Consolidation of Municipality-owned Water Suppliers in Japan during the Great Heisei Era

Mahelet G. Fikru

Michelle A. Phillips

Abstract

This study examines the characteristics of municipalities that took advantage of incentives provided by the Japanese government to consolidate in what is known as the Great Heisei Era of consolidations. We find that economies of scale and government transfers were some of the main factors leading to consolidation of government services. This is expected given the Central Government's efforts to equalize public service levels, which have limited the effects of Tiebout sorting, and given the large cost savings available due to municipalities also being the sole providers of water services for these areas. Our results are consistent with the existing literature regarding the consolidation of public services and provide evidence that these effects occur outside of the traditionally examined areas of North America and Europe.

JEL: G34, L95, L98

Keywords: economies of scale, water utilities, customer density, Great Heisei Era, consolidation, mergers.

1. Introduction

The Japanese water industry is highly fragmented and dominated by several small water supply systems. Despite the numerous small water utilities, close to 95% of the country's population is supplied by large water supply systems. Large water utilities are usually engaged in

water intake, purification and distribution whereas the smaller systems focus on distribution only (Urakami 2006; Urakami and Parker, 2011).

Almost all of the water supply systems in Japan are owned by municipalities (Urakami 2006) which also own and operate other public utilities such as public schools and sewerage. Historically, Japanese municipalities have experienced waves of consolidation and amalgamation. Table 1 shows the number of Japanese municipalities steadily declining with the largest recent drop in the number of municipalities taking place between 1999 and 2006. These recent consolidations are generally attributed to a specific government incentive given to municipalities to promote amalgamations beginning in 1999 and ending in March of 2006. Even though the Central Government offered each municipality the same incentive, the decision to consolidate or not, the choice of a partner and ultimate population size was decentralized (Weese 2013; Saito and Yamada 2011). Besides political factors, the purpose of the amalgamation incentives was to create efficiency gains in the form of economies of scale and improve public services such as water utilities (Urakami and Parker 2011). The period between 1999 and 2006 where the number of municipalities sharply declined is historically known as the Great Heisei Era of Consolidation. During this time, many neighboring water supply systems were consolidated or amalgamated as a consequence of the consolidation of their respective municipalities. Urakami and Parker (2011) find that the Great Heisei Era of amalgamations has improved cost effectiveness of water utilities but to a limited extent.

Table 1: Historical decline in number of municipalities in Japan

Year	**Number of municipalities**	**Percentage decline**
1888	71,314	-
1889	15,859	77.8%
1898	14,289	9.9%
1908	12,448	12.9%
1922	12,315	1.1%

1930	11,929	3.1%
1940	11,498	3.6%
Oct, 1945	10,520	8.5%
Oct, 1953	9,868	6.2%
April, 1955	5,206	47.2%
Sept, 1956	3,975	23.6%
June, 1961	3,472	12.7%
April, 1965	3,392	2.3%
April, 1975	3,257	4.0%
April, 1985	3,253	0.1%
April, 1995	3,234	0.6%
April, 1999	3,229	0.2%
April, 2005	2,395	25.8%
March, 2006	1,821	24.0%

Source: Table compiled by Yokomichi (2007) using data from the Data Book: National Municipalities 2005 and the Ministry of Internal affairs and communications. Note: Merger waves occurred during: 1888-1889 (Great Meiji Consolidation), 1953-1956 (Great Showa Consolidation), and 1999-2006 (Great Heisei Consolidation). This table lists all municipalities, including those that do not own and operate water utility monopolies.

The purpose of this paper is to study the characteristics of municipalities that chose to consolidate with others, among the subset of municipalities that own and operate water utilities, during this Era. We use the water utility industry as an example since it heavily relies on economies of scale.[1] We expect mergers between municipalities owning and operating water utilities in particular to be driven by cost savings stemming from factors present in the municipalities themselves but also, to a greater extent, from their water utilities.

While there are some empirical studies addressing consolidation incentives for utilities, results are at best mixed. In addition, studies are limited to the United States (Torres and Paul 2006) and Europe (Bottasso and Conti 2009; Zschille 2012) with no focus on the Asian economy. Since a significant number of utility consolidations take place in Asia (48% of the consolidation deals and close to 20% of the value of deals, according to FactSet Review (2013,a,b,c)), it is important to examine utility consolidations in one of the biggest Asian economies, Japan.

[1] Water services and electricity are classic examples of natural monopolies, firms for which it is more efficient to have a sole provider, given their high fixed costs. The electricity sector in Japan is operated by 10 regulated regional monopolies, encompassing fairly large areas. Water utilities, on the other hand are municipality based, resulting in thousands of individual water utility providers.

Empirically, the Japanese case is interesting to study because consolidations concentrated on a specific period by design. To our best knowledge, the only study that uses Japanese water industry data to study consolidation of Japanese municipalities is Urakami and Parker (2011). Urakami and Parker (2011) discuss the economic effects of consolidation among Japanese water utilities and find that there are limited gains from cost savings. Rather than focusing on gains and losses following consolidations, we focus on the characteristics of entities that made the decision to consolidate, among a subset of municipalities that own and operate water utilities.

Our results suggest that municipalities with a lower population have a higher probability to consolidate with other municipalities, presumably because the gains from economies of scale are higher. Furthermore, municipalities that receive subsidies from the prefectural government have a higher probability to consolidate illustrating government influence. We also find that Tiebout forces do not seem to play a major role, which is expected given the Japanese government's long standing policy of equalization of government services across municipalities.

In the following section, we present background information on some of the events that led to the consolidation of municipalities in Japan. In section 3 we review previous studies that examine consolidation of water utilities and set up the theoretical framework for forwarding our hypotheses. In Section 4 we present our methodology and discuss the variables chosen to perform the analysis. Results and findings are discussed in Section 5. We conclude and forward questions for future work in Section 6.

2. Japan's Consolidation-Promotion Policy

Japan has a unitary national government often referred to as the *Central Government*. Under the unitary government, the country is divided into 47 prefectures each of which has an elected governor (chief executive) and legislators in a unicameral prefectural assembly. Given that

Japan is not a federal government, prefectures are more similar to U.S. counties than states. The average prefecture has a population of 2.7 million and an approximate area of 8,000 square kilometers (Yagi 2004). Municipalities, in turn, operate under prefectural governments. Each municipality has a mayor (chief executive) and members in a unicameral municipal assembly (Horiuchi 2009).

Japan has a very strong Central Government which has traditionally controlled municipalities through intergovernmental grants aimed at equalization. These grants, known as the Local Allocation Taxes, are automatic formula-based transfers going from the Central Government to municipalities. The purpose is to provide a standard set of public services across the country and to ensure that local governments provide a minimum quality of services. The formula-based transfers by design favor smaller localities on a per capita basis (Mabuchi 2001). Hence, a special fiscal incentive would be required to trigger municipality consolidations. With this in mind, the Central Government amended the Municipal Merger Law in 1999 allowing local governments to consolidate into larger authorities (Urakami and Parker 2011). The amendment allowed the Central Government, under the control of the Liberal Democratic Party (LDP) at the time, to give each municipality the same fiscal incentives to consolidate beginning in May 1999 and ending in March 2006 (Saito and Yamada 2011).

Specifically, the incentive included a combination of maintaining pre-merger transfer amounts, options for financing consolidation and post- consolidation costs and job protection. First, the Central Government guaranteed that the Local Allocation Taxes would be maintained at pre-merger levels for a specified 10-year period even if consolidations resulted in improved fiscal conditions. This incentive was necessary since the formula-based transfers from the Central Government to municipalities favored smaller localities on a per capita basis which meant that any

consolidation would have resulted in lower transfers (Mabuchi 2001). Second, the Central Government gave merging municipalities the option to issue special municipal bonds to help finance the cost of planning new cities post-merger, on the condition that it would bear 70% of the principal repayments through the Local Allocation Tax (Kawaura 2010; Yokomichi 2007). Moreover, municipalities were not expected to undertake new duties after the mergers (Yokomichi 2007). Third, since long-serving mayors would be reluctant to merge with larger municipalities in fear of not being reelected (Kawaura 2010), the Central Government promised job protection for local council members facing reductions in number of seats post-merger (Hirota and Yunoue 2011).

The consolidation decision was decentralized in order to take advantage of local information that would not be available at the national level. Furthermore, the LDP did not impose a minimum population size nor did it specify potential merger partners (Weese 2013). Despite the significant incentives offered to municipalities, the LDP provided very little formal explanation for its decision to push for consolidations. Urakami and Parker (2011) cite political factors and a desire to improve public services as the general reason for consolidating municipalities. However, it is unlikely that the sole motivation was political, particularly considering evidence showing that consolidations eroded the LDP's support base, resulting in reduced turnouts and declining vote shares for two consecutive national elections (Saito and Yamada 2011; Horiuchi and Saito 2009; Shimizu 2012).

Although consolidation incentives can also be viewed as decentralization reforms, it is believed that the LDP's major rationale for seeking mergers had to do with the country's demographic changes (Saito and Yamada 2011). Japan's rapidly aging population, low birth rate and shrinking population have resulted in lower tax collections and larger public expenditures.

Consolidations in the public sector are expected to create efficiency gains, mainly in the form of economies of scale. Urakami and Parker (2011) find some evidence of cost savings due to economies of scale following municipality mergers, but these savings were lower than expected. Likewise, Miyazaki (2013) finds that municipalities that stood to benefit from economies of scale were more likely to consolidate.

3. Theoretical Background and Hypotheses

There are several studies that forward alternative theories to explain why consolidations take place in the private sector. For instance, consolidated entities can create synergy through economies of scale, economies of scope and improve operating efficiency by acquiring competitors (Perry and Potter 1985; Farrell and Shapiro 1990; Fauli-Oller 1997, 2002; Levin 1990; Qiu and Zhou 2007). In contrast, creating value is more important that just cutting costs in the public sector (Xantus Publication 2010; Grant Thornton Publication 2010). Furthermore, there is no fight for getting higher market share by eliminating competitors in the public sector (Xantus Publication 2010).

Even though consolidation in the public sector is less frequent than in the private sector, the optimal scale of local government services has always been a subject of intense study in the public economics literature (Frumkin 2003; Gordon and Knight, 2009; Kenny and Schmidt, 1994). The topic of consolidation in the public sector is closely related to theories of government competition. According to Charles Tiebout's (1956) hypothesis, under certain assumptions, individuals will, without cost, sort themselves across local communities according to their preferences for public goods. Hence, local competition, in terms of providing a range of local municipal choices, enhances efficiency (Huck 2004). There is clearly a tradeoff between having

local governments that are able to closely match local preferences and economies of scale arising from consolidation (Weese 2008; Miyazaki 2013; Alesina et al. 2004).

Despite relatively fewer studies examining the incentives to merge in the public sector, there is some evidence that the public sector seeks to gain efficiency, economies of scale and responds to the government's direct influence and regulation. In the following sub-sections we examine the role of economies of scale, influence from the government and regulation in public sector consolidations. Based on findings of previous studies and implications of economic theory we test two hypotheses.

3.1 Economies of scale

Most public utilities are classic examples of natural monopolies, entities for which it is more efficient to have a sole provider, given their high fixed costs. Consolidation in the public sector facilitates the combination of similar functions by reducing duplication, minimizing managerial inefficiency, overcoming fragmentation and providing opportunities for innovation and service sharing. There is growing evidence that the public sector seeks to gain efficiency and economies of scale by becoming bigger (Grant Thornton Publication 2010). Several countries have attempted to lower the cost of public service provision via consolidations. Gordon and Knight (2009) find that economies of scale and heterogeneity are among some of the reasons why school districts merged in Iowa in the 1990s. Kenny and Schmidt (1994) argue that scale economies are one of the reasons for the decline in the number of school districts in the United States from 1950 to 1980. The UK's regulator of communication industries, Ofcom, was formed from 5 different public regulators with the purpose of cost savings (National Audit Office 2006, 2010). However, when it comes to scale economies due to water utility consolidation, there are fewer studies with different results (Marques and De Witte 2011).

Bottasso and Conti (2009) show that mergers allow for some cost-savings in the water industry in England while Torres and Paul (2006) argue that cost-efficiencies are generated mostly for smaller water utilities in the United States. De Witte and Marques (2011) and Marques and De Witte (2011) study scale economies in the Portuguese water sector in 2005 and find that the number of water utilities should be reduced by 80%. On the contrary, De Witte and Dijkgraaf (2007) show that the merger wave in the water utility sector in the Netherlands did not produce scale economies. Similarly, Ballance et al. (2004) fail to find scale economies resulting from consolidation of the English and Welsh water companies. In Japan, there is evidence that consolidation among Japanese water utilities had a small but beneficial impact on cost effectiveness (Urakami and Parker 2011). Urakami (2007) confirms the existence of scale economies in the Japanese water industry while Mizutani and Urakami (2001) find low diseconomies of scale.

The Japanese water industry, owned by municipalities, is fragmented and dominated by several small water supply systems. Japanese municipalities are also local water monopolies which have historically been considered too small to be efficient (Mizutani and Urakami 2001; Weese, 2013). We expect mergers between municipalities owning and operating water utilities in particular to be driven by cost savings stemming from economies of scale present in the municipalities themselves (resulting from, for instance, less duplication of services, government workers and offices) but also, to a greater extent, from their water utilities. This is a characteristic that makes consolidation of Japanese municipalities different from other countries.

Population size clearly matters for costs of municipally provided services. A document released by the Internal Affairs Ministry of Japan in 2003 suggests that the per-capita cost of administrative service provision surges for municipalities with populations smaller than 10,000

inhabitants (Takaharu 2007). Thus we expect smaller municipalities to have a higher need to consolidate in order to gain from economies of scale.

In addition, because we expect the bulk of economies of scale cost savings to arise from increases in size of water utilities, we expect water suppliers with lower density of customers to gain more from consolidation than suppliers with higher density of customers. This is because the cost of adding one more customer to a water network is higher in a less densely populated area. Assuming a fixed network length, adding more and more consumers should translate into higher levels of output given these fixed inputs. Urakami and Parker (2011) hypothesize that cost savings due to consolidations were offset by extra expenditures incurred from having to supply water to areas with low population density. As a result, it is important to consider both size of municipality and density of water supply provision.

Hypothesis 1a: The smaller the size of a given municipality, the higher the probability of consolidation with another municipality(ies).

Hypothesis 1b: The lower the density of population served by a water utility supplier, the higher the probability of consolidation with another municipality (ies).

3.2. Government influence

Most government-owned public utilities are directly or indirectly influenced by the local and Central Government's political objectives. Given agency problems in publicly-owned services, governments are expected to favor (but not necessarily, force) consolidations in order to fight inefficiencies stemming from small sizes and duplication of services. Furthermore, public institutions affiliated with the ruling government's political party may find it beneficial to consolidate for political reasons.

In Portugal, Marques and De Witte (2011) discuss the national government's recent recommendations for a vertical and horizontal consolidation of the water and waste water utilities. Since the Portuguese water industry is not very fragmented (total of 300 utilities) the underlying reasons for recommending the merger were not clearly justified. In Germany, even though the federal government does not enforce consolidation of water utilities, it is highly recommended and encouraged based on efficiency justifications (Zschille 2012). In the Netherlands, the provincial governments promoted mergers among several publicly owned water utilities in order to achieve one water utility per province (De Witte and Dijkgraaf 2010). Gordon and Knight (2009) find that in addition to economies of scale, state financial incentives are among some of the reasons why school districts merged in Iowa in the 1990s.

In the Japanese case, municipality consolidations were directly incentivized by the Central Government. Nakazawa and Miyashita (2013) argue that intergovernmental grants played a key role in amalgamation of Japanese municipalities from 1999 to 2005. The purpose of these transfers is to provide a "standard set of public services" across the country and ensure that each local government provides a minimum quality of services (Miyazaki 2013; Weese 2008). These intergovernmental transfers are expected to limit Tiebout sorting, making the loss from moving from a small locally tailored government to a larger one less noticeable. Hirota and Yunoue (2011) argue that the consolidation choices of Japanese municipalities are expected to be affected by the national government's influence in the area.

Hypothesis 2: Municipalities with a greater influence from the central and local government are more likely to consolidate.

4. Data and Methods

Data used in this study were obtained from the "Annual Statistics of Public Enterprises" publication (Chihou Kouei-Kigyou Nenkan), the Japan Meteorological Agency, and the Japan Geographic Data Center. The data report several financial and quantitative variables for all water utilities in Japan with the exception of a few privately owned utilities. This study examines factors characterizing municipalities that chose to merge during the Great Heisei Consolidation Era of Japan by using the following probit model:

$$Pr(merger_i = 1) = \Phi(a_0 + a_1 Population_{it} + a_2 Density_{it} + a_3 X_{it} + a_4 C\_sub_{it} + a_5 P\_sub_{it} + \lambda_t + \kappa_p)$$

$Pr(merger_i = 1)$ is the probability that municipality *i* is ever engaged in a merger and Φ(.) is the cdf of a normal distribution. The merger variable takes a value of 1 if the municipality consolidated one or more times during 1999-2007 and a value of 0 otherwise.[2] Variables $Population_{it}$ and $Density_{it}$ are used to test hypothesis 1a and 1b respectively. $Population_{it}$ represents the population of municipality *i* in year *t*. We expect smaller municipalities to have a higher incentive for consolidation. $Density_{it}$ represents the customer density of water utility owned by municipality *i* . We expect utilities with sparsely located customers to have a higher need for consolidation. C_sub_{it} and P_sub_{it} represent the amount of subsidies water utility owned by municipality *i* received from the central and prefectural government respectively in year *t*. X_i represents other factors that possibly affect the incentive of municipalities to consolidate. κ_p represents prefecture dummy variables to control for time-invariant differences that may affect consolidation decisions. λ_t represents year dummy variables to control for overall temporal trends that may affect consolidation decisions.

[2] The incentives were given from 1999 to 2006. Because many consolidations occurred in groups larger than two, a bivariate probit model cannot be used.

The merger variable takes a value of 1 if the municipality consolidated one or more times during 1999-2007 and a value of 0 otherwise. Our sample is limited to municipalities that own and operate local water monopolies. Since data on some utility specific variables are not available for the years 1999-2003, our analysis is based on annual data from 2004 to 2007. Municipalities in our dataset are classified into five groups by the Japanese government based on ownership of the water utilities. The water utilities are owned by: prefectures, ordinance cities, cities, towns/villages or cooperatives. We analyzed mergers for water utilities owned by towns/villages and cities (including ordinance cities). We did not analyze cooperative and prefecture owned water utilities because very few observations were available for these.

Table 2 lists characteristics of water suppliers in Japan based on 2004-2007 data. On average, water intake, purification and distribution capacity seem to have increased with the increase in population of customers from 2004 to 2007. Furthermore, the table indicates that even though the highest percentage of consolidations occurred in 2004 there still was a significantly high percentage of suppliers which consolidated thereafter.

Table 2: Characteristics of water suppliers in Japan

Variables	**2004**	**2005**	**2006**	**2007**
Number of water suppliers	1650	1344	1329	1325
Average population of customers (person)	71,908	88,741	90,045	90,657
Average length of pipes (1000 meter)	354.3	443.1	453.5	460.7
Average water intake volume (cubic m/day)	26,962	32,829	33,143	33,420
Average number of purification plants	2.57	3.24	3.30	3.37
Average annual delivered water volume (1000 cubic m)	9,556	11,735	11,755	11,758

Percentage of suppliers consolidated	35.75%	20.98%	19.86%	19.39%

4.1. Variable selection

Population and density variables are used to measure the expected cost savings resulting from economies of scale. We measure population as the number of inhabitants in a given municipality. Our density measure is defined using a metric related to water provision: customer density, which is defined as the number of customers per length of pipe (person/1,000 m).

To measure influence from government and test our second hypothesis we use two variables: the Central Government's Treasury subsidies and prefectural subsidies received by each water utility. The Central Government of Japan has two types of subsidies going to municipalities in order to equalize the provision of public services: Local Allocation Taxes and Treasury subsidies. The Local Allocation Tax is mainly determined by formulae, while the Treasury disbursements are specific subsidies attached to individual tasks (Saito 2010). Data on the Local Allocation Taxes are not publicly available (Weese 2013). The Treasury subsidies allow the Central Government to subsidize part of the business costs of local governments, as defined by the Central Government. We assume that the Local Allocation Tax is less likely to suffer from political influence because it is based on formulae. On the other hand Treasury subsidies serve as a measure of political influence because, even though transfers are supposed to be mainly for equalization, studies have shown that the transfer decision can be affected by politics. For instance, Meyer and Naka (1998) found evidence that the LDP manipulated transfers from the Central Government to local governments presumably to maintain their electoral positions.[3]

[3] Generally speaking, the Local Allocation Tax is less likely to suffer from political intervention because it is based on formulae. But some studies indicate that it can be modified through informal channels based on feedback from municipalities (Meyer and Naka 1998). If this is so, political influence may be present in both of these transfers. We indirectly assume that Local Allocation Tax and Treasury subsidies move together. This is safe to assume in general, since municipalities with more difficult fiscal situations receive heavier allotments of both transfers and vice versa. In this way, the Treasury subsidies are expected to do a good job at reducing the possibility of omitted variable bias.

In addition to the Treasury subsidy, we control for the level of prefectural subsidies. Revenue at the prefectural level comes from tax collections and Central Government transfers. According to Mochida (2001) major programs including education, health, and public works are formulated and financed at the national level by intergovernmental grants that are disbursed either directly to each municipality or to each prefecture.

There is a concern that the use of the Treasury subsidy variable could be endogenous and hence result in inconsistent estimation. The major source of endogeneity being reverse causation where consolidation influences the level of the Treasury subsidy given to municipalities. One of the stated goals of consolidating municipalities in Japan is to reduce transfers from the central to local governments. A 2006 report from the Ministry of Internal Affairs and Communication estimates that the average annual savings from consolidations after 2016 (the end of the 10 year grace period) will be 1.8 trillion yen, the bulk of which will come from reductions in the Local Allocation Taxes (Takaharu 2007). We address this by statistically testing whether our data suggests that the Treasury subsidy is endogenous or exogenous. We use average rainfall as an instrument for our test since rainfall is expected to be exogenous. To be valid, the instrument should be correlated with the Treasury subsidy and uncorrelated with the error term of the municipal consolidation model. Rainfall shocks should generate a regional variation in the need for subsidies from the government. Water utilities usually get water from two main sources: (1) their own water (taken from local sources such as dams or surface water) and (2) purchased water. Based on our sample, about 24% and 27% of the water intake capacity of large and small water suppliers comes from surface water, respectively. Since this represents a fairly good share, rainfall is expected to affect the water intake capacity of the water utilities. The more water that municipalities have to purchase, the more expensive their costs are and the more subsidies they

will need from the Central Government. The more it rains, the more municipalities are able to use a higher proportion of their "own water". So rainfall is negatively correlated with subsidies received but shouldn't directly influence mergers other than through its effect on subsidies. We use the Blundell-Smith exogeneity test (Smith and Blundell 1986). The null hypothesis states that Central Government subsidies are exogenous. The test yields a chi-squared with a *p*-value of 0.7753 for utilities owned by towns/villages and a *p*-value of 0.8498 for utilities owned by cities including ordinance cities. These results suggest that we do not have enough evidence to reject the stated null hypothesis.

In addition to the two main hypotheses discussed in the previous section, we control for other factors that possibly affect the incentive of municipalities to consolidate. Below we discuss three control variables and the justification for including them: outsourcing, performance and number of municipalities in a given prefecture.

One among many recent measures the Japanese government has undertaken to ameliorate the effects of demographic changes and fiscal problems is to allow outsourcing of municipal water utility functions. Outsourcing in Japanese municipalities operating water utilities takes place for routine operations, maintenance of treatment plants and network pipes, checking and executing repair works, engineering design, construction supervision, information and telecommunication technology services, and metering and billing (Ueda and Benouahi 2009). The entire operation can be outsourced to another municipality's water utility or to private firms. We measure outsourcing as the ratio of number of staff based on outsourcing to the number of total staff, following Yane and Berg (2013). We expect the probability of consolidation to decrease with outsourcing, since the alternative to consolidation for water utilities is the outsourcing of certain functions. In other

words, consolidation and outsourcing can be viewed as substitutable strategies with cost reduction objectives.

All else equal, we expect municipalities to choose whether or not to merge based on performance measures. Since we expect the bulk of cost savings from mergers of municipalities that are also water utility monopolies to arise from savings in water provision, we measure performance in two ways that depend directly on the performance of water utility functions. The first measure looks at the ratio of total revenue to total expenditure of the municipality's water utility. The second measure looks at overstaffing, a measure that is commonly used to measure managerial efficiency in water utilities. We measure overstaffing as the ratio of total staff to population of customers. A World Bank report on infrastructure services finds that overstaffing is one of the main problems facing state-owned water utilities (Jha 2005). Overstaffing can be an indicator of weak performance for the following reasons: (1) Managers of municipal water utilities generally do not have incentives to reduce the work force, since savings are seldom rewarded. (2) Politicians can view organizations delivering public services as an "employer of the last resort." (3) Politicians can control jobs available in utilities as a way to reward those faithful to their party and to gain support from key labor leaders (Berg 2013).

We also control for the number of potential merger partners by considering the number of municipalities in each prefecture. Having more municipalities in a given prefecture could be a reflection of Tiebout tendencies, even though we expect this to be low in Japan due to the equalization subsidies. Areas with heterogeneous tastes are expected to have a higher level of inter-jurisdictional competition for residents, reflected by a larger number of municipalities being available to provide differing levels of municipal services. However, studies indicate that there is a tradeoff in the public sector between the benefits of providing each citizen with the quality they

demand and cost savings arising from economies of scale (Kenny and Schmidt 1994; Kenny 1982). Thus, if there are any Tiebout forces still present (even if minimal), we expect prefectures with more municipalities to be less likely to merge, since these prefectures have homogeneity within each municipality (and more heterogeneity across municipalities). On the other hand, if Tiebout forces are no longer present (due to years of equalization policies), we expect prefectures with several municipalities to be more likely to merge, because they would have several options for possible merger partners. Miyazaki (2013) finds that conventional measures of preferences (education and income level) do not seem to matter for consolidation of Japanese municipalities. A possible explanation for this is that several years of intergovernmental grants aimed at equalization have resulted in local governments that do not necessarily reflect the preferences of their residents (Miyazaki 2013).

Table 3 presents summary statistics of the main variables used in this study. Water utilities are divided into two: utilities owned by towns/villages and water utilities owned by cities and ordinance cities. There are 2,646 utility-year observations for the town/villages subsample and 2,780 observations for the cities/ordinance cities subsample. Units of measurement are presented in parenthesis. All monetary units are expressed in real terms by using 2004 as the base year.

Table 3: Summary statistics

	Town/villages				**Cities/ordinance cities**			
Variables	Mean	Standard deviation	Min	Max	Mean	Standard deviation	Min	Max
Population of municipality	16,715	9,421	3,456	52,999	136353	259,790	5,322	3,660,323
Density (person/1000 m)	128.20	317.5	15.07	11,463.6	191.15	831.54	31.08	43,618
Revenue/Expenditure	1.07	0.14	0.49	2.69	1.077	0.09	0.04	1.73
Central Subsidy (1000 yen)	10,764	34,478	0	426,947	43521.75	117,718	0	2,008,650

Prefecture Subsidy (1000 yen)	1,330	10,498	0	259,137	3379.05	22,782	0	437,939
Number of municipalities per prefecture	40.80	23.50	6	104	36.25	20.35	6	104
Overstaff (10^{-4})	4.80	0.20	0.65	26.89	4.24	1.74	1.19	16.25
Outsourcing	0.63	0.49	0	7.03	0.76	0.48	0.06	6.52
Merger dummy (1=yes, no=0)	0.23	0.42	0	1	0.28	0.44	0	1

Note: All monetary units are expressed in real terms using 2004 as the base year.

4. Results and Discussion

Tables 4 and 5 present regression results from several probit models based on our specification presented in section 4. Regression results in Tables 4 and 5 are based on sub-samples of utilities owned by towns/villages and those owned by cities/ordinance cities respectively. Columns 4.c and 5.c in each table present regressions based on standard errors clustered at the prefecture level. Marginal effects from each probit regression are also presented for each specification.

The coefficient on the population variable is significant, and as hypothesized, negative for most of the regressions based on the towns/villages sample. This indicates that the probability of consolidation decreases with population size, as expected. Municipalities that serve smaller populations benefit more from consolidation than municipalities that serve larger populations. Given that smaller populations stand to benefit from economies of scale arising from mergers, our results are consistent with the findings of Miyazaki (2013). This is particularly true when referring to municipalities of towns/villages that are also local water monopolies.

The coefficient on the population variable for mergers involving at least one large city is statistically significant with a positive coefficient. This indicates that the probability of consolidation increases with population size. Because this sample only includes areas large enough to be considered cities and ordinance cities, we expect the dynamics to be different than

for small towns and villages. A possible explanation for this unexpected result is that mergers involving large cities predominantly involved large cities absorbing smaller towns/villages, rather than mergers between entities of similar sizes. It is possible that while economies of scale were an important objective for small water utilities, this was not the case for already large utilities.

The density variable is not statistically significant for any of the regressions. The variable used to measure Central Government subsidies is not significantly different from zero in all specifications and samples. The variable used to measure Prefectural subsidies, however, is statistically significant with a positive coefficient in most of the specifications (except the towns/villages sample with clustered standard errors at the prefecture level). The Prefectural subsidies variable suggests that, as expected, municipalities that are already getting more help from Prefectural governments would be more likely to need to merge. This result is consistent with Nakazawa and Miyashita (2013) and with the LDP's stated decentralization objectives. Consolidations had artificially been prevented in periods prior to the Great Heisei Era Consolidation by the Local Allocation Tax equalization transfers, which provided an incentive for municipalities to remain small.

The overstaffing variable is not statistically significant, suggesting that the managerial performance of municipalities in regards to staff levels does not affect the probability of consolidation. This is perhaps because these municipal water utilities operate in the public sector and consolidation does not necessarily require managerial effort/talent.

The revenue-expenditure ratio variable is statistically significant with a consistently negative coefficient, suggesting that municipalities that had better monetary performance were less likely to merge. This may be because as water utilities are able to generate more revenue the need for their municipalities to consolidate may be lower.

The outsourcing variable is not statistically different from zero for towns/villages but statistically significant with a negative coefficient for cities/ordinance cities. For the cities sample, this suggests that municipalities with more outsourcing are less likely to merge. This is consistent with our expectation since outsourcing is an alternative to mergers.

The number of municipalities in a given prefecture is statistically significant and has a positive coefficient for the towns/villages sample, indicating that the probability of merging increases with the number of municipalities nearby. If Tiebout forces are no longer present (due to years of equalization policies), we expect prefectures with more municipalities nearby to be more likely to merge, since they would have more possible merger partners.

Table 4: Regression results and marginal effects using towns/villages sample

Variables	Model 4a	Marginal effects	Model 4b	Marginal effects	Model 4c	Marginal effects
Population	-0.00002[a] (4.62e-06)	-4.41e-06 [a]				
Ln Population			-0.2343[a] (0.0753)	-0.0593 [a]	-0.2343[a] (0.1094)	-0.0593[a]
Density	-0.0009 (0.0009)	-0.0002	-0.0011 (0.0010)	-0.0003	-0.0011 (0.0011)	-0.0003
Revenue/Expenditure	-0.62[a] (0.2384)	-0.1577 [a]	-0.627 [a] (0.2389)	-0.1589 [a]	-0.6275 [a] (0.3609)	-0.1589 [a]
Central Subsidy	3.14e-07 (9.78e-07)	7.93e-08	3.48e-07 (9.76e-07)	8.81e-08	3.48e-07 (1.16e-06)	8.81e-08
Prefecture Subsidy	5.74e-06[c] (3.20e-06)	1.45e-06 [c]	5.76e-06 [c] (3.18e-06)	1.46e-06 [c]	5.76e-06 (4.55e-06)	1.46e-06
Number of municipalities	0.0355[a] (0.0125)	0.0089 [a]	0.0353 [a] (0.0125)	0.0089 [a]	0.0353 [a] (0.0166)	0.0089 [a]
Overstaff	-128.77 (140.04)	-32.53	-116.35 (142.18)	-29.46	-116.35 (233.08)	-29.46
Outsourcing	-0.050 (0.0723)	-0.0119	-0.0612 (0.0724)	-.01550	-0.0612 (0.1060)	-0.0155

Pseudo R-square	0.434	0.437	0.437
Clustered standard error	No	No	Yes
Observations	2,557	2,557	2,557

Notes: Dependent variable is 1 if a municipality ever merged during 1999-2007 and 0 otherwise. We present robust standard errors in parentheses. Pseudo R^2 is calculated based on McKelvey and Zavoina's R^2. All regressions include prefecture and year fixed effects. Robust standard errors are clustered at the prefecture level for model 4.c. Marginal effects are calculated at average values. [a] represents significance level at 1%, [b] represents significance level at 5% and [c] represents significance level at less than 10%.

Table 5: Regression results and marginal effects using cities/ordinance cities sample

Variables	Model 5.a	Marginal effects	Model 5.b	Marginal effects	Model 5.c	Marginal effects
Population	3.80e-07[a] (1.39e-07)	1.27e-07 [a]				
Ln Population			0.1557 [a] (0.0347)	0.0519 [a]	0.1557 [b] (0.0851)	0.0519 [b]
Density	2.4e-05 (2.26e-05)	8.01e-06	0.00002 (0.00002)	7.14e-06	0.000021 (0.00002)	7.14e-06
Revenue/Expenditure	-1.071 [a] (0.2992)	-0.3583 [a]	-1.08 [a] (0.3027)	-0.3606 [a]	-1.08 [b] (0.4987)	-0.3606 [b]
Central Subsidy	-7.23e-08 (2.40e-07)	-2.42e-08	-1.68e-07 (2.33e-07)	-5.62e-08	-1.68e-07 (4.68e-07)	-5.62e-08
Prefecture Subsidy	7.43e-06 [a] (2.41e-06)	2.48e-06 [a]	7.42e-06 [a] (2.42e-06)	2.47e-06 [a]	7.42e-06 [b] (3.61e-06)	2.47e-06 [b]
Municipalities	-0.0012 (0.0123)	-0.0004	-0.0005 (0.0123)	-0.0002	-0.0005 (0.0077)	-0.0002
Overstaff	312.37 (214.15)	104.431	373.85 (216.81)	124.77	373.85 (449.36)	124.77
Outsource	-0.213 [a] (0.0690)	-0.071 [a]	-0.216 [a] (0.0696)	-.072199 [a]	-0.2163 [b] (0.1114)	-0.0722 [b]
Pseudo R-square	0.187		0.194		0.194	
Clustered standard error	No		No		Yes	
Observations	2,592		2,592		2,592	

Notes: Dependent variable is 1 if a municipality ever merged during 1999-2007 and 0 otherwise. We present robust standard errors in parentheses. Pseudo R^2 is calculated based on McKelvey and Zavoina's R^2. All regressions include prefecture and

year fixed effects. Robust standard errors are clustered at the prefecture level for model 5.c. Marginal effects are calculated at average values. [a] represents significance level at 1%, [b] represents significance level at 5% and [c] represents significance level at less than 10%.

5. Conclusion

The literature on mergers of municipalities has traditionally focused on the tradeoff between economies of scale and Tiebout forces. Japan's Great Heisei Era Consolidation provides an interesting case to study for several reasons: (1) Tiebout forces are limited through equalization measures which have been in place since the 1950s, (2) the potential for economies of scale is presumably large because municipalities in Japan also own and operate water utility monopolies, (3) the Government offered strong incentives for municipalities to consolidate, all of which had set expiration dates, and (4) most other studies in this area have focused on events taking place in Europe and North America.

In this study, we use data from municipalities which own and operate water utilities to characterize municipalities that chose to consolidate and identify their incentives to merge. Our results indicate that for utilities owned by towns and villages, the probability of consolidation decreases with population size and increases with the number of municipalities nearby and amount of prefectural subsidies, meanwhile for utilities owned by cities, the probability of mergers increases with population size of the municipality and amount of prefectural government subsidies. Furthermore, for all utilities in both samples the probability of merger declines with increases in monetary performance of the utilities suggesting that 'richer' utilities may have less of a need for merging.

Being able to know what characterizes municipalities that chose to consolidate during this era is important for several reasons. When examining the effects of consolidation of municipalities on other factors, like for instance the performance of water utilities, a complication arises due to

the lack of a counterfactual. Knowing how merging municipalities differ from non-merging municipalities is thus, essential. Given the difficult economic conditions Japan has faced since the 1990s, the adjustments needed to adapt to problematic demographic changes (since aging populations provide lower tax bases and require higher welfare expenditures), and the previously existing disincentives for small municipalities to merge, Japan would have probably had a very hard time continuing to manage its local governments at the levels its citizens were accustomed to in the absence of consolidations. Future studies in this area should focus on examining the effects consolidations had on cost savings stemming from economies of scale and on dependence on the Central Government after the year 2016.

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