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The Impact of Decentralization on Fiscal Competition: Evidence from Sub-National Governments in Japan

Kota Sugahara

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京都産業大学大学院経済学研究科
〒603-8555　京都市北区上賀茂本山

Graduate School of Economics
Kyoto Sangyo University
Motoyama-Kamigamo, Kita-ku, Kyoto,
603-8555, Japan

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The Impact of Decentralization on Fiscal Competition: Evidence from Sub-National Governments in Japan

Kota Sugahara*

Kyoto Sangyo University

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Abstract

Although there is extensive literature concerning the relationship between fiscal decentralization and the size of government, the impact of decentralization on the behavior of sub-national government has rarely been studied. This study analyzes fiscal competition among prefectures in Japan empirically, and considers the degree of fiscal decentralization by prefecture. The results show that fiscal decentralization stimulates fiscal competition, and consequently causes the size of government to increase.

Key words: Fiscal decentralization, Fiscal competition, Spatial interaction

JEL Classification: H77, H72

1 Introduction

The purpose of this study is to investigate how fiscal decentralization affects fiscal competition among sub-national governments, and consequently changes the size of government, by an empirical analysis of the interaction among prefecture governments in Japan.

For the past three decades, an extensive literature has discussed the impact of fiscal federalism on the size of government. According to Feld et al. (2003), a substantial number of empirical studies find a significantly negative relationship between the degree of fiscal decentralization and the size of government, and conclude that fiscal decentralization reduces the size

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of government. Feld et al. (2003) summarize three transmission channels of the impact of fiscal federalism on the size of government: a decentralization-hypothesis linked to the decentralization theorem (Oates 1972), a fragmentation hypothesis that considers the competition created by decentralization as an instrument that curbs the Leviathan behavior (Brennan and Buchanan 1980), and the tax competition hypothesis, which is concerned with a 'race to the bottom' (cf. Wilson 1999). Furthermore, recently, Fiva (2006) found that expenditure decentralization is positively related to government size, whereas tax revenue decentralization is negatively correlated with it. He suggests that fiscal competition by decentralized sub-national governments brings about an imbalance in the composition of government expenditure, according to the theoretical considerations proposed by Keen and Marchand (1997).

Almost all the literature in this field begins by modeling an estimation equation with the indicator of fiscal decentralization, which is represented by the ratio of sub-national government expenditure (or tax revenue) to total government expenditure (or tax revenue). However, the indicators commonly adopted do not distinguish whether sub-national government's expenditure is financed by own-source revenue or by intergovernmental grants[1]. Furthermore, these indicators '*cannot yield much useful information on where political decision-making actually occurs*' (Wolman 1990 p. 40). Therefore, this paper begins by presenting the fiscal decentralization indicators, and considering their divergence of revenue sources. In addition, we discuss the relationship between the behavior of sub-national governments engaged in fiscal competition and the degree of decentralization in a theoretical model, before our empirical estimation.

For this reason, this paper deals with the evidence that fiscal decentralization in Japan, particularly revenue decentralization, is still in progress[2]. According to Mochida (2006), the first step in the current decentralization was the resolution to promote decentralization, passed by both houses of parliament in 1993. The Committee for the Promotion of Decentralization, established by the Decentralization Promotion Law in 1995, released five recommendations. Subsequently, the Comprehensive Decentralization Law, based on these recommendations, was enacted in 2000. The 'Agency-delegated functions' were extensively reformed by this law[3].

[1] Recently OECD (1999), Ebel and Yilmaz (2002) and Stegarescu (2005) have tried to measure decentralization, including the difference in revenue sources.

[2] The stream of fiscal decentralization in Japan after World War II is described by Akizuki (2001) and Mochida (2006).

[3] The agency-delegated functions constituted the system that '*effectively obliged leaders of local governments to act as agents of the central government*' (Mochida 2006 p. 151).

As a result, the broad authority for expenditure was transferred to sub-national and local governments[4]. In 2007, part of the income taxation resources were also transferred, although the power to decide tax bases and tax rates remains in the hands of the central government.

From such evidence of 'partial fiscal decentralization' in Japan, we expect that the result of our analysis of Japanese data will differ from the results of previous literature. We do not expect tax competition to occur, because no local tax rate is sufficiently controllable. The decentralization theorem has not been realized due to the lack of any linkage between the benefit and the cost of the public services provided by sub-national and local government. Therefore, we expect that the only pressure on the size of government to increase may be the result of a fiscal illusion, the Leviathan's behavior and so on. If the Japanese evidence shows that fiscal decentralization increases the size of government, we must recognize that tax revenue decentralization is needed essentially as a way of obtaining the fruits of decentralization[5].

The rest of this paper is organized as follows. Section 2 introduces the indicators of fiscal decentralization, which are distinguished according to the revenue sources of sub-national government. Section 3 presents a theoretical model of fiscal competition among sub-national governments with a constrained budget, and then considers the impact of fiscal decentralization on the behavior of sub-national government. Section 4 provides the estimation results, after describing the data and the econometric issues. Section 5 discusses the relationship between fiscal decentralization and the size of government. Section 6 summarizes and provides concluding remarks.

2 Fiscal decentralization by prefecture

In this section, we measure the degree of fiscal decentralization by prefecture. For this purpose, we start by disaggregating central government expenditure at prefecture-by-prefecture level, according to the criteria for disaggregation. Feld et al. (2001) have doubts about the disaggregation approach as employed by Joulfaian and Marlow (1990), for the expenditure of the federal government of the United States. However, since the central government in a unitary country, like Japan, plays a more important role in the administration of policy at the level of

[4] Sugahara and Kunizaki (2006) found that the Comprehensive Decentralization Law stimulated fiscal competition among prefecture governments.

[5] Kim (2008) reviews previous discussions of the fruits of decentralization.

sub-national jurisdiction than the United States federal government, we consider that disaggregated central government expenditure indicates the approximate benefit of the public service provided by the central government.

Ishi et al. (1982) and Hayashi et al. (1997) study and discuss which criteria are appropriate for the disaggregation of central government expenditure, in order to measure the benefit and the burdens of the total government sector at the prefecture level. We apply the criteria established by them for each of item of expenditure, as Appendix A. Then we disaggregate each expenditure, using the ratio of each prefecture to the whole country by the relevant criterion. Expenditure for national debt payment is excluded from this calculation, because it does not correspond with the public service provided in the same period. Furthermore, while such expenditure as the Local Allocation Tax grants (unconditional grants; hereafter-called *Lat*) is excluded from the accounts of central government, it is included in the account of each prefecture government as grant revenue, to avoid double counting.

In addition, we create the indicators of decentralization, using the disaggregated expenditure of the central government, and prefecture government expenditure[6]. On considering the revenue sources of prefecture government, we distinguish three dimensions of fiscal decentralization, as follows:

$$GFD_i = \frac{Ex_i}{Ex_i + DEx_i - Ntd_i}$$

$$MFD_i = \frac{Ex_i - Ntd_i}{Ex_i + DEx_i - Ntd_i}$$

$$NFD_i = \frac{Ex_i - Ntd_i - Lbr_i}{Ex_i + DEx_i - Ntd_i}$$

In these equations, Ex_i and DEx_i are the expenditure of prefecture i's government and the disaggregated central government expenditure in prefecture i, respectively. Ntd_i is the

[6] In the same way as in the accounts of central government, the expenditure for prefectural debt payment is excluded from the accounts of prefecture government.

National Treasury Disbursements (conditional grants) transferred to prefecture i, which are deducted from the denominator to avoid double calculation. Lbr_i is the local bonds revenue.

To consider the meanings of these indicators, we explain the characteristics of Ntd and Lbr. Since Ntd has been given to prefecture and municipal governments in order to finance administration related to the 'agency-delegated functions', and those projects whose necessity has to be agreed upon by the central government, Ntd generally accompanies strong initiatives by central government.

On the other hand, since the central government was the major renter for local bonds, permission, from the central government, to issue local bonds was necessary until the Comprehensive Decentralization Law was enacted in 2000. However, a prefecture government with a healthy budget was able to issue bonds subject to less control by the central government. Therefore, we consider that Lbr allows the central government less initiative rather than Ntd.

The definitions of decentralization by Bird and Vaillancourt (1998) is useful in explaining the meanings of the terms *de-concentration*, *delegation* and *devolution*[7]. The first indicator, gross fiscal decentralization (GFD), includes all revenue: tax revenue, unconditional grants, Ntd and Lbr. Therefore, GFD represents *de-concentration*, which is the weakest definition of fiscal decentralization of the three indicators in this paper.

The second indicator, medium fiscal decentralization (MFD), includes tax revenue, unconditional grants and Lbr. Therefore, MFD represents *delegation*. That is, control by the central government is weaker than in GFD, but it still exists, particularly in the case of a prefecture government with an unhealthy budget.

The last indicator, net fiscal decentralization (NFD), denotes *devolution*. This means that the expenditure in the numerator is financed by tax revenue, Lat and other unconditional grants. In other words, prefecture governments can spend this type of expenditure for their own policy purposes[8].

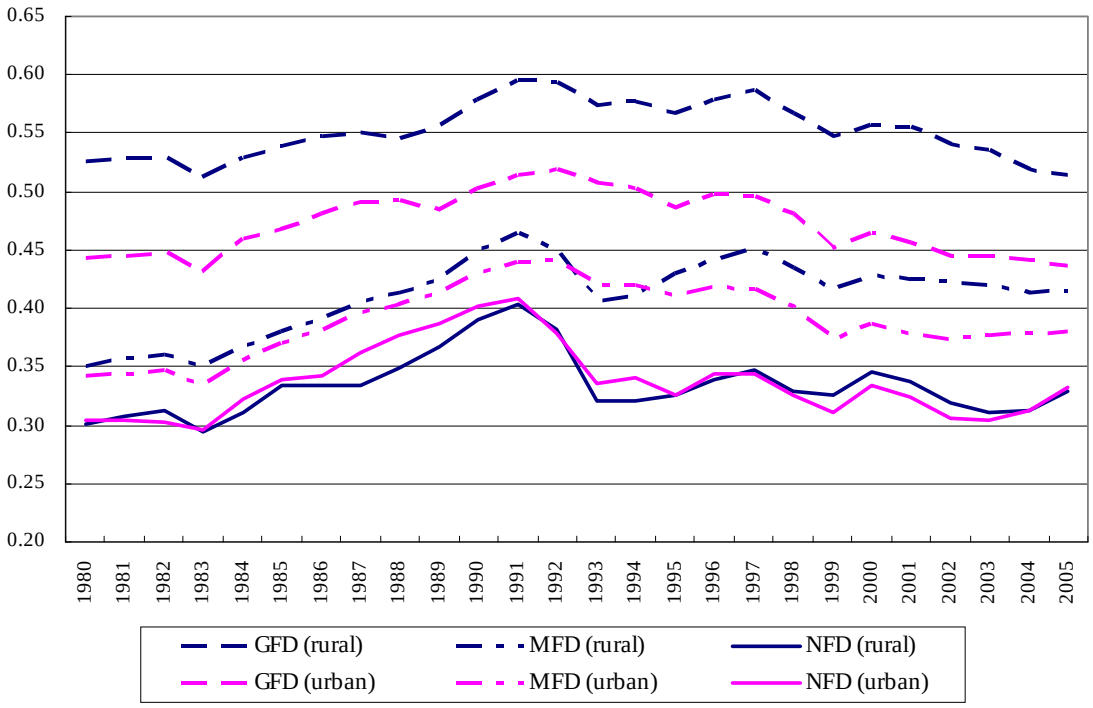
In figure 1, 47 prefectures are classified into urban area or rural area, according to population density[9]. The figure shows that all indicators in both areas increase until 1991, and then decline.

[7] See Bird and Vaillancourt (1998) for the details of description of each definition.

[8] Since a prefecture government cannot freely control its tax, and Lat is calculated according to a formula prepared by the central government, NFD in this paper does not correspond precisely with the definition by Bird and Vaillancourt (1998).

[9] Seven prefectures—Saitama, Chiba, Tokyo, Kanagawa, Aichi, Osaka and Fukuoka—whose population densities are greater than 1,000 people per km^2 throughout the subject period, are classified as urban areas. The

Figure 1. Transition of Fiscal Decentralization



The background to this difference lies in the change in the tax revenue of the central and prefecture governments during and after a boom period (the Bubble Economy). In particular, NFD fell suddenly from 1991 to 1993 due to the direct influence of the decrease in tax revenue of both forms of government after the Bubble burst. On the other hand, MFD and GFD did not fall significantly, because the 'Comprehensive Economic Measures', which were implemented ten times, beginning in 1992, were financed by Ntd and Lbr at the prefecture level[10].

Furthermore, the difference between urban and rural areas in MFD and GFD is interesting. The MFDs of both areas remained at almost the same level until the first half of the 1990s. However, an obvious difference has been seen in the recent years. On the other hand, the degree of GFD of rural areas has been substantially higher than that of urban areas from the beginning. This means that Lbr and Ntd, in particular, were transferred more to rural prefectures than to urban areas.

From these findings, we see that fiscal decentralization has been reduced in recent years,

other 40 prefectures are in rural areas. The figure shows the mean of each indicator in both areas.

[10] It is considered that Ntd, particularly in this period, was financed by the national bonds revenue. According to MOF (2008), the national bonds revenue increased from 6.7 trillions yen in 1991 to 34 trillions yen in 1998, while tax revenue decreased from 59.8 trillions yen to 49.4 trillions yen in the same period.

and that the degree of fiscal decentralization in rural prefectures is higher than that in urban prefectures, according to the wider definitions such as MFD and GFD.

3 Framework of fiscal competition

As the next step of analysis, this section describes the theoretical model of fiscal competition. Our model differs from the commonly employed models, such as Keen and Marchand (1997), regarding the behavior of sub-national government, because we consider the sub-national government in a unitary country. According to Arcalean et al. (2007), we assume that sub-national governments control the budget allocation, taking their revenue (local tax and intergovernmental grants) as given. Then we consider the impact of fiscal decentralization on their behavior, in the empirical analysis in the next section.

3.1 Theoretical model

Suppose two jurisdictions (L and S) that are heterogeneous in respect of population (n_i), capital endowment (h_i) and production technology (a_i). For later estimation, we emphasize the asymmetry of population size, that is, $n_L > n_S$. Population is standardized as $n_L + n_S = 1$ and immobility between jurisdictions is assumed. On the other hand, residents can invest their own capital in both jurisdictions.

In each jurisdiction, competitive firms produce private goods, employing private capital (k_i), labor inelastically provided (n_i) and public input (p_i). Assuming linear homogeneous production function, production per capita is written as follows[11]:

$$y_i = a_i k_i p_i - \frac{k_i^2}{2}, \quad i = L, S. \tag{1}$$

From the first order condition of profit maximization and the equilibrium condition of capital market ($n_L k_L + n_S k_S = H, \quad H \equiv n_L h_L + n_S h_S$), the equilibrium interest rate (π^*) and the equilibrium capital investment (k^*) are represented as follows:

[11] It is assumed that $a_i p_i - k_i > 0$.

$$\pi^* = n_L a_L p_L + n_S a_S p_S - H, \tag{2}$$

$$k_i^* = n_j \left[a_i p_i - a_j p_j\right] + H, \quad i, j = L, S, \quad i \neq J. \tag{3}$$

Residents in each jurisdiction are assumed to be homogeneous and to consume private goods (x_i) and public goods (g_i). Using the preference for public goods (b_i), the utility of representative resident is written as $U^i = x_i + b_i g_i - \frac{g_i^2}{2}$[12]. A budget constraint is denoted by $x_i = y_i - \pi\left(k_i - h_i\right) - t_i - t^C$, where t_i and t^C are taxes of the prefecture and the central governments, respectively. For simplicity, taxes are assumed to be given for a prefecture government.

In order to focus on the behavior of a prefecture government, we treat the central government as a simple redistribution system: that is, the tax revenue of the central government is exogenously redistributed as $t^C = n_L T_L + n_S T_S$. On the other hand, a prefecture government decides the budget allocation between public input and public goods, taking its own tax revenue and grant from the central government as given.

$$p_i = \frac{R_i}{1 + R_i}\left(t_i + T_i\right), \quad g_i = \frac{1}{1 + R_i}\left(t_i + T_i\right) \tag{4}$$

R_i is the ratio of public input to public goods (hereafter the '*budget allocation ratio*: BAR'), that is,

$$\frac{p_i}{g_i} = \frac{\frac{R_i}{1+R_i}}{\frac{1}{1+R_i}} = R_i. \tag{5}$$

A prefecture government maximizes the utility of its own residents by controlling BAR as follows:

[12] It is assumed that $b_i - g_i > 0$.

$$\begin{aligned} \max_{R_i} U^i &= x_i + b_i g_i - \frac{g_i^2}{2} \\ s.t.\ x_i &= y_i - \pi\left(k_i - h_i\right) - t_i - t^C \\ p_i &= \frac{R_i}{1+R_i}\left(t_i + T_i\right) \\ g_i &= \frac{1}{1+R_i}\left(t_i + T_i\right) \end{aligned} \tag{6}$$

From the first order condition, we obtain the following reaction function[13].

$$p_i = \frac{a_i n_i}{a_i^2 n_i n_j + 1}\left[a_j n_j p_j - n_j\left(h_j - h_i\right) - \frac{1}{a_i n_i}\left\{b_i - \left(t_i + T_i\right)\right\}\right] \tag{7}$$

Then differentiating equation (7), we represent the coefficient of the reaction function as follows.

$$\frac{dR_i}{dR_j} = \frac{a_i a_j n_i n_j}{a_i^2 n_i n_j + 1}\left[\frac{t_j + T_j}{\left(1+R_j\right)^2}\right]\left[\frac{\left(1+R_i\right)^2}{t_i + T_i}\right] \tag{8}$$

In equation (8), the first square brackets term represents the marginal public input (MPI) in jurisdiction j, as the prefecture government of jurisdiction j marginally changes its BAR. The second square brackets term denotes the inverse of MPI in jurisdiction i.

We consider the impact of fiscal decentralization on the behavior of the prefecture government. As mentioned in the previous section, in this paper each indicator of fiscal decentralization represents the revenue condition of the prefecture government, including the influence of central government policy. Therefore, we expect fiscal decentralization to affect the slope of the reaction function of i through the change in the MPI in jurisdiction i.

At first, we can relate NFD to $t_i + T_i$, because NFD shows the degree of expenditure decentralization that is financed by own tax revenue and unconditional grants. Therefore, we expect the rise in NFD to affect negatively the slope of the reaction function of i, through the decrease in the inverse of the MPI in jurisdiction i. This means that, as its own MPI

[13] While it is denoted by p_i in this section for visual simplicity, the reaction function, which is denoted by R_i, but complicated form, is in Appendix B.

increases, prefecture government i becomes more tolerant toward the competitive behavior of a rival.

On the other hand, the impacts of decentralization indicated by GFD and MFD are realized ambiguously, because they embody the effects of Ntd and Lbr, in addition to tax revenue and unconditional grants. Furthermore, in our model Ntd and Lbr finance various projects and administrations: that is, both public goods and public input. However, we consider that both GFD and MFD affect the MPI through various channels, and consequently have an impact on the behavior of a prefecture government, which is denoted as the slope of the reaction function.

From the relationship between the indicator of fiscal decentralization and the slope of the reaction function, we conclude that the slope of the reaction function becomes large, if fiscal decentralization stimulates competitive behavior by the prefecture governments, and vice versa.

However, we must note the possibility of overall control by the central government, especially through Ntd and Lbr. That is, if the central government controls all prefecture governments, the BAR of every prefecture may change in the same direction simultaneously. In such a situation, the behavior of prefectures is seemingly related to each other. Thus, in the empirical estimation, we have to doubt this possibility when the slope of the reaction function becomes insignificant after controlling for the effect of fiscal decentralization.

3.2 Framework of empirical analysis

For the empirical analysis, assuming the existence of the equilibrium, and linearizing the reaction function, we obtain the following estimation equation of the reaction function.

$$R_i = \alpha + \beta R_j + \mathbf{M}_i \lambda_m \tag{9}$$

In equation (9), β is the parameter representing the slope of the reaction function. $\mathbf{M}_i$ and λ_m are the vectors that include regional characteristics and their parameters, respectively.

Although we assumed one rival in the two-region model of the theoretical part, there are actually many rivals in our sample. Therefore, according to the previous empirical literature on fiscal competition, we calculate the average of the rival's BAR, using the weight to prefecture. Following Buettner (2001) and Sugahara and Kunizaki (2006), we employ two types of weight: weight by distance and weight by population. That is,

$$
\begin{aligned}
w_{ij}^{DIST} &= \frac{1/d_{ij}}{\sum_j 1/d_{ij}}, \quad w_{ii}^{DIST} = 0, \quad i \neq j \\
w_{ij}^{POP} &= \frac{1/\ |pop_i - pop_j|}{\sum_j 1/\ |pop_i - pop_j|}, \quad w_{ii}^{POP} = 0, \quad i \neq j,
\end{aligned}
$$

where d_{ij} is the distance between the seats of prefecture governments i and j. Using the matrix ($\mathbf{W}$) of these weights, we rewrite equation (9) as follows:

$$
R_i = \alpha + \beta Z_i + \mathbf{M}_i \lambda_m, \quad Z_i = \mathbf{W} R_i. \tag{10}
$$

Then we describe a procedure of estimation. Since fiscal decentralization is assumed to affect the slope of the reaction function, we identify the impact of fiscal decentralization by comparing the least squares estimators from two types of estimation models: the model *without* the indicator of decentralization, and the model *with* the indicator (D_i), as follows[14].

$$
\begin{aligned}
R_i &= \alpha^{wo} + \beta^{wo} Z_i + \mathbf{M}_i \lambda_m^{wo} + u_i \\
R_i &= \alpha^{dec} + \beta^{dec} Z_i + \delta D_i + \mathbf{M}_i \lambda_m^{dec} + e_i
\end{aligned}
$$

Applying the least squares to each of the models, we obtain $\widehat{\beta}^{dec}$ from the model with the indicator of decentralization, and $\widehat{\beta}^{wo}$ from the model without the indicator. $\widehat{\beta}^{dec}$ represents the effect of Z on R after controlling the effect of D on Z and R, in respect of the partial correlation coefficient. On the other hand, $\widehat{\beta}^{wo}$ involves such effects. Therefore, if fiscal decentralization significantly affects the behavior of the prefecture government, $\widehat{\beta}^{dec}$ obviously differs from $\widehat{\beta}^{wo}$.

Furthermore, if the result shows that $\widehat{\beta}^{wo} > \widehat{\beta}^{dec}$, and if $\widehat{\delta}$, which is the estimator of δ, is significant, $\widehat{\beta}^{wo}$ is made inefficiently large by the bias of the omitted effect of fiscal decentralization. In other words, this means that fiscal decentralization increases the slope of the reaction function. Therefore, we can recognize that, if $\widehat{\beta}^{wo} > \widehat{\beta}^{dec}$, fiscal decentralization stimulates the competitive behavior of the prefecture government. On the other hand, if $\widehat{\beta}^{wo} < \widehat{\beta}^{dec}$ and if $\widehat{\delta}$ is significant, we assume that fiscal decentralization has the opposite effect.

[14] As mentioned in a later section, we employ the two-stage least squares as estimation method. Thus, the description here uses the equation at the second stage of the 2SLS.

It should be noted that $\widehat{\beta}^{wo}$ is still significant, but that $\widehat{\beta}^{dec}$ is not significant, whereas $\widehat{\delta}$ is significant. Such a result shows that the interaction among prefectures is pretended. Therefore, we have to doubt whether the central government controls the decision-making of all the prefectures.

Since this procedure is the application of the omitted variable estimation, we need to check the relevance of D and the significance of the difference between $\widehat{\beta}^{wo}$ and $\widehat{\beta}^{dec}$.

4 Estimation and results

4.1 Data and econometric issues

4.1.1 Data setting

We use the samples of 47 prefectures from 1979 to 2005. The details of data are in Appendix C.

The dependent variable as the approximate variable of BAR is calculated as the ratio of the following two parts. As the public input in the numerator, we sum up commerce and industry expenses, agriculture, forestry and fishery expenses and civil engineering work expenses, and then deduct the Ntd for public works from the sum of these expenses. As the public goods in the denominator, we sum public welfare expenses, sanitation expenses, education expenses and police expenses, and then deduct the Ntds relating to them.

We consider three types of explanatory variable: the prefectural characteristics of demography, the economy and the constraint on the budget of the prefecture government. Population density (DEN), the ratio of population under 15 years old to total prefectural population (YOU) and the ratio of population over 64 years old to total prefectural population (OLD) represent the demographic characteristics. Savings per capita (CAP), the ratio of job offers to job seekers (JOB), the share of secondary industries (SEC) and the share of tertiary industries (TER) are the economic characteristics. The index of fiscal power (FP) and the ratio of debt payments to total expenditure (DP) represent the constraint on the budget of prefecture government[15].

[15] The index of fiscal power (FP) is calculated as the ratio of the 'standard financial revenues' to the 'standard financial requirements'. The standard financial revenues are the sum of the local tax revenue, which is adjusted by a certain formula, and unconditional grants. The standard financial requirements are calculated as the financial requirements of each local government, based on rational and appropriate standards (MIAC 2008). A more

Table 1 shows the descriptive statistics of variables, including the test statistics of unit root[16]. W_{dis}_BAR and W_{pop}_BAR denote the weighted averages of other prefecture's BAR by distance and by population, respectively. From the result of the unit root test, we verify the co-integration and apply the dynamic OLS for the estimation, as will be mentioned later.

Table 1. Descriptive Statistics

	Mean	Max.	Min.	Std. Dev.	Obs.	Unit Root St.	p-value
BAR	0.898	1.745	0.181	0.258	1269	3.642	1.000
W_{dis}_*BAR*	0.884	1.109	0.498	0.112	1269	6.343	1.000
W_{pop}_*BAR*	0.924	1.271	0.588	0.129	1269	4.261	1.000
GFD	0.541	0.677	0.366	0.056	1269	0.514	0.697
MFD	0.406	0.633	0.275	0.052	1269	-3.967	0.000
NFD	0.333	0.599	0.165	0.046	1269	-6.823	0.000
DEN	0.627	5.982	0.066	1.074	1269	5.328	1.000
YOU	18.338	29.237	11.328	3.505	1269	-2.929	0.002
OLD	15.145	27.095	5.767	4.423	1269	21.493	1.000
CAP	2.245	16.293	0.394	1.666	1269	2.395	0.992
JOB	0.829	2.680	0.140	0.425	1269	-8.704	0.000
SEC	33.649	58.787	12.120	8.379	1269	6.949	1.000
TER	66.279	93.998	41.787	8.594	1269	8.533	1.000
FP	2.181	90.208	0.200	11.745	1269	-4.206	0.000
DP	12.276	26.300	2.300	4.514	1269	2.151	0.984

4.1.2 Econometric Issues

We have three econometric issues for the estimation of the reaction function: simultaneous equations, unit root and spatial correlation of the disturbances. For the first issue, we apply the two-stage least squares according to Kelejian and Prucha (1998) and Buettner (2001). We employ regional characteristics and their weighted averages as the instrument variables in the first stage of regression.

$$R_{it} = \gamma_0 + \mathbf{M}_{it}\gamma_m + \mathbf{WM}_{it}\widetilde{\gamma}_m + \theta_{it}$$

Then, using the fitted variable of BAR, we carry out the second stage estimation.

detailed procedure for the calculation of these standards is described by Mochida (2007) and MIAC (2008).

[16] Following Baltagi (2001), we applied Im, Pesaran and Shin's test statistic with a null hypothesis assuming nuit root.

$$
\begin{aligned}
R_{it} &= \alpha^{wo} + \beta^{wo} Z_{it} + \mathbf{M}_{it}\lambda_m^{wo} + u_{it} \\
or \quad R_{it} &= \alpha^{dec} + \beta^{dec} Z_{it} + \delta D_{it} + \mathbf{M}_{it}\lambda_m^{dec} + e_{it} \\
with \quad Z_{it} &= W\widehat{R}_{it}, \quad \widehat{R}_{it} = R_{it} - \theta_{it}
\end{aligned}
$$

Second, we verify the co-integration and then apply the following dynamic OLS at the second stage of 2SLS, according to Kao and Chiang (2000).

$$
R_{it} = \alpha + \beta^{dec} Z_{it} + \delta D_{it} + \mathbf{M}_{it}\lambda_m^{dec} + \sum_{q=-2}^{4} \varepsilon_{iq} \Delta\Omega_{i,t+q} + \mu_{it} \tag{11}
$$

$\Delta\Omega_{i,t+q}$ is the difference term for all explanatory variables with four period lags and two period leads.

The third issue is the spatial correlation of the disturbances, discussed by Anselin (1988) and other spatial econometric analyses. For this issue, Kelejian and Prucha (1998) present the feasible GLS with estimated spatial correlation at the second stage. However, Beck and Katz (1995) point out the risk that such feasible GLS gives an inefficient estimator when the time-series period is shorter than the observations of the cross-section, and recommend instead the OLS estimator with panel-corrected standard errors. Since our data have only 27 periods as against 47 cross-section observations, we follow the recommendation of Beck and Katz (1995).

4.2 Results

Considering the asymmetry of population size among prefectures, we estimated the samples of urban prefectures and rural prefectures, respectively. Tables 2 and 3 show each of these results. The classification of prefectures is the same as in section 2. It should be noted that the weighted average of BAR in both estimations is constructed from the BAR of 47 prefectures. Thus, the estimations reflect the model of asymmetric fiscal competition described in the previous section.

Although we applied the fixed effect model of panel estimation for equation (11), tables 2 and 3 exclude the results of the difference terms ($\Delta\Omega_{i,t+q}$) and the fixed effect terms, for visual

simplicity. The values under the coefficients and the adjusted R-squared show t-values and the standard error of regression, respectively. The ADF-t shows the test statistic of the co-integration test accompanying p-value[17]. The Redundant-F shows an F-statistic with p-value of the redundancy test for the indicator of fiscal decentralization. The Difference-t shows a t-statistic that checks the significance of the difference $(\widehat{\beta}^{dec} - \widehat{\beta}^{wo})$ by using the standard error of $\widehat{\beta}^{dec}$.

Comparing the estimators of β in table 2, it seems that fiscal decentralization in the urban area stimulates fiscal competition $(\widehat{\beta}^{wo} > \widehat{\beta}^{dec})$. However, $\widehat{\beta}^{dec}$ is not significant, while $\widehat{\delta}^{dec}$ is significantly positive. This means that the competitive behavior of urban prefectures may be pretended, particularly by Ntd and Lbr. As mentioned in section 2 above, these revenues are affected by the decision-making of the central government. Therefore, the urban prefectures seem not to be engaged in fiscal competition, but rather to be controlled by the central government. The degree of fiscal decentralization has a positive effect on the BAR of the urban prefecture government.

On the other hand, in the results of rural area in table 3, $\widehat{\beta}^{dec}$ is smaller than $\widehat{\beta}^{wo}$. Furthermore, both of $\widehat{\beta}^{dec}$ and $\widehat{\delta}$ is significantly positive. The Difference-t statistic shows that the difference between $\widehat{\beta}^{dec}$ and $\widehat{\beta}^{wo}$ is significant, particularly in the results with GFD and MFD. This means that rural prefectures voluntarily compete against rivals, and that fiscal decentralization stimulates their competitive behaviors. The degree of fiscal decentralization also raises the BAR of the rural prefecture government.

The difference between the behavior of the prefectures in each area is suggested by the significance of other explanatory variables. That is, while seven variables, except for $\widehat{\beta}^{dec}$ and $\widehat{\delta}$, are significant in the results of urban area, only two or three variables are significant in the results of rural area. Therefore, while the urban prefecture governments seem to make decisions by looking inward at their own prefectural conditions, the rural prefecture governments seem to weigh the outward behavior of the other prefectures.

Such a difference in prefecture behavior seems to be caused by the difference in the intra-prefectural relationship between prefecture government and municipalities in each prefecture.

Some specific cities are allowed to have prefectural responsibilities, in particular the urban areas: the 'designated cities (*Seirei-Toshi*)', in which many areas of competence that are

[17] Following Baltagi (2001), we apply the Kao test with null hypothesis assuming no co-integration.

Table 2. Impact of Decentralization on Fiscal Competition (Urban Area)

	Weight by Distance				Weight by Population			
	WO	*NFD*	*MFD*	*GFD*	*WO*	*NFD*	*MFD*	*GFD*
W_BAR	1.305 ***	0.596 **	0.240	-0.176	1.514 ***	0.415	-0.267	-0.890
	5.732	2.076	0.695	-0.521	4.295	0.950	-0.520	-1.681
NFD		3.777 ***				3.249 ***		
		4.290				3.405		
MFD			4.504 ***				4.708 ***	
			4.373				4.408	
GFD				5.479 ***				5.422 ***
				5.257				5.330
DEN	0.110	0.020	0.292	0.303	-0.043	-0.017	0.260	0.316 *
	0.536	0.101	1.565	1.620	-0.217	-0.088	1.449	1.705
YOU	0.016	0.011	0.032 **	0.022 *	0.030 *	0.013	0.030 *	0.012
	1.139	0.841	2.338	1.734	1.750	0.803	1.782	0.768
OLD	0.060 ***	0.041 **	0.075 ***	0.070 ***	0.081 ***	0.054 **	0.085 ***	0.073 ***
	2.909	2.055	3.527	3.587	3.540	2.357	3.734	3.670
CAP	0.056 ***	0.016	0.004	0.006	0.062 ***	0.025	-0.002	0.000
	4.248	1.062	0.251	0.362	5.141	1.614	-0.127	0.012
JOB	-0.014	-0.115 *	-0.217 ***	-0.175 ***	-0.037	-0.111 *	-0.223 ***	-0.170 ***
	-0.256	-1.996	-3.200	-2.906	-0.677	-1.860	-3.525	-3.143
SEC	-0.010	-0.027 ***	-0.024 ***	-0.018 **	-0.022 **	-0.028 ***	-0.021 ***	-0.010
	-1.061	-2.887	-2.860	-2.324	-2.389	-3.303	-2.659	-1.382
TER	-0.036 ***	-0.042 ***	-0.040 ***	-0.037 ***	-0.043 ***	-0.041 ***	-0.035 ***	-0.028 ***
	-3.031	-3.682	-3.860	-3.482	-3.822	-3.978	-3.474	-2.773
FP	-0.481 **	0.013	-0.512 **	-0.356 *	-0.224	0.158	-0.425 **	-0.343 *
	-2.135	0.055	-2.563	-1.784	-0.991	0.687	-2.022	-1.707
DP	-0.005	-0.008	-0.021 ***	-0.015 ***	0.003	-0.003	-0.022 ***	-0.019 ***
	-0.848	-1.492	-3.490	-3.084	0.478	-0.564	-2.966	-2.990
C	1.603	2.301	0.827	-0.084	2.169 *	2.480 **	0.784	-0.183
	1.290	2.185	0.836	-0.077	1.831	2.498	0.771	-0.166
AR(1)	0.292 *	0.066	0.052	-0.271	0.254	-0.007	0.038	-0.182
	1.879	0.364	0.252	-1.306	1.626	-0.045	0.201	-1.040
adj R^2	0.938	0.950	0.952	0.957	0.938	0.949	0.952	0.958
	0.040	0.036	0.035	0.033	0.040	0.036	0.035	0.033
OBS	147	147	147	147	147	147	147	147
ADF-t	2.296 **	2.160 **	2.195 **	2.115 **	3.156 ***	2.976 ***	2.874 ***	2.845 ***
	0.011	0.015	0.014	0.017	0.001	0.002	0.002	0.002
Redundant-F	-	15.878 ***	17.623 ***	26.969 ***	-	10.865 ***	18.723 ***	28.101 ***
		0.000	0.000	0.000		0.002	0.000	0.000
Difference-t	-	-2.472 **	-3.081 ***	-4.384 ***	-	-2.513 **	-3.475 ***	-4.539 ***
		0.016	0.003	0.000		0.015	0.001	0.000

Notes

The values under the coefficients are t values. The values under AR(1), ADF-t, Redundant-F and Difference-t are p values. ***, ** and * indicate significance at 1%, 5% and 10% levels, respectively.

Table 3. Impact of Decentralization on Fiscal Competition (Rural Area)

	Weight by Distance				Weight by Population			
	WO	*NFD*	*MFD*	*GFD*	*WO*	*NFD*	*MFD*	*GFD*
W_BAR	1.645 ***	1.533 ***	1.239 ***	1.199 ***	1.716 ***	1.491 ***	1.184 ***	1.128 ***
	7.616	6.754	5.437	4.887	5.599	5.132	4.019	3.692
NFD		1.720 ***				1.511 **		
		2.994				2.377		
MFD			3.403 ***				3.599 ***	
			5.936				5.833	
GFD				3.785 ***				4.403 ***
				5.029				5.957
DEN	0.106	0.181	0.073	0.192	-0.140	-0.096	-0.124	0.077
	0.201	0.340	0.151	0.399	-0.247	-0.178	-0.262	0.155
YOU	-0.002	0.001	0.025	0.024	-0.006	-0.003	0.023	0.021
	-0.116	0.027	1.395	1.211	-0.241	-0.145	1.218	1.001
OLD	0.047 ***	0.045 ***	0.032 **	0.048 ***	0.052 ***	0.047 ***	0.033 *	0.053 ***
	2.862	3.020	2.134	3.135	2.852	2.852	1.858	3.058
CAP	-0.183 ***	-0.175 ***	-0.182 ***	-0.215 ***	-0.235 ***	-0.214 ***	-0.218 ***	-0.255 ***
	-4.030	-4.106	-5.335	-5.310	-4.883	-5.084	-6.066	-6.223
JOB	0.019	0.022	0.056	0.060	0.020	0.062	0.074 *	0.060
	0.417	0.473	1.326	1.292	0.447	1.395	1.871	1.395
SEC	-0.007	-0.006	0.004	0.001	-0.002	-0.005	0.005	0.006
	-0.595	-0.538	0.360	0.101	-0.121	-0.431	0.450	0.509
TER	-0.013	-0.009	0.004	0.005	-0.008	-0.008	0.006	0.011
	-1.142	-0.875	0.413	0.444	-0.644	-0.675	0.576	0.951
FP	-0.013	-0.011	0.003	0.004	-0.008	-0.010	0.005	0.009
	-1.405	-1.377	0.409	0.496	-0.780	-1.045	0.565	0.922
DP	-0.014 ***	-0.010 **	-0.004	-0.004	-0.010 *	-0.009 *	0.000	0.000
	-2.643	-2.038	-0.765	-0.806	-1.867	-1.742	-0.078	0.025
C	0.363	-0.511	-2.637 **	-3.468 ***	-0.317	-0.576	-2.901 **	-4.429 ***
	0.307	-0.453	-2.464	-2.794	-0.253	-0.517	-2.630	-3.524
AR(1)	0.654 ***	0.630 ***	0.587 ***	0.619 ***	0.662 ***	0.621 ***	0.583 ***	0.615 ***
	12.124	11.333	10.075	11.033	12.098	10.903	10.001	10.805
adj R^2	0.922	0.924	0.927	0.927	0.917	0.919	0.923	0.923
	0.062	0.061	0.059	0.060	0.064	0.063	0.061	0.061
OBS	794	794	794	794	794	794	794	794
ADF-t	-4.859 ***	-5.473 ***	-6.177 ***	-6.477 ***	-3.075 ***	-3.391 ***	-5.623 ***	-4.067 ***
	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000
Redundant-F	-	9.448 ***	40.823 ***	29.593 ***	-	6.805 ***	42.658 ***	39.197 ***
		0.002	0.000	0.000		0.009	0.000	0.000
Difference-t	-	-0.490	-1.784 *	-1.819 *	-	-0.775	-1.807 *	-1.926 *
		0.623	0.074	0.069		0.439	0.071	0.054

Notes

The values under the coefficients are t values. The values under AR(1), ADF-t, Redundant-F and Difference-t are p values. ***, ** and * indicate significance at 1%, 5% and 10% levels, respectively.

normally allocated to the prefecture are permitted at both the organizational and functional levels, the 'core cities (*Chukaku-Shi*)', which have more limited prefectural responsibilities, and the 'exceptional cities (*Tokurei-Shi*)', which have some prefectural responsibilities[18]. Forty-two percent of these specific cities are in the six urban prefectures, excluding Tokyo. Therefore, it is expected that the government of an urban prefecture in which intra-prefectural decentralization has been promoted will have less initiative to compete than the government of a rural prefecture.

To verify this point, we measure intra-prefectural decentralization, and then check the correlation between the degrees of fiscal decentralization and intra-prefectural decentralization. The indicators of intra-prefectural decentralization are defined as follows.

$$MGFD_i = \frac{MEx_i}{MEx_i + Ex_i - Ptd_i}$$

$$MMFD_i = \frac{MEx_i - Ptd_i}{MEx_i + Ex_i - Ptd_i}$$

$$MNFD_i = \frac{MEx_i - Ptd_i - MLbr_i}{MEx_i + Ex_i - Ptd_i}$$

In these indicators, MEx_i and Ex_i are the expenditures of municipality governments and prefecture government in prefecture i respectively[19]. Ptd_i is the Prefectural Treasury Disbursements (conditional grants), which are transferred from prefecture government to municipality governments. They are removed from total expenditures in the denominator to avoid double counting[20]. $MLbr_i$ is the local bonds revenue of municipality governments.

Table 4 shows the correlation coefficients and the coefficients of simple regression between the indicators of fiscal decentralization and intra-prefectural decentralization. The signs of all coefficients are negative. Therefore, we can see that the prefecture governments that are *less* decentralized have transferred *more* fiscal resources and responsibilities to municipality

[18] See MIAC (2007). Tokyo has a different system from the other prefectures. There are 23 special wards (*Tokubetsu-Ku*) in the center of Tokyo. These wards are allowed fewer responsibilities than the ordinary designated cities.

[19] The National Treasury Disbursements, which are transferred to prefecture and municipality governments and the expenditure for debt payment of each government, are excluded from the expenditure of each government.

[20] The Fiscal Adjustment Grant to special wards, which is applied only between the prefecture government of Tokyo and the special wards governments is also excluded from the denominator.

governments, and vice versa. We suggest that governments in the urban area do not engage in fiscal competition, because they have less initiative to compete because of the extensive decentralization to municipalities in the prefecture.

Table 4. Fiscal and Intra-prefectural Decentralizati

	GFD	*MFD*	*NFD*
	The correlation coef.		
MGFD	-0.731	-0.655	-0.612
MMFD	-0.750	-0.567	-0.516
MNFD	-0.762	-0.511	-0.348
	The coef. of simple regression with fixed effect		
MGFD	-0.244 ***	-0.453 ***	-0.229 ***
MMFD	-0.250 ***	-0.402 ***	-0.183 ***
MNFD	-0.258 ***	-0.302 ***	0.032

*** indicates the significance at 1% level.

5 The impact on government size

Most previous literature has only suggested the channels of fiscal decentralization and the size of government, but we investigated the impact of fiscal decentralization on the behavior of prefecture governments, and found that fiscal decentralization stimulates particularly those prefecture governments in the rural area that engage in fiscal competition.

In the last part of our investigation, we discuss the relationship between fiscal decentralization and the size of government through fiscal competition among prefectures, by estimating the following equation.

$$GS_{it} = c + \phi Z_{it} + \varphi D_{it} + \mathbf{M}_{it}\psi_m + \nu_{it} \tag{12}$$

GS_{it} is the ratio of the government expenditure to prefectural GDP of prefecture i in period t. We employ two types of government shares: the expenditure of the prefecture government only (hereafter PGS), and the total expenditure of prefecture and central government (hereafter TGS) in the prefecture i[21]. Z_{it} is the weighted average of BAR, as employed in the previous section. The idea that leads us to include this term in the estimation equation is based on

[21] In the same manner as in the calculation in section 2, we exclude expenditure for debt payment from the expenditure of each government. Furthermore, Ntd is also excluded from the calculation of total expenditure, to avoid double counting.

Schaltegger (2001). We also interpret the coefficient of this term as representing the impact of fiscal interaction on the size of government. As in the previous section, D_{it} and $\mathbf{M}_{it}$ are the fiscal decentralization indicator and the vector of the regional characteristics of prefecture i, respectively. The equation includes the lags and leads terms because of unit root and co-integration, which are checked before estimation[22].

Table 5 summarizes the results of the urban prefectures[23]. The first three columns show the results with PGS as a dependent variable. The other three columns show the results with TGS. This corresponds to the results in the previous section, in that the coefficients of W_BAR (ϕ) are not significant, except in the case of NFD. This means that there are fewer possibilities for governments in the urban prefectures to affect the size of government through competitive behavior and fiscal decentralization in urban areas.

It is natural that the coefficients of all indicators are significantly positive in the case in which PGS is a dependent variable, since these indicators basically represent the amount of resources transferred from central government to prefecture government. On the other hand, it is interesting that only the impact of MFD has a positive effect on the size of government, in the case where TGS is a dependent variable. This result suggests that fiscal decentralization leads urban prefectures to finance expenditure by issuing their local bonds, not by tax revenue or intergovernmental grants.

Table 6 summarizes the results of rural prefectures in the same way as table 5. Contrary to the results of the urban prefectures, all the coefficients of W_BAR (ϕ) are significantly positive. Thus, we conclude that the competitive behavior of rural prefecture governments increases government size. Furthermore, the results show significantly positive coefficients of the decentralization indicators in the cases of both PGS and TGS, from which we see that fiscal decentralization in rural area increases the size, not only of the prefecture government, but also of the central government, both directly and through fiscal competition.

Regarding the meanings of these indicators mentioned above, we intuitively expect that the decrease in the size of central government is behind the increase in the size of prefecture government, only in the result of the case in which PGS is the dependent variable. However,

[22] In addition to these terms, the equation also includes the dummy variables reflecting the correction to GDP estimation. SNA1 assigns 1 to the period from 1990 to 1995, and 0 to the other years. SNA2 assigns 1 to the period from 1996 to 2005, and 0 to the other years.

[23] Since we did not find significant differences between the results with a distance weight and with a population weight, table 5 excludes the result with a population weight.

how do we explain the result that shows a positive relationship between the degree of fiscal decentralization and the total size of the prefecture and the central government?

One cause we considered is intra-prefectural centralization. This means that the rural prefecture government reduces the grants and the responsibilities that it transfers to municipalities. If such intra-prefectural centralization occurs simultaneously, the increase in the size of prefecture government may exceed the decrease in the size of central government, despite fiscal decentralization.

The other cause is the Leviathan behavior of the central government. That is, the central government intends, not only to transfer the expenditure resources to the rural prefecture government, but also to maintain or increase its own expenditure, by issuing national bonds. Fiscal decentralization, along with such behavior by central government, may affect positively not only the size of prefecture government, but also total government size.

Table 5. Fiscal Decentralization and the Size of Government (Urban Area)

PGS＝the expe. of pref. gov. / prefectural GDP
TGS＝(the expe. of pref. gov. + the expe. of the central gov.) / prefectural GDP

	Dependent = PGS			Dependent = TGS		
	NFD	*MFD*	*GFD*	*NFD*	*MFD*	*GFD*
W_RATE	0.068 ***	0.032	0.019	0.083 *	0.018	0.010
	3.539	1.565	0.586	1.697	0.343	0.114
NFD	0.162 ***			0.227		
	2.755			1.564		
MFD		0.263 ***			0.331 **	
		4.369			2.187	
GFD			0.261 ***			0.302
			3.200			1.378
DEN	-0.006	0.013	0.005	-0.027	0.017	-0.001
	-0.527	1.306	0.330	-0.715	0.695	-0.030
YOU	0.003 ***	0.005 ***	0.002 **	0.002	0.009 ***	0.003
	4.301	6.857	2.103	0.653	5.172	0.799
OLD	0.001	0.004 ***	0.005 **	0.005	0.008 **	0.009 **
	1.206	3.208	3.214	1.432	2.606	2.147
CAP	0.001	-0.001	-0.001	0.001	0.000	-0.001
	0.630	-0.727	-0.515	0.546	-0.201	-0.393
JOB	0.009 ***	0.005 *	0.003	0.000	0.017 **	0.004
	2.903	1.763	0.821	0.026	2.073	0.374
SEC	-0.001 *	-0.001 **	0.000	-0.001	-0.002 *	-0.001
	-1.811	-2.180	-0.081	-0.439	-1.797	-0.279
TER	-0.001	-0.001	0.000	0.002	-0.001	0.002
	-0.928	-1.421	0.561	0.842	-1.080	0.681
FP	0.040 ***	0.026 **	0.037 **	0.046	0.054 **	0.075 *
	2.704	2.650	2.462	0.948	2.322	1.737
DP	0.001 ***	0.000	0.001 **	0.002 *	0.001 *	0.002 *
	3.295	1.489	2.147	1.875	1.866	1.800
C	-0.050	-0.144 **	-0.221 **	-0.150	-0.152	-0.272
	-0.854	-2.634	-2.453	-0.587	-1.103	-1.009
AR(1)	0.108	0.232	0.278 *	0.440 ***	0.296	0.423 ***
	0.651	1.332	1.783	2.752	1.624	2.701
adj R_2	0.963	0.972	0.972	0.976	0.971	0.973
	0.002	0.002	0.002	0.004	0.004	0.004
OBS	147	147	140	140	147	140
ADF-t	3.361 ***	2.742 ***	3.079 ***	2.768 ***	3.093 ***	2.774 ***
	0.000	0.003	0.001	0.003	0.001	0.003

Notes

The values under the coefficients are t values. The values under AR(1) and ADF-t are p values.
***, ** and * indicate significance at 1%, 5% and 10% levels, respectively.

Table 6. Fiscal Decentralization and the Size of Government (Rural Area)

PGS＝the expe. of pref. gov. / prefectural GDP
TGS＝(the expe. of pref. gov. + the expe. of the central gov.) / prefectural GDP

	Dependent = PGS			Dependent = TGS		
	NFD	*MFD*	*GFD*	*NFD*	*MFD*	*GFD*
W_RATE	0.119 ***	0.109 ***	0.120 ***	0.228 ***	0.218 ***	0.201 ***
	6.386	5.081	5.072	6.660	6.039	5.291
NFD	0.132 ***			0.162 **		
	2.802			2.020		
MFD		0.258 ***			0.276 ***	
		5.111			3.469	
GFD			0.387 ***			0.314 ***
			7.896			3.858
DEN	-0.024	-0.023	-0.008	-0.040	-0.034	-0.040
	-0.472	-0.489	-0.154	-0.446	-0.375	-0.453
YOU	0.002	0.003 **	0.004 **	0.004 *	0.005 **	0.005 **
	1.636	2.180	2.391	1.768	2.107	2.041
OLD	0.002 **	0.002	0.004 ***	0.005 **	0.005 ***	0.007 ***
	1.978	1.605	3.236	2.489	2.400	3.450
CAP	-0.005 *	-0.005 *	-0.008 ***	-0.014 ***	-0.013 ***	-0.015 ***
	-1.680	-1.662	-2.706	-2.749	-2.927	-3.225
JOB	-0.009 **	-0.006 *	-0.004	-0.013 **	-0.009	-0.008
	-2.358	-1.732	-1.312	-2.127	-1.466	-1.349
SEC	-0.001	0.000	-0.001	-0.001	0.000	-0.001
	-0.725	-0.336	-0.786	-0.382	-0.306	-0.381
TER	-0.001	0.000	0.000	0.000	0.001	0.001
	-0.990	-0.059	0.360	0.194	0.660	0.954
FP	0.001	0.002 **	0.002 ***	0.004 ***	0.005 ***	0.006 ***
	1.266	2.373	3.088	3.005	3.338	3.820
DP	-0.001 ***	-0.001 *	0.000	-0.001	-0.001	0.000
	-2.673	-1.904	-0.831	-1.503	-1.326	-0.860
C	-0.003	-0.144	-0.318 ***	-0.165	-0.274 *	-0.366 **
	-0.032	-1.473	-3.141	-0.947	-1.635	-2.117
AR(1)	0.618 ***	0.649 ***	0.660 ***	0.671 ***	0.655 ***	0.636 ***
	10.343	11.113	11.485	12.183	11.896	11.186
adj R_2	0.986	0.988	0.991	0.989	0.989	0.989
	0.004	0.004	0.004	0.006	0.006	0.006
OBS	794	794	794	794	794	794
ADF-t	-5.414 ***	-5.523 ***	-5.633 ***	-2.191 **	-1.977 **	-4.848 ***
	0.000	0.000	0.000	0.014	0.024	0.000

Notes
The values under the coefficients are t values. The values under AR(1) and ADF-t are p values.
***, ** and * indicate significance at 1%, 5% and 10% levels, respectively.

6 Concluding Remarks

The purpose of this study is to investigate how fiscal decentralization affects fiscal competition among sub-national governments and, as a consequence, changes the size of government.

For this purpose, using the data of prefectures in Japan, we measured the degree of fiscal decentralization by prefecture, and then analyzed empirically the relationship between the degree of fiscal decentralization and the behavior of prefecture government, using the model of fiscal competition. Finally, we discussed the impact of fiscal decentralization on government size, through the competitive behavior of prefecture governments.

We obtained the following results. First, the degree of fiscal decentralization in the rural area is higher than in the urban area, particularly when measured by the indicators that define decentralization broadly. Second, fiscal decentralization stimulates or imitates the competitive behavior of the prefecture government in fiscal competition. Finally, we recognize that fiscal decentralization, particularly in the rural area, increases the size of government, both directly and through fiscal competition.

Therefore, we conclude that only through the competitive behavior of prefecture governments does fiscal decentralization in Japan increases government size. Therefore, we suggest the necessity of revenue decentralization, in order to obtain the essential fruits of decentralization in Japan.

On the other hand, there remain the other causes that affect government size, in addition to fiscal competition among prefectures. For example, there are intra-prefectural relationships between prefecture government and municipalities, and the Leviathan behavior of the central government. However, since our framework is based on a static model with a two-tier government sector, we cannot analyze, in this paper, the relationship between such causes and the size of government. Thus, we will construct an appropriate framework for the analysis of the relationship between the different levels of government, as the further extension of this paper.

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Appendix A

The criteria for the disaggregation of the central government expenditure

Item of Expenditure		**Criterion for Disaggregation**
Government Management		Number of Household
Local Allocation Tax Grants, etc.		Not included (included in the revenue of prefecture government)
National Defence		Number of Households
Public Works		Amount of National Treasury Disbursements for Public Works
Industry and Economy	Agriculture, Forestry and Fishery	Prefectural GDP of Primary Indutries
	Commerce, Manufacturing and Mining	Amount of Private Consumption
	Transport and Communication	As above
	Transfer to the Industrial Investment Special Account	As above
	Price Policy	As above
Education and Culture	Compulsory Education Services	Number of Elementary School and Junior High School Students
	Social Education and Culture	Number of Households
	Promotion of Science and Technology	Number of Households
Social Security	Social Insurance	Number of Households
	Social Welfare	Population under 15 years old, Population over 64 years old
	Public Assistance	Amount of National Treasury Disbursements for Public Assistanece
	Public Health Service	Number of Households
	Unemployment Measures	Amount of National Treasury Disbursements for Unemployment Measures
	Public Housing	Amount of Public Housing
	Medical Experiment	Number of Households
	Disaster Measures	Number of Households
Former Military Personnel Pension and Others		Population over 64 years old
National Dept Service		Not included
Miscellaneous		Number of Households

Appendix B

Arranging equation (7) by R_i and R_j, R_i is represented as a reaction function of R_j as follows.

$$R_i = \frac{R_j \left[A_j \left(t_j + T_j\right) - B_i + \left(t_i + T_i\right)\right] - B_i + \left(t_i + T_i\right)}{R_j \left[A_i \left(t_i + T_i\right) - A_j \left(t_j + T_j\right) + B_i\right] + A_i \left(t_i + T_i\right) + B_i} \tag{A-1}$$

Note that $A_i \equiv a_i^2 n_i n_j$, $A_j \equiv a_i a_j n_i n_j$, $B_i \equiv a_i n_i n_j \left(h_j - h_i\right) + b_i$. Then we obtain the first and the second differentials, which are needed to consider the shape of the reaction function as follows.

$$\frac{\partial R_i}{\partial R_j} = \frac{A_j \left(t_i + T_i\right) \left(t_j + T_j\right) \left(A_i + 1\right)}{\left[B_i + A_i \left(t_i + T_i\right) + \left\{B_i + A_i \left(t_i + T_i\right) - A_j \left(t_j + T_j\right)\right\} R_j\right]^2} \tag{A-2}$$

$$\frac{\partial^2 R_i}{\partial R_j^2} = -\frac{2A_j \left(t_i + T_i\right) \left(t_j + T_j\right) \left(A_i + 1\right) \left\{B_i + A_i \left(t_i + T_i\right) - A_j \left(t_j + T_j\right)\right\}}{\left[B_i + A_i \left(t_i + T_i\right) + \left\{B_i + A_i \left(t_i + T_i\right) - A_j \left(t_j + T_j\right)\right\} R_j\right]^3} \tag{A-3}$$

Since equation (A-2) is always positive, it is obvious that the reaction function has an upward slope. In addition, if $\left\{B_i + A_i \left(t_i + T_i\right) - A_j \left(t_j + T_j\right)\right\} > 0$ are assumed, equation (A-3) is negative, that is, the slope is declining. Furthermore, equation (A-1) is positive when $R_j = 0$ if $B_i < t_i + T_i$ is assumed. This means that the reaction function has a positive intercept. We can also write a similar form of R_j. Therefore, under these assumptions, we find that the concave reaction functions bring a unique equilibrium.

Let us verify the properties of the reaction function and the equilibrium budget allocation ratio under asymmetry, in particular respect of population. To focus on this point, we assume that $a_i = a_j$, $h_i = h_j$ and $t_i + T_i = t_j + T_j$. Thus, $A_i = A_j$, $B_i = b_i$.

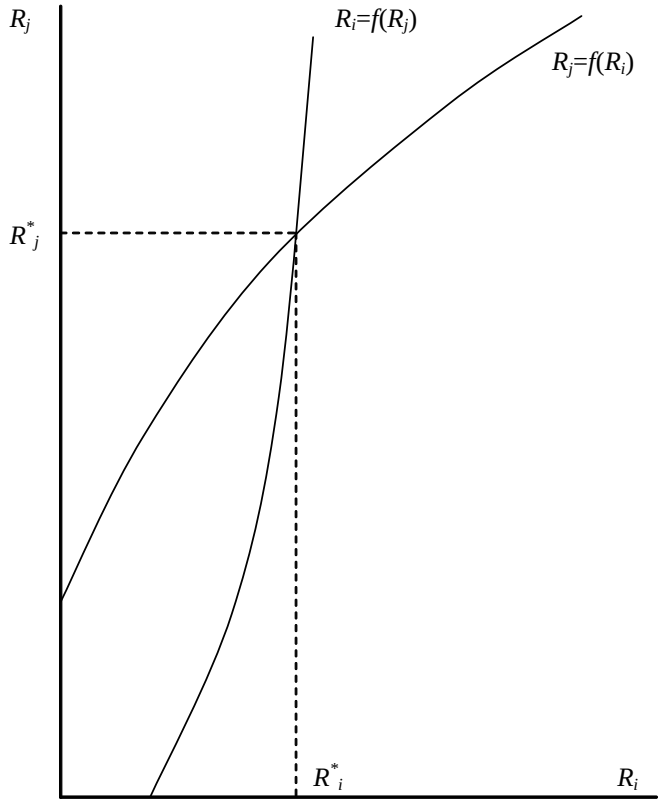
From differentiating R_i by n_i with taking R_j as zero, we derive:

$$\frac{\partial R_i}{\partial n_i}|_{R_j=0} = -\frac{\left(2n_i - 1\right) \left[\left(t_i + T_i\right) - b_i\right]}{A_i \left(t_i + T_i\right) n_i \left(n_i - 1\right)} < 0. \tag{A-4}$$

Then we obtain the following effect of n_i on the slope of the reaction function, by differentiating equation (A-2) by n_i.

$$\frac{\partial^2 R_i}{\partial R_j \partial n_i} = -\frac{a_i^2 (2n_i - 1)(t_i + T_i)^2 [b_i + A_i \{2b_i - (t_i + T_i) + b_i R_j (1 + 2A_i)\}]}{[A_i (t_i + T_i) + b_i (1 + R_j)]^3} < 0. \qquad \text{(A-5)}$$

That is, the intercept and the slope of the reaction function are reduced by the marginal increase in n_i. This means that the intercept and the slope of the reaction function of prefecture i are smaller than that of prefecture j when $n_i > n_j$. Therefore, we can describe the strategic relationship between R_i and R_j under asymmetry of population in the following figure. In this situation, we expect $R_j^* > R_i^*$.



Appendix C

Data Definition and References

Name of variable	Definition	Unit	Reference
BAR	(Commerce and industry expenses + Agriculture, forestry and fishery expenses + Civil engineering work expenses - Ntd for public works) / (Public welfare expenses + Sanitation expenses + Education expenses + Police expenses - Ntds)		Statistics of Local Public Finance (The Ministry of Internal Affairs and Communications)
Ntds	National Treasury Disbursement for Compuldory Education National Treasury Disbursement for Public Assistance National Treasury Disbursement for Child Welfare National Treasury Disbursement for Elderly Welfare National Treasury Disbursement for Tuberculosis Medical Treatment National Treasury Disbursement for Mental Health	Million yen	Statistics of Local Public Finance (The Ministry of Internal Affairs and Communications)
DEN	Population density	1000 people / km^2	Population Estimations (The Ministry of Internal Affairs and Communications), The Enquiries about Area of Prefecture and Municipalities (The Ministry of Land, Infrastructure, Transport and Tourism)
YOU	The ratio of population under 15 years old to total prefectural population	%	Population Estimations (The Ministry of Internal Affairs and Communications)
OLD	The ratio of population over 64 years old to total prefectural population	%	
CAP	Savings per capita	Million yen	Deposits, Loans and Discounts Outstanding of Domestically Licensed Banks by Prefecture (Bank of Japan)
JOB	The ratio of registered job openings to registered job applicants		Statistics of Employment Security Service (The Ministry of Health, Labor and Welfare)
SEC	The products of secondary industry / Prefectural GDP	%	Annual Report of Prefectural Account (Economic and Social Research Institute, Cabinet Office)
TER	The products of tertiary industry / Prefectural GDP	%	
FP	Standard Financial Revenues / Standard Financial Requirements		Statistics of Local Public Finance (The Ministry of Internal Affairs and Communications)
DP	Local Debt Payments / Total Expenditure	%	