The copycatting fiscal behavior of local governments and spatial econometric models

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Abstract

This paper proposes a model of Japanese cities' copycatting (so-called *yokonarabi*) spending behavior based on a spatial econometric model and reports its estimation results under four different specifications of *yokonarabi* in FYs 1970, 1980 and 1990. While estimations results generally fail to support the proposed copycatting spending model, the limited availability of fiscal data makes these modeling results less conclusive, and further research into the inner workings of *yokonarabi* must be crucial.

1. Introduction

A number of studies in the sister disciplines of the social sciences have reported one- or both-way interaction between a subnational government and its neighbors. Such interaction is sometimes called competition in one study or copycatting in another. While since the early 1970s, researchers have proposed and estimated their models of subnational government's spending behavior in the field of local public finance[1], copycatting fiscal behavior seems to have failed to get their serious attention until the late 1980s. In the early 1990s, along with the progress of spatial econometrics[2], several researchers tried to model subnational governments' copycatting fiscal behavior (e.g., Case, Rosen, and Hines 1993; Heikkila and Kantiotou 1992; Murdoch, Rahmatian, and Thayer 1993).

Within the modeling framework of copycatting fiscal behavior based on spatial econometric models, modeling results largely depend on how to define the spatial weight matrix (the parameters of copycatting behavior) of a model, and it is typical modeling practice to exogenously specify the elements of the spatial weight matrix. This implies that the inner workings of copycatting behavior must be well-understood beforehand and then these inner workings must be accurately codified into a specific form of the spatial weight matrix.

In Japan, copycatting fiscal behavior (so-called *yokonarabi*) has been reported in the past studies of local public finance and it has been understood as a typical decision-making style for

[1] For details of the median voter model of local government expenditure, see Inman(1979), Romer and Rosenthal(1979), Wildasin(1986, Chapter 3), and Rubinfeld(1987).
[2] For spatial econometrics, see Anselin (1988), Anselin and Bera (1998).

Japanese local governments[3](Noguchi et al. 1978; Yoshida 1991a). While Japanese local governments' *yokonarabi* has been frequently described in the past studies, *yokonarabi* itself has not been included in the past models of Japanese local government spending behavior[4].

The main objectives of this paper is to propose a model of Japanese municipalities' *yokonarabi* spending behavior by using a spatial econometric model and to test four different specifications of *yokonarabi* spending behavior by using findings from a survey of intercity rivalries in Japan.

The next section explains Japanese localities' *yokonarabi* fiscal behavior and presents a *yokonarabi* spending model based on a spatial econometric model. Third section firstly describes the data used for this study, especially those for four different specifications of the spatial weight matrix, and secondly reports their estimation results. The last section summarizes this study's findings and concludes this paper. The Appendix provides the derivation of a Japanese city's spending behavior model and information about the data used in this study.

2. Japanese Cities' Copycatting Spending Model

2. 1 *Yokonarabi*: Japanese-style Copycatting behavior

This paper focuses on municipalities' copycatting spending behavior in Japan where such copycatting behavior is called *yokonarabi* and frequently observed not only in the public sector but also in the private sector. Yoshimura and Anderson (1997) detailed *yokonarabi* in the private sector in their recent book, *Inside Kaisha: Demystifying Japanese Business Behavior.* While their examples are mainly taken from the private sector, the essence of *yokonarabi* can be found in the following quotations and it is applicable even for Japanese municipalities:

> Just as powerfully, *Japanese seek to avoid social embarrassment.* Models are important because they provide the predictability and stability that Japanese need to avoid embarrassing themselves. By socially embarrassing behavior, we mean actions that fail to match a reference group's norms, rules, or expectations. Given a context and a group, a Japanese person should know what he or she has to do. People who behave in socially unacceptable ways are considered poorly educated, because they don't know how act as others expect. (p. 46)
>
> ... Japanese people are much more motivated by the fear of appearing inferior than they are by the desire to succeed. As a consequence, Japanese firms engage in a practice called *yokonarabi*, which is the engine of much that is competitive in Japan. "*Yoko*" means "horizontal," and "*narabi*" means "side by side." Each of the major rivals in a market mirrors one or two others, matching their every move and try to do the same thing.(p. 112)
>
> The art of Japanese management lies in setting up a series of social pressures that guides workers to do what management wants them to do.(p. 174)
>
> Westerners who work in Japanese firms are often surprised at how seldom social expectations are conveyed in writing. (p. 178)

[3] In this study, the term local government in any Japanese context includes prefectures (*ken*) and municipalities, i.e., cities (*shi*), towns (*cho*), and villages (*son*). Japanese prefectures could be understood as an intermediary-tier between the national government and municipalities such as US states, but unlike US states, the autonomy of Japanese prefectures is considerably limited.
[4] For Japanese local public finance, see Ishihara(1986).

The fundamental nature of *yokonarabi* is neither written nor ordered by anybody and it works only among Japanese who understand unwritten expectations relevant to them.

In the context of Japanese local public finance, *yokonarabi* generally means that local government officials look around at their neighbors and/or relevant reference group members and then make their final decision in accordance with the counterpart of their reference group. There is an institutional incentive that compels Japanese local governments practice *yokonarabi*. Most of the Japanese localities are so financially dependent on grants from the national government that they are difficult to independently set their own service levels faraway from some nationally-accepted levels or initiate their own programs that the national government may object. If Japanese localities failed to conform to their reference group's expectations, the national government has a number of fiscal means to discipline those non-conformable localities. It is important to note that a result might be the same (each municipality has the same level of per capita spending concerning a municipal service) between competition in neo-classic economic theory and *yokonarabi*, but their processes, which reached the same result, are different; in the case of *yokonarabi*, they reached the same spending level not by competing one another but by conforming to a certain, reasonably acceptable service level among them for fear of being left our or the national government's fiscal discipline.

Although it is anecdotally known that Japanese localities frequently practice *yokonarabi*, its actual inner workings have not been rigorously investigated by the past studies of Japanese local governments' spending behavior. Particularly, these past surveys do not always agree with their findings about the determinants of *yokonarabi*. For example, Noguchi, et al. (1978) concluded that smaller local governments tend to rely on *yokonarabi* in their budgeting of social services, but a more recent questionnaire survey by Yoshida(1991b) reported that a city's reliance on *yokonarabi* in its assessment of a draft budget tends to increase as the population size of a city increases. In addition, the past surveys failed to explore how a locality selects their reference group members for its *yokonarabi*.

Of course, as in the private sector (Yoshimura and Anderson 1997, p. 114), it is unlikely that a city practices *yokonarabi* against any cities randomly. In his questionnaire, Yoshida (1991a) paraphrased *yokonarabi* as "to decide after consulting the service levels of its neighbors and/or non-coterminous localities whose attributes are similar to its counterparts. While a locality's former group members (coterminous localities) can be readily defined by consulting an administrative boundary map, there are a number of ways to specify its latter group members because the above past surveys failed to analyze what attributes are relevant to practicing *yokonarabi* spending. The population size of a locality is definitely considered one of these attributes because intergovernmental grants tends to be determined by the population size of a recipient, but there could be other important attributes. In order to determine each city's reference group members for *yokonarabi*, this study consulted data on intercity rivalries among Japanese cities. The next section will explain how this study used data on intercity rivalries to set the parameters of a city's *yokonarabi* spending behavior.

2.2 Japanese Municipalities' Copycatting Spending Behavior Model[5]

There are several approaches to modeling local governments' fiscal behavior in the field of state and local public finance. The functional form of the following basic spending behavior model for Japanese municipalities is largely based on Ladd and Yinger's spending model (Ladd and Yinger 1989). However, there is one subtle, but important difference between the two models. Whereas in the modeling framework of Ladd and Yinger, it is a city's the median voter whose preference function is maximized, the following Japanese spending model assumes that city officials act as honest agents for a city's the mean household and set the service level that maximizes its preference function. This assumption reflects peculiarities of the current Japanese civil service system and local governance and finance (Appendix A explains how this assumption could be justified in the institutional context of local governance and finance in Japan and also shows the derivation of the following basic spending model).

Basic Spending Model

$$\begin{aligned} ln(\mathrm{E}) = ln(\mathrm{c}) + \theta[ln(\mathrm{Y}) + \Sigma\beta_k \mathrm{IGA}_k/\mathrm{Y}] - \mu ln(\mathrm{EPT}) + (\mu+1)[\beta_{\mathrm{I_P}} ln(\mathrm{I_p}) + \beta_{\mathrm{N}} ln(\mathrm{N}) + \mathbf{c}_{\mathrm{F}}\boldsymbol{\gamma}] \\ + \mathbf{x}\boldsymbol{\beta} + \varepsilon \qquad (2.1) \\ \boldsymbol{\varepsilon} \sim \mathrm{N}(\mathbf{0}, \sigma^2\mathbf{I}) \end{aligned}$$

E_T	Per household expenditure (of fiscal years T)
c	Constant
Y	Mean household Income
IGA_k	Per household intergovernmental grants and gambling revenue
EPT	Local taxes export(import) variable
I_p	Wage index
N	Population (nighttime)
$\mathbf{C}_F$	Cost variables (row vector)
$\mathbf{x}$	Service preference variables (row vector)
$\lambda, \mu, \beta, \theta, \boldsymbol{\gamma}, \boldsymbol{\beta}$	Parameters to be estimated
ε	Error term

The above basic spending model does not include the component that specifies Japanese municipalities' *yokonarabi* behavior. This component will be added to the basic model in the next section after the so-called linear regression model with a spatially lagged dependent variable is introduced.

Spatial Econometric Models

Given the following classical linear regression model,

$$\mathbf{y} = \mathbf{X}\boldsymbol{\beta} + \boldsymbol{\varepsilon} \qquad \boldsymbol{\varepsilon} \mid \mathbf{X} \sim N(\mathbf{0}, \sigma^2\mathbf{I}) \qquad (2.2)$$

generally speaking, there are two approaches to accommodate a spatial interaction component within the above model (Anselin 1988, Chapter 4): (1) the linear regression model with spatially dependent errors,

[5] For simplicity, the index subscript for the observation number of each city is eliminated from mathematical expressions in this sub-section.

$$\mathbf{y} = \mathbf{X}\boldsymbol{\beta} + \boldsymbol{\mu}$$
$$\text{where} \quad \boldsymbol{\mu} = \lambda \mathbf{W}\boldsymbol{\mu} + \boldsymbol{\varepsilon} \qquad (2.3)$$
$$\boldsymbol{\varepsilon} \mid \mathbf{X} \sim N(\mathbf{0}, \sigma^2 \mathbf{I}) \text{ and } \mathbf{W} \text{ is the spatial weight matrix}$$

and (2) the linear regression model with a spatially lagged dependent variable or the mixed regressive and spatial autoregressive (MRSA) model:

$$\mathbf{y} = \rho \mathbf{W}\mathbf{y} + \mathbf{X}\boldsymbol{\beta} + \boldsymbol{\varepsilon} \qquad \boldsymbol{\varepsilon} \mid \mathbf{X} \sim N(\mathbf{0}, \sigma^2 \mathbf{I}) . \qquad (2.4)$$

Unlike a model for spillover effects of a public service among localities, *yokonarabi* (copycatting) is a local government's deliberate decision-making and therefore the MRSA model is more suited for this modeling situation.

There are various methods to code a given spatial structure as a spatial weight matrix (SWM) of the MRSA model (Anselin 1988, Chapter 3). For example, Case et al. (1993) tested four different SWM specifications to analyze fiscal policy interdependence and budget spillovers among the 48 contiguous mainland US states: (1) neighbors with common borders; (2) neighbors with similar incomes; (3) neighbors with similar proportions of blacks in their populations; and (4) others. Murdoch et al. (1993) used two SWM specifications to model a community's recreational spending in the Los Angeles Metropolitan Area, California : (1) inverse Distance; and (2)negative exponential of distance. Besides these specifications, other possible SWM specifications are (1) binary contiguity, (2) Cliff and Ord Matrix, and (3) Dacey Matrix. Among these alternatives, the binary contiguity (contiguous = 1; otherwise = 0) is the most simple and intuitive specification, and this study tested three other specifications besides the binary contiguity. The details of these four SWM specifications will be explained in the next section.

Yokonarabi spending model

The following is the final spending model that incorporates the *yokonarabi* component into the basic spending model:

Yokonarabi (Copycatting) Spending Model

$$ln(\text{E}) = ln(\text{c}) + \theta[ln(\text{Y}) + \Sigma(\beta_k \text{IGA}_k/\text{Y})] - \mu ln(\text{EPT}) + (\mu+1)[\beta_{IP} ln(\text{I}_p) + \beta_N ln(\text{N}) + \mathbf{c}_F\boldsymbol{\gamma}] + \mathbf{x}\boldsymbol{\beta}$$
$$+ \rho\Sigma \text{W}_j ln(\text{E}_j) + \varepsilon \qquad \boldsymbol{\varepsilon} \sim \text{N}(\mathbf{0}, \sigma^2\mathbf{I}) \qquad |\rho| < 1 \qquad (2.5)$$

where ρ is the spatial autocorrelation parameter to be estimated and W is a spatial weight matrix. The nature of *yokonarabi* spending behavior implies that the sign of ρ is positive, i.e., some positive spatial autocorrelation would be found among neighboring local governments' expenditure per household levels.

3. Results

3. 1 Data

The Study Area

This study selected all cities of the seven prefectures in the Kanto Region in Japan to estimate its basic and *yokonarabi* spending models. The primary reason for selecting the Kanto region is that because this region completely covers the Kanto Plane (the widest plane in Japan) within which most of the cities in the Kanto Region are located, it is almost unnecessary to consider any pre-fixed directions of spatial effects due to geographic barriers such as mountains. However, the following municipalities are excluded for various reasons: (1) the 23 semi-autonomous Tokyo wards because, unlike usual municipalities, they are not financially independent from their home prefecture (the Metropolitan Tokyo government), (2) two mega-cities (so-called designated cities, i.e., Yokohama and Kawasaki) because of their semi-prefecture status, (3) towns and villages because their detailed financial data have not been published by the Japanese Ministry of Home Affairs. The basic spending and copycatting spending models were estimated with the data of three fiscal years, 1970, 1980, and 1990 because some of the socioeconomic data essential to the two models are available only for census years[6].

Data for the Spatial Weight Matrix

Because the past studies of Japanese local governments' spending behavior have failed to report detailed information about the inner workings of *yokonarabi* spending behavior, this made infeasible to specify the alternative forms of the spatial weight matrix of the *yokonarabi* spending model by using firsthand information about *yokonarabi*. Consequently, this study consulted data on intercity rivalries in Japan to fill this void of information. Rigorously speaking, intercity rivalries may not exactly coincide with intercity copycatting (*yokonarabi*) patterns, but this study surmised that the data on intercity rivalries could be used as surrogates to set a city's *yokonarabi* reference group members, i.e., a group of municipalities to which a city pays attention.

When this study tabulated the survey results of intercity rivalries by two factors (i.e., each city's geographical proximity and its population class) based on the aforementioned characterization of *yokonarabi* by Yoshida(1991a), some steady pattern emerged. This pattern was then filtered and used as a template to specify hypothetical copycatting relationships among cities. This study chose the population classification scheme listed in an annual fiscal report on Japanese municipalities by the Japanese Ministry of Home Affairs, *Ruiji Dantai betsu Shichoson Zaisei Shisuhyo* except for adding the category of mega-cities (more than one million cities).

[6]For some cities, huge spikes were found in their expenditure data, and these cities were excluded from the final data pool. The number of excluded cities for FYs 1970, 1980, and 1990 are 5(3.85%), 12(8.05%), 15(9.74%), respectively.

Table 3.1
The Classification of Cities by Population

Class	Lower Limit	Upper Limit
0		34,999
I	35,000	54,999
II	55,000	79,999
III	80,000	129,999
IV	130,000	229,999
V	230,000	429,999
VI	430,000	999,999
Mega cities	1,000,000	

Source: Japan. Ministry of Home Affairs. Finance Bureau(1990)

Toyokeizai Shimpoha, a Japanese publishing company, has conducted a survey on Japanese cities in each year and has published its results in next year as an almanac, *Toshi Data Pack.* For several years during the 1990s, each city's response to a question about intercity rivalry had been reported. While this almanac does not describe its survey question in it, survey results suggest that each city was asked to list an unspecified number of its rivals. The response ratio for the Kanto Region in 1991 was 43.13 percent and a little better than the national average, 41.15 percent.

Table 3.2
Intercity Rivalries in the Kanto Region (1991)

Prefecture	Responded Cities	No. of Cities	Response Ratio	One-way	Reciprocal	Total
Ibaraki	8	20	40%	12	0	12
Tochigi	4	12	33%	8	0	8
Gumma	6	11	55%	4	2	6
Saitama	12	42	29%	17	6	23
Chiba	12	29	41%	19	3	22
Tokyo	20	27	74%	25	8	33
Kanagawa	7	19	37%	12	1	13
Total	69	160	43%	97	20	117

Data Source: Toyokeizai Shimposha(1992)

The following are major findings after the data on intercity rivalries were tabulated by the two factors: (i) geographic proximity and (ii) differences in population class between cities:

(1) The percentage of one-way rivalries is 97/117= 82.9%, and the counterpart of reciprocal rivalries is 20/117= 17.1 percent (Table 3.2). Most of the reciprocal rivalries (80 percent) are found between two equal population class cities, whereas one-way rivalries do not substantially concentrate on equal population class relations. Reciprocal rivalries also tend to be found between a city and its coterminous cities (12/20= 60%; cf. one-way = 38/97= 39.17%) (Table 3.5).

(2) The population hierarchy of cities within a prefecture is one determinant of intercity rivalries. A city's rivals tend to belong to equal or higher population classes (equal = 62/117= 52.99%; higher = 42/117= 35.90%; lower = 13/117= 11.11%; within ±1 = 107/117= 91.45%; equal and + 1 = 95/117= 81.20%). In other words, intercity rivalries tend to be one-way (upward rivalries) rather than reciprocal (Tables 3.3 and 3.4).

Table 3.3
Intercity Rivalries and Proximity

Prefecture	Proximity 0	0/OP	1	2	3	4	WP	OP	OR	Total
Ibaraki	5			1				5	1	12
Tochigi	3		1	1				1	2	8
Gumma	2		3	1						6
Saitama	14		5	1	1	1			1	23
Chiba	4		7	1	2	1	1	2	4	22
Tokyo	18	2	6	5	2					33
Kanagawa	2		3	2		1		1	4	13
Total	48	2	25	12	5	3	1	9	12	117

Data Source: Toyokeizai Shimposha(1992); Note: WP = Within Prefecture; OP = Out of Prefecture; OR = Out of the Kanto Region; 0/OP = coterminous but Out of Prefecture; 0, 1, 2, 3, and 4 means coterminous, one-locality away, two-localities away, and so on.

Table 3.4
Population Class and Intercity Rivalries

Own Class	Rival Class 0	I	II	III	IV	V	VI	Mega City	Total
0		2		1					3
I		8	2	1					11
II		1	11	3	4				19
III			4	12	10	1	1		28
IV			1	1	17	6		1	26
V					2	8	6		16
VI						4	6	4	14
Mega-city									0
Total	0	11	18	18	33	19	13	5	117

Table 3.5
Proximity and Types of Rivalries

Proximity	One-way	Reciprocal	Total
0	38	12	50
1	19	6	25
2	12	0	12
3	5	0	5
4	3	0	3
> 4	20	2	22
Total	97	20	117

Table 3.6
Classification of Actual Rivalries by Proximity and Differences in Population Class

Proximity	Differences in Population Class - 2	-1	0	+ 1	+ 2	+ 3
0	1	8(78)	20(78)	17(78)	4	
1		2	16(166)	5	1	1
2			11(72)	1		
3			2	2	1	
4			3			
> 4 or OP			6	4		

Note: This table excluded rivalries beyond the Kanto Region; the number in parentheses is the number of possible intercity rivalries in each cell

(3) In the case of downward rivalries (a city's rivals belong to lower population classes), a city's downward rivals are usually its coterminous cities (8/13= 61.54%) (Table 3.6).

(4) A city's rivals are almost always cities within its prefecture except for a few special cases: (i) prefectural capitals (cities) tend to regard other prefectural capitals or large cities outside their prefectures as their rivals ; this special case may apply for relatively large cities (more than 300,000 in population) [In contrast to state capitals of the United States, a Japanese prefectural capital is usually the most populous city within its prefecture]; (ii) a city that is well-known nationwide for its industrial specialization (e.g., tourism, fishery business, steel) tends to regard its competitors (usually outside its prefecture) in the industry as its rivals.

(5)A city's within-prefecture, non-coterminous rivals have one or two intervening municipalities, except for several unusual rivalries (Table 3.3).

It is clear that intercity rivalries mainly concentrate in the five shaded cells of Table (3.6). Since the number of possible intercity rivalries is not constant across cells, the number of possible intercity rivalries was computed for each of the five cells (denoted by the number in parentheses in each of the five cells). The cell of {(proximity, class difference) = (0,0)} shows a comparatively high occurrence rate of intercity rivalries (more than 25 percent), with the remaining four cells having lower occurrence rates (around 10 percent). Because of higher occurrence rates in these five cells, this study inferred that a city's *yokonarabi* reference group would be comprised of cities located in the five cells: more specifically, a given city's hypothetical *yokonarabi* reference group consists of (1) coterminous cities whose population classes are within ± 1 population class differences from its counterpart and (2) cities whose population classes are the same as its counterpart but are one or two municipalities away from it. While this scheme may not exactly replicate each city's actual *yokonarabi* reference group members, it would approximate each city's *yokonarabi* reference group because at least each city's neighbors are to be included in its reference group.

Based on the above scheme, study chose the following four specifications for the spatial weight matrix of the *yokonarabi* spending model:

(1) First-order connectivity (contiguity)

Although a city might not always practices *yokonarabi* only against its coterminous (i.e., first-order contiguity) cities, this specification was tried as a baseline.

(2) Hypothetical yokonarabi

This specification is based on the aforementioned scheme for selecting hypothetical *yokonarabi* reference group members.

(3) Actual intercity rivalry 1 (asymmetric)

This specification exactly codifies the elements of the SWM as intercity rivalries reported in the almanac (Toyokeizai Shimposha 1992) and therefore this specification was limited to the FY 1990 data set only. Because the reported intercity rivalries are not always reciprocal relationships, this SWM is asymmetric.

(4) Actual intercity rivalry 2 (symmetric)

This specification is the same as (1) first-order connectivity except for an additional condition: one-way rivalries are turned into reciprocal ones, i.e., this SWM is symmetric; this estimation was also limited to the FY 1990 data set only.

In all of the above four coding specifications, a city's reference group members for *yokonarabi* were coded 1 and non-members were coded 0 in each element of a SWM. After this binary coding scheme, each element of a given row of a spatial weight matrix was normalized (divided) by its row sum. While non-binary coding schemes would be possible by using some ratio scale measurement, this binary (0,1) coding scheme was justified on the basis that city officials' spatial cognition would be discrete rather than continuous. In other words, it is more likely that city officials perceive their reference group members as a coterminous city or a one (two, three, and so on)-locality-away city, rather than all cities within 30 km of their city hall.

3.2 Estimation Results

The estimation of the *yokonarabi* spending model was done by the maximum likelihood method with originally written FORTRAN programs (double precision). There are several alternatives for the maximization of a given log-likelihood function of the MRSA model in terms of (1) optimization routines and (2) the calculation of a Jacobian term, $ln|\mathbf{I} - \rho\mathbf{W}|$. First, this study used the golden section search (Press et al. 1992, pp. 390-395) for its maximization of log-likelihood functions because the golden section search does not require derivatives and numerically smooth log-likelihood functions. Second, this study initially employed the following two methods to check differences in accuracy between these approaches: (a) the direct calculation of a determinant, $|\mathbf{I} - \rho\mathbf{W}|$, by the scientific library (ESSL) available on the IBM RISC System; and (b) Ord's approach (Ord 1975) based on the eigenvalues of a spatial weight matrix **W**. Since noticeable accuracy differences between the two methods were not found within eight significant digits, estimation results based on the first method are reported in this study.

The following two tables shows four test statistics, i.e., Moran's I, the Lagrangian Multiplier test, log-likelihood ratio test, and asymptotic t-test, for each specification of the *yokonarabi* spending model. Because the Lagrangian Multiplier test can be done without actually estimating the MRSA model, it is convenient means to check whether or not adding a spatially lagged dependent variable to a baseline regression model could make any statistically significant difference beforehand. The spatial autocorrelation parameter estimates of the *yokonarabi* spending model were expected to be positive ($\rho > 0$). While some of the test results in the two tables are statistically significant, the magnitudes of the spatial autocorrelation parameter estimates (ρ) are generally close to zero and their signs tend to be negative except for one case.

Moran's I statistics for FY 1990 cases are positive (two cases are statistically significant) but their magnitudes are again very small around or less than 0.1. On the other hand, Moran's I statistics for FYs 1970 and 1980 are all negative but statistically insignificant.

The different specifications of the SWM do not make any consistent difference in test results between the three fiscal years. Four different SWM specifications for FY 1990 do not yield notable differences in parameter estimates between them. Although the hypothetical *yokonarabi* case shows three strong statistically significant test results, the magnitude of its spatial autocorrelation parameter estimate itself is close to zero, which is not so different from the other three specifications. For FYs 1970 and 1980, the first-order case of FY 1980 gains some statistically significant test results, but the other three cases fail to achieve statistically significant test results.

Table 3.8 Estimation Summary for FY 1990

SWM	1st-order	Hypothetical	One-way	Reciprocal
Moran's I	0.0859	0.0135	0.0355	0.1067
z(I)	1.7213 *	0.7311	1.0894	1.9657 **
LM Test	1.3297	8.2631 ***	2.6802	0.8301
LR Test	1.3307	8.5437 ***	2.7054	0.8365
ρ estimate	-0.0046	-0.0092	-0.0035	-0.0022
Asymp.t test(ρ)	-1.1532	-2.9667 ***	-1.6522 *	-0.9172

Note: * p < 10%, ** p < 5%, *** p< 1%; z(I) = the standardized Moran's I test statistic; LM Test = Lagrangian Multiplier Test; LR Test = Log-likelihood Ratio Test

Table 3.9 Estimation Summary for FYs 1970 and 1980

Year	1970	1970	1980	1980
SWM	1st-order	Hypothetical	1st-order	Hypothetical
Moran's I	-0.0653	-0.1516	-0.0028	-0.1069
z(I)	-0.2738	-1.2824	0.5449	-0.8977
LM Test	2.3098	0.2295	2.7064 *	0.9108
LR Test	2.3454	0.2303	2.7432 *	0.9152
ρ estimate	-0.0100	0.0023	-0.0060	-0.0022
Asymp. t test(ρ)	-1.5406	0.4810	-1.6660 *	-0.9588

Tables 3.10-13 display detailed estimation results for FYs 1970, 1980, and 1990, respectively. As already reported above, because the magnitudes of the spatial autocorrelation parameter estimates are generally close to zero, the other parameter estimates do not considerably change after the *yokonarabi* component (spatially lagged dependent variable) is added except for few cases.

Table 3.10 Estimation Results for FY 1970

Model/SWM	Basic		1st-order		Hypothetical	
Variable	Estimate	t	Estimate	Asymp. t	Estimate	Asymp. t
Constant	1.0181	1.164	0.7813	0.9441	1.0887	1.308
TINCM	0.5114	5.158	0.5332	5.7172	0.5039	5.352
KOFU	1.5822	1.248	1.5993	1.3574	1.5274	1.281
IPPANT	-13.1755	-0.622	-8.1964	-0.4115	-13.9419	-0.701
NGDISB	12.0130	4.662	11.4146	4.7083	12.2103	4.987
PGDISB	13.2536	3.889	13.9201	4.3554	13.0047	4.019
GAMBLE	9.0131	9.836	8.9464	10.4923	9.0550	10.488
EXPORT	0.3426	2.263	0.3143	2.2154	0.3387	2.383
LOGPOP	-0.0407	-2.168	-0.0366	-2.0725	-0.0419	-2.359
WGINDX	-0.3113	-1.977	-0.3496	-2.3567	-0.3064	-2.071
DENS	0.0605	1.033	0.0712	1.2991	0.0584	1.061
RAILDST	-0.0315	-0.839	-0.0300	-0.7352	-0.0324	-0.919
CHILD	1.1055	1.882	1.1784	2.1515	1.0947	1.987
NPRIM	-0.2739	-1.514	-0.2542	-1.5069	-0.2778	-1.637
LEMPL	0.1675	2.230	0.1803	2.5632	0.1650	2.336
ρ			-0.0100	-1.5406	0.0023	0.481
R^2	0.7330					
Adj. R^2	0.6990					
LM Test			2.3098		0.2295	
LR Test			2.3454		0.2303	
N	125		125		125	

Table 3.11 Estimation Results for FY 1980

Model	Basic		1st-order		Hypothetical	
Variable	Estimate	t	Estimate	Asymp. t	Estimate	Asymp. t
Constant	1.1478	1.403	0.7920	0.998	0.9980	1.270
TINCM	0.5048	5.496	0.5360	6.101	0.5232	5.902
KOFU	0.7207	1.034	0.6753	1.036	0.7680	1.168
IPPANT	12.8962	2.103	13.9438	2.420	13.2569	2.294
NGDISB	9.9009	9.421	9.9915	10.162	10.0415	10.047
PGDISB	6.2743	4.018	6.4844	4.426	6.3422	4.314
GAMBLE	4.4823	4.744	4.5845	5.182	4.6297	5.136
EXPORT	0.3629	3.745	0.3451	3.786	0.3718	4.056
LOGPOP	-0.0248	-2.147	-0.0209	-1.893	-0.0235	-2.143
WGINDX	0.1819	1.819	0.1835	1.964	0.1752	1.859
DENS	-0.1104	-2.444	-0.0940	-2.171	-0.1031	-2.390
RAILDST	-0.0612	-2.137	-0.0600	-2.047	-0.0604	-2.241
CHILD	1.0643	3.474	1.1643	3.981	1.1074	3.799
NPRIM	0.3571	1.745	0.3635	1.900	0.3375	1.743
LEMPL	0.3166	4.29	0.3448	4.859	0.3119	4.481
ρ			-0.0060	-1.666	-0.0022	-0.959
R^2	0.8737					
Adj R^2	0.8593					
LM Test			2.7064		0.9108	
LR Test			2.7432		0.9152	
N	137		137		137	

Table 3.12 Estimation Results for FY 1990 (Part 1)

Model/SWM	Basic		1st-order		Hypothetical	
Variable	Estimate	t	Estimate	Asymp. t	Estimate	Asymp. t
Constant	0.4712	0.497	0.2064	0.224	0.109	0.124
TINCM	0.6572	6.563	0.6810	7.060	0.6912	7.480
KOFU	2.7195	3.643	2.6361	3.740	2.8074	4.102
IPPANT	16.2795	3.030	17.4378	3.385	17.1862	3.485
NGDISB	8.9246	4.306	9.1839	4.683	9.4399	4.953
PGDISB	4.4837	2.094	4.3256	2.144	5.076	2.574
GAMBLE	7.7886	6.163	7.8261	6.585	8.0233	6.914
EXPORT	0.7252	7.703	0.7114	7.966	0.7355	8.524
LOGPOP	-0.0116	-0.821	-0.0096	-0.718	-0.0117	-0.902
WGINDX	0.0376	0.312	0.0361	0.319	0.0111	0.100
DENS	0.0326	0.686	0.0411	0.907	0.0518	1.176
RAILDST	0.0053	0.150	0.0077	0.231	-0.0133	-0.402
CHILD	1.0846	1.777	1.1280	1.961	1.33	2.352
NPRIM	0.0730	0.347	0.0906	0.456	0.1158	0.599
LEMPL	0.1145	1.228	0.1306	1.473	0.1286	1.505
ρ			-0.0046	-1.153	-0.0092	-2.967
R^2	0.8125					
Adj. R^2	0.7913					
LM Test			1.3297		8.2631	
LR Test			1.3307		8.5437	
N	139		139		139	

Table 3.13 Estimation Results for FY 1990 (part 2)

Model/SWM	Basic		One-way		Reciprocal	
Variable	Estimate	t	Estimate	Asymp. t	Estimate	Asymp. t
Constant	0.4712	0.497	0.3962	0.446	0.3035	0.333
TINCM	0.6572	6.563	0.6623	7.067	0.6699	7.028
KOFU	2.7195	3.643	2.6828	3.840	2.7691	3.928
IPPANT	16.2795	3.030	16.0032	3.182	16.2076	3.203
NGDISB	8.9246	4.306	8.6050	4.417	8.8610	4.538
PGDISB	4.4837	2.094	5.1214	2.510	4.8949	2.369
GAMBLE	7.7886	6.163	7.8230	6.617	7.7598	6.518
EXPORT	0.7252	7.703	0.7221	8.198	0.7262	8.191
LOGPOP	-0.0116	-0.821	-0.0077	-0.571	-0.0061	-0.417
WGINDX	0.0376	0.312	0.0502	0.445	0.0398	0.351
DENS	0.0326	0.686	0.0364	0.818	0.0387	0.856
RAILDST	0.0053	0.150	0.0183	0.535	0.0137	0.395
CHILD	1.0846	1.777	1.0356	1.812	1.0698	1.861
NPRIM	0.0730	0.347	0.0631	0.320	0.0663	0.334
LEMPL	0.1145	1.228	0.1193	1.367	0.1171	1.333
ρ			-0.0035	-1.652	-0.0022	-0.917
R^2	0.8125					
Adj. R^2	0.7913					
LM Test			2.6802		0.8301	
LR Test			2.7054		0.8365	
N	139		139		139	

Geographically speaking, not all of the cities in the Kanto Region belong to Metropolitan Tokyo. Therefore, most of the cities outside Metropolitan Tokyo are not coterminous with cities within the metropolitan area. In other words, off-diagonal elements of a given spatial weights matrix for those cities outside Metropolitan Tokyo are zero. Thus, it was suspected that these sparsely connected cities outside this metropolitan area might affect the magnitudes of the spatial autocorrelation parameter estimates in these three models. To answer this question, cities whose nearest railroad stations are within 60 km of the JR Tokyo Station were selected to re-estimate the *yokonarabi* model. The railroad distance (60 km) reaches nearly 80 percent of coterminous cities within Metropolitan Tokyo plus a few cities in the Ibaraki Prefecture. When these results from this restrict pool of cities were compared with those of the non-restricted cases, it was found that cities outside Metropolitan Toyo do not have much an influence on the spatial autocorrelation parameter estimates. Because the share of the restricted sample is more than 50 percent of the full sample for all three fiscal years, the above finding may not be surprising.

This study also estimated the *yokonarabi* spending models for five major disaggregated expenditures (public education, public works, social services, sanitation and garbage collection, general administration) for the three years because Yoshida(1991a) shows the weight of *yokonarabi* is higher for social services and lower for capital-investment-related expenditures. However, generally speaking, estimation results from these disaggregated expenditure cases also failed to support the *yokonarabi* model; the magnitudes of the spatial autocorrelation parameter estimates are close to zero (0.0125 ~ - 0.0507 for statistically significant cases) similar to those of total expenditure cases.

The aforementioned statistically insignificant results failed to support the *yokonarabi* spending model. There are at least two possible explanations for this failure: (1) the spatial weight matrix (SWM) was misspecified and (2) town and villages were excluded from the modeling. First, one likely misspcecation case is that while Japanese cities are still practicing *yokonarabi*, but the four SWM specifications of this study did not reflect the actual inner workings of cities' *yokonarabi*. Although this might be true, this question cannot be answered unless some detailed information about *yokonarabi* is available from new surveys (or in-depth interviews) of localities' *yokonarabi* fiscal behavior. Another possible explanation is that a city's consideration of other cities' spending (service) levels might be discrete rather than continuous. For example, city officials might perceive the service (spending) levels of their neighbors or similar cities in terms of quality rather than quantity. If their neighbors constructed new community centers and initiated new family assistance initiatives, city officials would pay attention to not how much their reference group cities spent for these projects but what kind of project was provided or initiated by these cities. In other words, symbols (buildings and new service names) rather than contents (per household spending or service level) might be much more important for city officials because a city cannot conform to neighbors' service levels or similar localities' spending levels beyond its limited means (revenues).

Second, the data set of this study consisted of cities in Kanto region and about two thirds of all municipalities (towns and villages) in Kanto region were excluded partly due to the availability of crucial fiscal data. Consequently, rows of the SWM for cities in less urbanized prefectures are relatively sparse and this might result in very small (and sometimes negative) spatial autocorrelation coefficient estimates. While the survey of intercity rivalries indicate that a city's lesser neighbors such as towns and villages are generally not considered its rivals, such towns and villages are its neighbors anyway. Therefore, these smaller municipalities should be included into the estimation of the *yokonarabi* model if their detailed fiscal data become available.

4. Summary and Conclusions

The main objective of this study was to test a Japanese municipalities' copycatting (*yokonarabi*) spending behavior by using a spatial econometric model with four different specifications of its spatial weight matrix. While estimation results from this model were expected to yield large, positive spatial autocorrelation parameter estimates, for most of the estimation cases including disaggregated expenditure ones and geographically restricted sample ones, the magnitudes of these estimates are generally close to zero and their estimates were statistically insignificant. These estimations results suggest that more detailed information about the inner workings of Japanese municipalities' *yokonarabi* is essential to specify a more accurate model of Japanese municipalities' spending behavior.

Conversely, it is also possible to positively interpret the above statistically insignificant results; *yokonarabi* might have been overemphasized more than they should and anecdotal evidence of *yokonarabi* may have elevated its relative position among Japanese localities' fiscal decision-making methods. The past surveys of Japanese localities' spending behavior report that *yokonarabi* (conforming to other localities' spending/service levels) is not the most important determinant for Japanese localities' fiscal decision-making. Of course, *yokonarabi* is one of the several important determinants, especially for social service-related expenditures, but other factors such as whether or not a program is in conformity with the national and prefectural policy guidelines or its own comprehensive plan are much more important than *yokonarabi* (Yoshida 1991a). In this regard, the above modeling results could be regarded as the limit of Japanese municipalities' *yokonarabi* practice.

Finally, this study used one particular spatial econometric model (MRSA model) to specify the yokonarabi spending model. Other spatial econometric models such as the linear regression model with spatially dependent errors could provide alternative specifications for modeling Japanese localities' *yokonarabi* spending behavior. As in the case of MRSA model, most of the estimation results from the spatially dependent error model did not show high spatial autocorrelation parameter estimates except for several statistically significant, but modestly high, negative estimate cases (-0.3 ~ - 0.4). It seems that the past spatial econometric modeling efforts have concentrated on positive spatial autocorrelation cases and that negative spatial autocorrelation cases have failed to get researchers' enough attention so far. While it may not be easy to analyze negative spatial autocorrelation in human-interacted phenomena such as copycatting, this can be regarded as a new opportunity to expand the horizon of spatial econometrics.

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Appendix

A. The Basic Model of a Japanese city's Spending behavior

The basic spending behavior model of a Japanese city is based on the following two key assumptions about the bureaucracy of a Japanese city and its budgeting process .

In order to formulate an empirically testable form of a Japanese city's spending behavior model, this study employs the neoclassical economists' demand approach to the determination of local public services (Inman 1979). The essence of this demand approach is that the determination of local government expenditure is defined as preference maximization for a politically important citizen of a locality, subject to his or her budget constraint. In the median voter framework of local government expenditure, this politically important citizen is the median voter of a locality, which is empirically approximated as the median income citizen (household) of this city. By contrast, this study regards city officials as honest agents who maximize service preferences of their city's representative (average) household. Justification for this specification is divided into two parts: (1) for the assumption of city officials as honest agents who optimally set the levels of city services on behalf of their city's politically important entity; and (2) for the selection of the average household of a city as its politically important entity.

a) The city official as an honest service preferences maximizer

While this assumption must be diametrically opposite to the budget maximization assumption about bureaucracy (e.g., Niskanen (1971)), it can be justified by Japanese citizens' more positive perception of bureaucracy and Japanese municipalities' peculiar institutional arrangement. For instance, Jun and Muto (1995) report that the Japanese general public places greater trust on the impartiality of bureaucracy compared with the US counterpart. This difference can be attributed to the rigidity of the Japanese civil service system, especially its rigid personnel system that recruits entry-level position applicants once a year and fills vacancies for senior (middle- and top-level) positions with internal promotions only. In addition, the number of political appointees in a municipal bureaucracy is few — just a deputy mayor and a treasurer — and the remaining positions are filled with career officials. Such rigidity is expected to promote continuity or inflexibility in the decision making of local bureaucrats and buffer external political influences.

Institutional constraints force city officials more or less to take into account their citizens' demand for city services during their budgeting. Since this study deals with cities whose population sizes are at least 50,000 (30,000),[7] the socioeconomic composition of citizens of each city is comparatively heterogeneous and their demand for public services is at least fairly diversified. In addition, the size of a city government is relatively large enough to uphold city officials' professionalism and bureaucratic rules against its local elite's interventions. By contrast,

[7] Thirty thousand had been the minimum population size to become a city in Japan from 1947 to 1954. In 1954, the minimum population size was increased to 50,000, and since then this threshold has been maintained except for three occasions between 1958 to 1972.

the majority of local residents in villages and towns (rural municipalities) tend to be farmers, and these relatively homogeneous residents' demand for public services would not be so diversified and easily described. And it is more likely that the local elite of a town (or village), rather than town officials, would implicitly dictate and steer major public decisions.

More specifically, on the one hand, from the local residents' perspective, all city residents are no longer a local/community boss's passive followers, especially after the rise of ordinary citizens' active participation in city politics in Japan in the early 1970s (MacDougall 1989, p.153-5). In particular, new residents (usually younger white-collar salaried workers and their dependents) who moved from the Tokyo Prefecture to its suburban cities would be politically less conservative than their native residents (mainly farmers), and these newcomers would expect the levels of city services they enjoyed in the Tokyo Prefecture. These newcomers' demand for certain types of city services, such as public education, would be quite different from its counterpart for native residents and consequently shake up the existing policy priorities of rapidly growing suburban cities. On the other hand, from the city officials' perspective, little leeway remains for a city to allow the local elite's outright behind-the-scene manipulation of local public decision making processes. Principally, the process of public decision making at a city hall has to be accountable to the general public, rather than just its local power elite. Similarly, in the absence of persuasive reasons, the budgeting process of a city has to avoid at least apparent favoritism for specific communities. Under these circumstances, city officials no longer rely on town (village) officials' face-to-face personal communications with native residents for fiscal decision making in order to gain more precise and objective information about heterogeneous citizens' comparatively diversified demands for city services. As a result, city officials have to more or less rely on non-personal and objective means, such as social surveys and official statistics. Moreover, as the size of local government becomes larger, local officials have to rely on more objective information (e.g., official statistics) as their main means of persuasion during their interdepartmental budgetary negotiations. Since municipal governments in Japan routinely collect official and in-house statistics on behalf of the national and prefectural governments, Japanese city officials are formally endowed with practical means, such as various official statistics and other quantitative information, for estimating their citizens' demand for city services. Furthermore, the involvement of city assembly members in the budgeting process is substantially weak in Japan, and the number of political appointees in municipal government is few. Thus, Japanese local bureaucracy, especially cities, would be institutionally less susceptible to effects of local politics.

In summary, it is reasonable to assume that city officials essentially would take into account their citizens' demand for public services during the budgeting process by using official statistics and other objective means available to them. Therefore, city officials could be assumed to be honest agents who optimally set the levels of city services on behalf of their city's politically important entity.

b)The average household of a city as its politically important entity

For city officials, a household rather than a voter or a resident would be a practical and intuitively appealing unit for estimating their citizens' city service preferences. Some municipal services (e.g., garbage collection, public hygiene, and certain welfare programs) are provided for local residents on a household basis in Japan. In addition, under the mandatory resident (household basis) registration system, all Japanese residents must register themselves at their municipal offices to receive public services. This institutional arrangement clearly supports the estimation of municipal service levels on a household basis.

Next, average (mean) measures would be the most intuitively appealing and politically persuasive not only for ordinary citizens but also for city officials. As argued above, when the socioeconomic profile of a city is more heterogeneous, city officials are under a more watchful eye and no longer can afford to always submit themselves to local power brokers' wills. Naturally, city officials would have to rely on more objective measures for their estimation of city service levels to demonstrate their objectivity and impartiality, and mean measures, such as those per household measure, would satisfy this need. Also, technically speaking, Japanese official statistics usually do not include median statistics; this empirically favors mean measures.

This study consulted Ladd and Yinger (1989, Chapter 10) in order to derive the final mathematical form of a Japanese city expenditure model. While the Japanese city expenditure model resembles Ladd and Yinger's counterpart in terms of mathematical expression, a fundamental difference between the two models is that Ladd and Yinger's study follows the median voter framework, whereas this study assumes that city officials are honest agents who optimally set the levels of their city services on behalf of the mean household of their city. The following three additional assumptions have been set here in order to derive the mean household's demand for city services:

(1)City services are financed by some city tax, and each household shares an equal amount of the tax burden;

(2)A city service is purchased at a constant cost per unit (but not constant across cities) in each city;

(3)The mean household's demand for city services is expressed by a constant elasticity demand function (D) that is comprised of its tax price (TP), which is the price the mean household has to pay for another unit of a city service and its income level (Y):

$$D = cY^{\theta}(TP)^{\mu} \qquad \text{(A1)}$$

where

c is a constant,

θ is the income elasticity of demand for a city service, and

μ is the price elasticity of demand for a city service ($\mu < 0$).

Since detailed local taxation data have not been released (published) in Japan, the above second assumption, a single local tax and equal tax burden sharing among all households, was a necessary compromise between theory and the availability of data. In contrast to American cities, Japanese cities (municipalities) have to levy several mandatory municipal taxes, which complicates the specification of the tax price variable of a Japanese city expenditure model. Three major mandatory Japanese municipal taxes are municipal personal income tax, municipal corporate profit tax, and property tax. While each municipality's tax rates have not been published by the Ministry of Home Affairs, as for the municipal personal income tax, all Japanese municipalities have used the same standard rates for decades. Japanese municipalities tend to increase their municipal corporate profit tax rates and property tax rates when they face severe revenue shortfalls. However, the Japanese national government strictly limits maximum rates of these municipal taxes nation-wide, and inter-municipal tax rate differentials are relatively small.[8] Therefore, municipal tax rates are almost irrelevant factors for corporations' locations or home buyers, in contrast to the United States. Under these circumstances, relatively speaking, increases in municipal tax rates are unlikely policy options for municipalities to finance their additional provision of municipal services. Rather, the structure of municipal tax bases, such as the export of tax burden to nonresidents and corporations, seems to be a more important factor for a municipality's spending behavior. Thus, this study focuses on a city's tax export and includes a tax export variable (EPT) that adjusts a city's total tax base. Since the mean household has been chosen as the politically important entity of a city in this study, as shown below, tax-related terms cancel out from the tax price term after mathematical manipulations are made. As a result, only the tax export variable and cost function (C) remain in the final specification of the tax price term:

$$D = cY^{\theta}(TP)^{\mu} \cong cY^{\theta}(C/EPT)^{\mu} \qquad \text{(A2)}$$

$$T_p = \frac{C \cdot (\text{Mean household's taxpayment})}{EPT \cdot (\text{City's total taxbase/HH})} = \frac{C}{EPT}$$

where C is per household marginal cost of a public service, HH is the number of households of a city, and EPT is an adjustment variable for tax export/import.

The per household expenditure function (E), i.e., demand function (D) multiplied by per unit cost of a public service (C), is given by:

$$E = D \cdot C = cY^{\theta}(EPT)^{-\mu}C^{\mu+1} \qquad \text{(A3a)}$$

or in natural logarithm form:

$$\ln(E) = \ln(c) + \theta\ln(Y) - \mu\ln(EPT) + (\mu+1)\ln(C) \qquad \text{(A3b)}$$

Intergovernmental grants and revenue from public gambling would fractionally increase a citizen's income level. Since strings attached to these grants and gambling revenue (income-related variables) are different, relative weights (parameters β_k in equation (A4)) of these variables would differ from one another. Thus, the income term of the above expenditure model can be approximated as follows:

$$\ln(Y+\Sigma\beta_k IGA_k) = \ln[Y(1 + \Sigma\beta_k IGA_k/Y)] = \ln(Y) + \ln(1 + \Sigma\beta_k IGA_k/Y)$$

[8] Japanese municipalities' property assessment methods are standardized by the national government, and every three years all Japanese municipalities must update their assessment of property values.

$$\cong \ln(Y) + \Sigma\beta_k IGA_k/Y \tag{A4}$$

$$\geq \ln(1 + x) \cong x \text{ if } 0< |x| \ll 1$$

where IGA_k are intergovernmental grants and revenue from public gambling, and β_k are their parameters. Substituting the above approximation (A4) for the original income term of the expenditure function (A3b) yields:

$$\ln(E) \cong \ln(c) + \theta\ln(Y) + \theta\Sigma(\beta_k IGA_k/Y) - \mu\ln(EPT) + (\mu+1)\ln(C) \tag{A5}$$

The functional form of the cost function (C) was defined after following the approach of Bradbury et al. (1984) and Ladd and Yinger (1989) :

$$C \equiv (I_P)^{\beta_P} \cdot N^{\beta_N} \cdot \exp[\mathbf{c}_F \cdot \boldsymbol{\gamma}] \tag{A6}$$

where

I_P	is price (wage) index,
N	is a city's population,
$\mathbf{c}_F$	is a row vector of cost variables,
β_I	is the parameter of Ip,
β_N	is the parameters of N, and
$\boldsymbol{\gamma}$	is the vector of the parameters of $\mathbf{c}_F$.

Because it is expected that citizens' preferences of public services would differ from city to city due to demographic differences among cities such as those in the percentage of a city's school-age population, a row vector of several demographic variables (**z**) and their parameter vector ($\boldsymbol{\beta}$) were added to the above spending model (A5) as follows:

$$\ln(E) = \ln(c) + \theta \cdot [\ln(Y) + \sum_k \frac{\beta_k \cdot IGA_k}{Y}] + \mu \cdot \ln(X) + (\mu + 1)\ln(C) + \mathbf{z}\boldsymbol{\beta} \tag{A7}$$

This model (A7) is referred to as the basic spending model in this paper. Finally, in order to empirically estimate this model, the usual error term assumption of the classical linear regression model (i.e., a normally distributed spherical error term), ε, was added to (A7).

$$\ln(E) = \ln(c) + \theta \cdot [\ln(Y) + \sum_k \frac{\beta_k \cdot IGA_k}{Y}] + \mu \cdot \ln(X) + (\mu + 1)\ln(C) + \mathbf{z}\boldsymbol{\beta} + \varepsilon$$
$$\varepsilon \sim N(\mathbf{0}, \sigma^2\mathbf{I}) \tag{A8}$$

B. Data

1. Definitions of Final Variables

Table B1 Definitions of Final Variables

Variable	Definition	Expected Sign
$EXPD_i$	= LOG($EXPEND_i$/HSHLD) (i = 1970,1980,1990)	NA
TINCM	= LOG(INCM/(HSHLD*α_{19ii}))	+
KOFU	= KOFUZEI/HSHLD/TXINCM	+
IPPANT	= IPPANTA/HSHLD/TXINCM	+
NGDISB	= NGDISBT/HSHLD/TXINCM	+
PGDISB	= PGDISBT/HSHLD/TXINCM	+
GAMBLE	= GAMBL/HSHLD/TXINCM	+
EXPORT	= DAYTIME POPULATION/NIGHTTIME POPULATION	+
LOGPOP	= LOG(POPL/100,0000)	Indeterminate
WGINDEX	= LOG(WAGEINDEX)	Indeterminate
DENS	= POPL/SURFACE/10000	Indeterminate
CHILD	= CHILDREN/POPL	Indeterminate
NPRIM	= SECN+TERT	Indeterminate
LEMPL	= LPEMPL/HSHLD	Indeterminate
RAILDST	= RAILDIST/100	Indeterminate

Note: $$\alpha_{19ii} \equiv \frac{\text{\# of Employed Residents in 19ii}}{\text{Adult (15 ~ 65yrs old) Population in 19ii}} \Bigg/ \text{Max}\left[\frac{\text{\# of Employed Residents in 19ii}}{\text{Adult Population in 19ii}}\right]$$

where ii = 70, 80, and 85

2. Variables used in the above definitions

Table B2 Variables used in the above definitions

Variables	Definitions
CHILDREN	The population cohort of minors (0 - 15 years old) in a city
EXPENDi	Total or each individual (disaggregated) expenditure of fiscal year i (i = 1970,1980,1990) (unit = ¥1,000)
WAGEINDEX	Wage Index (all Industries except for 1970, all monetary payments per month, Tokyo = 1.00, prefectural data, service industries are excluded in FY 1970 data)
INCM	A city's total taxable income: for models of 1990 the latest available year (1988) (unit = ¥1,000)
KOFUZEI	Sum of general and special fiscal equalization grants from the national government to a city (unit = ¥1,000)
IPPANTA	Sum of minor revenue sharing grants (unit = ¥1,000)
NGDISBT	Sum of national grants (excluding KOFUZEI) to a city (unit = ¥1,000)
PGDISBT	Sum of prefectural grants to a city (unit = ¥1,000)
GAMBL	Gambling revenue (unit = ¥1,000)
POPL	A city's night-time population
SURFACE	A city's surface area (unit = km^2)
HSHLD	A city's total number of households
LPEMPL	The number of a city's employed residents
SECN	The proportion of secondary-industry employment among a city's employed residents
TERT	The proportion of tertiary-industry employment among a city's employed residents
RAILDIST	The railroad distance (km) from the railroad station nearest to each city hall to the JR Toyo Station (unit: km)

3. Data Sources

Table B3 Data Sources

Variable	Source	
EXPEND, KOFUZEI, IPPANTA, NGDISBT, PGDISBT, GAMBLE, SURFACE	Japan. Ministry of Home Affairs. Finance Bureau. *Shichoson betsu Kessan Jokyo Shirabe*. Tokyo: Chiho Zaimu Kyokai.	Published annually. FYs 1970, 1980, and 1990 were used.
CHILDREN, EXPORT, POPL, LPEMPL, SECN, TERT	Japan. Management and Coordination Agency. Census Bureau. *Population Census*. Tokyo: The Bureau.	1970, 1980, 1985, 1990 Population Censuses data were used for this study.
HSHLD, TXINCM	Shichoson Zeimu Kyokai. *Kojin Shotoku Shihyo*. Tokyo: Nippon Marketing Kyoiku Center.	Published annually. 1970, 1980, 1988, 1990 data were used.**
WAGEINDEX	Japan. Ministry of Labor. Policy and Research Section. *Maitsuki Kinro Tokei Yoran*. Tokyo: Rodo Horei Kyokai.	Published Annually. 1970, 1980, 1990 data were used.
RAILDIST	Japan Tourist Bureau. *JTB Jikokuhyo*. Tokyo: The Bureau.	Published monthly. The December 1992 issue was used.
Intercity Rivalries	Toyokeizai Shimpoha. *Toshi Data Pack*. Tokyo: The company.	Published annually. 1992 edition was used.
Population Class	Japan. Ministry of Home Affairs. Finance Bureau. *Ruiji Dantai betsu Shichoson Zaisei Shisuhyo.* Tokyo: Chiho Zaimu Kyokai.	Published Annually. 1990 edition was used.

Note: In each calendar year, a Japanese municipality levies its municipal personal income tax on its residents' incomes of the **last calendar year. For example, the total taxable income of a city taken from the report of its 1990 tax collection is actually the total taxable income of 1989.

4. Intercity Rivalries: Temporal Difference in Response Rate

Other than its 1992 edition (the survey was undertaken in 1991), *Toshi Data Pack* has reported results about intercity rivalries in several years during the 1990s. While the response rate has declined since 1995, the contents of the reported intercity rivalries are relatively stable (relatively few abrupt changes). *Toshi Data Pack* did not report intercity rivalries in 1992-1994, and 1999.

Table B4 Intercity Rivalries: Response Rate

Year	1991	1995	1996	1997	1998
Ibaraki	8	7	6	6	7
Tochigi	4	5	4	3	2
Gumma	6	3	3	2	2
Saitama	12	19	15	14	14
Chiba	13	16	17	17	17
Tokyo	20	16	15	15	15
Kanagawa	7	4	3	3	3
Total	70	70	63	63	60

Source: *Toshi Data Pack*