U	9835	44026	-35.20	-6.57***
	M	9835	9837	0.00	-0.01
Area	U	93.179	121.210	-22.60	-4.84***
	M	93.179	97.438	-3.40	-0.80
Area2	U	18944.000	35221.000	-18.60	-3.7***
	M	18944.000	19175.000	-0.30	-0.09
Primary ind	U	20.07	15.92	35.30	8.19***
	M	20.07	19.75	2.70	0.53
Ttertiary ind	U	45.65	50.57	-48.40	-10.77***
	M	45.65	45.16	4.80	0.98
LAT grants	U	0.36	0.28	58.60	12.69***
	M	0.36	0.35	5.20	1.11
Specific grants	U	0.07	0.08	-28.90	-6.51***
	M	0.07	0.07	7.80	1.62
Subordinate merger (B)					
Pop.	U	9135	42250	-35.00	-5.79***
	M	9150	9081	0.10	0.13
Pop.2	U	160000000	20000000000	-9.80	-1.64*
	M	160000000	150000000	0.00	0.24
Area	U	96.01	119.06	-18.70	-3.62***
	M	96.33	104.49	-6.60	-1.34
Pop. 65	U	0.23	0.20	46.90	9.62***
	M	0.23	0.23	7.10	1.23
Pop. 15	U	0.16	0.16	-15.20	-3.22***
	M	0.16	0.16	-2.50	-0.36
LAT grants	U	0.36	0.29	63.70	12.37***
	M	0.36	0.36	-0.70	-0.14
Specific grants	U	0.07	0.08	-32.20	-6.56***
	M	0.07	0.07	4.70	0.82

Notes: ***, **, * indicate statistical significance at 1, 5, 10 percent level, respectively.

A.4 PSM with DID

Table A.4: PSM with DID in FY2005.

	Total expenditure		Investment		Bond	
	2004	2003	2004	2003	2004	2003
Basic model						
Nearest Neighbor Matching	51.244***	1.368	40.124***	5.765	14.483***	3.200
	(11.117)	(10.425)	(6.510)	(6.453)	(4.899)	(5.138)
On support: Treated	756	756	546	756	754	754
On support: Control	1,322	2,110	1,322	2,110	1,314	2,101
Radius Matching	52.345***	-2.542	31.741***	3.425	16.649***	1.719
	(8.367)	(6.709)	(4.485)	(4.054)	(4.242)	(3.370)
On support: Treated	756	756	546	756	754	754
On support: Control	1,322	2,110	1,322	2,110	1,314	2,101
Kernel Matching	53.597***	-4.568	33.901***	2.799	16.049***	0.547
	(8.648)	(6.734)	(4.605)	(4.067)	(3.597)	(3.382)
On support: Treated	756	756	546	756	754	754
On support: Control	1,322	2,110	1,322	2,110	1,314	2,101
Subordinate merger (A)						
Nearest Neighbor Matching	47.414***	-9.891	35.875***	0.402	14.936***	4.117
	(13.790)	(11.372)	(7.069)	(6.767)	(5.437)	(5.712)
On support: Treated	696	696	696	696	694	694
On support: Control	1,384	2,172	1,384	2,172	1,377	2,165
Radius Matching	51.353***	-2.257	32.574***	4.491	17.851***	2.881
	(8.632)	(6.994)	(4.682)	(4.233)	(3.632)	(3.511)
On support: Treated	696	696	696	696	694	694
On support: Control	1,384	2,172	1,384	2,172	1,377	2,165
Kernel Matching	52.798***	-4.346	34.861***	3.966	17.006***	1.469
	(8.954)	(7.033)	(4.818)	(4.256)	(3.738)	(3.528)
On support: Treated	696	696	696	696	694	694
On support: Control	1,384	2,172	1,384	2,172	1,377	2,165
Subordinate merger (B)						
Nearest Neighbor Matching	48.896***	3.163	33.594***	2.101	15.906***	4.075
	(13.402)	(11.545)	(7.387)	(6.310)	(5.658)	(5.444)
On support: Treated	546	546	546	546	544	544
On support: Control	1,540	2,327	1,540	2,327	1,533	2,318
Radius Matching	38.239***	-10.366	26.067***	-2.656	12.053**	-1.652
	(9.849)	(7.931)	(5.359)	(4.592)	(4.242)	(4.076)
On support: Treated	545	546	545	546	544	544
On support: Control	1528	2,311	1,528	2,311	1,521	2,302
Kernel Matching	39.786***	-9.631	25.037***	-2.684	13.568***	-.0447
	(9.600)	(7.881)	(5.244)	(4.562)	(4.164)	(4.055)
On support: Treated	546	546	546	546	544	544
On support: Control	1,540	2,327	1,540	2,327	1,533	2,318

Notes: ***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively. Standard errors are reported in brackets. Standard errors of radius and kernel matching caluclated with the bootstrap method. We used 100 bootstrap iterations. The r for theradius matching is 0.01, and the bandwidth for the kernel matching is 0.06.

B Dominant merger partner model

B.1 Propensity score using probit model

Table B.1: Propensity score using probit model

Variables	Merged year 2004 (T=218)	Merged year 2005 (T=297)
Pop.	0.000	-0.000
	(0.000)	(0.000)
Area	0.001***	0.001***
	(0.000)	(0.000)
Pop. 65	6.129***	3.045***
	(1.118)	(0.973)
Pop. 15	7.580***	3.727*
	(2.369)	(2.066)
LAT grants	-1.838***	-1.494***
	(0.390)	(0.353)
specific grants	2.853***	4.180***
	(0.993)	(0.910)
Debt (stock)	-0.001***	-0.001***
	(0.000)	(0.000)
Constant	-3.234***	-2.090***
	(0.475)	(0.409)
Observations	3220	3220
Log likelihood	-739.910	-903.504

Notes: ***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively. Standard errors are reported in brackets.

B.2 Balancing test

Table B.2: Balancing test

Merged Year 2004

Variables		Treated	Control	bias	t
Dominant merger model					
Pop.	U	65401	34546	26.70	3.60***
	M	65401	54775	9.20	1.01
Area	U	132.59	113.88	15.90	1.96**
	M	132.59	122.29	8.80	0.87
Pop. 65	U	0.19	0.21	-24.00	-3.10***
	M	0.19	0.19	10.10	1.14
Pop. 15	U	0.17	0.16	23.20	2.90***
	M	0.17	0.17	-6.30	-0.67
LAT grants	U	0.25	0.30	-45.70	-6.23***
	M	0.25	0.24	2.80	0.30
Specific grants	U	0.09	0.08	35.40	4.80***
	M	0.09	0.09	-9.70	-0.89
Debt(Stock)	U	475.13	686.64	-49.40	-5.58***
	M	475.13	451.35	5.6	1.00

Merged year 2005

Variables		Treated	Control	bias	t
Dominant merger model					
Pop.	U	66844	33566	26.40	4.48***
	M	66844	69947	-2.50	-0.17
Area	U	146.25	111.99	25.60	4.15***
	M	146.25	165.09	-14.10	-1.25
Pop. 65	U	0.18	0.21	-41.70	-6.04***
	M	0.18	0.19	-2.20	-0.29
Pop. 15	U	0.17	0.16	24.20	3.71***
	M	0.17	0.16	8.00	1
LAT grants	U	0.24	0.31	-53.60	-8.44***
	M	0.24	0.24	-2.70	-0.32
Specific grants	U	0.09	0.08	41.40	6.56***
	M	0.09	0.09	-2.60	-0.28
Debt(Stock)	U	459.77	693.91	-54.60	-7.13***
	M	459.77	482.97	-5.4	-1.11

Notes: ***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively. U shows the unmatched data, and M shows the matched data after propensity score matching.

B.3 PSM with DID

Table B.3: PSM with DID

Merged year 2004	Total expenditure		Investment		Bond	
	2003	2002	2003	2002	2003	2002
Dominant merger model						
Nearest Neighbor Matching	25.148***	16.405**	5.667	2.647	-0.722	-3.861
	(9.769)	(8.350)	(5.806)	(5.678)	(3.960)	(4.056)
On support: Treated	218	218	218	218	218	218
Control	2,503	2,601	2,503	2,595	2,496	2,595
Radius Matching	17.607***	17.304***	2.360	3.842	-5.474*	-1.586
	(5.212)	(5.117)	(3.859)	(3.790)	(2.890)	(2.865)
On support: Treated	218	218	218	218	218	218
Control	2,503	2,601	2,503	2,595	2,496	2,595
Kernel Matching	16.213***	15.567***	1.765	3.053	-4.175	-1.353
	(5.319)	(5.207)	(3.915)	(3.836)	(2.938)	(2.907)
On support: Treated	218	218	218	218	218	218
Control	2,503	2,601	2,503	2,595	2,496	2,595

Merged year 2005	Total expenditure		Investment		Bond	
	2004	2003	2004	2003	2004	2003
Dominant merger model						
Nearest Neighbor Matching	15.889*	6.476	1.188	-0.022	0.265	-1.494
	(9.535)	(7.815)	(4.775)	(4.901)	(3.971)	(3.981)
On support: Treated	297	297	297	297	297	297
Control	1,805	2,525	1,805	2,525	1,796	2,516
Radius Matching	16.064***	1.134	0.641	-2.951	-2.568	-8.148***
	(6.121)	(5.183)	(3.127)	(3.174)	(2.855)	(2.623)
On support: Treated	297	297	297	297	297	297
Control	1,805	2,525	1,805	2,525	1,796	2,516
Kernel Matching	12.486**	-1.351	-0.797	-4.094	-2.886	-6.917**
	(6.321)	(5.361)	(3.261)	(3.289)	(2.932)	(2.709)
On support: Treated	297	297	297	297	297	297
Control	1,805	2,525	1,805	2,525	1,796	2,516

Notes: ***, **, and * indicate statistical significance at the 1, 5, and 10 percent level, respectively. Standard errors are reported in brackets. Standard errors of radius and kernel matching caluclated with the bootstrap method. We used 100 bootstrap iterations. The r for theradius matching is 0.01, and the bandwidth for the kernel matching is 0.06.