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Is Japanese Local Finance Really Centralized?:
From Viewpoint of the Revenue-Expenditure Nexus

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Abstract

We analyze whether Japanese local finance system is centralized or not. We apply the literature on the revenue-expenditure nexus through the Granger causality tests to examining it. We propose another interpretation with considering Japanese local finance system. The causality from revenues to expenditures means that the management of local finance is more centralized. The causality from expenditures to revenues implies that the management of local finance is more decentralized. The bidirectional causality between expenditures and revenues suggests that that Japanese local finance is managed jointly by the control of the central government and the request of the local governments. We confirm the bidirectional causality between revenues and expenditures in most (70~80%) prefectures through the Granger causality tests in VAR established by Toda and Yamamoto (1995). We conclude that the central government and prefectural governments jointly affect the decision of revenues and expenditures in Japanese prefectural finance. It implies that Japanese local finance system is legally centralized, but the prefectures also have the enough power to affect the management of prefectural finance in fact.

Key words: The Revenue-Expenditure Nexus, Japanese Local Finance,
Granger Causality Test, Toda-Yamamoto Vector Autoregressions
JEL classification: H71, H72, H77, D78

I. Introduction

We investigate whether Japanese local finance is centralized or not, through the Granger causality tests in this paper. We have never directly and comprehensively analyzed that Japanese local finance is centralized not in name (its legal institution) but in fact (its management).

We can apply many previous papers on the relationship between revenues and expenditures in the U.S. that is a federal state. There exist empirical evidences as follows. In one case, the levels of revenues affect the decision of expenditures. In another case, changes in expenditures cause changes in revenues. Time series analyses have been employed in examining these revenue-expenditure nexus. Finding the relations is useful to explain the decision of the government size.

We newly consider another interpretation of these relations with considering Japanese local finance system as follows. As we will describe in Section II, Japanese local revenues are managed by the central government. On the other hand, local expenditures can be reflected needs of the residents by local governments. In other words, the decision of revenues is more centralized, and the decision of expenditures is more decentralized in Japanese local finance. Therefore if we can confirm the causality from revenues to expenditures in Japanese local finance, its management is centralized. if we can find the causality from expenditures to revenues, Japanese local finance system is substantially decentralized.

This paper consists of four sections. In Section II, we propose an original interpretation of the revenue-expenditure nexus in Japanese local finance with considering its institution. We also show how to test it. Section III reports the results of the test of the revenue-expenditure nexus in Japanese prefectural finance. Concluding remarks follow in Section IV.

II. Empirical Framework

II-1. Previous works on the revenue-expenditure nexus

On the relation between revenues and expenditures, previous studies have advanced the following hypotheses: the causality from expenditures to revenues, the causality from revenues to expenditures, the bidirectional causality between expenditures and revenues, and the independence of expenditures and revenues. We review the interpretations of these hypotheses according to previous research.

The causality from expenditures to revenues, that is, the spend-tax hypothesis, means that expenditures change before revenues. It is valid when increasing expenditures created by some special events and crises compels governments to increase taxes. This hypothesis is proposed by Peacock and Wiseman (1979) and so on. Barro (1974) also implies such a view because he implies that households consider issuing government bonds with increasing expenditures today as a tax increase in the future. Moreover this hypothesis is supported by Barro (1978), i.e. the tax-smoothing model.

The causality from revenues to expenditures, that is, the tax-spend hypothesis, suggests that revenues change before expenditures. It is true when the level of expenditure is adjusted in response to changes in revenues. This hypothesis is advocated by Friedman (1978) and so on.

The bidirectional causality between expenditures and revenues, namely the fiscal synchronization hypothesis, suggests that expenditures change concurrently with revenues. It is valid when the levels of both expenditures and revenues are decided with respect to the requests of the voters. Musgrave (1966) and Meltzer and Richard (1981) argue this hypothesis.

The independence of expenditures and revenues implies that changes in expenditures and revenues are dominated by macroeconomic fluctuations, rather than changes in the other. Buchanan and Wagner (1977, 1978) suggest this hypothesis.

In previous studies, the revenue-expenditure nexus have been investigated through causality test defined by Granger (1969). The techniques of vector autoregression (VAR) and error correction models (ECMs) have been used in this test. The causality from expenditures to revenues has been supported by von

Fustenberg, Green and Jeong (1985, 1986), Anderson, Wallace and Warner (1986), Jones and Joulfaian (1991). The causality from revenues to expenditures has been supported by Blackley (1986), Manage and Marlow (1986), Marlow and Manage (1987, 1988), Ram (1988), Holtz-Eakin, Newey and Rosen (1989), Joulfaian and Mookerjee (1990), and Owoye (1995). The bidirectional causality between expenditures and revenues has been supported by Chowdhury (1988), Miller and Russek (1989), and Baghestani and McNown (1994). Finally the independence of expenditures and revenues has been supported by Hoover and Sheffrin (1992).[1]

The objects of most empirical studies are the U.S. revenues and expenditures at the federal, state and local levels. We have never comprehensively examined the test in Japanese local finance.

II-2. Application to Japanese local finance

The tasks of our paper are testing the above hypotheses in Japanese local finance, and evaluating the results with considering its institution. In this section, we show another interpretation of these hypotheses that applies to Japanese local finance. In other words, the interpretation of these hypotheses in a centralized local system such as Japan is different from that in a federal system such as the U.S..

Reed (1986) suggests that Japanese local governments have less authority than in federal states but more authority than in other unitary states from case studies. One of points that Japanese local governments have less authority than in federal states is the decision of the local revenues.[2] The local revenues are divided into six categories; Local Taxes, Local Transfer Taxes, Local Allocation Tax, National Government Disbursements, Local Public Bonds, and Miscellaneous Revenue. The revenues can be controlled by the central government in Japan. Rates and sources of Local Taxes are basically decided by national laws, local governments rarely have discretion over them. Issuing Local Public Bonds is controlled through the central

[1] Hoover and Sheffrin (1992) obtain such a result while the period following the mid-1960s. They also gain the result that taxes causes spending prior to the mid-1960s.

[2] See Shibata (1993) for further details.

government. Local Transfer Taxes, Local Allocation Tax, and National Government Disbursements are distributed to local governments by the central government.

Accordingly Japanese local revenues are managed by the central government. On the other hand, local expenditures can be reflected needs of the residents by local governments. If Japanese local governments want to manage their finance as they require, they need to request the central government to distribute these revenues. Especially, the interregional distribution of National Government Disbursements often affects political pressure, suggested by Doi and Ashiya (1997). Namely the Dietmen, the prefectural governors, and mayors appeal to the central bureaucrats to distribute more in their own jurisdictions.

To sum up, the decision of revenues is more centralized, and that of expenditures is more decentralized in Japanese local finance. We newly construct an interpretation of these hypotheses with considering its institution as follows. The causality from revenues to expenditures means that the management of local finance is more centralized, because changes in revenues decided by the central government lead to changes in expenditures. The causality from expenditures to revenues implies that the management of local finance is more decentralized, since changes in expenditures required by the local governments lead to changes in revenues. The bidirectional causality between expenditures and revenues suggests that Japanese local finance is managed jointly by the control of the central government and the request of the local governments. The independence of expenditures and revenues implies that the levels of expenditures and revenues are independently determined each other.

Therefore testing the revenue-expenditure nexus in Japanese local finance means investigating whether it is centralized or not. We explain the methods of this test in the next section.

II-3. Test Procedure

In previous works, the Granger causality tests using the conventional VAR analysis and ECMs have been implemented. One of these shortcomings is the tests

cannot implement when the orders of integration of revenues and expenditures are different, or when either order of integration is more than two. To avoid it, we employ the method of Toda and Yamamoto (1995).[3] An advantage of this method is that we can implement the Granger causality tests when the order of integration of revenues is not equal to that of expenditures and when either order of integration is more than two. The method is as follows.

We consider the following VAR of an n-vector time series $\{\mathbf{y}_t\}_{t=-k+1}^{\infty}$ ($k \geq 1$):

$$\mathbf{y}_t = \mathbf{b}_0 + \mathbf{b}_1\mathbf{t} + A_1\mathbf{y}_{t-1} + \cdots + A_k\mathbf{y}_{t-k} + \cdots + A_l\mathbf{y}_{t-l} + \mathbf{e}_t, \qquad (1)$$

$$\text{where } \mathbf{y}_t \equiv \begin{pmatrix} y_{1t} \\ y_{2t} \\ \vdots \\ y_{nt} \end{pmatrix}, \quad A_i \equiv \begin{pmatrix} a_{11}^i & a_{12}^i & \cdots & a_{1n}^i \\ a_{21}^i & a_{22}^i & & \\ \vdots & & \ddots & \vdots \\ a_{n1}^i & & \cdots & a_{nn}^i \end{pmatrix},$$

A_i (i = 1,2, .., k, .., l) denotes an n×n matrix of coefficients, $\mathbf{t}$ denotes a vector of a time trend, and $\mathbf{e}_t$ denotes an n-vector of the innovation. We assume that the order of integration of $\mathbf{y}_t$ is at most $d_{\max}$ around a linear trend. $d_{\max}$ denotes the maximal order of integration of variables in $\mathbf{y}_t$.

First we select the lag length in (1). According to Toda and Yamamoto (1995), under the following null hypothesis:

$$H'_0: A_{m+1} = \ldots = A_l = \mathbf{0},$$

where $k \leq m \leq l$-1

the usual Wald statistic obtained from the OLS estimators of coefficients in (1), has an asymptotic χ^2 distribution with $n^2(l - m)$ degrees of freedom if $m \geq d_{\max}$. After this test, we select the lag length as the null hypothesis can be rejected. p denotes the selected lag length.

For implementing the Granger causality tests, we estimate the following VAR:

$$\mathbf{y}_t = \mathbf{b}_0 + \mathbf{b}_1\mathbf{t} + A_1\mathbf{y}_{t-1} + \cdots + A_k\mathbf{y}_{t-k} + \cdots + A_p\mathbf{y}_{t-p} + \mathbf{e}_t, \qquad (2)$$

In this regression, the i-th variable, y_{it}, does not Granger-cause the j-th variable, y_{jt},

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[3] Examples that apply this method are Morimune and Zhao (1995), and Asai and Shiba (1995). There is no study employing this method on the revenue-expenditure nexus.

if we cannot reject the following null hypothesis:

$$H_0: a^1_{ji} = \ldots = a^p_{ji} = 0.$$

Toda and Yamamoto (1995) prove that under the above null hypothesis, the the usual Wald statistic obtained from the OLS estimators of coefficients in (2), has an asymptotic χ^2 distribution with p degrees of freedom if $p \geq k + d_{\max}$. Note that the conditions, $p \geq k + d_{\max}$ and $k \geq 1$, must be satisfied.

III. Empirical Results

III-1. Data

We analyze the revenue-expenditure nexus in Japanese local finance. In investigating the log-run relation between local revenues and local expenditures, prefectural data are suitable in Japan. The reasons that we deal with not municipalities but prefectures, are (1) municipal time series data are discontinuous by mergers with other municipalities, (2) we can obtain municipal data for about 30 years that are shorter than in prefectural data, and (3) municipal governments have less authority than prefectural governments. There is no merger among Japanese prefectures in the postwar era. We use data by prefecture in all prefectures excluding Okinawa. We cannot obtain the data on Okinawa prefecture before FY1971. We can gain the 41 years prefectural data from FY1955 to FY 1995. The data source is Ministry of Home Affairs, "Annual Statistical Report on Local Government Finance."

We define the expenditures, E_t, used in the test as what exclude the reserve for the adjusting fund for finance from Total Expenditure. We also define the revenues, R_t, as what exclude the transfer from the adjusting fund for finance from Total Revenue. It is because we eliminate the effect of fund flow between Ordinary Account and the adjusting fund for finance. Moreover we prepare another definition. We define the expenditures, G_t, as what exclude the local debt service from E_t, and

the revenues, T_t, as what exclude Local Public Bonds from R_t.[4] In this paper, we set the above $\mathbf{y}_t$ as $[R_t, E_t]'$, or $[T_t, G_t]'$.

We deal with nominal values of these variables in these tests. Because nominal values are employed in the budget process, and we analyze how to decide the budget. We set the sample periods as from FY1956 to FY1995 and FY1960 to FY1991.

We investigate these hypotheses by prefecture, that is, as cross section data. We don't try panel analyses. Because the method of Toda and Yamamoto (1995) cannot be directly applied to panel analyses,[5] and the techniques of panel unit root tests, for instance Levin and Lin (1992), have been established but those of panel cointegration tests have not been stylized yet.

We examine the following tests using these data.

III-2. Unit root tests

Before the Granger causality tests, we implement the unit root tests by prefecture. We employ the augmented Dickey-Fuller tests because the number of observation of these variables is not enough large in order to implement the Phillips-Perron tests. We use the criteria advocated by Pantula, Gonzalez-Farias and Fuller (1994), and based on the principle of parsimony in deciding the lag length.

We find the order of integration of each variable in each prefecture by the augmented Dickey-Fuller tests. We set the 5% significance level in testing the null hypothesis that the variable has a unit root. The order of integration of each variable by prefecture is shown in Table 1. From this result, we set $d_{\max}$ as the larger of the two variables; E_t and R_t, or G_t and T_t.

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[4] Strictly speaking, we should define G_t as what also exclude the transfer to the bond redemption fund, that appropriate for repayments of local bonds in the future, from E_t. Unfortunately, we cannot obtain the data on the transfer by prefecture. Hence we set such a definition.

[5] In panel analyses, we must use the method of moments, not OLS, in estimation of VAR as mentioned by Holtz-Eakin, Newey and Rosen (1989), Baltagi (1995) and so on.

III-3. VAR results

In the next step, we select the lag length of VAR. As mentioned above, we decide the lag length, p, using the Wald statistic by prefecture. The results are reported in Table 2. We note that the conditions, $p \geq k + d_{\max}$ and $k \geq 1$, must be satisfied.

We estimate the VAR, equations (2), whose lag length is equal to p reported in Table 2, and implement the Granger causality tests based on the Wald statistics from the OLS estimators. We estimate four versions of VAR; $\mathbf{y}_t = [R_t, E_t]'$ from FY1956 to FY1995, $\mathbf{y}_t = [R_t, E_t]'$ from FY1960 to FY1991, $\mathbf{y}_t = [T_t, G_t]'$ from FY1956 to FY1995, and $\mathbf{y}_t = [T_t, G_t]'$ from FY1960 to FY1991. The Wald statistics are reported in Table 2. They have an (asymptotic) $\chi^2(p)$. Asterisks indicate the significance levels.

In all versions shown in Table 2, there is the bidirectional causality between revenues and expenditures in most (70%~80%) prefectures. Furthermore, there is no case of the unidirectional causality, from revenues to expenditures, or from expenditures to revenues, excluding the case of $\mathbf{y}_t = [T_t, G_t]'$ from FY1956 to FY1995 in Kumamoto prefecture. It generally implies not that the central government or the prefectural government only affects the management of local finance, but that the central government and prefectural governments jointly affect the decision of revenues and expenditures in Japanese prefectural finance.

There is the independence of expenditures and revenues in some prefectures. It may mean that the levels of expenditures and revenues are independently determined each other. Or it may mean that the causality is ambiguous in sample period, since there is the causality from expenditures to revenues in some period, and there is the causality from revenues to expenditures in another period. We cannot conclude which interpretation is accurate in our data and tests .

We consider the relation between causality and prefectural circumstances. Where the causality exists (or not). The prefectures where the bidirectional causality exists in all version are Hokkaido, Aomori, Miyagi, Yamagata, Ibaraki, Tochigi, Chiba, Tokyo, Toyama, Gifu, Kyoto, Osaka, Hyogo, Nara, Wakayama, Shimane, Okayama, Tokushima, Ehime, Fukuoka, Nagasaki, and Miyazaki. The prefecture where any causality does not exist in all version is Shizuoka. There exist the prefectures where

the bidirectional causality exists in all version in not only rural areas but urban areas. From our tests, we cannot easily conclude the reason that the bidirectional causality exists.

IV. Concluding Remarks

We examine the long-run relation between revenues and expenditures in Japanese prefectural finance, and evaluating the results with considering its institution. We propose an original interpretation that applies to Japanese local finance. If we confirm the causality from revenues to expenditures, the management of local finance is more centralized. Because changes in revenues decided by the central government lead to changes in expenditures. If we find the causality from expenditures to revenues, the management of local finance is more decentralized, since changes in expenditures required by the local governments lead to changes in revenues. When we confirm the bidirectional causality between expenditures and revenues, Japanese local finance is managed jointly by the control of the central government and the request of the local governments. The independence of expenditures and revenues implies that the levels of expenditures and revenues are independently determined each other.

We confirm the bidirectional causality between revenues and expenditures in most (32~38) prefectures through the Granger causality tests in VAR established by Toda and Yamamoto (1995). This method is implemented the causality tests when the order of integration of revenues is not equal to that of expenditures and when either order of integration is more than two.

We conclude Japanese local finance is managed jointly by the control of the central government and the request of the local governments. In this sense, Japanese prefectural finance is not perfectly centralized in fact. We support the study of Reed (1986) through econometric methods. Also Doi (1998a, 1998b) show that the voters affect the gubernatorial election, the elected governor petitions the central government as a agent of the voters, and the central government manages

local expenditures through interregional grants to reflect the preference of the voters in its jurisdiction. The results in this paper are consistent with these.

There are other issues that we have not investigated in our model. We need to deal with also real revenues and expenditures deflated by price level. We also need to consider the relation between causality and prefectural circumstances. In this paper, there is no clear relation. These are our further research.

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Table 1

The Order of Integration

Sample Period: FY1956-FY1995

The significance level is 5%.

Prefecture	R_t	E_t	d_{max}	T_t	G_t	d_{max}
Hokkaido	3	3	3	2	2	2
Aomori	3	2	3	2	2	2
Iwate	2	2	2	2	2	2
Miyagi	2	2	2	2	2	2
Akita	2	2	2	2	2	2
Yamagata	2	2	2	2	3	3
Fukushima	2	2	2	2	2	2
Ibaraki	2	2	2	2	2	2
Tochigi	2	2	2	2	2	2
Gumma	2	2	2	2	2	2
Saitama	1	2	2	2	2	2
Chiba	2	2	2	2	2	2
Tokyo	2	3	3	4	3	4
Kanagawa	2	2	2	3	3	3
Niigata	2	2	2	2	2	2
Toyama	2	2	2	2	2	2
Ishikawa	2	2	2	2	2	2
Fukui	2	2	2	2	2	2
Yamanashi	3	2	3	2	2	2
Nagano	2	2	2	2	2	2
Gifu	3	3	3	2	2	2
Shizuoka	2	2	2	2	2	2
Aichi	2	2	2	3	2	3
Mie	2	2	2	2	2	2
Shiga	2	2	2	2	2	2
Kyoto	2	2	2	2	2	2
Osaka	2	2	2	2	2	2
Hyogo	3	3	3	2	3	3
Nara	2	2	2	2	3	3
Wakayama	2	2	2	2	2	2
Tottori	2	2	2	2	3	3
Shimane	2	2	2	1	2	2
Okayama	2	2	2	2	2	2
Hiroshima	2	2	2	2	2	2
Yamaguchi	2	2	2	2	2	2
Tokushima	3	2	3	2	2	2
Kagawa	3	3	3	2	3	3
Ehime	2	2	2	2	2	2
Kochi	3	2	3	3	2	3
Fukuoka	2	2	2	2	2	2
Saga	2	2	2	2	2	2
Nagasaki	2	2	2	2	2	2
Kumamoto	2	2	2	2	2	2
Oita	2	2	2	2	2	2
Miyazaki	2	2	2	2	2	2
Kagoshima	2	3	3	3	2	3

Table 2

The Granger Causality Tests

Period	1956-1995					1956-1995				
Revenues	R_t					T_t				
Expenditures	E_t					G_t				
Causality		$R_t \rightarrow E_t$		$E_t \rightarrow R_t$			$T_t \rightarrow G_t$		$G_t \rightarrow T_t$	
Prefecture	Lag	Wald statatistic		Wald statatistic		Lag	Wald statatistic		Wald statatistic	
Hokkaido	4	22.847	***	20.933	***	6	15.190	**	21.239	***
Aomori	4	24.881	***	23.204	***	6	49.334	***	20.292	***
Iwate	3	4.089		5.367		6	41.241	***	16.597	**
Miyagi	6	40.345	***	32.388	***	4	32.602	***	16.663	***
Akita	4	4.766		2.805		6	47.790	***	19.982	***
Yamagata	3	20.015	***	16.737	***	5	14.308	**	33.706	***
Fukushima	3	6.355	*	4.820	*	5	11.019	*	12.172	*
Ibaraki	3	34.305	***	12.643	***	6	53.325	***	10.523	**
Tochigi	5	15.456	***	6.615	**	4	63.726	***	12.110	**
Gumma	3	4.581		3.136		4	8.448	*	9.866	*
Saitama	5	7.201		7.013		4	1.971		1.527	
Chiba	6	36.653	***	29.616	***	5	13.466	**	3.489	**
Tokyo	5	130.059	***	83.097	***	6	51.813	***	27.561	***
Kanagawa	4	16.896	***	12.810	**	6	10.641		15.555	
Niigata	3	9.557	**	6.004	**	4	34.116		12.293	
Toyama	5	29.977	***	20.647	***	3	18.156	***	11.098	**
Ishikawa	4	11.272	**	7.814	**	6	10.432		12.249	
Fukui	4	23.432	***	27.939	***	3	3.505		7.966	
Yamanashi	6	63.507	***	50.129	***	3	8.402	**	6.132	**
Nagano	3	7.172	*	10.641	*	3	9.674	**	3.862	**
Gifu	6	37.210	***	40.745	***	4	34.313	***	54.413	***
Shizuoka	3	5.151		1.431		6	9.737		4.231	
Aichi	3	13.152	***	7.303	**	6	20.446	***	56.020	***
Mie	4	21.351	***	37.095	***	3	6.604	*	2.346	*
Shiga	4	10.047	**	8.987	**	3	2.756		5.635	
Kyoto	5	47.629	***	34.067	***	3	17.499	***	11.612	***
Osaka	3	8.789	**	7.864	**	6	24.729	***	10.799	**
Hyogo	4	21.324	***	18.044	***	5	86.570	***	27.235	***
Nara	3	7.841	**	5.894	**	4	15.297	***	10.855	**
Wakayama	3	7.855	**	2.247	**	5	31.006	***	13.839	**
Tottori	3	7.807	*	7.248	*	5	24.218	***	21.020	***
Shimane	3	20.942	***	16.927	***	5	17.871	***	14.456	**
Okayama	3	22.406	***	9.449	**	3	10.900	**	2.257	**
Hiroshima	3	1.173		2.517		4	13.630	***	18.202	***
Yamaguchi	3	5.517		2.758		5	41.977	***	24.570	***
Tokushima	6	35.338	***	55.816	***	4	26.819	***	20.351	***
Kagawa	4	13.652	***	8.899	***	6	22.544	***	14.498	**
Ehime	6	14.338	**	8.713	**	6	25.519	***	74.440	***
Kochi	4	9.410	*	10.219	*	4	11.046	**	3.569	**
Fukuoka	5	31.299	***	23.445	***	4	15.095	***	1.284	**
Saga	3	2.821		6.114		4	16.707	***	10.470	**
Nagasaki	6	50.281	***	63.742	***	6	62.606	***	37.836	***
Kumamoto	4	7.836	*	7.753	*	4	9.255	*	14.287	***
Oita	3	0.841		1.559		6	70.662	***	39.716	***
Miyazaki	3	9.065	**	5.837	**	3	12.041	***	4.424	**
Kagoshima	4	15.564	***	5.058	**	4	30.640	***	11.428	**

Note: ***, **, and * denote significance at 1%, 5%, and 10% level, respectively.

Table 2
(continued)

The Granger Causality Tests

Period	1960-1991					1960-1991				
Revenues	R_t					T_t				
Expenditures	E_t					G_t				
Causality		$R_t \rightarrow E_t$		$E_t \rightarrow R_t$			$T_t \rightarrow G_t$		$G_t \rightarrow T_t$	
Prefecture	Lag	Wald statatistic		Wald statatistic		Lag	Wald statatistic		Wald statatistic	
Hokkaido	5	88.081	***	61.147	***	5	37.002	***	83.259	***
Aomori	4	25.894	***	25.307	***	5	58.428	***	43.854	***
Iwate	4	6.080		2.182		5	61.391	***	85.504	***
Miyagi	4	16.866	***	18.821	***	4	54.428	***	50.422	***
Akita	4	6.391		5.994		5	67.560	***	43.964	***
Yamagata	3	18.454	***	11.084	**	5	25.580	***	60.226	***
Fukushima	4	10.464	**	4.712	**	5	20.205	***	31.121	***
Ibaraki	5	41.596	***	26.959	***	5	35.990	***	26.051	***
Tochigi	5	13.625	**	9.212	**	4	39.743	***	28.839	***
Gumma	5	22.364	***	21.488	***	4	5.051		8.680	
Saitama	5	8.055		7.947		4	20.122	***	6.104	**
Chiba	5	38.741	***	27.762	***	5	21.037	***	27.347	***
Tokyo	5	187.024	***	108.972	***	5	36.330	***	14.656	**
Kanagawa	3	11.887	***	11.766	***	5	8.903		14.586	
Niigata	3	8.081	**	2.398	**	4	19.779	***	27.521	***
Toyama	4	44.049	***	40.343	***	3	11.295	**	16.672	***
Ishikawa	5	14.970	**	12.270	**	5	30.673	***	25.672	***
Fukui	4	24.632	***	27.404	***	3	2.948		7.885	
Yamanashi	5	26.462	***	21.749	***	3	6.279	*	2.594	*
Nagano	5	36.013	***	42.442	***	3	2.052		6.642	
Gifu	5	31.959	***	31.010	***	4	44.270	***	50.339	***
Shizuoka	3	4.722		0.977		5	7.107		5.485	
Aichi	3	15.787	***	10.196	**	5	23.009	***	54.832	***
Mie	5	29.745	***	40.839	***	3	7.929	**	14.607	***
Shiga	5	45.461	***	27.668	***	3	2.994		7.385	
Kyoto	3	26.367	***	19.687	***	3	24.680	***	4.912	**
Osaka	3	14.124	***	11.483	***	5	29.158	***	11.911	**
Hyogo	5	32.774	***	36.752	***	5	11.076	**	28.280	***
Nara	5	20.855	***	15.892	***	4	15.523	***	10.959	**
Wakayama	3	8.056	**	1.596	**	5	27.446	***	28.579	***
Tottori	5	9.058		9.045		5	86.621	***	87.237	***
Shimane	3	35.933	***	29.053	***	5	19.328	***	17.290	***
Okayama	3	22.050	***	11.315	**	3	27.289	***	22.992	***
Hiroshima	3	9.670	**	16.190	***	4	11.676	**	41.948	***
Yamaguchi	5	7.603		3.510		5	35.967	***	47.513	***
Tokushima	5	29.731	***	19.945	***	4	24.561	***	27.833	***
Kagawa	4	13.957	***	11.845	**	5	10.548	*	8.398	*
Ehime	3	11.481	***	9.237	**	5	28.910	***	67.881	***
Kochi	4	16.845	***	12.347	**	4	43.969	***	22.530	***
Fukuoka	5	39.010	***	26.747	***	4	15.730	***	1.808	**
Saga	3	2.556		4.975		4	17.149	***	26.736	***
Nagasaki	5	46.564	***	53.645	***	5	52.582	***	20.868	***
Kumamoto	4	3.898		3.169		4	12.923	**	19.079	***
Oita	5	21.698	***	20.442	***	5	150.702	***	134.109	***
Miyazaki	3	8.357	**	3.247	**	3	28.732	***	27.084	***
Kagoshima	5	4.762		2.360		4	62.048	***	42.946	***

Note: ***, **, and * denote significance at 1%, 5%, and 10% level, respectively.