A NEW E-GOVERNMENT ROLE IN IMPROVING LOCAL GOVERNMENT PERFORMANCE: A STUDY BASED ON A YARDSTICK COMPETITION MODEL

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—Abstract —

In this paper, we present a new e-government role in improving local government performance, following an investigation based on a yardstick competition model into the theoretical and empirical importance of local governments delivering policy information and understanding the residents' preferences for public goods and services through e-government. We investigate the efficiency of a yardstick competitive equilibrium and, for empirical significance, present the estimated results of a yardstick competition and voting behavior functions, introducing new elements for evaluating e-government.

Key Words: *E-government, Yardstick Competition Model, Policy Evaluation and E-government Evaluation*

JEL Classification: D72, H41, H72

1. INTRODUCTION

1.1. Yardstick competition and efficiency of local public goods provision

In many countries, more than 60% of public goods are provided by the local or regional governments. Tiebout (1956), in his pioneering work, indicated that "voting with feet" leads to optimal provision of local public goods, if residents migrate from one local government to another in order to maximize utility. However, it requires extreme or unrealistic prior conditions, including "free mobility."

Seabright (1996), on the other hand, constructed a "yardstick competition" model of incomplete contracts under asymmetric information by factoring in local overnment elections, and indicated that voting behaviors of residents ensure the ultimate efforts of local government to provide local public goods, if residents take a vote after evaluating their public goods in comparison with those of neighbor jurisdictions. Furthermore, Baseley and Coates (2003) indicated the advantages of local government over central government in providing public goods under voting competition. Therefore, a yardstick competition can be expected to depict a more realistic inter-governmental competition. However, because individual choice of private and public goods is excluded in their model, the efficiency of a yardstick equilibrium has not been discussed.

Nishigaki, Higashi, and Nishimoto (2011a) introduced residents' consumption choice and tax into the yardstick competition model, and examined the efficiency of local public goods provision under yardstick competition. We obtained the following results. First, equilibrium under yardstick competition shows a tendency toward undersupplying local public goods, although the local governor attaches more importance to re-election. Second, in order to improve the efficiency of the yardstick equilibrium, local governments need to supply local public goods after considering regional disparities regarding residents' preferences, exogenous environmental conditions, and other factors. That is, policies for diminishing asymmetric information between the local government and residents are effective in improving efficiency. E-government is one of the promising devices that facilitate these policies.

For an empirical significance of yardstick competition, Baseley and Case (1995) indicated, using U.S. data, that the local tax level and the residents' evaluation of their government through their voting behavior are closely connected by the nexus of yardstick competition. Nishigaki, Higashi, Wong, and Nishimoto (2011b), on the other hand, indicated the yardstick relationship between local public goods

and the residents' evaluations of their government through voting behaviors by using Japanese data. Our results indicate the existence of yardstick competition among local governments in Japan, and e-government assumes a new role in their endeavor to enhance the effectiveness of and optimize public services.

1.2. E-government and its evaluations in Japan

According to Internet World Stats, about 75.5% of the population in Japan is Internet enabled, as of September 2009, and the number of people using the Internet increased to 80.0% in 2011. In terms of Internet penetration, South Korea is ranked number one in Asia with an 82.7% penetration rate, followed closely by Japan with a rate of 80.0%. With the mass of Internet-enabled people, governments need to reform their administrative processes and service delivery through e-government.

A recent e-government survey by UNPAN, in 2012, reveals that the top three countries in East Asia rank high in e-government: South Korea (rank 1), Singapore (rank 10) and Japan (rank 18). Since the introduction of the e-government survey by UNPAN in 2001, these three high-income developed countries consistently cornered the top three ranks in East Asia until 2012. Japan, specifically, has claimed the third position for most of the years except 2008, when it ranked second, making the country one of the top e-government leaders in East Asia.

Wong and Nishimoto et al. (2011), one of the few e-government studies in Japan, conducted a survey to evaluate Japanese central and local e-government in 2007 and 2010, and indicated their results in terms of four elements: "content completeness," "usability," "accessibility," and "feedback."

In this paper, we investigate the theoretical and empirical importance of the new e-government role in improving the efficiency of local public goods provision. By analyzing content completeness and feedback, the elements of e-government evaluation related to policy information, and usability and accessibility, the elements related to residents' satisfaction, as well as the probability of re-election of the incumbent governor, or data on public goods provided, we will indicate the importance of e-government as a device to improve local government performance and efficiency.

2. YARDSTICK COMPETITION MODEL AND EFFICIENCY OF LOCL PUBLIC GOODS PROVISION: A THEORETICAL BACKGROUND

2.1. The Yardstick Competition Model

Consider a simplified nation that comprises two symmetrical regions in which a total of N identical immobile households reside and n_i ($i = 1,2$) out of N reside in region i. We assume that each region has identical land and production technology.

Households living in region i derive utility from the consumption of private goods x_i and the public goods g_i supplied in region i. The residential utility is also affected by unobserved locality-specific shocks ε_i.

$$U_i = u(x_i, g_i) + \varepsilon_i, \; i = 1,2 . \qquad (1)$$

where ε_i is the noise that is independently drawn from a continuous density function $D(\varepsilon)$ with zero mean. We assume that $D(\varepsilon)$ has an identical distribution between regions. Here, random noise ε_i is considered as a distinctive natural or economic environment.

With these assumptions, we assume the following asymmetric information structure: the values of g_i, chosen by the local government, are not directly observable by the residents and remain the private information of the governments. Further, the utility of the residents, although observable by both residents and local government, is not verifiable. This means that the local governments do not know their residents' true public goods preferences, and the residents are unaware of the actual level of local public goods provided by their local government.

The residents supply 1 unit of labor per capita to a regional firm and gain a fixed wage w_i, which is the sole income earned by them. Suppose that their local government levies a lump-sum tax t_i on the residents, and the residents spend all the income left over after deducting t_i on private goods. The residents' budget constraint is indicated by the following equation: $x_i = w_i - t_i, \; i = 1,2$.

The local government in region i supplies local public goods g_i that benefit only the residents of region i. As g_i is subject to the lump-sum tax t_i, the local government's budget constraint is indicated as $g_i = t_i n_i, \; i = 1,2$.

In this model, we assume that the residents know the utility level of the neighboring region's residents. They can compare their own utility with that of the rival region's residents and re-elect the incumbent government if their own utility level surpasses the utility level of the residents in the neighboring region. That is,

$$u(x_i, g_i) + \varepsilon_i \geq u(x_j, g_j) + \varepsilon_j . \qquad (2)$$

The re-election rent for the incumbent government is R , and the local government's utility associated with the local public goods supply g_i is $\upsilon(g_i)$, where $\upsilon(g_i)$ is assumed to be a decreasing convex function with respect to g_i; that is, we assume $\upsilon'(g_i) < 0$, $\upsilon''(g_i) > 0$.

The local governmental problem for the Nash equilibrium is formulated as follows, where the utility of the residents in the neighboring region is considered to be given.

$$\max_{\{g_i, t_i\}} \quad E[\upsilon(g_i) + R] = \upsilon(g_i) + R \cdot pr[u(x_j, g_j) + \varepsilon_j - u(x_i, g_i) \leq \varepsilon_i]$$

$$s.t. \qquad U_i = u(x_i, g_i) + \varepsilon_i ,$$

$$x_i = w_i - t_i , \; i = 1,2, \; j \neq i ,$$

where, by definition of the distribution function,

$$pr\left[u(x_j, g_j) + \varepsilon_j - u(x_i, g_i) \leq \varepsilon_i\right] = \int_{u(x_j, g_j) + \varepsilon_j - u\left(w_i - \frac{g_i}{n_i}, g_i\right)}^{\infty} D(\varepsilon_i) d\varepsilon_i .$$

Substituting the constrained conditions with the objective function in the problem and rearranging the first-order conditions with respect to g_i, we have

$$\frac{\partial E[\upsilon(g_i) + R]}{\partial g_i} = \frac{d\upsilon(g_i)}{dg_i} + R \cdot -D[u(x_j, g_j) + \varepsilon_j - u(x_i(g_i), g_i)] \cdot \left(-\frac{\partial u}{\partial x_i}\frac{\partial x_i}{\partial g_i} - \frac{\partial u}{\partial g_i} \right) = 0$$

$$i = 1,2, \; j \neq i . \qquad (3)$$

Eq. (3) is a system of two equations that simultaneously determine the Nash equilibrium level of public goods in two regions. Assembling Eq. (3), we have the following condition of local public goods supply:

$$n_i \frac{u_g^i(x_i(g_i), g_i)}{u_x^i(x_i(g_i), g_i)} = 1 - \frac{d\upsilon(g_i)}{dg_i} \frac{1}{R \cdot D\left[u(x_j, g_j) + \varepsilon_j - u(x_i(g_i), g_i)\right]} \frac{n_i}{u_x^i(x_i(g_i), g_i)}$$
$$, i = 1,2, j \neq i \,. \qquad (4)$$

Equation (4) is a well-known Samuelson's condition of public goods provision. The left-hand side of Eq. (4) stands for the marginal rate of substitution between private good and local public good g_i. The first term in the right-hand side of Eq. (4) denotes the marginal rate of transformation between private good and public good, which is 1 in this case. The second term is a product of government utility decrease and re-election probability associated with the residents' utility level increase caused by the increase in local public goods.

Because the second term in the right-hand side of Eq. (4) is positive, and the marginal rate of transformation therefore exceeds the optimal level (1 in this model), the level of local public goods achieved in the yardstick competition model indicates a tendency to undersupply relative to the social optimal level of local public goods. The utility level of both regions, however, is expected to improve since yardstick competition leads to greater efforts on the part of both governments, i.e.,

$$\frac{dpr_i}{dg_j} = -\frac{du_j}{dg_j} \cdot D(g_i) < 0 \cdot \qquad (5)$$

To consider the properties of the equilibrium, we specify the density function $D(\varepsilon)$ as follows.

$$\int D(\varepsilon) d\varepsilon = \frac{1}{2\sigma\sqrt{\pi}}$$

As the standard deviation σ rises (falls), the probability of ε_i being located much closer to (distant from) mean zero rises. When the standard deviation σ rises (falls), therefore, the level of local public goods decreases (increases). The intuitive interpretation of this result can be stated as follows. When the standard deviation σ rises (falls), the range within which the noise ε_i undergoes a change expands (diminishes). As the range expands (diminishes), the local government's probability of re-election decreases; thus, the local government decreases (increases) the local public goods supply since its efforts do not pay off (pay off). Yardstick competition, therefore, usually causes the local government to undersupply local public goods; however, when the standard deviation σ

diminishes adequately, yardstick competition induces the local government to supply more local public goods.

2.2. An empirical study on the existence of yardstick competition in Japan

To determine the existence of yardstick competition among local governments, we implemented a preliminary statistical analysis using Japanese prefecture-level data. Besley and Case (1995) showed, by using U.S. local data, that tax cuts could attract voters and incumbent governments tended to cut residential or income tax to win votes for re-election. However, the operating margin of the local tax rate is relatively narrow in Japan, and the local tax rates of most local governments are about the same.

Considering these situations, we framed a hypothesis of yardstick competition based on local expenditure, and constructed a statistical model that explains the re-election of prefectural governors based on local expenditure. The estimation results are indicated in Table 1.

Table1. Estimation Result for a Yardstick Competition Function

Variable	Coefficient	Std. Error	Z-Statistic	Prob.	
Constant	−10.20	3.145	−3.243	0.001	*
Social Welfare & Security	−0.417	0.238	−1.752	0.080	***
Agriculture & Fishery	−0.155	0.233	−0.666	0.506	
Commerce & Industry	−0.026	0.123	−0.214	0.831	
Public Investment	0.121	0.186	0.651	0.515	
Education	1.064	0.369	2.882	0.004	*
Election Participation Rate	−0.053	0.023	−2.278	0.023	**
Age of Elected Candidate	0.093	0.026	3.590	0.000	*
McFadden R-squared	0.392	Mean dependent var		0.660	
S.D. dependent var	0.479	S.E. of regression		0.399	
Akaike info criterion	1.120	Sum squared residuals		6.210	

Notes; Dependent variable = re-election of incumbent governor; the estimation is based on QML (Huber/White) standard errors and covariance.

The estimation results show that the correlation coefficient of expenditure on social welfare and security is significantly negative and that of expenditure on education is significantly positive. These results, based on Japanese data, are suggestive of yardstick competition among prefectural governors seeking re-election, leading to expenditure growth in the field of education and expenditure cuts in the field of social security and welfare.

As was shown in the last section, a decrease in the asymmetric information improves the efficiency of yardstick equilibrium. An information policy seeking to reduce asymmetricity proves effective in improving efficiency. This means that local governments need to supply local public goods after considering regional

disparities in residents' preferences, exogenous environmental conditions, and other factors. Information technology, such as the e-government initiative, could be one of the factors facilitating this policy.

2.3. E-Government and Its Evaluations in Japan

The Japanese government implemented a 5-year project, from 2006 to 2010, to set up an information platform in order to ensure a seamless access environment. Furthermore, to promote e-government utilization, administrative procedures were computerized, and some regional disparities of e-government were eliminated. Thanks to the project, a nationwide broadband infrastructure has been established, and the broadband user population increased from 22 million at the end of 2005 to 35 million at the end of 2010. However, according to an e-government survey by UNPAN (2010), although the e-participation index of Japan is 0.7571, ranked 6th in the world, its e-government development index remains relatively low, at 0.7152, ranked 17th. Wong and Nishimoto et al. (2011), one of the few e-government studies in Japan, conducted a survey in 2007 and 2010 to evaluate Japanese central and local e-government.

To ensure a multidisciplinary and comprehensive evaluation, this assessment focused on four aspects: content completeness, usability, accessibility, and feedback. Content completeness evaluates whether the municipality provides essential, integrated information and whether the municipality achieves accountability by disclosure. Usability indicates whether the municipality provides information measuring up to the citizen's intent by using SNS, movie and streaming information, multi-language, and so on.

The third element, accessibility, evaluates whether sites implement the interface so that not only able-bodied persons but also disabled and aged persons can access the information equally. Feedback evaluates whether the municipality responds to citizens' e-mail queries rapidly, adequately, and politely.

From the evaluation results, most prefectures obtained high scores, on average, for content completeness. This result suggests that prefectures provided indispensable information; it also speaks of great efforts to achieve accountability through transparency. On the other hand, usability is related to advanced technology for content and information delivery through advanced personal media, such as SNS, to gain visibility as an e-democracy. Furthermore, feedback indicates that responding to citizen's queries is an important element in promoting e-participation, and prefectures scoring high on feedback seem to be motivated by the intention of promoting e-participation vigorously. However, in order to score

high on usability and feedback, prefectures need to communicate closely with citizens, which inevitably depends on the human resources of the administrative office. Generating opportunities for citizen participation by delivering adequate information and collecting public comment may require much time and involve heavy expenditure on the part of prefectures.

2.4. E-Government Evaluation and Behavior of Voters

Yardstick competition among regions is realized through the voting behavior of their residents, which reflects a yardstick evaluation of the incumbent governor. According to Riker and Ordeshook (1968), voters participate in an election if the expected utility they can obtain from voting is larger than the cost they will pay. In other words, they will vote in the next equation if $R > 0$.

$$R = P \cdot B + D - C \tag{6}$$

where R is the reward voters receive from their act of voting; B is the differential benefit that an individual voter receives from the election of his preferred candidate, that is, $B = E(u_{t+1}^{X}) - E(u_{t+1}^{Y})$, where u_{t+1}^{i} is the utility of the election of candidate I; P is the probability that the citizen will bring about the benefit B; D stands for the satisfaction from participating in political decisions; and C is the cost of voting.

Information delivered through e-government helps residents evaluate the incumbent governor's policy, fosters expectations about the utility of the opposite candidate, or simply produces satisfaction D for individual voters by raising the motivation to participate in voting. In that case, e-government helps increase R in Eq. (6) and promotes voting participation by residents.

Table2. E-Government Evaluation and Voting Behavior

Variable	Coefficient	Std. Error	Z-Atatistic	Prob.	
Constant	29.05	14.645	1.984	0.054	***
Per-capita Expenditure	0.357	0.127	2.819	0.007	*
E-Government Evaluation	0.253	0.137	1.847	0.072	***
Population	0.007	0.008	0.845	0.403	
Per-capita Income	-0.004	0.006	-0.655	0.516	
R-squared	0.163		Mean dependent var	48.872	
Adjusted R-squared	0.083		S.D. dependent var	10.374	
S.E. of regression	9.934		Akaike info criterion	7.530	

Notes: Dependent variable = election participation rate; the estimation is based on White's heteroskedasticity-consistent standard errors and covariance.

Table 2 indicates the estimation results of the voting model for the Japanese prefectural governor's election with e-government evaluation elements as explanatory variables. In the estimated equation, the dependent variable is the

participation rate, the population represents the variable P in Eq. (6), and per-capita income stands for the cost of voting. The variable B is represented by per-capita total expenditure. Furthermore, content completeness is used as a control variable for e-government performance. In the table, the coefficient of e-government evaluation is significantly positive, which suggests that e-government influences the voting behavior of individuals and therefore promotes yardstick competition among local governments in Japan.

3. CONCLUSIONS

In this paper, we present a new e-government role in improving local government performance, following an investigation based on a yardstick competition model into the theoretical and empirical importance of local governments delivering policy information and understanding the residents' preferences for public goods and services through e-government. We investigate the efficiency of a yardstick competitive equilibrium and, for empirical significance, present the estimated results of a yardstick competition and voting behavior functions, introducing new elements for evaluating e-government.

Our results suggest that enhancing the effectiveness of and optimizing public services provides a new index for e-government evaluation, which in turn leads to new elements for governmental performance evaluation.

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