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Do Accrual-based Financial Statements Improve Local Public Sector Efficiency? Evidence from Japan

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Abstract

After international organizations such as The Organisation for Economic Co-operation and Development (OECD) advocated for national governments to adopt accrual accounting, the number of countries that switched from traditional cash-based accounting to accrual accounting or amended former cash-based accounting is increasing. This change in the accounting system is referred to as the New Public Management (NPM). One of the core elements of NPM is enhancing budget transparency, efficiency, and accountability of decision making using business-like management tools such as the double-entry bookkeeping method. This study examines the impact of the "local public account revolution" on the efficiency of Japanese local governments using a stochastic frontier approach and panel data. We present evidence that preparing business-like financial statements may increase the efficiency of local governments.

Keywords: Financial statements, Accrual accounting, Efficiency, Fiscal transparency, New public management (NPM)

JEL Classification H1; H7

1. Introduction

As fiscal strain increases, there is a strong need for fiscal efficiency and sustainability. International organizations such as The Organisation for Economic Co-operation and Development (OECD) have recommended that member countries adopt accrual accounting (OECD and IFAC, 2017). European Public Sector Accounting Standards (EPSAS) is based on the International Public Accounting Standards (IPSAS) (European Commission 2013), and the majority of EU member states have already adopted accrual accounting. The background for the introduction of business-like accrual accounting in the public accounting system is New Public Management (NPM) (Hood 1991, 1995), which pioneered its introduction in the UK and New Zealand in the 1980s[1]. NPM is about increasing the efficiency of the public sector by adopting private sector management practices; the introduction of business-like accrual accounting into the public accounting system is also a key element of NPM (Sutcliffe 2003; Olson et al. 2001)[2]. The introduction of accrual accounting into the public accounting system is intended to clarify the long-term effects of policy decisions on public finances and improve fiscal efficiency through an accurate understanding of public assets and liabilities, and the centralized management of stocks and flows. Public accounting reform in Japan differs from that in the EU countries. The formal

[1] Hood (1991) notes that an emphasis on accountability is an important element of NPM in the United Kingdom, Australia, New Zealand, and many other OECD countries, and Hood (1995) notes that private sector-style accounting is important to the emphasis on accountability. It also indicates that public choice theory views, particularly those against bureaucracy, are behind NPM.

[2] Both studies show that the impact of public accounting systems on public finances is not small. However, Olson et al. (2001) points out that continual public financial management reforms can increase the cost per unit of public service.

public accounting system, whether national or local, is based on cash. On the contrary, financial statements based on the accrual basis are also prepared and published. Therefore, the financial situation is publicly disclosed, based on two accounting principles. Broadly, however, it can be said to be the introduction of accrual accounting into the public accounting system.

Introducing accrual accounting into the public accounting system is costly. France has spent approximately $1.7 billion to change its public accounting system from a cash basis to an accrual basis (European Commission 2013). In Germany, it is estimated to cost about $3.5 billion (German 2017). In Japan, the formal public accounting system is based on cash, but the cost of maintaining a fixed asset ledger has been a major barrier to the adoption of accrual accounting[3]. Japan's Ministry of Internal Affairs and Communications has surveyed the costs of preparation and maintenance. In this survey, some municipalities spent more than 10 million yen (about 77,000 USD[4]) to establish and maintain a fixed asset ledger. In addition, they are struggling to secure the personnel and budget needed to prepare financial statements (Ministry of Internal Affairs and Communications, 2014).

Several studies have established that the introduction of accrual accounting improves fiscal transparency and efficiency (van der Hoek 2005). However, as Lampe et al. (2015), Christofzik (2019), and Dorn et al. (2021) point out, few studies have clarified, based on

[3] This is because in many local governments, the management of the fixed assets themselves and the management of the municipal bonds issued at the time of acquisition of the fixed assets were managed separately. The establishment of a fixed asset ledger will unify these management systems.

[4] 1 JPY is 0.0077 USD as of Jan 2023.

quantitative analysis, whether the costs of adopting accrual accounting are commensurate with the benefits, and evaluations of the introduction of accrual accountings still have not reached a consensus. They empirically analyze the effects of introducing accrual accounting in German local governments. This study provides further evidence to evaluate the introduction of accrual accounting by conducting an empirical analysis of local governments in Japan. What makes public accounting reforms in Japanese local governments differ from those in other countries is the coexistence of multiple accounting standards. The variation in implementation is useful to identify the impact of the introduction of accrual accounting on local government finance. It is a major advantage of using local-level data in Japan compared with other countries that have changed from the cash basis of accounting to the accrual basis of accounting all at once.

The theoretical background of NPM is based on public choice theory, which views the government as a "leviathan" rather than a "benevolent despot," and emphasizes the need for pre-set rules and institutions to control the growth of the government sector. Identifying what rules and institutions are effective is one of the main arguments in public choice theory (e.g. Dorn et al. 2021). Alt and Lowry (1994), Poterba (1996), Von Hagen and Harden (1995), Alesina and Perotti (1999), and Alesina et al. (1999) suggest that rules and institutions can lead to restrictions on government spending. The use of "creative accounting" helps prevent governments from violating fiscal rules (Von Hagen 1991; Milesi-Ferretti 2004). The introduction of accrual accounting in the public accounting system and the increase in fiscal transparency through the integrated management of stocks and flows discourage using the "creative accounting" trick. This study clarifies whether accrual accounting can function as

a system to control government bloats and contributes to the development of a major debate in public choice theory.

The remainder of this paper is organized as follows. Section 2 introduces global trends in accrual accounting. Section 3 explains the institutional background and section 4 provides the related literature. Section 5 delineates the empirical strategy and data used in this study. Section 6 presents the empirical results, and section 7 concludes the paper.

2. The global evolution of accrual accounting

The EU countries and other international organizations such as the International Monetary Fund (IMF), OECD, and World Bank have been instructed to adopt accrual accounting. A report by the International Federation of Accountants (IFAC) and the Chartered Institute of Public Finance and Accountancy (CIPFA) states that 25% (37 countries) of the countries whose actual status is known and 65% (98 countries) will publish financial statements on an accrual basis by 2023 (IFAC and CIPFA 2018). In the EU, most countries have already adopted accrual accounting since the switch to the accrual basis of accounting was required in 2014. Austria, Belgium, Cyprus, Ireland, Italy, Malta, and Portugal are implementing the transition (European Commission 2019). The adoption of accrual accounting has thus become a global trend. In Japan, both national and local governments prepare and publish financial statements on the accrual basis of accounting, but the formal public accounting system for both national and local governments is still on a cash basis. This aspect distinguishes Japan from other countries such as the EU member states, which have adopted accrual accounting.

3. Institutional background

3.1 Local public finance in Japan[5]

Japan is a unitary state consisting of three levels: national, prefectural, and municipal. As of January 2023, there are 47 prefectures and 1,718 municipalities. Approximately 27.0% of the gross domestic product in 2020 was accounted for by the public sector. The total size of expenditures by the national and local governments combined was 222.5 trillion yen, of which the national and local governments accounted for 44.0% and 56.0%. Meanwhile, the ratio of national and local taxes, the main sources of expenditure by the national and local governments, was 61.4% for national taxes and 38.6% for local taxes. The gap between local government expenditure and local tax revenue is financed by intergovernmental fiscal transfers from the national government. The main fiscal transfer system is called a "local allocation tax grant (LAT grant)," with the total amount of LAT grants planned by the Ministry of Finance and allocated by the Ministry of Internal Affairs and Communications. Local governments also rely heavily on the intergovernmental fiscal transfer system, known as national government disbursements, to implement their policies. Among local government revenues, local taxes account for 40.8 trillion yen, LAT grants for 16.9 trillion yen, and national government disbursement for 37.5 trillion yen. Thus, Japan's local governments implemented their policies in coordination with the Ministry of Internal Affairs and Communications (MIC) and other national ministries and agencies.

[5] The following figures in this section are of 2020, and are based on the White paper on local government finance 2022 (Ministry of Internal Affairs and Communications, 2022).

3.2 The progress of local public accounting reform in Japan

Since Japan's bubble economy burst in 1990, public finances have deteriorated rapidly, and both national and local government debt levels have increased significantly. This situation has led to an increase in fiscal transparency by preparing financial statements on an accrual basis to reduce government assets and debt. The national government began preparing a balance sheet in FY1998. Since FY2003, it has prepared a statement of expenses and other financial statements in addition to the balance sheet. When Mie Prefecture began preparing financial statements based on the NPM approach in 1999, the practice spread to several prefectures. However, the preparation of financial statements did not spread to many local governments until 2006, when the Ministry of Internal Affairs and Communications requested that all local governments prepare financial statements (Ministry of Internal Affairs and Communications 2006).

The purpose of introducing accrual accounting was to increase fiscal transparency by making it easier to understand government assets and liabilities than cash-based accounting. Although the MIC did not set any penalties for not preparing financial statements, many local governments followed its request to prepare financial statements because of MIC's influence over them. At that time, the MIC presented two accounting standards—'Basic' and 'Revised' models—and asked each local government to choose one. The 'Basic model' is completely accrual and requires a double-entry bookkeeping method, whereas the 'Revised model' is partly accrual and partly cash. Therefore, the 'Revised model' could be introduced at a lower cost to local governments. In the case of the 'Basic model', the accrual-based valuation of fixed asset ledgers is time-consuming and expensive, and a new accounting system is

required to introduce the double-entry bookkeeping method. By presenting two accounting standards with different degrees of difficulty, the MIC intended to allow all local governments to begin preparing their financial statements based on one of the accounting standards, regardless of how much money and manpower each they could devote to the process. The revised model is a revision of the former MIC model (the 'Old model'), which was presented by the MIC on a trial basis in 2000. Unlike 'Basic' and 'Revised' models, the 'Old model' does not require the maintenance and management of a fixed asset ledger. Table 1 summarizes these differences.

Figure 1 illustrates the accounting standards chosen by each local government. While many local governments have chosen the 'Revised model', some continue with the 'Old model', others do not prepare financial statements. Moreover, some local governments choose their own accounting standards that differ from those presented by the MIC. This wide variation is another point of difference between the evolution of accrual accounting in other countries and Japan. In 2021, 99% of local governments adopted the newly proposed accounting standards to prepare their financial statements. The new accounting standards are perfectly accrual accounting.

Table 1 Key features of accounting standards in the evolution of Japanese local public accounting

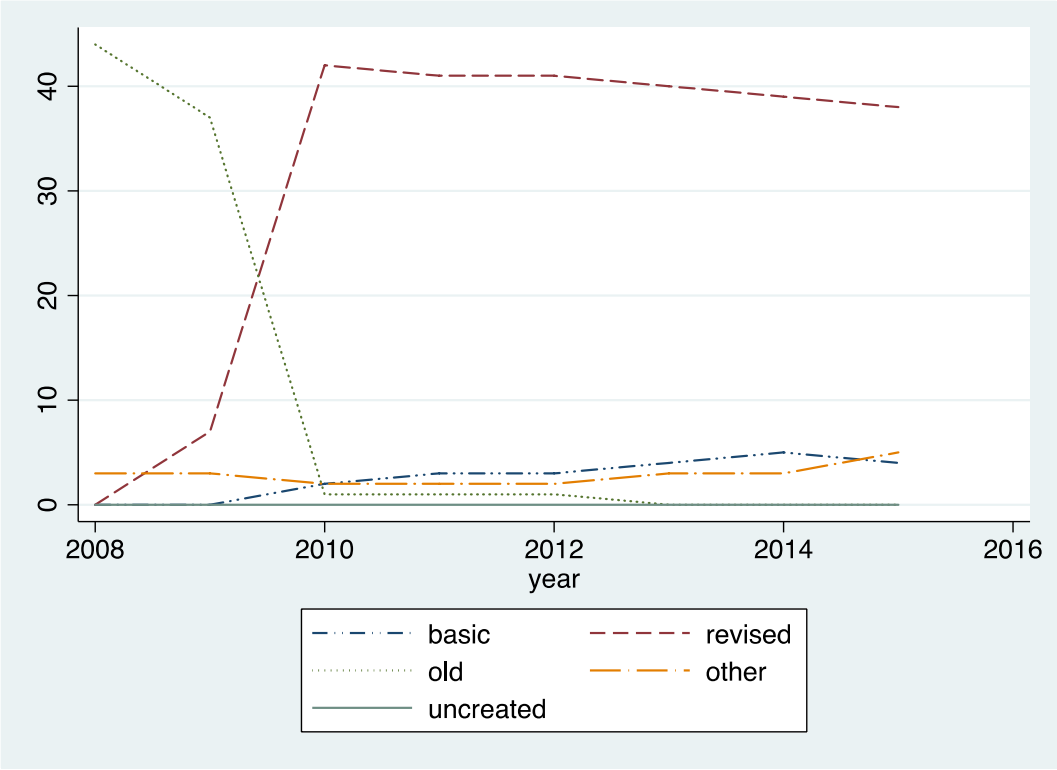
Basic Model	Revised Model	Old Model
Records transactions with double-entry bookkeeping method	Records transactions with single entry bookkeeping method	Records transactions with a double single bookkeeping method
Prepare financial statements from journal entries	Prepare financial statements by reclassifying cash basis closing statistics	Prepare financial statements by reclassifying cash basis closing statistics
Need to maintain fixed asset ledger perfectly on an accrual basis	Fixed asset ledgers are partly on an accrual basis and partly on a cash basis	Maintenance of fixed asset ledgers is not required.

Source:

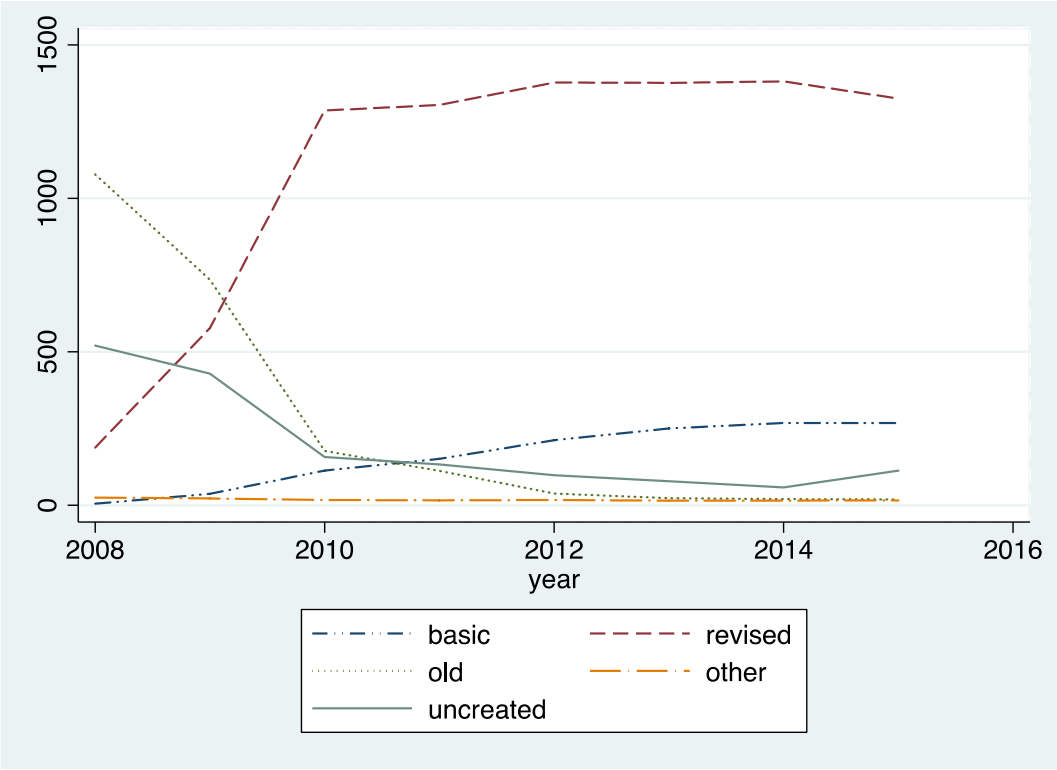
By author using the Ministry of Internal Affairs and Communications (2006)

Fig. 1 The choice of public accounting standards by prefectures and municipalities

(a) The number of prefectures which adopted each accounting model



(b) The number of municipalities which adopted each accounting model



Source: By author using MIC "Investigation of the status of preparation of financial statements (2008-2015)".

4. Related studies

4.1 Evaluation of accrual accounting

Representative studies such as those by Alt and Lowry (1994), Poterba (1996), Von Hagen and Harden (1995), Alesina and Perotti (1999), and Alesina et al. (1999) demonstrate that fiscal rules and institutions can lead to restrictions on government spending. In a recent study in Japan, Akai and Ishikawa (2019) empirically analyze the impact of the Law Relating to the Financial Soundness of Local Governments passed in 2007 on local government finances,

and reports that requiring local governments to disclose financial indicators can lead to spending restraints. Research that explores the fiscal impact of introducing accrual accounting into the public accounting system are Lampe et al. (2015), Christofzik (2019), and Dorn et al. (2021). Lampe et al. (2015) use stochastic frontier methods to assess the impact of the introduction of accrual accounting on the cost efficiency of local governments in the German state of North Rhine-Westphalia. The introduction of accrual accounting leads to the enhanced efficiency of local governments, but there is no evidence that efficiency will improve over time after the introduction. Christofzik (2019), using German state-level data, find that switching to accrual accounting has no effect on the fiscal balance. Dorn et al. (2021), using Difference in Differences (DID), hold that the adoption of accrual accounting in the local government of Bavaria, Germany, may not have had a significant impact on technical efficiency as calculated by Data Envelopment Analysis (DEA).

Nonetheless, Kondoh and Ogawa(2020a), Kondoh and Ogawa (2020b), Ogawa (2020), Bessho and Hirota (2021), and Tran and Noguchi (2022) analyze the impact of Japan's public accounting reforms on local government finance using municipal-level panel data. Both studies show that preparing and publishing accrual-based financial statements lead to local government spending controls. Tran and Noguchi (2022) use DEA to measure the efficiency of local governments in Tokyo, the capital of Japan and asserts that preparing financial statements on an accrual basis increases efficiency. However, no study has empirically captured the impact of public accounting reform on the efficiency of all local governments in Japan, and the evaluation of public accounting reform in Japanese local governments is not consistent. This study provides further evidence to determine whether public accounting

reform is worth the cost.

4.2 Evaluation of local government's efficiency

There are many studies on local government efficiency. De Borger and Kerstens (1996) employ DEA and stochastic frontier methods to measure the efficiency of local governments in Belgium and conclude that block grant per capita and average income are negatively related to efficiency. Worthington (2000) measures local government efficiency in Australia using DEA and stochastic frontier methods, and compares the results, to establish that the determinants of efficiency differ between DEA and stochastic frontier methods. Geys (2006) reveals spatial interdependence in the efficiency of Belgian local governments, and Geys and Moesen (2009) find that in Belgium, larger and more densely populated local governments are less efficient, and subsidiaries from higher-level governments associated with strict spending oversight increase efficiency. Kalb (2010) measures the efficiency of local governments in Germany and confirms that efficiency decreases as the amount of intergovernmental subsidies increases. Geys et al. (2010) demonstrate that efficiency improves with the degree of voter involvement in German local government, as measured by voter turnout and the existence of free voter unions in local councils.

In Japan, Akai et al. (2003), Nakazawa and Miyashita (2016), Maeda (2018), and Sumi (2021) use stochastic frontier methods to measure local government efficiency. Akai et al. (2003) report that local governments that rely more heavily on LAT grants are less efficient. Nakazawa and Miyashita (2016) hold that when municipalities merge, the more municipalities participate in the merger, the lower the post-merger efficiency. Maeda (2018)

avers that local governments that can accumulate more funds improve their efficiency. Sumi (2021) provide a multidimensional analysis of the factors that affect the efficiency of local governments. The study finds that the Law Relating to the Financial Soundness of Local Governments passed in 2007 has not led to improved efficiency, that the LAT grant reduces efficiency, and that a decrease in political competition reduces efficiency. The decrease in political competition is expressed in the percentage of votes and length of the term of office of local government chiefs. However, Sumi (2021) also does not analyze the impact of preparing accrual accounting financial statements on efficiency. This study measures the efficiency of Japanese local governments using the stochastic frontier method but adopts the same approach as Sumi (2021) for the data on local public service levels necessary for the measurement.

5. Estimation approach and data

5.1 Estimation approach

To clarify the impact of introducing local public accounting on local government efficiency quantitatively, we estimate the cost function of municipalities based on stochastic frontier analysis (SFA). SFA was originally proposed by Aigner et al. (1977) and Meeusen and van der Broeck (1977), and was extended to panel data setting by Battese and Coelli (1995). In the estimation of standard cost functions, services suppliers are implicitly assumed to minimize their cost; however, in SFA, we can explicitly treat the distance from the frontier, which corresponds to the minimum cost, as inefficiency. If we assume the Cobb=Douglas

form as a cost function, a stochastic frontier cost function and an inefficiency term can be written as follows:

$$lnC_{it} = \beta_0 + \beta lnY_{it} + \sum_{r=1}^{R} \beta_r X_{r,it} + v_{it} + u_{it} \qquad (1)$$

$$u_{it} = \sum_{k=1}^{K} \delta_k z_{k,it} + \omega_{it} \qquad (2)$$

C denotes the cost of local public service provision. Y is the output measure of the local public services. X are control variables that may affect the cost of local public service provision and z are explanatory variables related to inefficiency. β and δ denote the parameters to be estimated, and v, u, and ω are the error terms.

Error terms in stochastic frontier models are divided into two parts: a standard error term, which follows i.i.d., $v \sim N(0, \sigma_v^2)$ and a non-negative error term u, which accounts for sources of inefficiency. The empirical strategy developed by Battese and Coelli (1995) simultaneously estimates the frontier cost function (1) and the inefficiency term (2) using the maximum likelihood method[6]. It allows us to distinguish inefficiency from stochastic noise in the cost functions. We introduce a dummy variable relating to the preparation status of local public financial statements as an explanatory variable in the inefficiency term, thereby clarifying whether introducing local financial statements (balance sheets) positively and significantly affects the local government's efficiency.

[6] Battese and Coelli (1995) estimates stochastic frontier production function as examples, however, the same empirical strategy is applicable to cost functions.

5.2 Data and hypotheses

Our sample is Japanese municipal-level panel data for fiscal years FY 2009 to FY 2015. However, we omit some municipalities from our sample because some data are not available for some years of our sample period. Yubari city, Hokkaido prefecture, located in the northern part of Japan, is also excluded because the city is designated as a fiscal rehabilitation entity. Moreover, we exclude ordinance-designated cities from our sample because these cities have a large population (more than 500,000 people, in principle) and additional public services and revenues that other municipalities do not have[7]. Thus, the number of municipalities included in our sample is 1362, and the total sample size is 9534 (=1362 x 7). Our estimation model is as follows:

$$lnC_{it} = \beta_0 + \beta lnY_{it} + \beta_1 lnWAGE_{it} + \beta_2 lnPOP_{it} + \beta_3 (lnPOP_{it})^2 + \beta_4 OLD_{it} + \beta_5 YOU_{it} + \beta_6 DENS_{it} + \beta_7 DINC_{it} + \beta_8 GEJED_{it} + \beta_9 RID_{it} + +v_{it} + u_{it} \quad (3)$$

$$u_{it} = \delta_1 GRANT_{it-1} + \delta_2 CTAX_{it-1} + \delta_3 ACCOUNT_{it-1} + \omega_{it} \quad (4)$$

We use the log of per capita current expenditure or the log of per capita total expenditure as the cost of local public service provision C . Current expenditure is calculated as the sum of personnel expenses, supply and services expenses, expenses for maintenance and repairs,

[7] For example, ordinance-designated cities have more authority on public services including public welfare, environmental preservation, public health, education and urban planning, which are in charge of prefectures in ordinary cities, towns and villages.

expenses for social assistance, and subsidies, which do not include construction expenses and debt service. It would be normal to use current expenditures to analyze the efficiency of the local public sector; however, it should also be worth examining total expenditures, including construction expenses, given that introducing local public financial statements is expected to be effective for more efficient provision of local infrastructure. Therefore, we use both current expenditure and total expenditure as the cost of local public service provision[8].

Y represents the output of local public service, for which we use data on the level of local public service provision developed by Sumi (2021)[9]. We classify the local government's expenditure by purpose and calculate scores by administrative purpose. Finally, the level of local public service provision is calculated as a weighted average of scores based on the actual proportion of each expenditure to total expenditures. As mentioned earlier, owing to differences in public service provision between cities and towns and villages, we calculate this index separately between cities, towns, and villages. Specifically, we calculated it as follows:

$$Y = \sum_{s=1}^{S}\left\{\alpha_s\left(\sum_{j=1}^{J}\theta_{sj}SSCORE_{sj}\right)\right\}, \quad \sum_{s=1}^{S}\alpha_s = 1, \quad \sum_{j=1}^{J}\theta_{sj} = 1 \qquad (5)$$

[8] Akai et al. (2003) uses current and total expenditure for Japanese case. Lampe et al. (2015) uses net current expenditure and net current expenditure minus real investment and repayments of loans as an input variable.

[9] As Lampe et al. (2015) mentioned, it is difficult to measure an output of public sector (p. 4354). They pick up four areas: education, recreation, social need and infrastructure following previous studies, and includes indexes relating to these four areas as explanatory variables in the frontier function.

s denotes areas of local public service and j represents more subdivided items of local public service. We consider five areas of local public service, and we consider 5 areas: expenses for social welfare, education, sanitation, general administration, and public works from local expenditure by purpose. These expenditures are further subdivided by area. For example, expenses for social welfare are divided into expenses for welfare for the aged and child welfare, the number of beds per population aged over 65, and capacity of long-term care facilities per population aged over 65 are used as indices for evaluating the service level of welfare for the aged. The original values of these indices（G_{sj}）are standardized, and the local public service level of the s-th area, the j-th item（$SSCORE_{sj}$）is calculated as follows:

$$SSCORE_{sj} = \left(\frac{G_{sj} - \overline{G_{sj}}}{\sigma_{G_{sj}}}\right) \times 10 + 50 \quad (6)$$

$\overline{G_{sj}}$, $\sigma_{G_{sj}}$ denotes the nationwide mean and standard deviation of the public service index of the sth area and jth item, respectively. These indices for local public service level（$SSCORE_{sj}$）are averaged on weights calculated from actual expenditure weights α_s, θ_{sj} , which become the level of local public service, Y. Expenditure areas, items, and weights that are needed to calculate the level of local public service are shown in Table 2.

Table 2 Level of Local Public Service : Definition and Sources

Expenditure Area	Item	Municipalities αs	θsj	Index
Public welfare		0.325		
	Welfare of aged		0.344	No. of beds per population aged over 65 *3
				Capacity of long-term care facilitiy per population aged over 65 *5
	Child welfare		0.656	No. of children in nuesery school per population aged 0-4 *4
				Area size of nuesery school per population aged 0-4 *4
Education		0.156		
	Kindergarten		0.051	No. of kindergarten children per population aged 0-4 *2
	Elementary school		0.298	No. of teachers per elementary school pupils *2
	Junior high school		0.176	No. of teachers per junior high school pupils *2
	Social education		0.224	No. of city halls per population *1
	Health & physical education		0.25	No. of museums per population *1
				No. of physical education facilities per population *1
Sanitation		0.146		
	Waste disposal		0.495	Amount of waste disposal per population *1
	Public health		0.505	No. of health center per population *1
General administration		0.197		
	General administration management		1	No. of meeting places per population *1
				Area size of government building per population *1
Public works		0.176		
	Roads & bridges		0.335	Total road length per area size *1
	City planning		0.665	Area size of parks per population *1

Sources
*1: Survey of Public Facilities Situation, Ministry of Internal Affairs and Communication
*2: School Basic Survey, Ministry of Education, Culture, Sports, Science and Technology
*3: Survey of Medical Institutions, Ministry of Health, Labour and Welfare
*4: Survey of Social Welfare Institutions, Ministry of Health, Labour and Welfare
*5: Survey of Institutions and Establishments for Long-term Care, Ministry of Health, Labour and Welfare

The following variables are introduced as other explanatory variables in the frontier cost function: the log of the average monthly salary ($lnWAGE$) is used as a proxy for the factor price. This information is available in the Survey on Salary and Capacities, published by the Ministry of Internal Affairs, Administration, and Communication (MIAC), Japanese government. The log of the population ($lnPOP$) and the square of the log of population $(lnPOP)^2$, the ratio of population aged over 65 (OLD), ratio of population under 15 (YOU) and population density ($DENS$) are included as possible determinants of the cost of municipalities, and the change in taxable income ($DINC$) is added to capture the change in the municipality's economic situation. Moreover, we include the Great East Japan Earthquake ($GEJED$) and a remote island dummy (RID) to account for time- or area-specific factors. The Great East Japan Earthquake dummy takes the value of 1 if a municipality is included as a designated affected area by the Great East Japan Earthquake that occurred on March 11, 2011, and if the year is 2011 onwards, and otherwise 0. This dummy variable captures possible changes in revenue or expenditure in the areas affected by the Great East Japan Earthquake. The remote island dummy takes 1 if the entire area of a municipality is designated as a remote island by laws[10] that aim for remote island development, and otherwise 0. This dummy variable captures the additional costs of these municipalities made up of remote islands. Data on taxable income come from the Survey on City, Town, and

[10] This includes Remote Islands Development Act (Rito Shinko Ho, in Japanese), Act on Special measures for the Ogasawara islands Development (Ogasawara Shoto Shinko Kaihatu Tokubetu Soti Ho, in Japanese), Act on Special measures for the Amami islands Development (Amami Gunto Shinko Kaihatu Tokubetu Soti Ho, in Japanese), and Act on Special measures for Okinawa Development (Okinawa Shinko Kaihatu Tokubetu Soti Ho, in Japanese).

Village Taxation Situation published by MIAC, while others are collected from the Census or Estimate of Population, which is also provided by MIAC.

Regarding the inefficiency term, we introduce dependence on the LAT grant ($GRANT$) and dependence on cooperate taxation ($CTAX$) in consideration of the possibility that fiscal assistance from the central government to a municipality and cooperating taxation of local taxes loosens the fiscal discipline of the municipality, following the discussion of previous studies in Japan, such as Akai et al. (2003) and Sumi (2021). Dependence on LAT grants is defined as the ratio of LAT grants to the standard financial scale. Dependence on corporate taxation is calculated as the ratio of enterprise tax for cooperation to local tax revenue. The literature, including Akai et al. (2003), point out that higher dependence on LAT resulted in soft budget problems in local public finance and that higher dependence on cooperative taxation made municipalities less sensitive to the costs of public funds and led to inefficiency because of tax exporting. If these effects exist, dependence on the LAT grant ($GRANT$) and on corporate taxation ($CTAX$) are expected to have statistically positive coefficients.

The most important variables of interest in our study are dummy variables ($ACCOUNT$) which capture the effects of the introduction of the local public account system (preparation of financial statements conforming to one of the public account standards). Financial statement dummy variables take the value of 1 if the municipality completed the preparation of financial statements, which is required by local public accounting reform, and 0 otherwise. Data are obtained from the Situation on Preparation of Financial Statements of Local Governments published by MIAC. In this survey, municipalities were asked to report the preparation of financial statements based on the previous fiscal year's settlements at the end

of each fiscal year. During our estimation period, several models for financial statements coexisted, as mentioned in Section 3.2. Specifically, we classify these into three models: 1. 'Basic model', 2. 'Revised model', 3. 'Old model,' and make dummy variables corresponding to each. Among them, the 'Basic model' requires a double entry bookkeeping and needs to maintain a fixed asset ledger, and this standard is regarded to be most consistent with the concept of accrual accounting. On the contrary, the most commonly employed format in our sample period was 'Revised model,' which was used by about 50% of municipalities in our sample. However, the 'Revised model' does not require a double entry bookkeeping because financial statements are allowed to be made based on traditional standard cash-based public accounting. The 'Old model' is a format that was proposed earlier than the 'Revised model'. Thus, these two models are considered simplified formats for making local public financial statements.

If the introduction of public financial statements based on these models improves fiscal efficiency by enhancing fiscal transparency, dummy variables related to the preparation status of these financial statements are expected to be negatively significant. Moreover, in introducing more accrual-based accounting standards, 'Basic model' may be more effective in improving local government efficiency[11]. Therefore, our empirical hypotheses are two folds:

[11] As mentioned earlier, Japanese local governments used to manage fixed assets separately from the management of municipal bonds issued at the time of acquisition of fixed assets. The integration of these managements through the development of fixed asset ledgers may lead to the reduction of fixed assets and wasteful maintenance of fixed assets.

H1: Introducing financial statements improve local government efficiency.

H2: Introducing more accrual accounting-based financial statements improve government efficiency.

If the financial statement dummy is negatively significant, which means H1 holds and that introducing financial statements matters in improving local government efficiency. If a financial statement dummy for the 'Basic Model' is negatively significant, which means H2 holds and that it is important to introduce not only financial statements but also more accrual-based financial statements in improving the cost efficiency of local governments.

All explanatory variables in inefficiency terms take a one-year lag as a baseline and a two-year lag and three-year lag as extensions because these effects may have time lags. Table 3 summarizes the descriptive statistics.

Table 3 Descriptive statistics

Variables	Mean	S.D.	Minimum	Maximum
Stochastic frontier cost function				
Current expenditure (in log)	5.669	0.363	5.021	7.233
Total expenditure (in log)	6.248	0.455	5.432	8.505
Level of local public services (in log)	3.909	0.090	3.753	4.353
Wage (in log)	12.681	0.056	12.453	12.872
Population (in log)	10.149	1.259	7.036	13.326
Squared population in log	104.579	25.775	49.507	177.585
Ratio of population aged over 65	0.299	0.069	0.112	0.605
Ratio of population aged under 15	0.122	0.021	0.030	0.220
Change in taxable income	-0.012	0.044	-0.469	0.882
Great East Japan Earthquake dummy	0.045	0.206	0.000	1.000
Remote island dummy	0.028	0.164	0.000	1.000
Population density	8.922	18.202	0.028	135.300
Inefficiency term				
Dependence on LAT grant	0.443	0.244	0.000	0.894
Dependence on cooperate taxation	0.068	0.036	0.005	0.657
Financial Statements Dummy	0.666	0.472	0.000	1.000
FS Dummy (Basic Model)	0.077	0.267	0.000	1.000
FS Dummy (Revised Model)	0.503	0.500	0.000	1.000
FS Dummy (Old Model)	0.086	0.280	0.000	1.000

6. Estimation results

The stochastic frontier cost function in Equation (3) and inefficiency term in Equation (4) are simultaneously estimated using the maximum likelihood method. Estimation results are shown in Table 4 (where we take one-year lag as financial statements dummies), Table 5 (where we take a two-year lag as financial statement dummies), and Table 6 (where we take a three-year lag as financial statement dummies). In each table, the estimation results using the current expenditure as the dependent variable are displayed in columns (1) and (2), while the estimation results using the total expenditure as the dependent variable are shown in columns (3) and (4). Regarding financial statement dummies, cases where financial statement dummy (which does not discriminate what model of financial statement are employed) is used are shown in column (1) and (3). In contrast, cases where 3 dummies ('Basic', 'Revised', 'Old') are used are indicated in column (2) and (4), which will enable us to find the differences in effects of introducing financial statements depending on its model.

The validity of the inefficiency term in the stochastic frontier cost function is verified by two variance parameters: σ_u and $\lambda = \sigma_u/\sigma_v$. The null hypothesis that no inefficiency effects exist is strongly rejected in all the specifications. Moreover, λ is larger than 1 for all cases, which means that the variance caused by the inefficiency term u is larger than that caused by v. Hence, this formulation, including inefficiency, seems to be adequate.

Table 4 Estimation results (Baseline; financial statements one-year lag)

Dependent variable	Current		Total	
	(1)	(2)	(3)	(4)
Stochastic frontier cost function				
Level of local public services (in log)	1.4105***	1.4137***	1.5979***	1.6005***
	(0.0348)	(0.0348)	(0.0396)	(0.0396)
Wage (in log)	0.3478***	0.3466***	0.2746***	0.2758***
	(0.0354)	(0.0354)	(0.0411)	(0.0411)
Population (in log)	-0.7623***	-0.7562***	-0.8658***	-0.8681***
	(0.0230)	(0.0232)	(0.0256)	(0.0257)
Squared population in log	0.0344***	0.0341***	0.0390***	0.0391***
	(0.0011)	(0.0011)	(0.0012)	(0.0012)
Ratio of population aged over 65	0.4837***	0.5182***	0.8034***	0.7971***
	(0.0807)	(0.0827)	(0.0846)	(0.0846)
Ratio of population aged under 15	0.1772	0.2103	1.0934***	1.0964***
	(0.1547)	(0.1557)	(0.1740)	(0.1740)
Change in taxable income	0.1917***	0.1894***	0.3241***	0.3235***
	(0.0523)	(0.0524)	(0.0596)	(0.0596)
Great East Japan Earthquake dummy	0.0657***	0.0660***	0.1277***	0.1272***
	(0.0082)	(0.0082)	(0.0098)	(0.0097)
Remote island dummy	0.1381***	0.1399***	0.1565***	0.1558***
	(0.0135)	(0.0136)	(0.0147)	(0.0147)
Population density	0.0003***	0.0003***	-0.0006***	-0.0006***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Inefficiency term				
Dependence on LAT grant	1.0539***	1.0778***	1.2476***	1.2420***
	(0.0600)	(0.0647)	(0.0442)	(0.0443)
Dependence on cooperate taxation	1.3535***	1.3858***	1.5769***	1.5719***
	(0.1233)	(0.1285)	(0.0976)	(0.0975)
Financial Statements Dummy	-0.0263***		-0.0136**	
	(0.0083)		(0.0069)	
FS Dummy (Basic Model)		-0.0159		-0.0408***
		(0.0172)		(0.0149)
FS Dummy (Revised Model)		-0.0346***		-0.0128*
		(0.0096)		(0.0074)
FS Dummy (Old Model)		-0.0012		-0.0017
		(0.0157)		(0.0132)
Sample size	9415	9415	9415	9415
Log likelihood	3592.70	3595.02	2343.04	2345.50
σ u	0.2039***	0.2061***	0.1839***	0.1844***
	(0.0068)	(0.0072)	(0.0077)	(0.0075)
σ v	0.1048***	0.1056***	0.1320***	0.1314***
	(0.0029)	(0.0029)	(0.0055)	(0.0055)
λ (= σ u/ σ v)	1.9457***	1.9511***	1.3928***	1.4039***
	(0.0077)	(0.0080)	(0.0128)	(0.0125)
Average inefficiency	1.259	1.255	1.359	1.361

Notes: Statndard errors are in parentheses. Results on year dummies are omitted.
***, **, * denotes statistically significance at 1%, 5%, 10% respectively.

Table 5 Estimation results (Extension; financial statements two-year lag)

Dependent variable	Current		Total	
	(1)	(2)	(3)	(4)
Stochastic frontier cost function				
Level of local public services (in log)	1.398***	1.4013***	1.5742***	1.5767***
	(0.0379)	(0.0379)	(0.0432)	(0.0432)
Wage (in log)	0.3437***	0.3429***	0.2821***	0.2827***
	(0.0386)	(0.0386)	(0.0451)	(0.0451)
Population (in log)	-0.7867***	-0.7819***	-0.8750***	-0.8776***
	(0.0249)	(0.0252)	(0.0278)	(0.0280)
Squared population in log	0.0354***	0.0352***	0.0393***	0.0395***
	(0.0011)	(0.0012)	(0.0013)	(0.0013)
Ratio of population aged over 65	0.4092***	0.4378***	0.7447***	0.7376***
	(0.0887)	(0.0914)	(0.0921)	(0.0922)
Ratio of population aged under 15	0.1646	0.1928	0.9987***	0.9991***
	(0.1693)	(0.1707)	(0.1900)	(0.1900)
Change in taxable income	0.1613***	0.1596***	0.3220***	0.3233***
	(0.0555)	(0.0555)	(0.0631)	(0.0631)
Great East Japan Earthquake dummy	0.0659***	0.0661***	0.1275***	0.1271***
	(0.0083)	(0.0083)	(0.0099)	(0.0099)
Remote island dummy	0.1368***	0.1382***	0.1595***	0.1588***
	(0.0146)	(0.0147)	(0.0160)	(0.0160)
Population density	0.0003***	0.0003***	-0.0006***	-0.0006***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Inefficiency term				
Dependence on LAT grant	1.0457***	1.0637***	1.2680***	1.2619***
	(0.0595)	(0.0638)	(0.0475)	(0.0478)
Dependence on cooperate taxation	1.3160***	1.3437***	1.6226***	1.6175***
	(0.1320)	(0.1371)	(0.1101)	(0.1103)
Financial Statements Dummy(t-2)	-0.0238***		-0.0068	
	(0.0085)		(0.0074)	
FS Dummy (Basic Model)(t-2)		-0.0172		-0.0308*
		(0.0185)		(0.0168)
FS Dummy (Revised Model)(t-2)		-0.0300***		-0.0053
		(0.0097)		(0.0080)
FS Dummy (Old Model)(t-2)		-0.0064		-0.0018
		(0.0153)		(0.0135)
Sample size	8070	8070	8070	8070
Log likelihood	3020.97	3022.13	1937.61	1938.94
σ u	0.1998***	0.2004***	0.1838***	0.1846***
	(0.0068)	(0.0071)	(0.0089)	(0.0086)
σ v	0.1055***	0.1062***	0.1337***	0.1329***
	(0.0033)	(0.0034)	(0.0063)	(0.0062)
λ (= σ u/ σ v)	1.8839***	1.8865***	1.3742***	1.3895***
	(0.0080)	(0.0083)	(0.0147)	(0.0143)
Average inefficiency	1.269	1.265	1.364	1.367

Notes: Statndard errors are in parentheses. Results on year dummies are omitted.
***, **, * denotes statistically significance at 1%, 5%, 10% respectively.

Table 6 Estimation results (Extension; financial statements three-year lag)

Dependent variable	Current		Total	
	(1)	(2)	(3)	(4)
Stochastic frontier cost function				
Level of local public services (in log)	1.3735***	1.3763***	1.5415***	1.5423***
	(0.0418)	(0.0419)	(0.0476)	(0.0475)
Wage (in log)	0.3465***	0.3464***	0.2920***	0.2918***
	(0.0426)	(0.0426)	(0.0498)	(0.0498)
Population (in log)	-0.8150***	-0.8113***	-0.8833***	-0.8887***
	(0.0274)	(0.0278)	(0.0306)	(0.0307)
Squared population in log	0.0366***	0.0365***	0.0397***	0.0399***
	(0.0013)	(0.0013)	(0.0014)	(0.0014)
Ratio of population aged over 65	0.3432***	0.3644***	0.6589***	0.6410***
	(0.0993)	(0.1027)	(0.1019)	(0.1018)
Ratio of population aged under 15	0.1412	0.1633	0.9043***	0.8899***
	(0.1886)	(0.1905)	(0.2109)	(0.2109)
Change in taxable income	0.0735	0.0723	0.2101***	0.2155***
	(0.0633)	(0.0633)	(0.0712)	(0.0712)
Great East Japan Earthquake dummy	0.0653***	0.0657***	0.1258***	0.1251***
	(0.0084)	(0.0084)	(0.0100)	(0.0100)
Remote island dummy	0.1416***	0.1425***	0.1591***	0.1581***
	(0.0162)	(0.0163)	(0.0177)	(0.0177)
Population density	0.0003***	0.0003***	-0.0006***	-0.0006***
	(0.0001)	(0.0001)	(0.0002)	(0.0002)
Inefficiency term				
Dependence on LAT grant	1.0278***	1.0398***	1.2780***	1.2660***
	(0.0599)	(0.0635)	(0.0510)	(0.0509)
Dependence on cooperate taxation	1.2223***	1.2396***	1.6590***	1.6463***
	(0.1345)	(0.1385)	(0.1174)	(0.1171)
Financial Statements Dummy(t-3)	-0.0146*		0.0038	
	(0.0088)		(0.0081)	
FS Dummy (Basic Model)(t-3)		-0.0101		-0.0223
		(0.0210)		(0.0197)
FS Dummy (Revised Model)(t-3)		-0.0188*		0.0087
		(0.0101)		(0.0088)
FS Dummy (Old Model)(t-3)		-0.0044		-0.0042
		(0.0149)		(0.0138)
Sample size	6725	6725	6725	6725
Log likelihood	2453.71	2454.15	1559.22	1560.75
σ u	0.1985***	0.1995***	0.1881***	0.1893***
	(0.0068)	(0.0071)	(0.0091)	(0.0086)
σ v	0.1035***	0.1041***	0.1316***	0.1300***
	(0.0036)	(0.0039)	(0.0067)	(0.0066)
λ (= σ u/ σ v)	1.9183***	1.9169***	1.4302***	1.4568***
	(0.0084)	(0.0085)	(0.0153)	(0.0146)
Average inefficiency	1.285	1.282	1.381	1.386

Notes: Statndard errors are in parentheses. Results on year dummies are omitted.
***, **, * denotes statistically significance at 1%, 5%, 10% respectively.

The results on the stochastic frontier cost function show that our output measure, the level of local public services, is significantly positive, which implies that the level of local public services are good proxies for local public sector output. Wage as a factor price of local public services is also positively associated with a cost for all cases, which is consistent with the theoretical prediction. As for population, the coefficients of logged population and logged population squared are negative and positive, respectively, which means that the relationship between population and cost of municipalities is U-shaped. This result is consistent with those of previous studies in Japan (e. g. Akai et al. 2003). It implies that economies of scale exist in the cost function of local public services. The Great East Japan Earthquake dummy and remote island dummy are always positively significant, which indicates that areas affected by large-scale disasters and remote islands incur additional costs for public services. Population density is positively significant for current expenditure, whereas it is negatively significant for total expenditure. This result may be because the total expenditure includes construction expenditure, and intergovernmental grants for construction expenses are heavily allocated to sparsely populated areas (e.g. Mizutani and Tanaka 2010).

Turning to the results on the inefficiency term, dependence on LAT grants and corporate taxation are strongly and positively significant in all specifications. These results are also consistent with those of previous works for the Japanese case (e. g. Akai et al. 2003), which state that the soft budget problem of intergovernmental grants or tax exporting make the expenditure structure of local governments inefficient.

The effects of introducing financial statements on local public efficiency are our main interest. If we look at Table 4, where either the current or total expenditure is used as a dependent, the financial statement dummy is negative and statistically significant at 1% level. Therefore, H1 holds. In the case of using dummy variables, which identify a model of financial statements, 'Revised model' dummy is negatively significant at the 1% level in column (2), whereas 'Basic model' dummy is negatively significant at the 1% level and 'Revised model' dummy is negatively significant at 10% level in column (4). This result implies that it is only in the case of total expenditure where more accrual-based financial statements matter in improving local government efficiency. It may be due to the fact that the total expenditure includes construction expenditure and fixed asset ledger which is needed for 'Basic Model' financial statements is helpful for the wise planning of public investment policy in the long run. Therefore, we conclude that H2 partially holds true.

In the baseline case (Table 4), we take a one-year lag as the financial statement variable. How do the results change if we take a two-year (Table 5) or a three-year lag (Table 6)? In Table 5, the financial statements dummy is negatively significant at 1% level for the current expenditure (column 1); however, we do not find significant results for the total expenditure (column 3). In case of specifications with three financial statement dummies, 'Revised model' dummy is negatively significant at 1% level for the current expenditure (column 2), and 'Basic model' dummy is negatively significant at the 10% level for the total expenditure (column 4). These results are similar to those in Table 4, but the significance levels are weak. As Table 6 reveals, this tendency becomes more evident. Financial statement dummy is negatively significant (column 1) and 'Revised model' dummy is also negatively significant

only at 10% level (column 2) for the current expenditure. It may be because the two- or three-year lags are too far from being affected by financial statements on the budget or efficiency of local public services. In other words, a one-year lag is the most suitable time lag for analyzing the effects of introducing financial statements on the cost efficiency of local governments.

Following these results, we find that the preparation of financial statements may decrease the inefficiency (or increase efficiency) of local governments. Moreover, we have strong evidence that introducing more accrual-based financial statements improves the efficiency of local governments for total expenditure but not for current expenditure. It may be because the preparation of financial statements contributes to efficiency through construction expenses, including public works, rather than current expenditures. In addition, we examine whether these conclusions differ depending on the time lag between the preparation of financial statements and the cost efficiency of local governments. If we take two- or three-year lags, we obtain similar results, but the relationship between introducing financial statements and local government efficiency becomes less evident. This fact may imply the importance of a time lag in detecting the effects of introducing financial statements on local government efficiency.

7. Conclusion

This study clarifies whether the preparation of financial statements of local governments proceeded by local public accounting reform in Japan in the mid-2000s affects the efficiency of local public services. From this perspective, we analyze the effects of the preparation of

financial statements on the efficiency of local governments using a stochastic frontier approach with Japanese municipality-level panel data. Our main estimation finds that the financial statement dummy is negatively and statistically significant for current and total expenditure. It provides strong evidence that H1, which states that introducing financial statements matter in improving local government efficiency, is supported. Moreover, the more accrual-based financial statement ('Basic model') is negatively significant for the total expenditure, which is the evidence that H2, which states that introducing more accrual-based financial statement helps improve efficiency, partially holds. We also examine whether our results change depending on the time lag between the completion of financial statements and local government efficiency. Although we have similar results for two-year and three-year lags instead of one-year lags, the connection between financial statements and local government efficiency weakens. It may imply that the time lag is important for examining the relationship between them.

An interesting feature of local public accounting reform in Japan is that the model of financial statements adopted by municipalities differs between municipalities. Our empirical results suggest two possibilities: adopting more accrual-based financial statements ('Basic model') or adopting more comparable financial statements ('Revised model') may improve the efficiency of local public services. This implies that introducing accrual-based accounting may be effective in reducing asymmetric information between citizens and government, and therefore leads to local governments efficiency. The experience and results gained from local public accounting reform in Japan will provide important lessons not only to other countries where similar movements are now ongoing but also to public choice theory.

Our study has some limitations. First, we consider only two factors as sources of inefficiency besides financial statement dummies. However, other sources should also be incorporated. This aspect is a possible extension of the present study. Second, differences in the preparation or utilization of local public financial statements may affect the efficiency of local governments. This extension will be an interesting topic for future research.

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