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Municipality amalgamation in Japan: an examination using event history analysis

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Abstract

This study considers the factors behind municipality amalgamation in Japan from fiscal year 1999 to 2005 by using event history analysis. We use a discrete-time logistic model and a 21,165 person-year dataset. Our findings show that the central government's carrot-and-stick policy strongly influenced municipality amalgamation for those with high ratios of inter-governmental grants to total revenue. Moreover, the amalgamation of neighboring municipalities became a trigger for other municipalities to amalgamate.

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1. Introduction

Many countries have implemented municipality amalgamation or boundary reform in order to create larger local governments. Several studies on this topic have focused on the local public expenditure of the municipality *after* amalgamation (Mehay, 1981; Liner, 1992, 1994; Bish, 2001; Byrnes and Dollery, 2002; Reingewertz, 2012). However, only a few have paid attention to the decision making of the municipality beforehand.

Bhatti and Hansen (2011), for instance, examined municipality amalgamation in Denmark. They constructed a dataset that represented feasible combinations of municipalities and compared the features of municipalities that actually amalgamated by using logistic regression. They found that having a similar population size and geography plays an important role in amalgamation patterns. Similarly, Hirota (2007) used logistic regression to examine whether Japanese municipalities amalgamate or not.

While these studies consider municipality amalgamation from the aspect of participants, they consider neither the presence of amalgamation alone nor its timing. In particular, municipality amalgamation in Japan progressed between fiscal year (FY) 1999 and FY 2005,[1] while the timing of amalgamation differs by municipality. To the authors' knowledge, no studies have thus far examined the timing of amalgamations. In this study, we bridge this gap in the literature by using event history analysis to examine amalgamation timing.

Our findings show that the central government's policy forced amalgamation on municipalities with high ratios of inter-governmental grants to total revenue. Moreover, the amalgamation of neighboring municipalities became a trigger for other municipalities to amalgamate.

2. Background

Between April 1999 and January 2012, the number of municipalities in Japan decreased from 3,229 to 1,719. According to the Japanese Ministry of Internal Affairs and Communications (MIC, 2010), amalgamation was encouraged in order to establish suitable administrative and fiscal foundations for a new "basic model" municipality. To promote amalgamation, the MIC introduced a special law in FY 1999 that supported municipality amalgamation through financial provisions. First, the guaranteed period for receiving the same amount of inter-governmental subsidy (local allocation tax (LAT) grant) was extended to 15 years after amalgamation.[2] Second, the law allowed amalgamated municipalities the 95% of the amalgamation cost (e.g., construction) by issuing special purpose municipal bonds for 10 years, and the central government covered 70% of the principal and interest repayments. Nonetheless, total LAT declined by 21% from 21.4 trillion JPY to 16.9 trillion JPY between FY 2000 and FY 2005.

[1] The fiscal year in Japan starts on April 1.
[2] LAT is the inter-governmental subsidy that aims to adjust the uneven distribution of central government resources between local governments.

By using such a carrot-and-stick policy, financially unstable municipalities, especially those that relied on the LAT for their survival, embraced amalgamation in greater numbers. Moreover, the law ended in FY 2005 and this was replaced in FY 2006 by a new law. Because the financial support provided by the national government for amalgamations was revised in this new law, many municipalities only pursued amalgamation until the end of FY 2005. Thus, we analyze municipality amalgamations in Japan from FY 1999 to FY 2005.

3. Empirical Methods and Data

Event history analysis is a multivariate analysis that considers both occurrence probability and the timing of the event. This analysis technique examines the studied event based on a change in the attributes and in the state of the object (Allison, 1984). We adopt a discrete-time logistic regression model because amalgamation decision making typically occurs annually, and thus the presented dataset comprises annual data. Moreover, a discrete-time logistic regression model allows its variables (i.e., financial and social variables in this case) to change by period (i.e., every fiscal year herein).

The discrete-time logistic regression model is formulated as follows:

$$\ln\left[\frac{P_t}{(1-P_t)}\right] = a_t + \sum_{i=1}^{n} \beta_i X_{i,t-1} \qquad (1)$$

where P_t is the hazard ratio in year t and a_t is the time (year) variable as the base hazard. The time variable takes 1 when the year is 1999, and this increases throughout the study period. $X_{i,t-1}$ represents the fundamental municipality characteristics that affect the probability of amalgamation.

We construct the person-year dataset of the investigated municipalities from FY 1999 to FY 2005.[3] The number of municipalities is 3,184, and this includes 1,967 municipalities that amalgamated during this period. The total amount of person-year data is 21,165.

We consider the characteristics of each municipality to be explanatory variables. First, we adopt demographic, geographic, and industrial structure variables that affect the decision to amalgamate. *pop* is the population of a municipality. Municipalities that have a large population have a weak incentive to amalgamate. *space* is the area of a municipality in km^2. Municipalities that have a greater area also have trouble amalgamating because of the subsequent expansion of the duties of the post-amalgamation administration. The variables of *agri* and *manufa* represent the proportion of labor in the agricultural and manufacturing sectors respectively, relative to total labor. These variables thus serve as an index of non-urbanization. When these percentages are high, the incentive to amalgamate is strong.

As explained in Section 2, the financial conditions of a municipality seem to have a major

[3] The explanatory variables run from FY 1998 to FY 2004.

influence on the decision to amalgamate. Therefore, we use the following financial variables for municipalities before amalgamation. First, we adopt a ratio that indicates the financial resilience and soundness of a municipality (*r_cb*).[4] This ratio implies that the elasticity of finance is adversely affected when the value of this index is high. We also adopt a measure of local public debt per capita (*r_debt*), because poor financial conditions might serve as a positive incentive to amalgamate. Moreover, we use the ratio of inter-governmental grants to total revenue (*r_grant*), which shows the degree to which a municipality depends on LAT as a revenue source.

Finally, we adopt the amalgamation rate of municipalities in the same prefecture as an indicator of the neighborhood effect (*r_neighbor*). The acceleration of the amalgamation of a neighboring municipality means that the number of amalgamation partners decreases for other municipalities. Therefore, when this index is high, the municipality might hurry towards amalgamation. The data used for the estimation with their sources and descriptive statistics are described in Table 1.

Table 1. Data descriptions and descriptive statistics

Variable	Description	Mean	S.D.	Min	Max
pop	Population (1,000 people)	37.16	126.40	0.20	3,518.10
space	Area (km^2)	116.00	137.00	1.27	1,408.00
agri	Percentage of labor in agriculture	16.61	11.88	0.10	79.40
manufa	Percentage of labor in manufacturing	33.41	9.06	1.00	63.40
r_debt	Financial index of stock Ratio of principal and interest repayment of debt to scale of government finance	14.67	4.17	0.40	39.00
r_cb	Financial index of flow Ratio that indicates financial resilience and soundness	84.11	7.70	35.00	164.50
r_grant	Financial capability index Ratio of inter-governmental grants to total revenue	0.34	0.15	0.00	0.78
r_neighbor	Amalgamation rate of municipalities in the same prefecture	0.13	0.34	0.00	0.66

Source: The population, space, and industrial structure variables are derived from the national censuses carried out in 1995 and 2000.[5] The municipality financial variables in each FY are from the Statistics Bureau,

[4] *Keijyou-shyushi hiritu* in Japanese.
[5] The variables in each year are calculated by using linear interpolation between 1995 and 2000. The variables of a small number of municipalities that amalgamated before 2000 are calculated by using the same method

Ministry of Internal Affairs and Communications in Japan. The amalgamation rate of municipalities in the same prefecture and the dummy variable for the absorption form of amalgamation are calculated from data provided by the Ministry of Internal Affairs and Communications (Digital Archive of Amalgamation).

4. Estimation Results

The estimation results are presented in Table 2. We report the estimation results by using odds ratios and z values. In this estimation, we adopt three models. Model 1 uses only the time variable. Model 2 uses the time variable and the financial, demographic, and industrial structure variables of each municipality. Model 3 is the full model including the neighborhood effect.

Table 2. Estimation results of the discrete-time logistic model

	Model 1		Model 2		Model 3	
	Odds ratio	z	Odds ratio	z	Odds ratio	z
time	4.273 ***	45.16	4.396 ***	41.82	4.001 ***	36.57
pop			1.000	-1.51	1.000	-1.43
space			0.998 ***	-8.25	0.998 ***	-7.71
agri			1.021 ***	5.36	1.021 ***	5.45
manufa			1.031 ***	7.68	1.029 ***	7.32
r_debt			1.021 ***	2.88	1.022 ***	2.98
r_cb			1.027 ***	5.75	1.026 ***	5.49
r_grant			2.528 ***	3.10	2.447 ***	2.97
r_neighbor					4.521 ***	5.66
constant	0.000 ***	-50.14	0.000	-30.87	0.000 ***	-29.78
Log likelihood	-4039.781		-3887.235		-3870.808	
LR Chi^2	5012.240		5317.330		5350.190	
Pseudo R^2	0.382		0.406		0.409	

Notes: ***, **, and * indicate statistical significance at the 0.01, 0.05, and 0.1 levels, respectively.

The result of the time variable is significant, and the odds ratio is very high for all models. When calculating the marginal effect by using the result of Model 3, the probability of amalgamation is 0.8%, implying that amalgamations were advanced under the advantageous financial support of the old law.

The demographic and industrial structure variables of Model 2 and Model 3 are robust. The population scale is not significant, while the size of space significantly lowers the amalgamation probability. The other industrial structure variables are all significantly positive for the probability of amalgamation in each fiscal year. These results mean that municipalities with a small area and those in rural locations choose to amalgamate. However, the odds ratios

between 1990 and 1995.

of these variables are close to 1. Thus, the effect on the probability of amalgamating is not as strong.

The results of the financial variables are also robust for Model 2 and Model 3. The higher value of the variables *r_debt* and *r_cb* means a lower elasticity of fiscal management, which improves the probability of amalgamation but not to a large degree. By contrast, the ratio of inter-governmental grants to total revenue is shown to strongly improve the probability of amalgamating. Given, as mentioned in Section 2, that LAT grants decreased through the study period, this finding suggests that municipalities that highly depend on inter-governmental grants as a form of revenue prefer amalgamation.

Finally, the neighborhood effect significantly affects the probability of amalgamating for each fiscal year. Moreover, the amalgamation situations of municipalities in the same prefecture influence the amalgamations of other municipalities.

5. Conclusion

The presented findings suggested the strong influence of the central government's policy on municipality amalgamation. The reduction in LAT grants and financial support after amalgamation (a carrot-and-stick approach) provided a strong incentive for amalgamation for those municipalities with high ratios of inter-governmental grants to total revenue. We also found a strong influence for the central government's policy from the result of the time effect. The amalgamation probability rises to exploit the benefits of the old law. Although the elasticity of fiscal management, the magnitude of municipality space, and industrial structure also affect the decision to amalgamate, these effects are not as strong. Moreover, we found that the amalgamation of neighboring municipalities became a trigger for other municipalities to amalgamate.

This study focused on municipality-level factors. However, the period in which amalgamation is approved is not only a factor of an individual municipality but also depends on the consensus building process between municipalities that are preparing for the amalgamation. Analysis that considers the difference between municipalities that plan to amalgamate is a future research topic. Event history analysis might also be useful in this regard.

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