Local government expenditure and council size: Quasi-experimental evidence from Japan

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ABSTRACT

In order to evaluate a fiscal common-pool problem, this paper focuses on the relationship between local government council size and its expenditure. Generally, local councilors internalize the benefit of public projects targeted at their political jurisdictions, but underestimate and prefer to externalize the cost of public projects due to the national subsidy system. When council sizes become larger, their expenditure might be larger because of the selfish behavior of local council members.

This paper estimates the positive effect of local council size on local government expenditure using a dataset of 13,989 municipalities in Japan over a period of 6 years. In Japan, local council size is a deterministic and discontinuous function of municipal population size under legal rules. We pay attention to this exogenous discontinuity and apply a regression discontinuity design to consider an endogeneity bias. The results show that the larger the size of the local council the larger the size of expenditure they undertake. In particular, we find that growing small municipalities tend to increase their expenditures, so that for example, 1% increases in local council size lead to about 1.2% increases of expenditures by small municipalities. Our results show that the fiscal common-pool problem is produced in small municipalities.

Keywords: fiscal common-pool problem, local council size, government expenditure, regression discontinuity design

JEL classification: D72, H11, H72

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1. Introduction

Japan has suffered from several fiscal problems, particularly in local government, where deficits have become large. With the advance of decentralization, the role of the local government has become increasingly important, and there has been active promotion of government reform.

In political economics, government expenditure and fiscal deficit are affected by political effect.[1] A growing fiscal deficit is caused by political institutional problems. The fiscal common-pool problem relates to the free rider problem, pork-barrel spending, and law of 1/n, which are all very similar phenomena. Weingast, Shepsle, and Johnsen (1981) formalized the fiscal common-pool problem.[2] For example, consider the situation in which there are some districts that receive most of the marginal benefits from public projects, while marginal costs are paid by all districts. The financial resources of public projects are covered across the districts. Local politicians internalize the benefit of public projects targeting their own specific political districts. They also underestimate and prefer to externalize the cost of public projects due to the debt issue or national subsidy system (see e.g., Bradbury and Crain, 2001; Bessho, 2010).

The degree of the fiscal common-pool problem depends on government fragmentation. Fragmentation of the policy decision-making process is closely related to the notion of internalization of the costs of fiscal policy. There are two types of fragmentation: legislative and executive. Legislative fragmentation depends on the number of ruling party members. The greater the number of ruling party members, the larger is the difficulty in harmonizing their interests, and that increases adjustment costs. As a result, expanding the number of parties in a coalition increases government expenditure and fiscal deficits. Alesina and Perotti (1995) showed that the reduction of fiscal deficits of coalition parties is lower than that of single parties in OECD 20 countries. The latter indicates executive fragmentation. The point is the number of

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[1] See, e.g., Acemoglu (2005), Kirchgässner (2002), Persson and Tabellini (2000).

[2] von Hagen (2006) reviewed theoretical and empirical research about the fiscal common-pool problem.

spending ministers (cabinet size). The expansion of cabinet size tends to increase government expenditure and fiscal deficits. Kontopoulos and Perotti (1999) show how fiscal deficits are influenced by executive fragmentation in OECD 20 countries. The number of spending ministers has strong and robust effects on the level of government expenditure. The number of parties in the coalition also has a statistically significant association with government expenditure. Schaltegger and Feld (2009) show how larger cabinets are positively related to larger government expenditure in Swiss cantons. Their research showed how the fiscal common-pool problem depends on the structure of fiscal institutions.

In addition, council and government size are discussed by Gilligan and Matsusaka (1995, 2001), Persson and Tabellini (1999), Bradbury and Crain (2001), Baqir (2002), Bradbury and Stephenson (2003), Egger and Koethenbuerger (2010) and Pettersson-Lidbom (2011). When council size increases, expenditure will be larger because each politician tends to bring benefits to his/her own political district. The size of government is positively related to the number of council members. The phenomenon is also referred to as a fiscal common-pool problem. Gilligan and Matsusaka (1995, 2001) found a positive relationship between legislature size and expenditure in upper chambers of American state legislatures.[3] Bradbury and Crain (2001) showed the positive relationship between legislative size and government expenditure across countries in data from OECD countries. However, there is a greater effect in single than in two chambers. Bradbury and Stephenson (2003) used both state and national level data from the U.S. They also showed the positive relationship between legislative size and local government expenditure. Examining both the U.S.'s state and city data, Baqir (2002) found the increase of the number of a city's council members tends to increase per capita local government expenditure. An estimate for the elasticity of government size with respect to the number of districts is 0.11. Egger and Koethenbuerger (2010) showed evidence for a positive effect of council size on government expenditure using panel data from municipalities in the German

[3] However, lower chamber size has no council size effect on expenditure.

state of Bavaria. In contrast, Pettersson-Lidbom (2012) showed evidence for a negative effect of council size on government expenditure in both Finland's and Sweden's municipalities. These results of previous research are in conflict. Therefore, we analyze the relationship between council size and government size in Japan.[4]

In order to determine if there is a fiscal common-pool problem, this paper focuses on the relationship between council size and government expenditure using a dataset of 13,989 municipalities in Japan over a period of 6 years. In Japan, the size of local councils is by law a deterministic and discontinuous function of municipal populations. We address this exogenous discontinuity and apply a regression discontinuity design (RDD) to consider an endogeneity bias. The results indicate that the larger the size of the local council drives the size of expenditure. In particular, we find that small municipalities tend to increase their expenditure more than large municipalities, such that 1% increases in local council size lead to about 1.2% increases of expenditure in small municipalities. Thus, our results show that small municipalities induce the fiscal common-pool problem.

The rest of the paper is organized as follows. Section 2 discusses Japanese local councils. Sections 3 and 4 define the empirical model. Section 5 provides the results of the RDD estimation. Section 6 concludes the paper.

2. Background to Japanese local councils

There are three layers of government structures in Japan: central, prefectural, and municipal. The local government involves prefectures and municipalities (cities, towns, and villages). There are about 3,000 municipalities in Japan. Local government plays an important role in providing public services, including public welfare and health, school education, police and fire services, and public works such as roads and sewage systems, etc. The ratio of GDP consisting of Japanese local public finance is about 12%. This amount is about 2.5 times that of the central

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[4] Hirota and Yunoue (2011) showed that the expenditure of the local council is positively related to the number of council members.

government. Additionally, local tax resources are about 35% of the total revenues in municipalities. The total debt of municipalities was about 9.6% of municipal revenues of 53,854 billion yen at the end of FY2010.

We briefly explain the system of the Japanese local government and council within municipalities. There is a dual representation system in the Japanese local government and local council. It means the mayor and council members are directly elected as representative organs by voters in a public election that is held every four years. In Japan, being a local council member is a full-time job. Voters provide their requests by petition and lobbying. Moreover, the local government provides public services to voters and submits proposed budgets to local council members who determine local government budgets. They also monitor local government spending. Local council members have veto powers over local government spending, such as proposed budget amendments. Table 1 shows the upper limit of the local council size depending on the size of the municipal population under the law of council size (Local Autonomy Act, Article 91). There are six thresholds deciding city size. The Act prescribes a maximum council size in relation to a city's population size. The number of local council members might reach the upper limit in many cases. For example, if the population size is less than 50,000, then the number of council members should be at most 26. If the population size is more than 50,000 and less than 100,000, then the number of council members should be at most 30 and so on. There are exceptions for large cities with population sizes of 900,000. For those large cities, the maximum limit of the number of local council members can be increased by eight members for each increase of 500,000 in its population size. For example, if the population size is 1,400,000 (900,000 plus 500,000), the upper limit of the local council size is 64 (56 plus 8).

As in the case of cities, each town and village's maximum council size is also prescribed in relation to the population size by the law concerning local council size. On the right hand side of Table 1, there are four thresholds for towns and villages: 2,001, 5001, 10,001, and 20,001. If the population size is more than 2,000 and less than 5,000, the number of council members is 14. Therefore, there are 10 thresholds under Japanese municipal law.

3. Empirical framework

This paper analyzes the relationship between the local council size and local government size. We use regression discontinuity design (Angrist and Pischke, 2008; Imbens and Lemieux, 2007; Lee and Lemieux, 2010). As required by law, Japan's local council size is a deterministic and discontinuous function of the municipal population size. Council law prescribes a maximum limit of the council size in relation to the population size. As we explained earlier, there are 10 thresholds in Japan. We pay attention to exogenous discontinuity and apply an RDD to consider an endogeneity bias.

Bradbury and Crain (2001), Bradbury and Stephenson (2003), and Baqir (2002) reported the size of government is positively related to the number of council members. However, their research has some empirical problems.

Most studies apply empirical methods that do not support an identification of causal effects. Their estimation results depend on relatively small sample sizes supporting identification. For example, because council size changes are relatively infrequent, identification in existing empirical results depends on cross-sectional data in council size. We should use panel data analysis to address problems of endogeneity bias.

Egger and Koethenbuerger (2010) and Pettersson-Lidbom (2012) deal with these problems. Egger and Koethenbuerger (2010) applied sharp RDD to Germany's panel data. In German municipalities, council size law prescribes council size in relation to the population size. In their case, if the population size is less than 1,000, the number of council members must be 8; if the population size is more than 1,000 and less than 2,000, the number of members must be 12, and so on. There are 13 thresholds for council size in German municipalities. Egger and Koethenbuerger (2010) estimated an average treatment effect. They induced pork-barrel expenditure by taxes such as profits taxes. Pettersson-Lidbom (2012) estimated the Finland and Sweden cases. In Finland, council size law prescribes the council size in relation to the population size. If the population size is less than 2,000, the number of council members must be 17; if the population size is more than 2,000 and less than 4,000, the number of members should be 21, etc. There are nine thresholds like this determining the number of municipalities in Finland. Because the number of council members is a deterministic and discontinuous function of the population size in Finland, Pettersson-Lidbom (2012) used sharp RDD. Furthermore, council size law prescribes a minimum requirement of council size in relation to the population size in Sweden's municipalities. If the population size is less than 12,000, the number of council members is at least 31; if the population size is more than 12,000 and less than 24,000, the number of members is at least 41, and so on. There are four thresholds in Sweden. Because council size in Sweden is a discontinuous but not deterministic function of population size, the estimation method used is fuzzy RDD. Pettersson-Lidbom (2012) showed evidence for a negative effect of council size on government expenditure in both settings.

Figs. 1, 2, and 3 show the relationships between log expenditure and population size. Note that we excluded the expenditure of local councils from total expenditure. These figures also show the window size as 5%, 15%, and 30% of the population size, respectively. For example, we pick a population size of 5,000 and a window size that is plus or minus 5% around threshold. This figure shows that both relationships have a positive correlation. The center line shows the cutoff point for population size. On the left side, the regression line shows an expenditure average of below 5,000. On the right side, the regression line shows expenditure averages above 5,000. According to the two regression lines, there is a discrete change of the average value. This effect shows that the increase of the number of council members affects local government expenditure when the population size exceeds the 5,000 threshold. This jump shows an average treatment effect. When the population size of the local government increases by one, local government spending increases radically. This phenomenon, the fiscal common-pool problem, is caused by the expanding council size.

4. Estimation model

We estimate the relationship between the expenditure of the local government and the number of council members by the following equation. We apply two types of regression discontinuity design: sharp RDD and fuzzy RDD. RDD depends on quasi-experimental evidence. First, we use the sharp RDD model, which considers that the treatment variables are nonprobabilistic. The reason is that the upper limit of the Japanese local council size is decided by the central government. The estimation model uses sharp RDD as follows.

$$Y_{it} = \alpha + \beta Csize_{it} + f(x_{it}) + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

The dependent variable Y_{it} is the expenditure of the i*th* local government at time t. Note that we exclude expenditure by local councils from the total expenditure. α is a constant term, and $Csize_{it}$ represents the size of $the\ i$th local council at time *t* as the treatment variable. We take the logarithms of the expenditure and council size of the municipality. In order to obtain a robust estimator, the treatment variable is independent of the dependent variable (Y_{it}) at the thresholds. Therefore, the sharp RDD requires the observable continuous variable called the "Assignment Variable" and the discontinuous "Treatment Variable" to estimate the average treatment effect.[5] Because the number of council members in Japan is decided by a discontinuous function with the population size, the estimator shows the average changes of expenditure at the thresholds. The point of identifying the causal effect of council size on expenditure is to distinguish the discontinuous relationship between population size and expenditures by discrete changes in council size, from a continuous relationship between population size and expenditures. With the discontinuous relationship between population size and council size, RDD indicates natural experimental evidence. The causality that we considered is the population size decides the size of the local council first, and then the size of the local councils affects the expenditure of the local government.

The assignment variable is represented as $f(x_{it})$ and uses the size of the municipal population. An assignment variable with one linear term as an independent variable is rarely

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[5] Assignment variable is also called selection variable, forcing variable and treatment determining variable etc. See Imbens and Lemieux (2007) and Lee and Lemieux (2010).

used, because the functional form assumptions are very strong. We consider $f(x_{it})$ as a smooth nonlinear function of x. Note that this usually applies until the 4th order polynomial. X_{it} denotes the control variables. These are the per capita wage, size of the daytime population, and proportions of the population under 15 and over 65. We also consider the fixed effect μ_i, and time effect λ_t. ε_{it} is the error term.

Second, we also consider the fuzzy RDD. As mentioned earlier, the numbers of council members are only an upper limit depending on the size of the population of the municipality. It is not always true that all municipalities use upper limits on the number of local council members, because the council size law prescribes a maximum limit of council size in relation to the population size. This model assumes that the size of the local councils is a probabilistic discontinuous variable at the thresholds. Discontinuity is highly correlated with treatment. We employ the instrumental variables estimation. As Angrist and Pischke (2008) point out, the treatment effect of fuzzy RDD is estimated by IV estimation. We estimate this model with population size as an instrumental variable.

$$Y_{it} = \alpha + \beta Csize_{it} + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \qquad (2)$$

$$Csize_{it} = \alpha + \omega Z_{it} + \mu_i + \lambda_t + \varphi_{it} \qquad (3)$$

The data describe Japanese local government spending from FY2001 to FY2006. However, the central government encourages municipal mergers in tandem with work on economic and fiscal structural reforms. Through the municipal merger process, known as *Heisei-no-Daigappei*, the number of municipalities in Japan decreased from 3,232 in 1999 to 1,820 in 2006. We avoid the effect of municipal mergers in Japan, so we remove merged municipalities from our dataset. This leaves us with a remaining dataset of 13,989 Japanese municipalities. We quote the data from *Annual Accounts of Local Government* and *the Accounts of Local Government* in Japan. The descriptive statistics are reported in Table 2. The average council size has about 15 members.

5. Estimation results

We estimate the equations for the full sample, which include every threshold, and the equations for the discontinuity sample, which show the window size as 5%, 15%, and 30% of the population size, respectively.[6] In the following two sections, 5.1 and 5.2, we report the results on municipal expenditure and debt issues, respectively. We control for the per capita wage, rate of the daytime population, rate of the population under 15, rate of the population over 65, and population size, because these are considered to be a dataset of control variables in the empirical literature on estimates of local government expenditure. In addition, we consider a set of time-fixed effects and heteroskedasticity robust standard errors at the municipality level. In all estimation results, the coefficient of the council size is positive. These estimation results cover various statistical problems that previous research could not deal with.

5.1 Results on local government expenditure

The results using the full sample are reported in Table 3. Columns (1) and (2) show the results of Pooling OLS. Both results show the positive effect of the local council size. Column (1) shows that the estimated council size effect on spending is 2.29 without control variables. Column (2) shows that the estimated council size effect is 2.01 including control variables. Columns (3) and (4) represent the results of fixed effect estimation. Because the "fixed effect" is controlled, the estimated value of the local council size is smaller than the result of Pooling OLS in columns (1) and (2).

The result of sharp RDD is reported in columns (5) to (8). The estimated value of council size becomes much smaller than previous results. Of note, we consider the effect of assignment variables in these estimations. To specify the function of assignment variables, we use from the first to fourth degree of the polynomial population size and report the result of the likelihood

[6] Regression results with window size as 5%, 15%, and 30% of population from all thresholds are not reported. Detailed results for each window size (5%, 15%, and 30%) are available upon request.

ratio test (LR test) for all polynomial terms. While the LR test of between the fourth and third degree polynomials is insignificant, the test between the fourth and second degree is significant. Similarly, the LR test between the fourth and first degrees is significant. As a result, column (7) shows the council size effect is 0.05.

The estimation results of fuzzy RDD are reported in column (9). We check the specification of the model by using the Durbin–Wu–Hausman test. This test shows that the fuzzy RDD specification is plausible. The estimated value is positively significant and this result shows that if the number of council members is marginally increased, then expenditure will increase.[7] In other words, the increase of the local council size leads to about a 1.23% increase of expenditure by municipalities. Conclusively, the positive council size effect is supported by evidence from fuzzy RDD.

As a robustness check, we also consider the local effect of the number of local council members. It is necessary to check what happens in each threshold. "Using data only within a window size around threshold indicates the advantage that misspecification of the functional form of the polynomial is less likely than when using all data" (see Angrist and Pischke, 2009; Egger and Koethenbuerger, 2010). The result of the discontinuity sample whose threshold is 10,000 is reported in Table 4. We set the window size as 30% of the population size. We show the results of Pooling OLS (columns 1 and 2), fixed effect estimation (columns 5, 6, 7, and 8), and instrumental variable estimation (column 9). The coefficient of all council sizes is positive and significant. According to the Durbin–Wu–Hausman test, the fuzzy RDD estimation is plausible. Column (9) shows that the estimated value council size is 1.26.

Table 5 shows that the threshold is 20,000. We also set the window size at a 30% of cutoff population. These results are similar to previous results and the fuzzy RDD (column 9) is the

[7] The over-identification test shows that the one powered population is a more plausible instrumental variable than the second degree of the polynomial population in fuzzy RDD estimation.

most plausible. The estimated value of the size of the local councils is 1.778. As a result, the discontinuity sample shows similar findings to the full sample estimation model.

As another robustness check, Table 6 shows municipal expenditure categories (office, welfare, sanitation, agriculture, forestry and fishery, commerce and industry, civil engineering work, fire, and education) results by Fuzzy RDD.[8] The positive relationship between council size and expenditures has a consistent statistically significant effect on all categories.[9] Especially, increasing the council size leads to large spending increases of 2.05% for agriculture, forestry, and fishery expenditures, 2.40% for civil engineering work expenditures, 1.86% for welfare expenditures, and 1.59% for commerce and industry expenditures. It is noteworthy that the coefficient of the expenditure categories is large in related public projects such as agriculture, forestry, and fishery work, as well as civil engineering work, and welfare work.

5.2 Results on local government debt

With respect to the revenue side, we also focus on new issues of local government debt. If the expansion of the council size increases the number of new public projects, these projects are accompanied by an additional increase of municipal expenditure. The local government will borrow more to cover its expenditures, which will increase the public debt. However, the municipalities prefer to externalize the expenditure on public projects financed by debt. This section examines the possibility of the fiscal common-pool problem from the aspect of municipal debt. We use municipal debt issues of each fiscal year as the dependent variable. Figs. 4, 5, and 6 show the relationship between logs of new issues of debt and population size. These figures also show window sizes as 5%, 15%, and 30% of the population size, respectively. For example, we pick a population size of 10,000 and a window size plus or minus 30% around the threshold. This figure shows relationships with positive correlations. According to two regression lines, there is a discrete change in average values. This effect shows that the increase

[8] Our estimation model excludes labor expenditure for many missing values.

[9] On the Durbin-Wu-Hausman test, the fuzzy RDD estimation is plausible on all expenditures categories.

of the number of council members affects the local government debt issues when the population size is over the 10,000 threshold. When one person in local government increases, the total debt of the local government increases. These jumps indicate that the municipalities cover expenditures on new public projects by new debt issues. This phenomenon, also called the fiscal common-pool problem, is caused by the expansion of the council size.

The results from the full sample are reported in Table 7. Columns (1) and (2) show the results of Pooling OLS. Both results show the positive effects of local council size. Moreover, columns (3) and (4) represent the results of the fixed effect estimation. The estimated value of local council size is smaller than in the result of Pooling OLS in columns (1) and (2), as is also the case with Table 3. The results of sharp RDD are reported in columns (5) to (8). The estimated council size becomes much smaller than in previous results. As previously explained, we consider the effects of assignment variables in these estimations. The LR test between the fourth and third degrees is insignificant, as also are the tests between the fourth and second degrees. However, the LR test between the fourth and first degree is significant. As a result, column (6) shows that the council size effect is 0.11.

The estimation results of fuzzy RDD are reported in column (9). The Durbin–Wu–Hausman test shows that the fuzzy RDD specification is plausible at the 1% level. As in previous results, the positive council size effect is supported by evidence from the fuzzy RDD. Like the expenditure results, the estimated value is positively significant, and this shows that if the number of council members is marginally increased, then the expenditure will increase, as is the case shown in Table 3. Furthermore, the increase of local council size leads to about a 2.62% increase of municipality debt. The council effect on debt is larger than in expenditure cases.

In addition, we consider the local effect of the number of local council members. The results of the discontinuity samples whose thresholds are 10,000 and 20,000 are reported in Table 8 and Table 9, respectively. We show the results of Pooling OLS (columns 1 and 2), fixed effect estimation (columns 5, 6, 7, and 8) and instrumental variable estimation (column 9). The coefficient on all council sizes is positive and significant. While column (9) shows that the estimated value of council size is 5.62 in Table 8, column (9) results on council size effect are insignificant in Table 9. However, the discontinuity sample of debt also shows similar findings to the full sample estimation model and expenditure cases.

6. Conclusion

In this paper, we apply the regression discontinuity design to estimate the fiscal common-pool problem in Japanese local public finance. Because the number of members of Japanese local councils is decided by a discontinuous function of population size, we are able to avoid the endogenous problem. In other words, the effect of council size on local expenditure is considered exogenous.

Our results from the full sample show that the increase of the number of council members causes increasing expenditure by local government. This result supports the results of Egger and Koethenbuerger (2010). Our results from the discontinuity sample show that the average treatment has a positive effect on the expenditure around the thresholds of 10,000 and 20,000. Especially, these results imply that relatively smaller governments face the fiscal common-pool problem in Japanese local government. Moreover, we show that Japanese municipalities increase debt issues in response to an expansion of council size. Our results also indicate that council members have the potential to obtain pork-barrel expenditures by issuance of new debt.

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Fig. 1. Log expenditure and population around a threshold window of 5%.

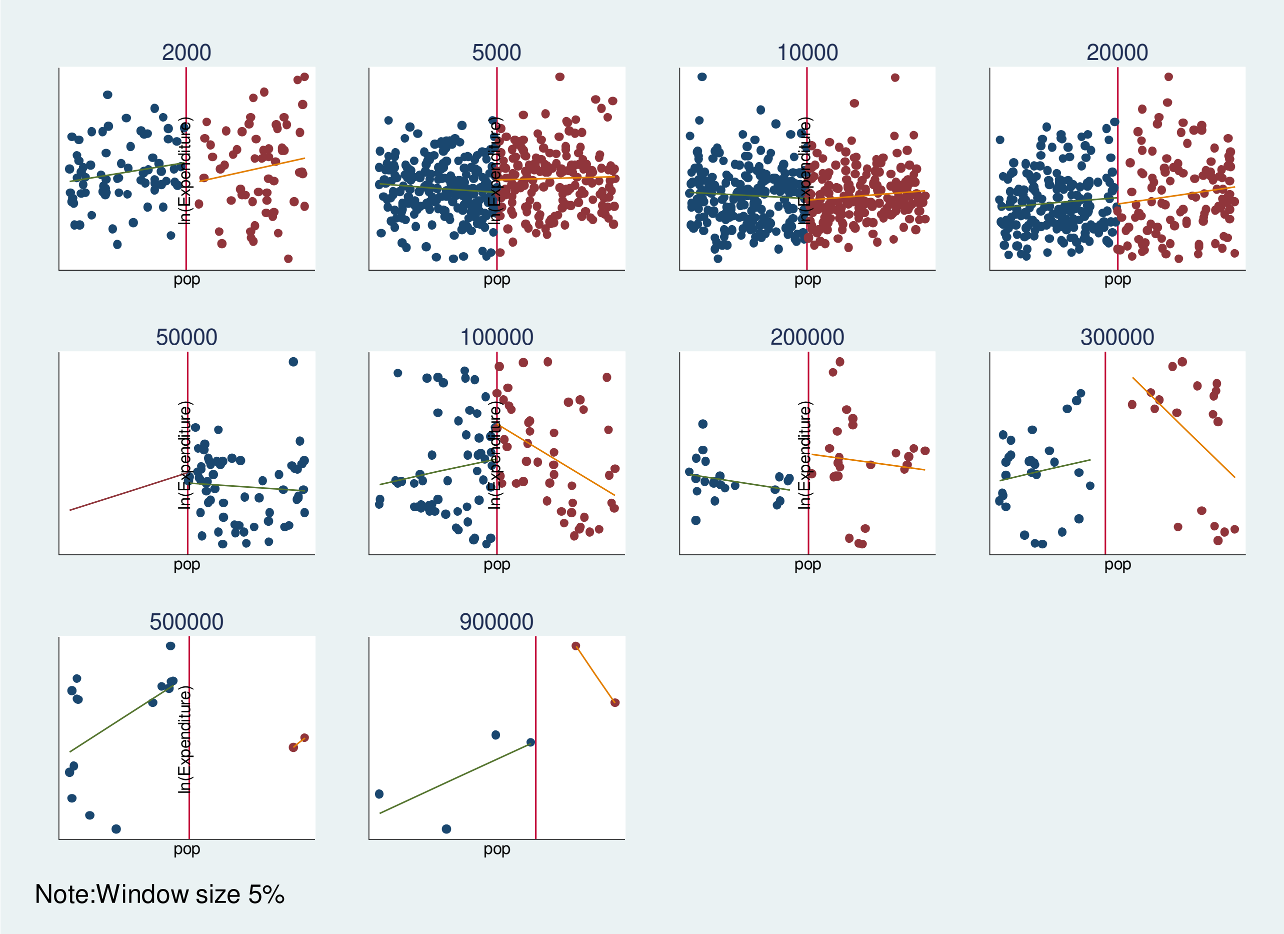

Fig. 2. Log expenditure and population around a threshold window of 15%.

Fig. 3. Log expenditure and population around a threshold window of 30%.

Fig. 4. Log debt and population around a threshold window of 5%.

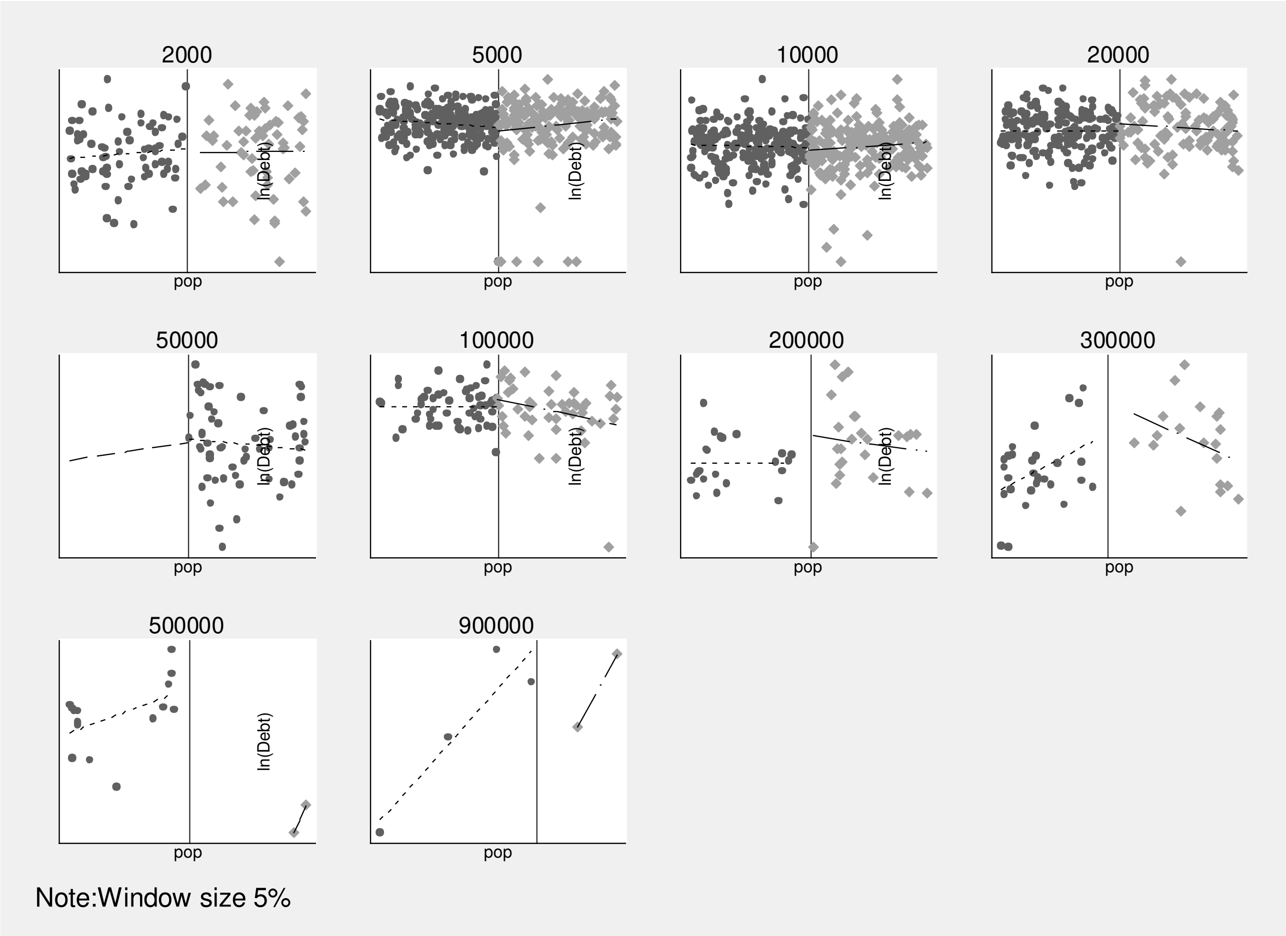

Fig. 5. Log debt and population around a threshold window of 15%.

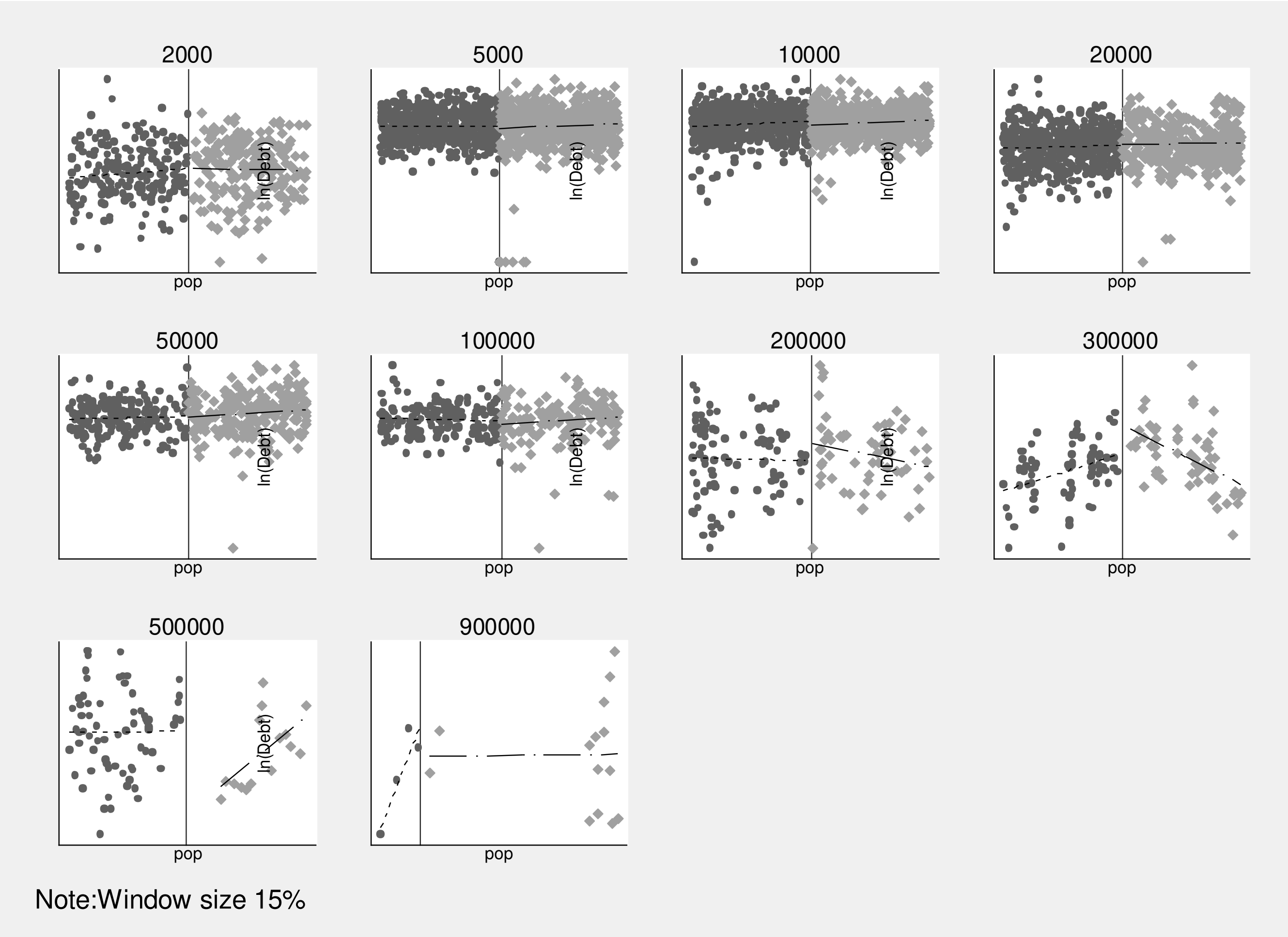

Fig. 6. Log debt and population around a threshold window of 30%.

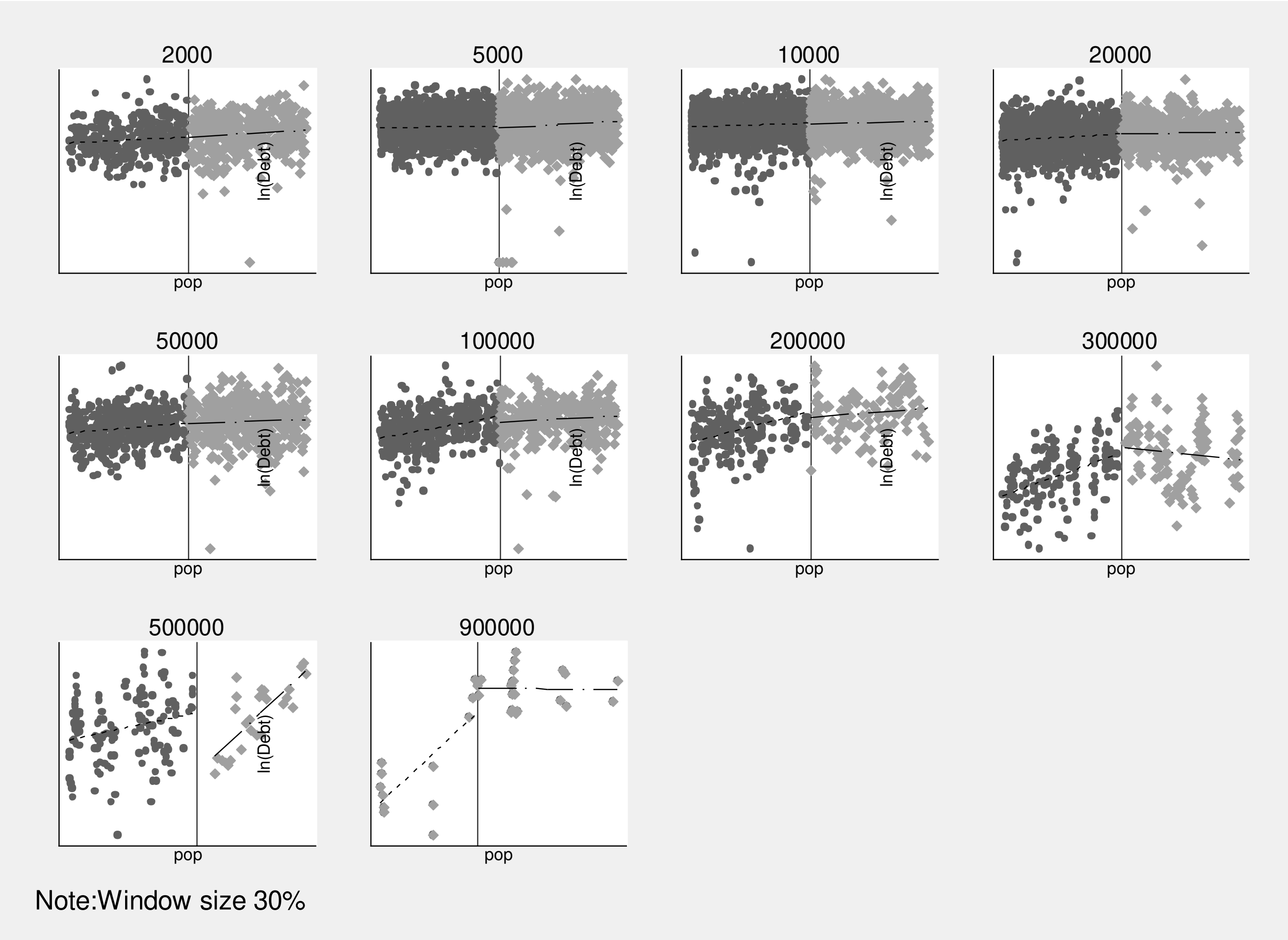

Table 1

Local council-size law: Japanese municipalities.

City		Town and village	
Population size	Number of council members	Population size	Number of council members
~50,000	26	~2,000	12
50,000 ~100,000	30	2,000~5,000	14
100,000 ~200,000	34	5,000~10,000	18
200,000~300,000	38	10,000~20,000	22
300,000~500,000	46	20,000~	26
500,000~900,000	56		
900,000~	56~96		

Table 2
Descriptive statistics.

	Mean	St.Dev.	Min	Max
Expenditure(thousand yen)	15700000.00	64800000.00	605945.00	1850000000.00
Office Expenditure	1877122.00	5053756.00	113621.00	135000000.00
Welfare Expenditure	3736155.00	17000000.00	65058.00	526000000.00
Sanitation Expenditure	1479320.00	5574664.00	19189.00	177000000.00
Agriculture, forestry, and fishery Expenditure	563577.60	650227.90	94.00	24900000.00
Commerce and Industry Expenditure	590142.10	4508100.00	86.00	134000000.00
Civil engineering work Expenditure	2756848.00	14100000.00	11291.00	472000000.00
Fire work Expenditure	571077.60	1830841.00	4495.00	46500000.00
Education Expenditure	1809353.00	6330626.00	37375.00	194000000.00
Debt	1696603.00	7601303.00	0.00	251000000.00
Council size	15.96	7.29	4.00	93.00
Population size	40840.70	139679.70	211.00	3562983.00
Per capita wage	6007.91	661.83	2496.07	10368.99
Rate of daytime population	0.94	0.24	0.57	22.59
Rate of population under 15	0.14	0.03	0.05	2.86
Rate of population over 65	0.24	0.09	0.07	6.33

Table 3 Estimation results (full sample).

Dependent var. ln(Expenditure)	Pooling OLS		Fixed Effect		Sharp RDD				Fuzzy RDD
Indepnedent var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treatment variable	2.287***	2.012***	0.294***	0.077***	0.047***	0.047***	0.047***	0.047***	1.229***
ln(Council size)	(0.010)	(0.012)	(0.011)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.101)
Assignment variables									
ln(pop)					0.966***	2.337***	11.307***	12.134*	
					(0.060)	(0.357)	(1.721)	(6.947)	
ln(pop)*2						-0.077***	-1.088***	-1.224	
						(0.020)	(0.191)	(1.123)	
ln(pop)*3							0.037***	0.047	
							(0.007)	(0.080)	
ln(pop)*4								-0.000	
								(0.002)	
Controls									
ln(per capita wage)		0.965***		-0.167***	-0.172***	-0.171***	-0.170***	-0.170***	0.094***
		(0.035)		(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.036)
Rate of daytime pupulation		0.826***		-0.006	-0.092*	-0.109**	-0.099**	-0.099**	0.108
		(0.026)		(0.050)	(0.050)	(0.050)	(0.050)	(0.050)	(0.069)
Rate of population under 15		-3.173***		1.883***	0.531**	0.604**	0.588**	0.588**	0.875***
		(0.146)		(0.234)	(0.246)	(0.247)	(0.246)	(0.247)	(0.332)
Rate of population over 65		-1.532***		-0.821***	0.111	0.137	0.110	0.110	-0.786***
		(0.058)		(0.152)	(0.161)	(0.161)	(0.161)	(0.161)	(0.208)
2002 Dummy		0.042***		-0.023***	-0.019***	-0.019***	-0.019***	-0.019***	0.007*
		(0.010)		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)
2003 Dummy		0.090***		-0.032***	-0.023***	-0.022***	-0.023***	-0.023***	0.030***
		(0.010)		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.006)
2004 Dummy		0.068***		-0.064***	-0.050***	-0.048***	-0.051***	-0.051***	0.010
		(0.011)		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.008)
2005 Dummy		0.126***		-0.056***	-0.082***	-0.079***	-0.083***	-0.083***	0.042***
		(0.013)		(0.006)	(0.007)	(0.007)	(0.007)	(0.007)	(0.012)
2006 Dummy		0.243***		-0.073***	-0.095***	-0.092***	-0.096***	-0.097***	0.098***
		(0.013)		(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.017)
Constant	9.592***	1.928***	14.960***	16.961***	7.931***	1.929	-23.961***	-25.807	11.567***
	(0.026)	(0.294)	(0.029)	(0.185)	(0.594)	(1.652)	(5.131)	(15.884)	(0.532)
Sample size	13,989	13,989	13,989	13,989	13,989	13,989	13,989	13,989	13,989
R-squared	0.805	0.836	0.064	0.176	0.195	0.196	0.198	0.198	
F stat	57666	7142	740.8	230.2	237.4	219.1	205.0	190.3	
Degree of polynomial in pop size	None	None	None	None	First	Second	Third	Fourth	First
Likelihood-ratio Test					LR chi2(3) =56.49***	LR chi2(2) = 36.83***	LR chi2(1) = 0.02		
Hausman Test				chi2(10) =-355.78	chi2(11) =629.30***	chi2(12) =-1482.48	chi2(12) = -94.98	chi2(7) =577.79***	
((9) Durbin-Wu-Hausman test)									chi2(10) = 131.56***

Note: Heteroskedasticity robust standard errors are in parentheses. Variables whose coefficients are significant at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively. The degree of freedom of the Hausman, LR, and Durbin–Wu–Hausman tests are also in parentheses

Table 4

Estimation results (discontinuity sample: 10,000, 30%).

Dependent var. ln(Expenditure)	Pooling OLS		Fixed Effect		Sharp RDD				Fuzzy RDD
Indepnedent var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treatment variable	0.738***	0.624***	0.327***	0.0933***	0.0856***	0.0859***	0.0862***	0.0861***	1.257***
ln(Council size)	(22.68)	(18.97)	(9.849)	(3.366)	(3.161)	(3.188)	(3.198)	(3.196)	(2.608)
Assignment variables									
ln(pop)					0.751***	12.59*	-191.4	610.6	
					(3.186)	(1.874)	(-0.417)	(0.289)	
ln(pop)*2						-0.649*	21.63	-110.7	
						(-1.766)	(0.431)	(-0.320)	
ln(pop)*3							-0.811	8.890	
							(-0.444)	(0.351)	
ln(pop)*4								-0.267	
								(-0.381)	
Controls	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Sample size	3,100	3,100	3,100	3,100	3,100	3,100	3,100	3,100	3,073
R-squared	0.183	0.297	0.083	0.209	0.214	0.215	0.215	0.215	
Degree of polynomial in pop size	No	No	No	No	First	Second	Third	Fourth	First

Note: Heteroskedasticity robust standard errors are in parentheses. Variables whose coefficients are significant at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively. The control variables are per capita wage, rate of daytime population, rate of population under 15, rate of population over 65, and year dummies. The results of control variables are not reported.

Table 5

Estimation results (discontinuity sample: 20,000, 30%).

Dependent var. ln(Expenditure)	Pooling OLS		Fixed Effect		Sharp RDD				Fuzzy RDD
Indepnedent var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treatment variable	0.518***	0.427***	0.247***	0.0401	0.0335	0.0331	0.0330	0.0331	1.778*
ln(Council size)	(13.48)	(10.92)	(6.610)	(1.182)	(1.012)	(1.001)	(1.000)	(1.002)	(1.716)
Assignment variables									
ln(pop)					0.758***	5.930	570.4	1,674	
					(3.395)	(0.494)	(0.713)	(0.836)	
ln(pop)*2						-0.264	-57.70	-229.0	
						(-0.430)	(-0.708)	(-0.768)	
ln(pop)*3							1.948	13.76	
							(0.703)	(0.685)	
ln(pop)*4								-0.306	
								(-0.590)	
Controls	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Sample size	1,993	1993	1,993	1,993	1,993	1,993	1,993	1993	1,976
R-squared	0.122	0.197	0.054	0.204	0.211	0.211	0.212	0.212	
Degree of polynomial in pop size	No	No	No	No	First	Second	Third	Fourth	First

Note: Heteroskedasticity robust standard errors are in parentheses. Variables whose coefficients are significant at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively. The control variables are per capita wage, rate of daytime population, rate of population under 15, rate of population over 65, and year are dummies. The results of control variables are not reported.

Table 6

Estimation results: municipal expenditure categories (full sample).

	Fuzzy RDD							
Dependent var. / Indepnedent var.	ln(Office)	ln(Welfare)	ln(Sanitation)	ln(Agriculture, forestry, and fishery)	ln(Commerce and Industry)	ln(Civil engineering work)	ln(Fire)	ln(Education)
Treatment variable	0.585***	1.855***	0.483***	2.053***	1.593***	2.403***	1.056***	1.578***
ln(Council size)	(0.163)	(0.145)	(0.150)	(0.238)	(0.316)	(0.244)	(0.124)	(0.229)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample size	13,989	13,989	13,989	13,989	13,989	13,989	13,989	13,989
Degree of polynomial in pop size	First	First	First	First	First	First	First	First

Note: Variables whose coefficients are significant at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively. The control variables are per capita wage, rate of daytime population, rate of population under 15, rate of population over 65, and year dummies. The results of control variables are not reported.

Table 7

Estimation results: debt (full sample).

Dependent var. ln(Debt)	Pooling OLS		Fixed Effect		Sharp RDD				Fuzzy RDD
Indepnedent var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treatment variable	2.054***	2.027***	0.559***	0.174***	0.109**	0.110**	0.110**	0.108**	2.623***
ln(Council size)	(0.014)	(0.019)	(0.044)	(0.046)	(0.047)	(0.047)	(0.047)	(0.047)	(0.322)
Assignment variables					2.069***	7.963***	13.771**	-1.035	
ln(pop)					(0.238)	(1.406)	(6.783)	(27.255)	
						-0.329***	-0.985	1.450	
ln(pop)*2						(0.077)	(0.753)	(4.406)	
							0.024	-0.150	
ln(pop)*3							(0.028)	(0.312)	
								0.005	
ln(pop)*4								(0.008)	
Controls									
ln(per capita wage)		0.620***		-0.685***	-0.694***	-0.690***	-0.689***	-0.688***	-0.126
		(0.055)		(0.080)	(0.079)	(0.079)	(0.079)	(0.079)	(0.115)
Rate of daytime pupulation		0.381***		-0.316	-0.526***	-0.596***	-0.588***	-0.588***	-0.052
		(0.043)		(0.202)	(0.203)	(0.203)	(0.203)	(0.203)	(0.229)
Rate of population under 15		-2.927***		3.654***	0.788	1.097	1.081	1.086	1.480
		(0.238)		(0.923)	(0.977)	(0.979)	(0.979)	(0.979)	(1.074)
Rate of population over 65		0.111		-0.551	1.519**	1.638**	1.618**	1.614**	-0.542
		(0.095)		(0.609)	(0.652)	(0.652)	(0.652)	(0.653)	(0.684)
2002 Dummy		0.199***		0.134***	0.143***	0.145***	0.145***	0.145***	0.199***
		(0.015)		(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.014)
2003 Dummy		0.439***		0.316***	0.336***	0.341***	0.340***	0.340***	0.449***
		(0.016)		(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.021)
2004 Dummy		0.207***		0.095***	0.127***	0.133***	0.132***	0.132***	0.254***
		(0.017)		(0.011)	(0.012)	(0.012)	(0.012)	(0.012)	(0.024)
2005 Dummy		0.023		-0.058**	-0.115***	-0.104***	-0.107***	-0.106***	0.152***
		(0.021)		(0.025)	(0.026)	(0.026)	(0.026)	(0.026)	(0.039)
2006 Dummy		0.036*		-0.178***	-0.226***	-0.213***	-0.216***	-0.216***	0.189***
		(0.021)		(0.026)	(0.027)	(0.027)	(0.027)	(0.027)	(0.056)
Constant	7.982***	2.521***	12.008***	18.811***	-0.557	-26.328***	-43.070**	-10.002	7.298***
	(0.039)	(0.464)	(0.118)	(0.720)	(2.345)	(6.496)	(20.204)	(62.325)	(1.701)
Sample size	13,950	13,950	13,950	13,950	13,950	13,950	13,950	13,950	13,950
R-squared	0.595	0.627	0.015	0.207	0.212	0.214	0.214	0.214	
F stat	20489	2347	161.7	280.2	263.3	243.3	224.6	208.6	
Degree of polynomial in pop size	None	None	None	None	First	Second	Third	Fourth	First
Likelihood-ratio Test					LR chi2(3)	LR chi2(2)	LR chi2(1)		
					=24.88***	=1.40	=0.41		
Hausman Test				chi2(10)	chi2(11)	chi2(12)	chi2(9)	chi2(8)	
				=1401.49***	=118.45***	=184.64***	=175.66***	=168.40***	
									chi2(10)
((9) Durbin-Wu-Hausman test)									=58.89***

Note: Heteroskedasticity robust standard errors are in parentheses. Variables whose coefficients are significant at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively. The degree of freedom of the Hausman, LR, and Durbin–Wu–Hausman tests are also in parentheses.

Table 8

Estimation results: debt (discontinuity sample: 10,000, 30%).

Dependent var. ln(Debt)	Pooling OLS		Fixed Effect		Sharp RDD				Fuzzy RDD
Indepnedent var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treatment variable	0.724***	0.956***	0.488***	0.221**	0.193*	0.196*	0.196*	0.197*	5.628**
ln(Council size)	(10.95)	(14.19)	(4.513)	(2.046)	(1.808)	(1.854)	(1.855)	(1.869)	(2.334)
Assignment variables									
ln(pop)					3.200***	71.49**	-386.3	-12,666	
					(2.970)	(2.523)	(-0.202)	(-1.405)	
ln(pop)*2						-3.743**	46.28	2,074	
						(-2.417)	(0.221)	(1.418)	
ln(pop)*3							-1.821	-150.6	
							(-0.239)	(-1.422)	
ln(pop)*4								4.092	
								(1.416)	
Controls	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Sample size	3,085	3,085	3,085	3,085	3,085	3,085	3,085	3,085	3,057
R-squared	0.230	0.061	0.011	0.228	0.233	0.235	0.235	0.236	
Degree of polynomial in pop size	No	No	No	No	First	Second	Third	Fourth	First

Note: Heteroskedasticity robust standard errors are in parentheses. Variables whose coefficients are significant at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively. The control variables are per capita wage, rate of daytime population, rate of population under 15, rate of population over 65, and year are dummies. The results of control variables are not reported.

Table 9

Estimation results: debt (discontinuity sample: 20,000, 30%).

Dependent var. ln(Debt)	Pooling OLS		Fixed Effect		Sharp RDD				Fuzzy RDD
Indepnedent var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treatment variable	0.832***	0.691***	0.367**	0.266*	0.251	0.248	0.247	0.245	4.596
ln(Council size)	(9.236)	(7.947)	(2.407)	(1.725)	(1.637)	(1.624)	(1.623)	(1.616)	(1.299)
Assignment variables									
ln(pop)					1.850	36.06	2,376	-16,276*	
					(1.400)	(0.549)	(0.635)	(-1.786)	
ln(pop)*2						-1.748	-239.8	2,657*	
						(-0.517)	(-0.631)	(1.937)	
ln(pop)*3							8.074	-191.8**	
							(0.626)	(-2.050)	
ln(pop)*4								5.168**	
								(2.120)	
Controls	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Sample size	1,991	1,991	1,991	1,991	1,991	1,991	1,991	1,991	1,974
R-squared	0.051	0.183	0.005	0.233	0.235	0.235	0.236	0.238	
Degree of polynomial in pop size	No	No	No	No	First	Second	Third	Fourth	First

Note: Heteroskedasticity robust standard errors are in parentheses. Variables whose coefficients are significant at the 10%, 5%, and 1% levels are indicated by *, **, and ***, respectively. The control variables are per capita wage, rate of daytime population, rate of population under 15, rate of population over 65, and year are dummies. The results of control variables are not reported.