Yardstick Competition, Performance Evaluation, and the Efficient Provision of Local Public Goods

Yasuyuki Nishigaki, Hideki Nishimoto, and Naoya Yasugi
Faculty of Economics, Ryukoku University, Kyoto, Japan
Email: {nisigaki, nisimoto}@econ.ryukoku.ac.jp, n.yasugi@gmail.com

Yuzo Higashi
Kobe City University of Foreign Studies, Kobe, Japan
Email: qqubm7my@vanilla.ocn.ne.jp

Wong Meng Seng
University of Nottingham Malaysia Campus, Selangor, Malaysia
Email: Wong.MengSeng@nottingham.edu.my

***Abstract*—This paper investigated performance evaluation from the point of view of inter-governmental competition and proposed an effective method to apply yardstick evaluation for regulating natural monopoly to evaluate local governmental performance. By using a yardstick competition model in which residents make contract with an incumbent governor under asymmetric information, it is indicated that an incentive contract using yardstick evaluation may attain the optimal of full information equilibrium. A preliminary empirical test which supports the theoretical results is conducted by using international data .**

***Index Terms*—yardstick evaluation, performance evaluation, yardstick competition, e-government, agency problems**

I. Introduction

Performance evaluation of the public activity is one of the key issues in the public projects administration, and there are many studies concerned so far. Cost=Benefit analysis, for example, is well known method to evaluate public project. However, the focus of cost benefit analysis is on the comparison of the total outcome over total input and judge the efficiency as internal rate of return.

Performance evaluation in the context of the New Public Management, on the other hand, examines the process of the planning or policy making, implementation and outcome of the policy, based on three aspects; the economy of input minimization, efficiency of output maximization, and effectiveness of outcome conforming to the given objectives. Quantitative assessment of policy schedule is, however, not easy in many cases and tends to be remained in a descriptive levels of evaluation.

This paper investigates it from the point of view of inter-governmental competition and proposes an effective method to apply yardstick evaluation for regulating natural monopoly to evaluate local governmental performance.

Competitions among local government are expected to discipline local governors and induce their effort to efficient provision of the local public goods. The theory of voting with their feet by Tiebout [1] has indicated that the residents of the local jurisdiction maximize their utility by moving to jurisdiction where they can attain maximal satisfaction from tax-cum public goods provision and free mobility of the residents among cities make clear residents' evaluation of performances of the jurisdiction.

A yardstick competition model by Seabright [2], on the other hand, argues that under the assumption of asymmetric information, residents (the principal) and local governor (the agent) enter into an incomplete contract concerning public goods provision and tax burden. If residents decide on whether or not to vote for their incumbent governor after comparing their jurisdiction's utility with that of neighbors', the yardstick competition among jurisdictions emerges and ensures maximal effort on the part of the government.

For an empirical significance of the yardstick competition, Besley and Case [3] 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. Nishigaki, Higashi, Nishimoto, and Yasugi [4], framed a hypothesis of yardstick competition based on local expenditure, and indicated a statistical model that explains the re-election of prefectural governors based on local expenditure.

On the other hand, Bivand and Szymanski [5] applied a yardstick evaluation model to contract for natural monopolies and indicated that, under the asymmetric information, yardstick evaluation utilizing the cost information of the neighboring jurisdictions can be optimal.

This paper extends the model of Bivand and Szymanski to the performance evaluation of the local public goods

Manuscript received July 5, 2014; revised October 14, 2014.
This work was supported in part by the Grant-in-Aid for Scientific Research (C: No. 24530375) by the Japan Society for Promotion of Science and the Institute of Social Science, Ryukoku University.

doi: 10.12720/joams.4.2.141-145

provision and indicates that an incentive contract using a yardstick evaluation of neighboring jurisdictions' information can attain the optimal as in the yardstick competition among public utility enterprises.

In the remaining part of the paper, a simple model of yardstick competition incorporated performance evaluation of local Government is presented in the next section. In section 3, a preliminary empirical analysis which supports the theoretical hypothesis is conducted by using international data. Section 4 concludes the paper.

II. A Simple Model of Yardstick Competition and Performance Evaluation of Local Government

A. Assumptions and the Model

In order to extend Bivand and Szymanski model into a yardstick competition model in which residents make contract with an incumbent governor under asymmetric information, this paper introduce residents' behavior and their utility function in addition to replacing the agents of natural monopolistic firms to governor in local jurisdiction.

There are two jurisdictions where one representative individual resides. As principal, she makes contracts with (re-elect) local governor according to their performance evaluation.

Principal (resident) derives their utility from local public goods and private goods.

$$U_p = (y_i)^{\rho} G^{\gamma} \tag{1}$$

where y_i is a private good and G_i is a local public good. The function is assumed to be CRRA (Constant Rate of Risk Aversion), and if $0 < \rho < 1$, they are risk averter and when $\rho = 1$, they are risk neutral.

Governor's utility function is assumed to be CRRA utility function also as:

$$U_G = (w_i - e_i^2/2)^{\theta} \tag{2}$$

where w_i is rent rewarded to the government, e_i is effort to supply public goods and services, and θ is fixed parameter ($0 < \theta \leq 1$). Each Governor has reservation utility Z .

To shed light, especially, on the cost of public goods or services provision, it is assumed that the fixed volume of a local public good. $G_i = 1$ is provided in each jurisdiction (as in Besley and Smart [6]) although the costs of provision differ from each other according to governors' effort level.

For each agent, the cost of public goods provision is:

$$C(e_i) = x_i - e_i + \varepsilon_i \tag{3}$$

where x_i is fixed parameter concerning cost of public goods provision and which is known to public, and e_i is the effort contributed by the governor which mainly reduce cost of public goods provision, and ε_i is random variable. Due to the presence of this random variable, true effort of the governor is unobservable to the principal and which causes the asymmetric information between the governor and the residents.

To simplify a production side of the model, residents in both localities have initial endowment R_i in per-capita term, and combining with their budget constraint, the amount of private goods they consume is indicated as:

$$y_i = R_i - C(e_i) - w_i \tag{4}$$

For the simplicity, the random variable is assumed to take one of two values, ε^H with probability p and ε^L with probability $(1-p)$. The mean or expected value of ε_i is $E(\varepsilon_i) = 0$.

The random variables associated with the provision of the public goods are assumed to be correlated between two jurisdictions, and correlation is depicted by parameter r . The unconditional probability, therefore, are:

$$\begin{aligned} \Pr(\varepsilon_1^H, \varepsilon_2^H) &= p[1-(1-p)(1-r)] \\ \Pr(\varepsilon_1^H, \varepsilon_2^L) = \Pr(\varepsilon_1^L, \varepsilon_2^H) &= p(1-p)(1-r) \\ \Pr(\varepsilon_1^L, \varepsilon_2^L) &= (1-p)[1-p(1-r)] \end{aligned} \tag{5}$$

$r = 0$ implies zero correlation which means there is no relations between the noise or the fluctuations in the cost of public goods provision. On the other hand, $r = 1$ implies perfect correlation, which means the noise of two jurisdictions move co-insides.

Since the principal does not know the true effort of the agent, performance evaluation of them is assumed to be based on the realized cost of public goods provision. For the simplicity, we assume that the principal offers one of two types of linear incentive contracts:

(1)Independent contract: $w_i = a_i - b_i C_i$,

(2)Yardstick contract: $w_i = a_i - b_i(C_i - C_j)$.

While an agent is rewarded based on their own realized cost in the independent contract case, agent's realized cost is compared with the cost of neighbor jurisdiction's agent and is rewarded only the excess part of their cost reduction as was shown in Shleifer [7] in the yardstick contract's case. In this way, the performance of the agent is evaluated in comparison with that of the neighboring jurisdictions' (a yardstick evaluation).

B. Optimum Incentive Contract

1) Full information equilibrium and the first best solution

From expected utility maximization, the agents set their utility maximizing level of effort as $b_i = e_i$, and which is, also, the incentive compatible parameter setting required to the principal.

Under full information with $\varepsilon_i = 0$, an optimal solution is derived by maximizing the resident's utility or

minimizing the total cost of providing public goods which consists of C_i and w_i. It is easy to show that $b=1$ in both cases of the linear incentive contracts is the optimal setting of the parameter, and which means offering the agent full insurance (Green and Stokey [8]).

2) Asymmetric information and linear contract solution

Under asymmetric information, an optimal solution of the incentive parameter under two contracts is derived by the maximization problem of the principal. When we assume the resident is risk averse and the governor is risk neutral as is seen in most cases, the maximization problem are:

$$\max L_i = E(R_i - C_i - w_i)^{\rho} - \lambda\{E[w_i - b_i^2/2] - Z\}$$

As indicated above, incentive compatible parameter setting which is required to the principal is $b_i = e_i$ from the first order condition for optimal agent effort.

By bearing this relationship to the principal's minimization problem, optimal values for the incentive parameter under the independent contract is shown to:

[Independent contract]

$$\begin{aligned}&\max L_i = \{R_i - (x_i - e_i + \varepsilon_i) - [a_i - b_i(x_i - e_i + \varepsilon_i)]\}^{\rho} \\ &- \lambda\{E[a_i - b_i(x_i - e_i + \varepsilon_i) - e_i^2/2] - Z\}\end{aligned} \quad (7)$$

By maximizing and rearranging the first order conditions, following rule for incentive parameter setting is obtained:

$$b_i^* = 1 - \frac{E(U_i' \cdot \varepsilon_i)}{E(U_i')} \quad (8)$$

where,

$$E(U_i' \cdot \varepsilon_i) = p(1-p)(U_H' - U_L')(\varepsilon^H - \varepsilon^L) > 0 \quad (9)$$

And U_H', for example, indicates the marginal utility of income when $\varepsilon_i = \varepsilon^H$.

3) Yardstick contracts solution

For the case of yardstick contract, the maximization problem is indicated as:

[Yardstick contract]

$$\begin{aligned}&\max L_i = \{R_i - (x_i - e_i + \varepsilon_i) \\ &+ [a_i - b_i(x_i - x_j - e_i + e_j + \varepsilon_i - \varepsilon_j)]\}^{\rho} \\ &- \lambda\{E[a_i - b_i(x_i - x_j - e_i + e_j + \varepsilon_i - \varepsilon_j) - e_i^2/2] - Z\}\end{aligned} \quad (10)$$

By maximizing and rearranging the first order conditions as in the case of independent contract, following rule for incentive parameter setting is obtained:

$$b_i^{**} = 1 - \frac{E[U_i'(\varepsilon_i - \varepsilon_j)]}{E(U_i')} \quad (11)$$

And:

$$E[U_i'(\varepsilon_i - \varepsilon_j)] = (1-r)\,p(1-p)(U_{LH}' - U_{HL}')(\varepsilon^H - \varepsilon^L) \quad (12)$$

where, U_{HL}' suggests the marginal utility of income when $\varepsilon_i = \varepsilon^H$ and $\varepsilon_j = \varepsilon^L$.

To compare (9) and (12), the only difference is that the covariance term associated with the composite random variable is contained in the equation (12). From this consideration, following proposition is obtained.

Proposition: With sufficiently large correlation between the random shocks of the two regions, yardstick contract which utilize the information of the neighboring jurisdiction improve the cost efficiency of public goods provision. And in the perfect correlated case, yardstick contracts attain the first best solution.

Proof: As correlation parameter r goes to unity in the equation (12), the expectation of the covariance term turned into zero and b_i^{**} goes to unity. This is the first best value of the incentive parameter with full information.

In the independent contract case, due to the presence of asymmetric information between government and residents, evaluation parameter of the government's (agent's) effort is higher than that in full information case, and which makes the cost of public goods provision higher.

By employing the yardstick contract scheme, principals (residents) can decrease the cost of public goods provision by using neighboring jurisdiction' information as a yardstick if their random noises are correlated each other. Furthermore, in the case of $r=1$ which means the case of perfect correlation, the evaluation parameter b coincides with that of the first best, full information case.

In order to facilitate the yardstick comparisons of the cost of local government, availability of the related information is an important precondition. More disclosures of local governmental information and using it in common among jurisdictions are one of the effective steps to increase administrative efficiency and information technology such as E-Government may be a promising measure for it.

III. Preliminary Empirical Analysis

A. Theoretical Hypothesis

In the preceding sections, this paper investigated how competitions through yardstick comparisons among local jurisdictions lead to a deduction of public goods provision. Under asymmetric information concerning the cost of public goods provision, performance evaluation of government through yardstick comparison brings about improvement of efficiency in public goods provision if the noise of the cost information are interrelated among the neighboring jurisdictions.

For the existence of yardstick competition among the local jurisdiction, Besley and Case [3] showed that the tax rate of the U.S. localities are inter-dependent through yardstick competition. Nishigaki, Higashi, Nishimoto, and Yasugi [4] investigated the presence of a yardstick competition by using Japanese data, and indicated the presence of a yardstick competition through public goods provision and dependence of the provided public goods among neighboring jurisdictions.

In this paper, we will investigate causality linkages among yardstick competition related variables, such as,

cost of public goods provision, decentralization of the central governmental authority, and transparency of the administration, and an E-Government index. As important variables such as stages of decentralization, disclosure of the government administrative cost information are basically common to all local jurisdiction in a country, a statistical analysis does not work well by using local data in a country. Instead, we will use the international cross section data provided by OECD and United Nations and investigate consequences of a cost deduction in public goods provision brought about by decentralization and local yardstick competition.

B. Data

The data which we utilize in this paper are public goods provision related data, decentralization and disclosure related data, and control variables of the scale of the economy.

For a public goods provision data, we utilize an index of a government scale for which a proxy is a share of government spending in the GDP, Per-capita Public Spending, and a cost of public goods provision which is input cost consists of the labor cost, intermediate input cost and users cost of capital. These data are from OECD Economic Outlook.

For decentralization and disclosure related data, we use a decentralization rate of central government authority for which a proxy is usually a share of local government spending, and an index of disclosure for which a proxy is a disclosing rules of governmental procurement cost. These data are from Government at a Glance 2011 by OECD.

Control variables such as population and per-capita GDP are from OECD National Accounts. E-Government Index is from UNPAN E-Government Survey. Since the newest issue of the Government at a Glance is 2011 edition which was published in 2013 and the year of the data is 2010, we utilize all data for 2010.

The descriptive statistics of the data is as follows:

TABLE I. DESCRIPTIVE STATISTICS

Variables	n	Average	Std. Dev.	Min.	Max.
Per-capita GDP	34	29646.652	10866.088	12520.897	67669.446
Population	34	36167.206	58250.770	318.000	309330.000
Exp./GDP	34	19.256	5.496	7.200	28.400
Per-capita Exp.	34	15919.824	6906.186	3479.000	36586.000
Decentral. Rate	34	32.674	15.049	6.300	65.900
Cost of P.G.	34	22.994	4.828	11.800	32.500
E-Govt. I.	34	0.691	0.101	0.478	0.879
Disclosure	34	7.353	1.765	3.500	10.000

C. Principal Component Analysis

The result of the principal component analysis is indicated below. As is shown in the Table II, we get three components of which eigenvalues exceed one and their cumulative contribution is 72.68%.

TABLE II. EIGEN-VALUES OF THE PRINCIPAL COMPONENTS

Principal Components	Eigenvalue	Contribution	Cumulative Contribution
1	3.187	39.84%	39.84%
2	1.576	19.70%	59.54%
3	1.051	13.14%	72.68%
4	0.814	10.18%	82.86%
5	0.624	7.80%	90.65%
6	0.493	6.16%	96.81%
7	0.214	2.67%	99.48%
8	0.041	0.52%	100.00%

Factor loadings of the three components are shown in the Table III.

In the component number one, almost all the coefficients except for population and disclosure are positive and, therefore, it is supposed that this component is a comprehensive index which indicates the synthetic information of the countries.

The component number two has a large positive factor loading from the Decentralized Rate (0.6698) and government information disclosure related variables such as E-Government Index (0.5639) and the Disclosure (0.1580). Therefore, we can suppose this component as a decentralization and transparency related component.

TABLE III. FACTOR LOADINGS

Variables	Comp. 1	Comp. 2	Comp. 3
Per-c. GDP	0.8084	0.2217	-0.4397
Population	-0.0575	0.6718	-0.2890
Exp./GDP	0.6935	-0.4259	0.1910
Per-c. Exp.	0.8888	-0.0320	-0.3227
Decentralization R.	0.1737	0.6698	0.5788
Cost of P.G.	0.6528	-0.3190	0.4947
E-Govt. I.	0.6583	0.5639	0.2052
Disclosure	-0.6083	0.1580	0.1075

This component has negative factor loadings from administrative cost related variables such as the Scale of

Government (-0.4259), Governmental input cost (-0.3190), and the Per-capita Expenditure (-0.0320), which implies that the decentralization of central governmental authority and transparency of the governmental activity lead to deducing the public goods providing cost and preventing from a 'Leviathan' government.

Since 'decentralization' and 'transparency' are indispensable pre-condition for inter-governmental competitions, especially for a yardstick competition, we can suppose these causal relationships as the consequences of the competition which brought about improvement of efficiency of the public goods provision.

IV. Conclusion

In this paper, we investigated performance evaluation from the point of view of inter-governmental competition and proposed an effective method to apply yardstick evaluation for regulating natural monopoly to evaluate local governmental performance. By using a yardstick competition model in which residents make contracts with an incumbent governor under asymmetric information, this paper pointed out that an incentive contract using yardstick evaluation may attain the optimal of full information equilibrium. After all, by using international data, a preliminary empirical test which supports the theoretical results is presented.

References

[1] C. M. Tiebout, "A pure theory of local expenditures," *Journal of Political Economy*, vol. 64, pp. 416-424, 1956.
[2] P. Seabright, "Accountability and decentralisation in government: An incomplete contracts model," *European Economic Review*, vol. 40, pp. 61-89, 1996.
[3] T. Besley and A. Case, "Incumbent behavior: Vote seeking, tax setting and yardstick competition," *American Economic Review*, vol. 85, pp. 25-45, 1995.
[4] Y. Nishigaki, Y. Higashi, H. Nishimoto, and N. Yasugi, "An empirical analysis on yardstick competition among local governments and implications for roles of E-government in efficient provision of local public goods," *Journal of Economics, Business and Management*, vol. 2, pp. 133-138, 2013.
[5] R. Bivand and S. Szymanski, "Spatial dependence through local yardstick competition: Theory and testing," *Economics Letters*, vol. 55, pp. 257-265, 1997.
[6] T. Baseley and M. Smart, "Fiscal restraint and voter welfare," *Journal of Public Economics*, vol. 91, pp. 755-773, 2007.
[7] A. Shleifer, "A theory of yardstick competition," *Rand Journal of Economics*, vol. 16, pp. 319-327, 1985.
[8] J. Green and N. Stokey, "A comparison of tournaments and contracts," *Journal of Political Economy*, vol. 91, pp. 349-364, 1983.
[9] Y. Nishigaki, Y. Higashi, and H. Nishimoto, "Voting with feet, yardstick competition and optimal provision of local public goods," in *Proc. Singapore Economic Review Conference*, CD-ROM, 2011.
[10] Y. Nishigaki, N. Yasugi, C. Y. Liu, M. S. Wong, and H. Nishimoto, "E-government evaluation its policy implications on efficiency of local government," T. Wendler, eds. *Challenges for Analysis on the Business and Economics*, DCM Verlag. 2013.
[11] Y Nishigaki, Y. Higashi, M. S. Wong, and H. Nishimoto, "A new e-government role in improving local government performance: A study based on a yardstick competition model," *International Journal of E-business and E-government Studies*, vol. 4, no. 2, 2012.

Professor Yasuyuki Nishigaki, who was born in Hyogo Prefecture, and born at Japan, 31 August 1956. His graduate school of economics, Nagoya University, Nagoya 464-808601, Japan. (Completed all doctoral studies courses) and won master degree of Economics. He has more than 30 years of professional and teaching experience in three universities in Japan: Nagoya University, Yokkaichi University, and Ryukoku University. He is the Dean of the Graduate School of Economics and the former Vice President of Ryukoku University. Prof. Nishigaki is a member of several academic societies: the Japan Economic Association, Japan Association of Public Finance, Japan Association of Environmental Economics and Policy Studies, and Japan Association of Local Public Finance.

