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Local Government Investments and Ineffectiveness of Fiscal Stimulus during Japan's Lost Decades*

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Abstract

This paper provides an explanation of the reason why previous works suggest that the effect of fiscal stimulus measure is, if any, small during the lost decades in Japan. To show this, it focuses on public investment by local governments which occupies a substantial portion of the total investment. Specifically, we divide it into subsidized and non-subsidized expense, and empirically study the differences between their decision-making processes from the perspective of fiscal stimulus measures. The results of this analysis reveal that subsidized expense is countercyclical to the economic situation of the nation as a whole, but on the other hand, no connection with business cycles is seen at prefectural level. Contrastingly, non-subsidized expense shows no reaction to the state of the macro economy. In the 2000s, in particular, it is shown to be procyclical in relation to economic fluctuation at prefectural level, due to the fiscal rigidity of local governments. Based on the fact that the majority of Japan's public investment is carried out by local governments, it becomes clear that, as a problem prior to the evaluation of its policy effects, public investment is not implemented with adequate timing to offset business cycles in the first place.

Keywords: Local governments, Public investment, Subsidized expense, Non-subsidized expense, Lost decades

JEL classification: H72, E62

1 Introduction

There have already been many precedent research studies on public investment as a fiscal stimulus measure in Japan, but most of these analyze without distinguishing between public investment by the central government and that by local governments. As is well known, public investment has played a central role in Japan's fiscal stimulus measures, but policy on public investment aimed at economic stabilization has been implemented through national fiscal stimulus measures using public works budgets, and fiscal stimulus measures by local governments using ordinary construction expenditure. In other words, in Japan's fiscal policy, not only does the central government give guidelines on local finances by formulating the Local Public Finance Program (the fiscal plans of local governments), but incentives for fiscal stimulus measures by local governments have also been given by means of funding measures through intergovernmental fiscal transfers, including Local Allocation Tax and national treasury disbursements.[1]

However, since individual revenues and expenditures in local finances are decided independently based on their respective budgetary constraints, it is not necessarily clear whether local governments have implemented fiscal stimulus measures in line with the Local Public Finance Program or other national policy. Even if the central government has set out fiscal stimulus measures and the government's policy has been indicated in the Local Public Finance Program, depending on the state of local finances, fiscal stimulus measures have not necessarily have been implemented coherently at central and local level.

As Miyazaki (2008) and others also state, if public investment is understood in terms of public capital formation in SNA (System of National Accounts), in Japan more than 80% of public investment by general governments has been implemented at local level. Consequently, when investigating trends in Japan's public investment, it is important to evaluate public investment by local governments. However, as shown by the precedent research summarized in Section 2 below, there has been no research demonstrating explicitly how public investment by local governments has reacted to economic fluctuation. In particular, public investment by local governments is divided into subsidized and non-subsidized public works expenses (hereafter subsidized and non-subsidized expenses), which are contrasting in nature, and local government decision-making on these is not necessarily uniform. Therefore, local government reactions to the economy should be evaluated from the perspective of fiscal stimulus measures divided into subsidized and non-subsidized expense. However, there is no existing research that attempts a verification from this perspective.

Given this background, this paper uses statistical analysis techniques to study empirically how fiscal stimulus measures have been implemented by the central and local governments.[2] As a result of the analysis, we assert that, since the 1990s, local governments have not necessarily made fiscal expenditures in line with national

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[1] The roles of the Local Public Finance Program include (1) ensuring consistency with state finances, the national economy, etc., (2) guaranteeing local funding so that local governments can ensure standard administrative levels, and (3) indicating the principles of financial management by local authorities. The positioning of Local Public Finance Program within fiscal stimulus measures can be seen as an indicative role of national principles.

[2] The framework is based on our preliminary note (Funashima, Horiba and Miyahara, 2013). The present work essentially differs from the previous one in that (1) the model specification here builds on the related literature and (2) the sample period includes the 1990s as well as the 2000s and a comparison of them is conducted.

policy. From the beginning of the 2000s, in particular, non-subsidized expense is shown to be procyclical in relation to economic fluctuation at prefectural level, and this is attributed to the fiscal rigidity of local governments. Based on the fact that the majority of Japan's public investment is implemented by local governments, it will be revealed that, as a problem prior to the evaluation of its policy effects, investment is not implemented with adequate timing to offset business cycles in the first place. As suggested in Bayoumi (2001), Ihori *et al.* (2003), Brückner and Tuladhar (2010), and others, it follows that the effect of fiscal stimulus measure is, if any, small during the lost decades in Japan.

In Section 2 below, we will give an overview of previous empirical studies and define the position of this study. In Section 3, as a target of ordinary construction expenditure, public investment by local governments is divided into subsidized and non-subsidized expense. The linkage between these and business cycles will then be verified from the perspective of fiscal plans and settled accounts of local governments. In Section 4, panel data for each prefecture will be used to estimate a public investment function, central and local government decision-making on business cycles will be investigated, and the difference between the two will be examined. In Section 5, finally, the main conclusions of this paper will be stated and issues for the future touched upon.

2   Related Literature

Japan's public investment policy has already been subject to plenty of empirical research from various perspectives. Here, we survey precedent research and define the position and characteristics of this study. Previous works can be divided into two types, one gauging the policy effects of public investment and the other examining the determinant factors behind it. In the following, existing research demonstrating the economic effects of public investment will first be summarized.

2.1   Policy Effects of Public Investment

The economic effects ensuing from public investment can be organized by dividing them into two aspects, namely demand and supply.[3] That is, from the demand side, investment is expected to produce a leveling of business cycles as a macro stabilization policy. From the aspect of supply, meanwhile, public capital formed by cumulative public investment is thought to have the effect of expanding production levels. The latter is known as the production (productivity) effect of public capital, and has already been the subject of numerous empirical analyses in relation to Japan (e.g., Mera, 1973). These trends have not only involved the productivity of public capital from the viewpoint of the nation as a whole; through estimation based on data for each region, studies of the interregional distribution of public capital have also been actively undertaken. Attempts to gauge the degree to which this public capital contributes to production or economic growth have also been undertaken in recent years, accompanied by a greater refinement of estimation methods.

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[3]In terms of temporal perspectives, the demand aspect and the supply aspect correspond to the short and long term, respectively. Moreover, public investment plays a variety of roles, and can also be arranged in correspondence to the three functions of government finance.

Also, as stated in Doi and Ihori (2009), among others, public investment in Japan has been used actively as a fiscal stimulus measure or means of discretionary fiscal policy. Similarly, many analyses focusing on Japan have already empirically verified the effectiveness of public investment as a macro stabilization policy. However, in precedent research it has been pointed out that this effect has declined since the 1990s (e.g. Bayoumi, 2001; Ihori *et al.*, 2003). In recent years, moreover, research to gauge the impact of public investment on regional business cycles has been progressing. Of those concerned with Japan, studies by Brückner and Tuladhar (2010), Kondo (2011), Miyazaki (2011), Miyazaki and Kondo (2012) may be mentioned.

Brückner and Tuladhar (2010) estimate a government expenditure multiplier based on data for each region, and show that the value of this fell throughout the 1990s. Kondo (2011), by measuring impulse response based on the vector auto regression (VAR) model, points out that fiscal outlays in the form of government consumption and public investment have had a small impact on local economies, particularly since the 1990s. Some points are shared by Brückner and Tuladhar (2010) and Kondo (2011); for example, they both divide samples into those before and those after 1990 for comparison and study, and show that the effectiveness of fiscal expenditure has decreased since 1990; moreover, their analysis is aimed at government consumption in addition to public investment. In Miyazaki (2011) and Miyazaki and Kondo (2012), data from 1990 to 2007 are analyzed to estimate the public investment policy shock at prefectural level. Here, public investment is shown to amplify business cycles in local economies. In Japan, there has not been enough research using econometric methods in an attempt to estimate the short-term impact of fiscal expenditure on local economies. In view of this point, the results produced by Brückner and Tuladhar (2010), Kondo (2011), Miyazaki (2011), Miyazaki and Kondo (2012) in actually evaluating the impact of public investment on local economies are regarded as significant.

Incidentally, many of the precedent research studies mentioned above have analyzed public investment without distinguishing between national and local investment. By contrast, Miyazaki and Kondo (2012) use data on public investment by local governments to conduct the same empirical analysis as Miyazaki (2011). They point out that public investment by local governments has amplified the scale of business cycles at local level. Also, in Miyazaki (2008, 2009a, b), public investment is separated into that by the central government and that by local governments, and the VAR model is used to verify and compare the impulse response in each. The results show that, although public investment by the central government has an impact on production or employment, no impact of public investment by local governments can be recognized.

As shown above, several attempts to investigate the effect of public investment by local governments have been made in recent years, but they have evidently yet to reach an adequately cumulative level.

2.2　Determinant Factors behind Public Investment

Next, precedent research that empirically analyzes the factors impacting Japan's public investment policy and fiscal expenditure decision-making will be summarized. There have been numerous examples, both in Japan and abroad, of empirical research based on estimating a policy reaction function, as well as other attempts to elucidate determinant factors behind public investment or government expenditure.

However, because the objectives of analysis are diverse, the formulation of econometric models assumed in these is extremely wide-ranging. Firstly, some existing research demonstrates that political factors have an influence on decision-making in public investment policy. For example, Doi (1998) and Kondo (2008) are among the cases of precedent research based on macro data from Japan. Doi (1998) and Kondo (2008) take account of an election dummy as an explanatory variable, in order to investigate the correlation between fiscal expenditure and national elections. Meanwhile, Kondo (2008) uses panel data for each prefecture to estimate a model with political factors added as an explanatory variable. He asserts that there is political influence over decision-making in public investment policy, at both national and local level.

On the other hand, if based on the role of public investment as macro stabilization policy, public investment is thought to react strongly to economic fluctuation. Although this is also a focus of the present research, precedent research expressly investigating the reaction of fiscal expenditure to business cycles is limited to Kitasaka (2008) and Funashima (2013), among others.[4] Kitasaka (2008) posits a Markov-switching model to formulate a government expenditure function based on economic indicators and fiscal deficits, and investigates regime change in terms of a chronological sequence in the reaction of government expenditure. Funashima (2013) posits a policy reaction function using panel data for each prefecture, based on similar analytical methods to those of Sorensen *et al.* (2001), Lane (2003), Hines (2010), Afonso and Jalles (2013). As a result, while Japan's public investment has been discussed as a fiscal stimulus measure in awareness of the economic state of the country as a whole, it is shown that the economic disparity between regions has not been taken into account. This is thought to support Brückner and Tuladhar (2010), Kondo (2011), Miyazaki (2011), Miyazaki and Kondo (2012), whose findings were skeptical of the short-term effect of public investment on local economies.

Although attempts to investigate the government's reaction to economic fluctuation have been made in this way, there are still issues remaining in the existing research. Funashima (2013) points out that Japan's public investment is countercyclical to economic fluctuation in the country as a whole but procyclical to economic fluctuation at local level, but nevertheless does not adequately elucidate the reasons for this. One such reason, as stated by Higo and Nakagawa (2001), is thought to be that local non-subsidized expense is procyclical to economic fluctuation at prefectural level. Also, as discussed by Miyazaki (2008), it is conceivable that fiscal stimulus measures formulated under government initiatives are not necessarily activated according to plan in non-subsidized expense where local discretion is more easily brought into play. Such points have yet to be analyzed sufficiently, however, and detailed empirical research will need to be accumulated. In this research, the focus is on the actions of local governments in fiscal stimulus measures. By positing a policy reaction function for each of subsidized and non-subsidized investment, the reason why public investment is procyclical to local economic fluctuation will be empirically studied.

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[4]Doi (1998) and Kondo (2008), though taking account of growth rate as an explanatory variable of the policy reaction function, offer no interpretation of the estimation results. In their studies, therefore, the growth rate is thought to be positioned merely as a control variable. Meanwhile, Funashima (2012) examines the correlation between Japan's government expenditure and business cycles within the framework of frequency domain analysis, and shows that public investment is countercyclical to business cycles.

The relative positions of the above-mentioned precedent research and this research are arranged in Table 1.

3 Fiscal Stimulus Measures and Public Investment by Local Governments

In terms of economic nature categories, the expenditure of local governments is divided into mandatory expenditure, investment expenditure, and other expenditure. Of these, fiscal stimulus measures can be perceived as being based on investment expenditure. When considering public investment by local governments in relation to fiscal stimulus measures, the discussion is usually based on ordinary construction expenditure.

Incidentally, the Cabinet prepares forecasts of total revenues and expenditures by local governments for the following fiscal year, and submits them to the National Diet, in accordance with Article 7 of the Local Allocation Tax Act. These forecasts of overall local finances for the following fiscal year are known as the Local Public Finance Program, or more specifically, the initial Local Public Finance Program. After supplementary budgets and other changes have been made to these initial fiscal plans, the Local Public Finance Program corresponding to settled accounts are called the revised Local Public Finance Program.

When the central government implements fiscal stimulus measures, funding measures are taken at the same time as the government's policy is indicated, to ensure that economic adjustment policies are implemented in line with government policy on local finances. As such, the central and local governments work together to implement fiscal stimulus measures. In this process, the policy on local government in relation to fiscal stimulus measures for each fiscal year has been shown in the Local Public Finance Program. That is, the Local Public Finance Program are seen as a signal to local governments concerning national fiscal stimulus measures. Specifically, central government policy on fiscal stimulus measures by local governments is indicated as the stated amount of ordinary construction expenditure in the Local Public Finance Program. Central government policy on fiscal stimulus measures to be implemented by local governments in the next fiscal year is indicated as the Local Public Finance Program at the beginning of the fiscal year, and central policy on fiscal stimulus measures including supplementary budgets is shown in the revised Local Public Finance Program. On the other hand, ordinary construction expenditure actually transferred to implementation is the amount finally accounted by the local authority (settlement accounts), and does not necessarily concur with the amount in the Local Public Finance Program. Comparing the amounts finally accounted by local authorities and the amounts in the Local Public Finance Program enables us to examine how the central and local governments have collaborated in implementing fiscal stimulus measures.

When comparing the Local Public Finance Program with their settled accounts, however, adjustments need to be made, as it is not possible to make simple comparisons, depending on the characteristics of each respective set of figures. That is, the Local Public Finance Program are the forecast amounts of revenues and expenditures in local finances for the next fiscal year, and are seen as collective fiscal projections for a standard local authority in the next fiscal year; they do not project single fiscal year revenues and expenditures on a budgetary basis. Therefore, amounts of

revenues and expenditures pertaining to deferred projects or supplementary budgets are not recorded in the initial Local Public Finance Program. On the other hand, because the amounts of deferred projects and supplementary budgets are included in settled accounts, to make a simple comparison, they are characterized in that final amounts in the Ordinary Accounts are greater than those in the Local Public Finance Program. For the above-mentioned reasons, to compare the Local Public Finance Program with settled accounts, they are adjusted to the Local Public Finance Program and the settled accounts of Ordinary Accounts, respectively, and the amounts of the revised Local Public Finance Program and revised settled accounts are calculated. Specific revisions include the following items.

- Since the categories of revenue and expenditure amounts in the Local Public Finance Program and settled Ordinary Accounts are not the same, categories need to be adjusted. For example, adjustment is made between ordinary construction expenditure, disaster restoration expenditure and unemployment measures expenditure in the type categories of settled Ordinary Accounts, and investment expenditure (subsidized, non-subsidized) in the Local Public Finance Program.

- Because supplementary budgets are not accounted in the Local Public Finance Program, the revised budget portion is added. As increases accompanying supplementary budgets in the middle of a fiscal year, revenues as well as increases in national treasury disbursements, municipal bonds, etc., and increases in the relevant expenditures are necessary for the amounts in the Local Public Finance Program.

- Because amounts brought forward from the previous fiscal year are not accounted in the Local Public Finance Program, adjustments are made. Adjustments are also made for excess taxation, reserves, etc. For example, amounts brought forward from the previous fiscal year are deducted from settled Ordinary Accounts and adjusted with the Local Public Finance Program.

Programs adjusted in this way are called the revised Local Public Finance Program, and settled accounts are called revised settled accounts. These are published every fiscal year by the Ministry of Internal Affairs and Communications.[5] As ordinary construction amounts, subsidized expenses amounts and non-subsidized expenses amounts, the figures in the diagrams below are the amounts in the initial Local Public Finance Program, the revised Local Public Finance Program and revised settled accounts after these adjustments have been made.

3.1 Fiscal Stimulus Measures and Ordinary Construction

Ordinary Construction Expenditure

Fig. 1 shows local ordinary construction expenditure as the total of non-subsidized expense and subsidized expense. Table 2, meanwhile, shows the Local Public Finance Program (initial and revised) and revised settled accounts for ordinary construction as a whole from FY1985 to FY2008.

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[5]Miyazaki (2008) uses the revised Local Public Finance Program and revised settled accounts to discuss the characteristics of subsidized and non-subsidized expense, but the initial Local Public Finance Program is outside the scope of analysis. Moreover, the correlation between these and business cycles is not verified.

Viewing the year-on-year increase in ordinary construction expenditure shown in Fig. 1 (a), ordinary construction expenditure in the revised Local Public Finance Program appears to have generally increased in periods of economic recession, shown by the shading.[6] On the rate of increase in ordinary construction expenditure, moreover, the revised Local Public Finance Program and revised settled accounts followed similar trends in the 1990s, while the initial Local Public Finance Program showed different trends. However, a change in these trends occurred from the beginning of the 2000s, when, if anything, it was initial and the revised Local Public Finance Program that started to follow the same trends. To put it differently, of the three, the initial Local Public Finance Program showed different trends in the 1990s, while revised settled accounts came to show different trends from the beginning of the 2000s. In other words, from the beginning of the 2000s, it is possible that some kind of change occurred in Japan's measures for fiscal stimulus via local finances.

As for the actual amounts for ordinary construction shown in Fig. 1 (b), the revised Local Public Finance Program showed an increasing trend up to FY1993, remained on a par with alternating increases and decreases for five years from FY1994 to FY1998, and have decreased since then. In other words, in terms of local fiscal stimulus measures in the 1990s, we find that the initial Local Public Finance Program did not change significantly, but that the revised Local Public Finance Program and settled accounts changed significantly or to the same degree. Conversely, everything turned to a decrease from the beginning of the 2000s, and revised settled accounts, in particular, fell greatly compared to initial and the revised Local Public Finance Program.

From this, the revised Local Public Finance Program suggests that fiscal stimulus measures using local finances were actively promoted as a national policy in the 1990s. Figures in settled accounts also point to the implementation of fiscal stimulus measures commensurate with this. On the other hand, not only has there been a lack of planned active fiscal stimulus measures since the beginning of the 2000s, but also, in the figures in some local settled accounts, even the amounts in those reduced programs have been unachievable. In other words, owing to the harsh fiscal circumstances of local finances, even local fiscal stimulus measures indicated in the Local Public Finance Program are thought to have become difficult since the beginning of the 2000s.

The Initial Local Public Finance Program, the Revised Local Public Finance Program and Revised Settled Accounts

Fig. 2 shows scatter diagrams of the rates of increase in the initial Local Public Finance Program, the revised Local Public Finance Program and revised settled accounts for each of non-subsidized expense, subsidized expense and ordinary construction expenditure. For example, the second column in the first row of Fig. 2 (a) shows a scatter diagram for the rates of increase in initial and the revised Local Public Finance Program in non-subsidized expense.

Firstly, viewing Fig. 2 (c) on the aforementioned ordinary construction expenditure, we find there to be a strong positive correlation between rates of increase in

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[6]The rate of increase rose sharply in FY1995, even though it was a period of economic expansion. This was due to special circumstances, in that public works for recovery and reconstruction were implemented in Osaka and Hyogo Prefectures following the occurrence of the Great Hanshin-Awaji Earthquake of January 17th, 1995.

the revised Local Public Finance Program and revised settled accounts. Also, it can be again be reaffirmed that the correlation between the initial Local Public Finance Program and revised settled accounts is low.

Next, in the scatter diagrams for rates of increase in non-subsidized expense and subsidized expense shown in Fig. 2 (a) and (b), while for non-subsidized expense a strong positive correlation is shown between initial and the revised Local Public Finance Program, for subsidized expense a strong positive correlation may be confirmed between revised settled accounts and the revised Local Public Finance Program. This would suggest that the positive correlation between the revised Local Public Finance Program and revised settled accounts in ordinary construction, seen above, is caused by subsidized expense. On the other hand, compared to subsidized expense, revised settled accounts deviate from the revised Local Public Finance Program in the rate of increase in ordinary construction expenditure. This is due to the fact that, in non-subsidized expense, the positive correlation between the revised Local Public Finance Program and revised settled accounts is relatively weak.

From the above, it may be posited that local governments have implemented fiscal stimulus measures for subsidized expense in line with the central government's fiscal programs, in relation to national fiscal stimulus measures shown in the revised Local Public Finance Program, but for non-subsidized expense, they have not implemented or have not been able to implement fiscal stimulus measures according to program.

3.2 Fiscal Stimulus Measures and Subsidized Expense

Table 3 shows the initial Local Public Finance Program, the revised Local Public Finance Program and revised settled accounts for subsidized expense from FY1985 to FY2008. Fig. 3 shows (a) the rate of year-on-year increase and (b) the subsidized expense amount of each. On the rate of increase for this subsidized expense, the revised Local Public Finance Program and revised settled accounts show almost the same trends. On this point, the scatter diagrams in Fig. 2 above also show, in row 3 column 2 related to (b) subsidized expense (row 2 column 3), a strong correlation between the revised Local Public Finance Program and revised settled accounts. These results reveal, in connection with subsidized expense, that local governments are implementing subsidized expense for the sake of fiscal stimulus measures, in line with the revised Local Public Finance Program indicating the national policy on fiscal stimulus measures. Of course, this must result from the fact that local governments are able to implement subsidized expense for fiscal stimulus measures thanks to government subsidies for subsidized expense and the accompanying funding measures. Therefore, for the subsidized expense that comprises ordinary construction expenditure, it is clear that fiscal stimulus measures have been implemented at the local stage as well, in response to national policies.

3.3 Fiscal Stimulus Measures and Local Non-subsidized Expense

Fig. 4 shows trends in local non-subsidized expense, while Table 4 shows the Local Public Finance Program and revised settled accounts for non-subsidized expense between FY1985 and FY2008. As seen in Fig. 4, characteristic features of non-subsidized expense are that it differs significantly from the subsidized expense men-

tioned earlier, in that the trends of initial and the revised Local Public Finance Program are the same, and that, if anything, the figures in the settled accounts show different trends. Viewing this in terms of the scatter diagrams shown above, characteristic features revealed by the scatter diagrams on the rate of increase in non-subsidized expense in Fig. 2 (a) are that initial and the revised Local Public Finance Program show a very strong correlation, and that the rates of increase in the revised Local Public Finance Program and revised settled accounts do not show a very strong correlation. A particularly characteristic point is that revised settled accounts have shown different trends since the 1990s. In other words, in terms of the amounts of non-subsidized expense, initial fiscal plans, revised fiscal plans and revised settled accounts have all shown a decrease since about 1995. However, the decrease is clearly greater in the settled account figures, and the degree of decrease in initial and the revised Local Public Finance Program is smaller than that of revised settled accounts. This shows that local governments did not implement investment to a sufficient amount, compared to the revised Local Public Finance Program indicating the central government's policy on fiscal stimulus measures. Moreover, focusing on the execution rate in Table 4, we find that this figure was below 70% from the beginning of the 2000s. In other words, particularly since the 2000s, it can be interpreted that, based on the independent judgment of local governments, the non-subsidized expense they implemented has vastly underperformed national programs.

3.4 Ordinary Construction Expenditure and Business Cycles

In the foregoing, historical trends in the initial Local Public Finance Program, the revised Local Public Finance Program and revised settled accounts for ordinary construction, non-subsidized expense and subsidized expense have been examined. Next, the focus will turn to the relationship between the rate of increase in revised settled accounts for ordinary construction expenditure and the state of the economy.

Table 5 (a) shows the correlation coefficients between the indexes of business conditions and the rates of increase in initial programs, revised programs and revised settled accounts for non-subsidized expense, subsidized expense and ordinary construction expenditure, respectively. Here, CI is the rate of increase in composite index (coincident index) and DI is diffusion index (coincident index). Moreover, t1, t2 and t3 express the rates of year-on-year increase in initial programs, revised programs and revised settled accounts for non-subsidized expense, respectively, while similarly h1, h2 and h3 and sum1, sum2 and sum3 correspond to the rates of increase in subsidized expense and ordinary construction expenditure, respectively.

The above shows that, while public investment by local governments is confirmed to have been implemented countercyclically to macro economic fluctuation to a certain extent, it has not been countercyclical enough, since non-subsidized expense has not been implemented according to program. Meanwhile, coefficients of correlation (with the exception of FY1995, the year of the Great Hanshin-Awaji Earthquake) are shown in Table 5 (b), evidently providing an outcome that more clearly concurs with the examination above.

4 Empirical Analysis Based on Estimation of Policy Reaction Function

In the previous section, the characteristics of public investment by local governments were discussed, with the focus mainly on differences between subsidized and non-subsidized expense from a macro perspective. The results suggested by the analysis in the previous section support the assertions of Miyazaki (2008, 2009a, b) that a fiscal stimulus effect cannot be seen in public investment by local governments. In other words, under the influence of non-subsidized expense, public investment by local governments is not sufficiently countercyclical to the macro economy, and its policy effects are therefore thought to be low.

In the previous section, as well as in Miyazaki (2008, 2009a, b), business cycles in the country as a whole and public investment by local governments were mainly studied on the basis of aggregated data. In recent years, however, attempts have been made to verify the impact of public investment on local economies (e.g. Brückner and Tuladhar, 2010; Kondo, 2011; Miyazaki, 2011; Miyazaki and Kondo, 2012). To attempt a more detailed analysis of fiscal stimulus measures by local governments, it will be useful to have an appraisal based on information for each region.

In this section, the correlation between business cycles and public investment in individual regions will be empirically studied by using panel data for each prefecture since the 1990s to estimate a public investment function. As was also stated earlier, attempts have already been made to estimate a policy reaction function from various angles, but there has been no research using econometric methods to indicate that the reaction to economic fluctuation at regional level differs between subsidized and non-subsidized expense. In the following, it will be shown that the reaction to economic fluctuation at regional level is different for subsidized and non-subsidized expense, and the causes behind this difference will be clarified. The analysis in the previous section revealed that, particularly since the 2000s, there has been a serious deviation between programs and settled accounts for non-subsidized expense. This implies the possibility that some structural change in local government decision-making occurred around the year 2000. Based on this point, the authors decided to divide the sample period into the 1990s and the 2000s for estimation.[7] The end of the sample period was set at FY2007 to eliminate the impact of the Lehman shock.[8]

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[7]As actual figures for real gross prefectural product, consistent data from the early 1990s to the 2000s are not available in the first place.

[8]The period from FY2000 to FY2007 straddles the 13th business cycle (Jan. 1999-Jan. 2002) and 14th business cycle (Jan. 2002-March 2009), based on the "date of business cycles," which is determined by the Cabinet office for the Government of Japan. In fact, the majority of it overlaps with the period of economic expansion in the 14th cycle (Jan. 2002-Feb. 2008). As is well known, the period of economic expansion in the 14th cycle lasted 73 months, and was the longest such period since the war. In other words, the 2000s, except FY2000 and FY2001, were a period of economic expansion for Japan in terms of business cycles. In connection with this point, Artis and Okubo (2011), using data on prefectural growth rates in Japan in 1955-1995, report that the degree of economic harmony between prefectures differs according to the epoch in question. Since the beginning of the 2000s, a considerable deviation in growth rates has arisen between prefectures.

4.1 Estimation Models and Data

Linkage between public investment by local governments and business cycles will be investigated by gauging the reaction of the logarithmic difference of public investment to that of production, in accordance with Lane (2003), Hines (2010), Funashima (2013) and others. As stated in section 2, the framework for empirical analysis here is based on Funashima (2013), but in this analysis, the focus is on public investment by local governments, with a clear distinction between subsidized and non-subsidized expense. This makes it possible to investigate public investment decision-making in greater detail from the perspective of local governments.

Specifically, on the policy reaction function of public investment, model (I) including only individual effects (μ_i) is posited as follows:

$$\Delta \ln G_{it} = \alpha + \beta \Delta \ln Y_{i,t-1} + \boldsymbol{z}'_{t-1} \boldsymbol{\theta} + \mu_i + \nu_{it},$$

and model (II), including both individual effects (μ_i) and temporal effects (λ_t) is posited as:

$$\Delta \ln G_{it} = \alpha + \beta \Delta \ln Y_{i,t-1} + \mu_i + \lambda_t + \nu_{it},$$

where Δ expresses first difference.[9]

To investigate the reaction to the macro economy as well, a macroeconomic index ($\boldsymbol{z}_t$) dependent only on time instead of temporal effects (λ_t) is included in the explanatory variables in model (I). As in Kitasaka (2008), Funashima (2013) and others, the focus was on $\boldsymbol{z}_t$ as the single-level logarithmic difference between gross domestic product and the government debt ratio. If public investment were countercyclical to the economy at national level, the estimate for gross domestic product would have to be negative. If investment were implemented with a view to stabilizing the macro economy, it would be countercyclical to the economy of the country as a whole. In other words, if the country as a whole were in recession, local public investment could be expected to be in a generally increasing trend. Besides, increases or decreases in fiscal deficits are thought to influence decision-making on national public spending and have a negative impact on public investment.

The data used were as follows. For public investment as the dependent variable, ordinary construction expenditure in the Local Finance Statistical Yearbook (settled accounts data published by the Ministry of Internal Affairs and Communications) was used. For data on regional production, actual figures on gross prefectural product in Prefectural Accounts (93SNA) (Cabinet Office) were used.[10] However, actual figures based on the fixed standard year method (1995 prices) were used for the 1990s and those based on the index-linked method (2000 index-linked prices) for the 2000s. Also, the GDP in National Accounts (93SNA) (Cabinet Office) was

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[9]Formulation based on logarithmic difference is widely adopted in precedent research, and β is used to approximate the reaction of the rate of increase in public investment to the growth rate. Meanwhile, Sorensen *et al.* (2001) estimate a model using single-level difference not based on logarithms.

[10]It should be borne in mind that the fiscal year data used here do not include information on economic cycles over periods of less than one year. For example, Wall (2007) and others who used quarterly data for the index of industrial production assert the existence of cross-regional differences in the timing of economic cycles. In other words, although this prefectural growth rate contains information on quantitative differences in regional economic cycles, it may not adequately reflect differences in timing. Nevertheless, since regional statistics on public investment on a monthly and quarterly basis are not provided, gross prefectural product is used as a proxy index for regional economic cycles in this paper.

used as an output index for the country as a whole, while actual figures based on the index-linked method (2000 index-linked prices) were used for the 1990s and those based on the index-linked method (2005 index-linked prices) for the 2000s. The government debt ratio, an index of fiscal deficits, was created by dividing total government debt (Bank of Japan) by nominal GDP in National Accounts (93SNA) (Cabinet Office). In the estimates for the 1990s, meanwhile, a Great Hanshin-Awaji Earthquake dummy was added to the explanatory variables, with 1 for Osaka and Hyogo Prefectures and 0 for others in FY1995. The purpose of this was to control increases in public investment aimed at reconstruction support in these prefectures.

4.2   Estimation Results

Tables 6 and 7 show the results of estimation for the 1990s and the 2000s, respectively. In both periods, fixed effect estimation was carried out for both models (I) and (II). Below, the results of estimation for the 1990s will first be examined.

Viewing the estimation results on subsidized expense in Table 6, for gross prefectural product, the $\hat{\beta}$ symbol is different in models (I) and (II), and a result not significantly differing from zero is produced. For gross domestic product and government debt ratio as macroeconomic indicators, conversely, the symbol condition is satisfied and there is significance at the level of 1%. These results show that, while subsidized expense generally moves countercyclically to economic fluctuation in the country as a whole, it does not react to economic fluctuation at prefectural level. That subsidized expense is countercyclical to the macro economy concurs with the point already highlighted in the previous section, and is thought to strongly reflect the central government's countercyclical decision-making. However, the results obtained here imply that, while subsidized expense is countercyclical to macro economic fluctuation uniformly across the nation, regional differences in this fluctuation have not been factored in. To put it another way, no countercyclical behavior toward economic fluctuation at prefectural level can be observed, and subsidized expense is not implemented to stabilize or support local economies.

Next, viewing the non-subsidized expense estimation results in Table 6, although the null hypothesis ($\beta = 0$) cannot be rejected for gross prefectural product, a positive estimate is obtained for both model (I) and model (II), and expenditure appears to be linked procyclically to economic fluctuation at prefectural level. Meanwhile, the Great Hanshin-Awaji Earthquake dummy is only significant in model (I) for non-subsidized expense, unlike for subsidized expense. This is thought to imply that reconstruction support led by the government was positively undertaken via subsidized expense.[11] As for macroeconomic indicators, although the government debt ratio is significantly negative, there is no significant result for gross domestic product. Moreover, as was also indicated in the previous section, we find that non-subsidized expense is not countercyclical to economic fluctuation at national level and is not linked.

Now, let us examine the estimation results for the 2000s. Viewing the subsidized expense estimation results in Table 7, the null hypothesis ($\beta = 0$) cannot be rejected for gross prefectural product, just as in the 1990s; gross domestic product is significantly negative, and the government debt ratio, albeit not significant, is a negative

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[11]This point would also be consistent with Fig. 3 (a) and Fig. 4 (a) in the previous section. In other words, in FY1995, the year of the Great Hanshin-Awaji Earthquake, the rate of growth in subsidized expense was clearly larger than that in non-subsidized expense.

estimate. On the other hand, the estimation results for non-subsidized expense show that, unlike those for subsidized expense, gross prefectural product in both models is positively significant at the 1% level. This means that non-subsidized expense reacts procyclically to economic fluctuation at regional level. As for the reaction to the macro economic environment, neither gross domestic product nor the government debt ratio is significant, and the estimate is positive. The fact that non-subsidized expense has no correlation to the state of the economy in the country as a whole, in contrast to subsidized expense, was also found in the previous section, and the same result could be said to have been obtained here. In view of the above, it is thought that discretionary decision-making by local governments in line with economic conditions at local level, rather than macro economic conditions, exerted a strong impact, particularly for non-subsidized expense in the 2000s.

In Funashima (2013), a procyclical result to business cycles at prefectural level was obtained because the policy reaction function was estimated using ordinary construction expenditure totaled from subsidized expense, non-subsidized expense and others as data on public investment. However, the interpretation of this was not sufficiently stated. The results obtained in this analysis suggest that this is because non-subsidized expense is procyclical.

4.3 Cause Analysis of Procyclical Non-subsidized Expense

Based on the analysis above, when seen at prefectural level, the reaction of public investment to economic fluctuation clearly differs between subsidized and non-subsidized expense; particularly in the 2000s, non-subsidized expense showed a procyclical reaction to economic fluctuation. Here, as the next topic, the reason why non-subsidized expense became procyclical from the beginning of the 2000s will be investigated.

As stated above, Higo and Nakagawa (2001) have already pointed out that the fiscal rigidity of local authorities lies behind the procyclical behavior of non-subsidized expense toward economic fluctuation at prefectural level. In particular, following a series of fiscal stimulus packages since the collapse of the bubble at the beginning of the 1990s and reduced tax revenues associated with economic stagnation, the freedom of local finances is thought to have suffered a serious decline in the 2000s. Fig. 5 shows the ordinary balance ratio plotted on the horizontal axis and non-subsidized expense (unit: 1 billion yen) on the vertical axis for Japan's 47 prefectures from FY2000 to FY2007.[12] But since the levels of non-subsidized expense depend on scale and other factors for each prefecture, they have here been divided into the following groups based on population scale as of 2005, and the difference in levels is approximately controlled.

Although the population of Osaka Prefecture is more or less the same as that of Kanagawa, it was split off and plotted as a separate Group (Group 2) because a positive correlation was observed between its ordinary balance ratio and its non-subsidized expense.

- Group 1 (Tokyo)

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[12]The ordinary balance ratio is calculated as the proportion of general revenue resources allotted to ordinary expenses such as personnel expenses, public assistance expenses, debt service and other annually disbursed expenses. That is, a higher ordinary balance ratio means less flexibility of the financial structure. For more details, see Ministry of International Affairs and Communications (2013).

- Group 2 (Osaka)

- Group 3 (Large): Hokkaido, Saitama, Chiba, Kanagawa, Aichi, Hyogo, Fukuoka

- Group 4 (Medium): Aomori, Iwate, Miyagi, Akita, Yamagata, Fukushima, Ibaraki, Tochigi, Gumma, Niigata, Toyama, Ishikawa, Nagano, Gifu, Shizuoka, Mie, Shiga, Kyoto, Nara, Wakayama, Okayama, Hiroshima, Yamaguchi, Kagawa, Ehime, Nagasaki, Kumamoto, Oita, Miyazaki, Kagoshima, Okinawa

- Group 5 (Small): Others

The following interpretation may be drawn from the scatter diagram and related coefficients of correlation shown in Fig. 5. Firstly, when seen as pool data for all prefectures, the correlation coefficient is -0.0814, and no clear correlation can be recognized. Even when excluding Tokyo, where there is a clear difference in level, a strong nonlinear relationship can be seen with a boundary near where the ordinary balance ratio is 95. In fact, the correlation coefficient when just excluding Tokyo is calculated at -0.0379, suggesting that there is no correlation after all.

On the other hand, viewing the scatter diagram of ordinary balance ratio and non-subsidized expense for each of the above Groups individually, a considerably negative correlation can be confirmed, particularly in Group 5 (Small), even though differences in level among the prefectures was easily controlled via population scale alone. The coefficients of correlation for each are brought together in Table 8. Moreover, as seen in Fig. 5, the FY2000 figure for Tokyo in Group 1 is clearly an outlier. Table 8 also as shows the correlation coefficient excluding the data for FY2000, but even then, the figure is -0.8142, revealing a strongly negative correlation in Tokyo as well.

As shown above, with Osaka in Group 2 as an exception, a negative correlation between non-subsidized expense and ordinary balance ratio can be confirmed. This is thought to reflect the fact that non-subsidized expense is controlled to the extent that fiscal administration becomes rigid. From such a simple correlation, however, it is not possible it draw the conclusion that rigidity of fiscal affairs causes non-subsidized expense to become procyclical to economic fluctuation. Thus, whether the ordinary balance ratio influences the reaction to economic fluctuation by non-subsidized expense will be investigated in the following, using the empirical approach of Lane (2003). For comparison, subsidized expense will also be estimated at the same time. The specific estimation procedure is as follows. As the first stage in the estimation, the reaction of the logarithmic difference of subsidized or non-subsidized expense (G) to the logarithmic difference of production (Y) is measured for each prefecture, in accordance with equation (1) in Lane (2003, p. 2667). As with Lane (2003), the error term (u_{it}) follows a single-level auto regression process, producing these expressions for estimation:

$$\Delta \ln G_{it} = \gamma_i + \beta_i \Delta \ln Y_{i,t-1} + u_{it}$$
$$u_{it} = \rho_i u_{i,t-1} + \epsilon_{it}$$

However, to gauge the reaction of local governments to economic conditions, the lag in explanatory variables was removed to resolve the problem of simultaneity, as in the models above. Here, unlike in Fig. 5, logarithmic difference is used instead of original units. This has the effect of controlling differences in level between

prefectures, such as those stated above. Also, unlike the previous models, potential differences in β between prefectures are tolerated.[13]

The second stage of the estimation, as shown in equation (2) of Lane (2003, p. 2668), is carried out by estimating a regression model using $\hat{\beta}$, estimated according to the above expression, as an explained variable. In this analysis, the ordinary balance ratio (ca) is included as an explanatory variable, and the following expression is used for estimation.

$$\hat{\beta}_i = \delta + \eta \times ca_i + v_i$$

In this second stage of estimation, however, a problem arises as to which temporal value should be used for the ordinary balance ratio. That is, the ordinary balance ratio is also influenced by business cycles every fiscal year, and the average value for each prefecture FY2000-FY2007 has to be used. Here, to remove the influence of outliers, it was decided that the median value would be used as a representative value for the ordinary balance ratio in FY2000-FY2007. It should be noted, incidentally, that the same estimation was attempted using the average ordinary balance ratio, producing the same estimation result as when using the median.

Fig. 6 shows the estimated value of β for subsidized and non-subsidized expense. Although there is a degree of difference among the prefectures, the median reveals a negative value for subsidized expense and a positive one for non-subsidized expense. In other words, even when estimating β for individual prefectures, it can be confirmed that non-subsidized expense is generally procyclical.

Fig. 7 is a scatter diagram taking ca_i as its horizontal axis and $\hat{\beta}_i$ as its vertical axis, and shows the regression line estimated using OLS. However, because outliers were observed in Fig. 6, a sample with outliers removed was used. The OLS estimated value of η yields 0.008 for subsidized expense and 0.172 for non-subsidized expense. For subsidized expense, this is not significant when using Newey and West's standard error, but for non-subsidized expense it is significant at a level of 5%. This result shows that the ordinary balance ratio exerts a positively significant influence on the $\hat{\beta}$ of non-subsidized expense. As such, a deterioration (rise) in the ordinary balance ratio could be said to increase the degree of procyclical behavior by non-subsidized expense. In other words, this means that, in regions where the degree of fiscal rigidity is particularly strong, non-subsidized expense increases when the economy is expanding and decreases when it is in recession.

To close this section, the results obtained from this analysis and their connection with precedent research will be stated. Firstly, Miyazaki (2008, 2009a, b) show that public investment by local governments makes no contribution to the stability of the macro economy. It may be concluded that one reason for this is that non-subsidized expense is not linked to the macro economy. Miyazaki (2008) proposes three possibilities to explain why public investment by local governments does not yield fiscal stimulus effects, namely (1) the content of public investment by local governments, (2) reduction in private demand caused by rising interest rates, and (3) the effect of substituting private consumption. Of these, Miyazaki (2009b) verifies the process through rising interest rates, and indicates that this kind of transmission process has not been observed. In Sections 3 and 4 of this paper, it was shown that

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[13]In the previous estimation, β was assumed to be constant for all prefectures as the primary approximation, but as discussed by Pesaran and Yamagata (2008), among others, β may conceivably depend on individual situations. Estimating for individual prefectures, therefore, should also be useful as additional verification of the earlier estimation results.

public investment by local governments is not sufficiently countercyclical to macro economic fluctuation, as a result of non-subsidized expense. If this result were classified under one of the three possibilities mentioned above, the problem could be said to lie in the content of public investment by local governments.

Furthermore, on the short-term impact of public investment on local economies, Brückner and Tuladhar (2010), Kondo (2011) and others point out that it has only limited effect. In particular, Miyazaki and Kondo (2012) focus on public investment by local governments, and report that their discretionary public investment makes local economies more subject to fluctuation. The empirical results obtained in this analysis support these assertions made by precedent research, and may be said to have clarified one of their causes. In other words, if it is accepted that subsidized expense is not linked to local economies but that non-subsidized expense is procyclical, public investment by local governments would inevitably not contribute to the stability of local economies.

5   Conclusion

In this paper, public investment by local governments in Japan has been divided into subsidized and non-subsidized expense, and the differences in their respective decision-making have been empirically studied. As summarized in Table 9, empirical analysis based on panel data for each prefecture revealed the following differences between subsidized and non-subsidized expense. Firstly, subsidized expense is countercyclical to the economy in the country as a whole, but no correlation with economic fluctuation at prefectural level could be seen. Contrastingly, particularly from the beginning of the 2000s, non-subsidized expense did not react to macro economic circumstances, i.e. the state of the economy at national level or the government debt ratio, but was shown to be procyclical to economic fluctuation at prefectural level. Furthermore, it was demonstrated that this procyclical behavior of non-subsidized expense is caused by the fiscal rigidity of local governments.

Summarizing these results in terms of economic stabilization, the following statements can be made. Firstly, subsidized expense strongly reflects central government decision-making and displays countercyclical trends with a view to stabilizing the macro economy. When it comes to stabilizing or supporting local economies, however, it is not necessarily implemented in a way that offsets business cycles. Non-subsidized expense, meanwhile, is more strongly impacted by the freedom of local finances than by central decision-making, and as a result is not linked to the macro economy. Not only that, but at prefectural level it is, if anything, implemented in a way that amplifies economic fluctuation. In that most of Japan's public investment is implemented by local governments, as a problem prior to that of evaluating its policy effects, it has become clear that it is not implemented with adequate timing to offset business cycles in the first place. It follows that the effect of fiscal stimulus measure is, if any, small during the lost decades in Japan.

The main research tasks that remain are as follows. Firstly, when exploring the factors behind procyclical non-subsidized expense, not enough study has been made on the appropriateness of using a median or average value for the ordinary balance ratio during the sample period. Particularly in some prefectures, the ordinary balance ratio fluctuates greatly during the period in question, causing a need for an alternative approach and additional verification. Also, fiscal policies in particular

are accompanied by an implementation lag, but this point has not been examined. Furthermore, comprehensive evaluation of public investment by local governments will require issues such as chronological changes in the weighting of subsidized and non-subsidized expense to be considered. These are seen as tasks for the future.

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Figure 1: Ordinary Construction Expenditure

(a) Rate of Year-on-year Increase in Ordinary Construction Expenditure
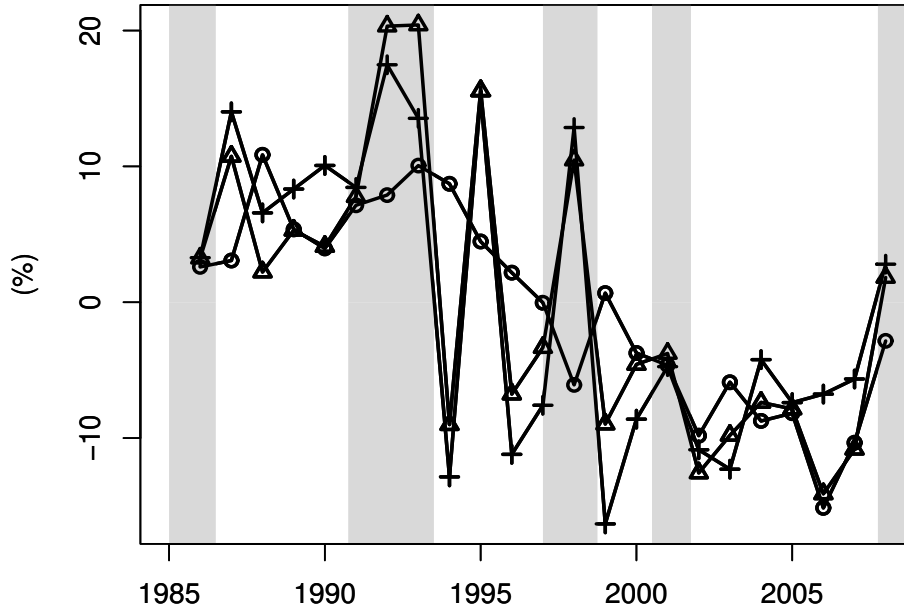
(b) Ordinary Construction Amounts (100 million yen)
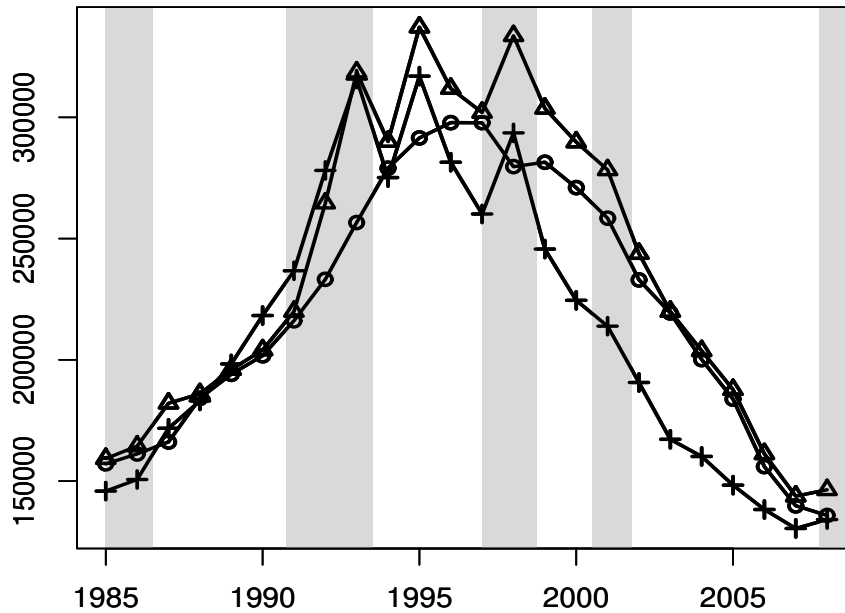
-○- Initial programs   -△- Revised programs   -+- Revised settled accounts

Source: Chiho Zaisei Yoran (Local Finance Handbook)
Note: Shading represents periods of recession

Figure 2: Scatter Diagrams of Rates of Increase in the initial Local Public Finance Program, the revised Local Public Finance Program, and Revised Settled Accounts

(a)Rate of Increase in Non-subsidized Expense
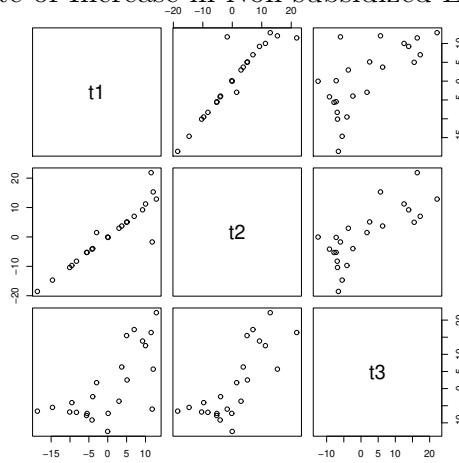
(b)Rate of Increase in Subsidized Expense
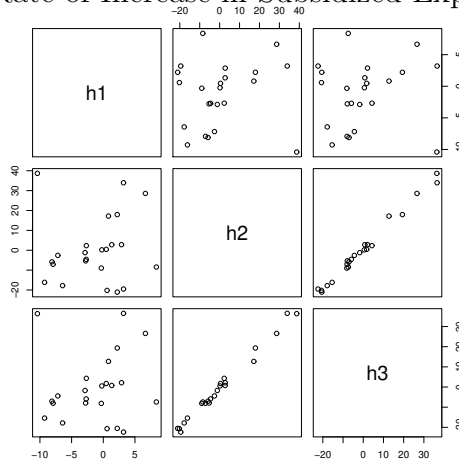
(c)Rate of Increase in Ordinary Construction Expenditure
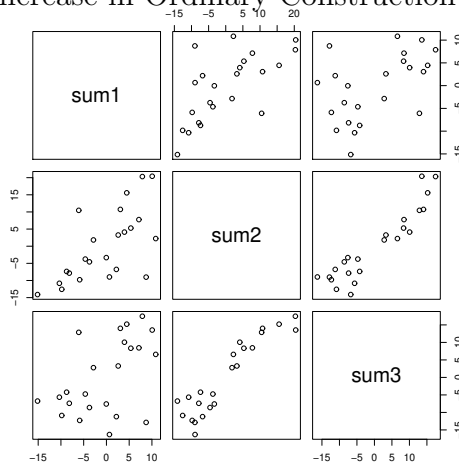
Notes: t1: Non-subsidized (initial program), t2: Non-subsidized (revised program), t3: Non-subsidized (revised settled accounts), h1: Subsidized (initial program), h2: Subsidized (revised program), h3: Subsidized (revised settled accounts), sum1: Ordinary construction expenditure (initial program), sum2: Ordinary construction expenditure (revised program), sum3: Ordinary construction expenditure (revised settled accounts)

Figure 3: Subsidized Expense

(a) Rate of Year-on-year Increase in Subsidized Expense
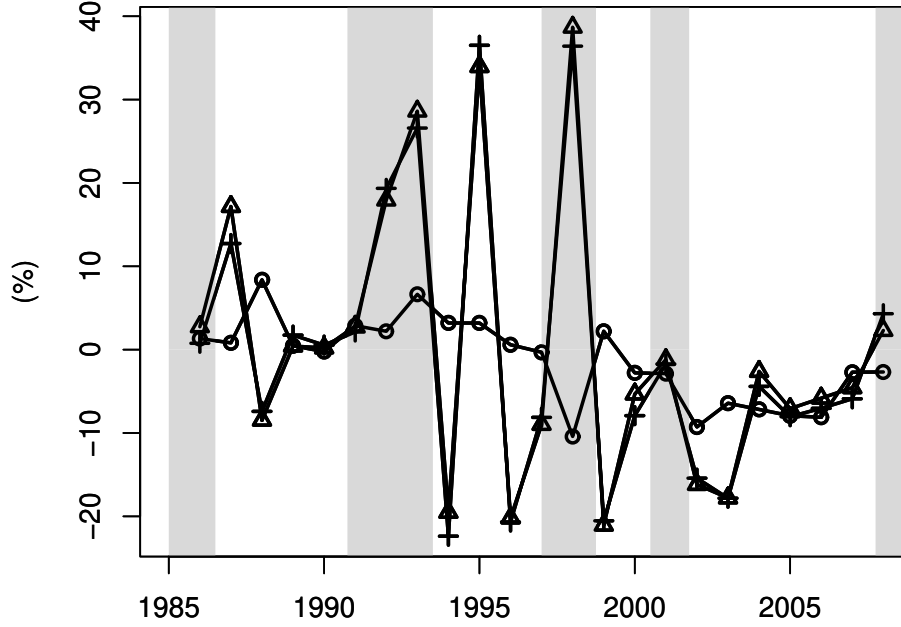
(b) Amount of Subsidized Expense (100 million yen)
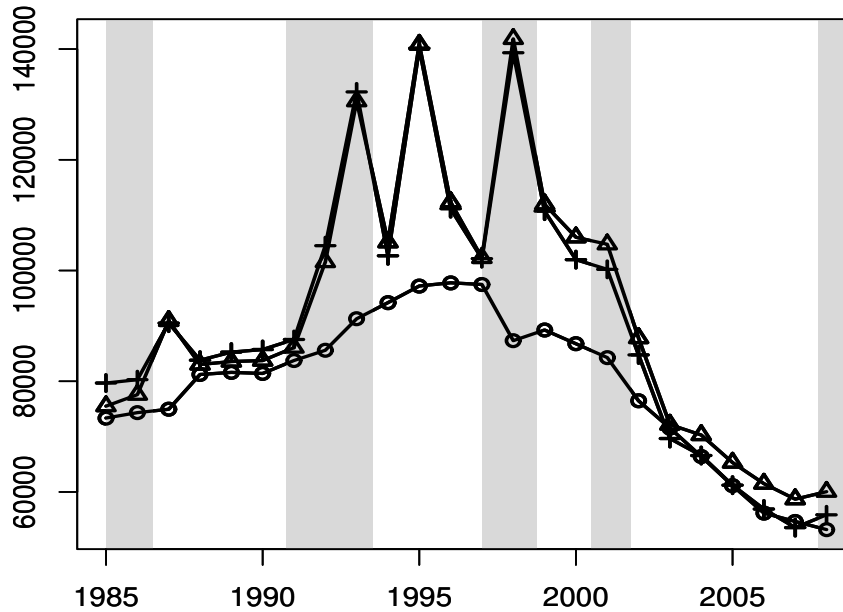
-○- Initial programs   -△- Revised programs   -+- Revised settled accounts

Source: Chiho Zaisei Yoran (Local Finance Handbook)
Note: Shading represents periods of recession

Figure 4: Non-subsidized Expense

(a)Rate of Year-on-year Increase in Non-subsidized Expense
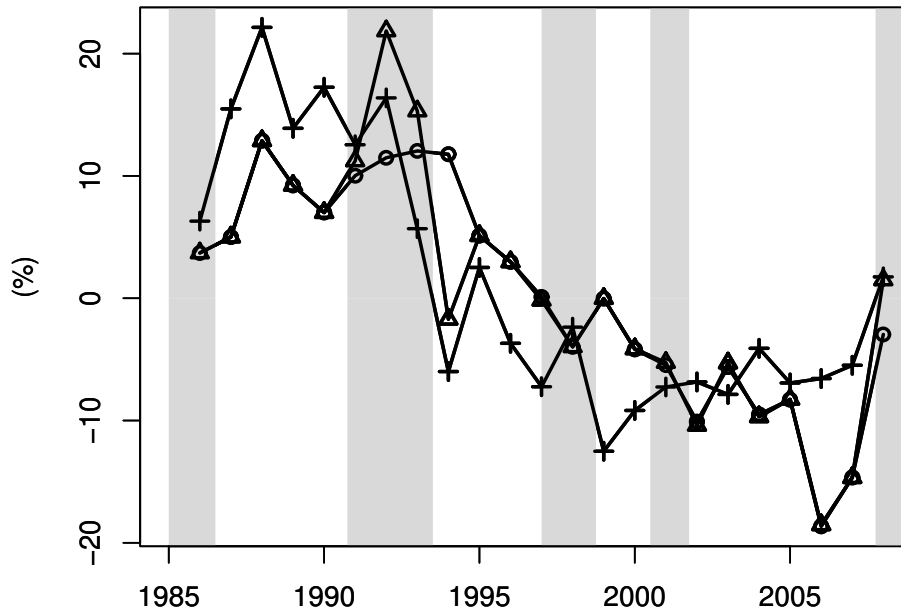
(b)Amount of Non-subsidized Expense (100 million yen)
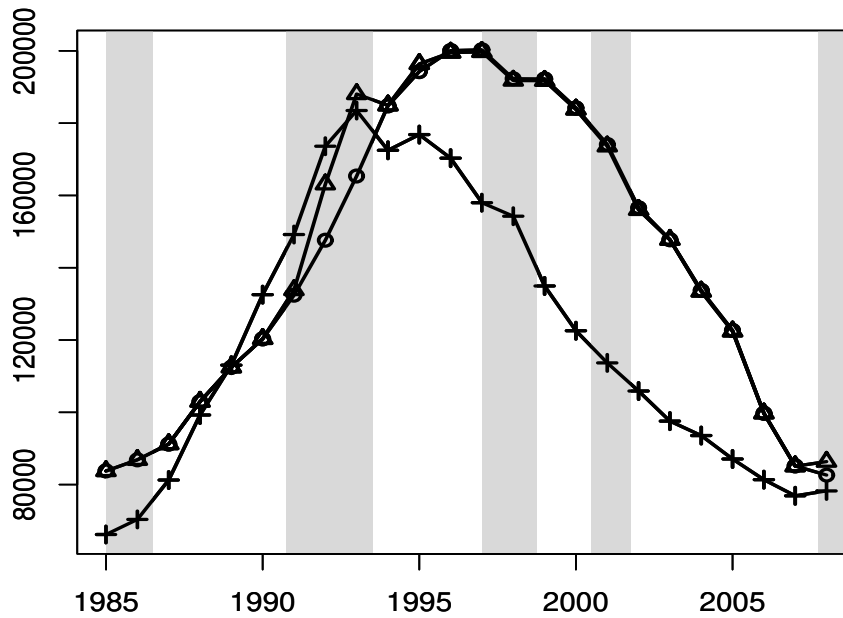
-○- Initial programs   -△- Revised programs   -+- Revised settled accounts

Source: Chiho Zaisei Yoran (Local Finance Handbook)
Note: Shading represents periods of recession

Figure 5: Ordinary Balance Ratio and Non-subsidized Expense (1 billion yen)
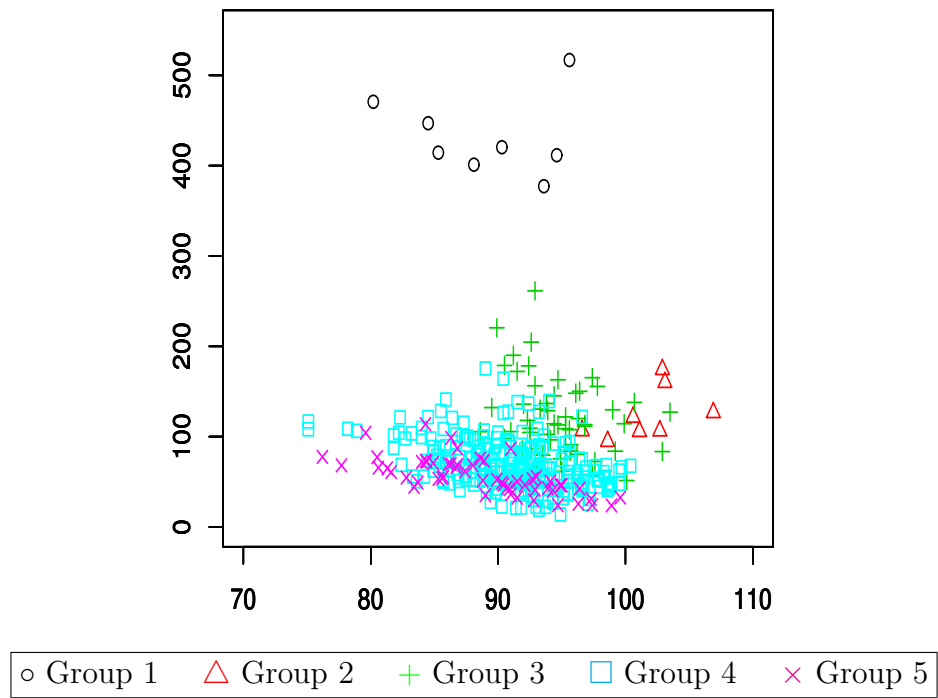
Figure 6: β Estimation Results
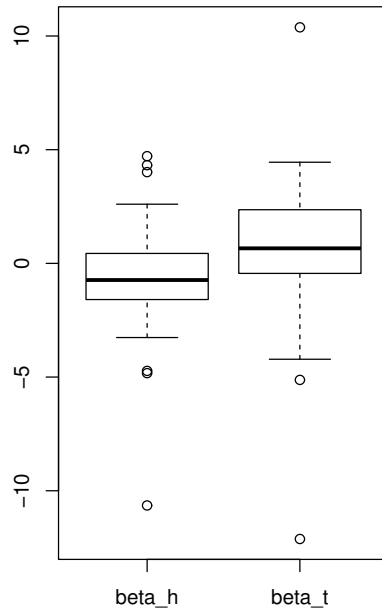
Notes: subsidized expense (left), non-subsidized expense (right)

Figure 7: $\hat{\beta}_i$ and the Ordinary Balance Ratio

Subsidized Expense

Non-subsidized Expense
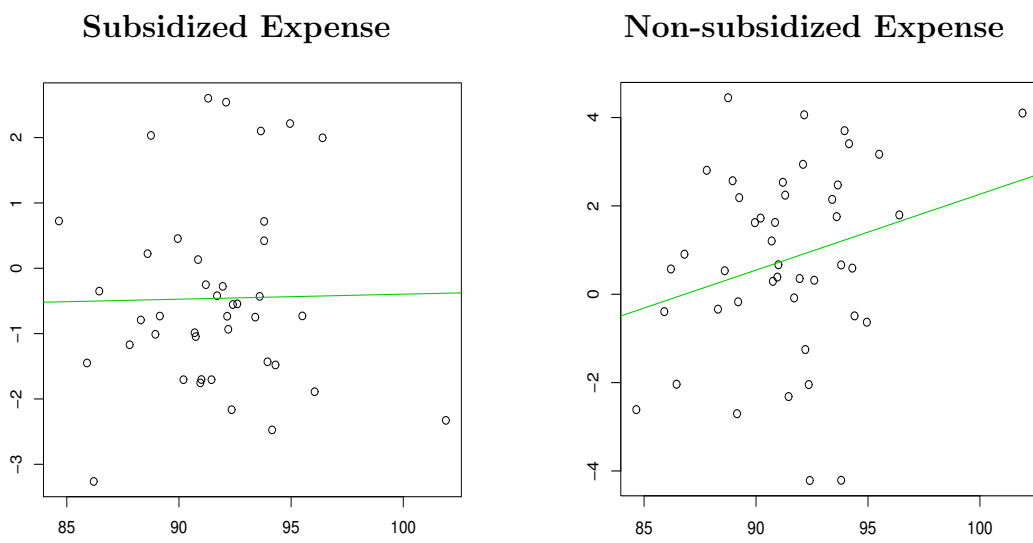
Table 1: Empirical Analysis on Public Investment in Japan

	Policy effects (Demand aspects)	Determinant factors
Macro data	Bayoumi (2001)	Doi (1998)
	Ihori *et al.* (2003)	Kitasaka (2008)
	*Miyazaki (2008, 2009a, b)	*Kondo (2008)
Local data	Brückner and Tuladhar (2010)	*Kondo (2008)
	Kondo (2011)	Funashima (2013)
	Miyazaki (2011)	*This research
	*Miyazaki and Kondo (2012)	

Note: * Research involving analysis aimed mainly at public investment by local governments.

Table 2: Execution and Adjustment of Ordinary Construction Expenditure

Fiscal year	Initial program (100 million yen)	Revised program (100 million yen)	Settled accounts (100 million yen)	Deviation	Execution rate	Initial program (rate of increase)	Revised program (rate of increase)	Settled accounts (rate of increase)
1985	157118	159266	145872	-13394	0.92			
1986	161196	164439	150653	-13786	0.92	2.60	3.25	3.28
1987	166145	182104	171767	-10337	0.94	3.07	10.74	14.01
1988	184168	185973	183062	-2911	0.98	10.85	2.12	6.58
1989	194051	196015	198314	2299	1.01	5.37	5.40	8.33
1990	201736	204063	218280	14217	1.07	3.96	4.11	10.07
1991	216135	219928	236729	16801	1.08	7.14	7.77	8.45
1992	233191	264629	278108	13479	1.05	7.89	20.33	17.48
1993	256651	318648	315758	-2890	0.99	10.06	20.41	13.54
1994	279031	290031	275159	-14872	0.95	8.72	-8.98	-12.86
1995	291495	337173	316984	-20189	0.94	4.47	16.25	15.20
1996	297842	311891	281488	-30403	0.90	2.18	-7.50	-11.20
1997	297750	302001	260135	-41866	0.86	-0.03	-3.17	-7.59
1998	279631	333620	293590	-40030	0.88	-6.09	10.47	12.86
1999	281509	303698	245682	-58016	0.81	0.67	-8.97	-16.32
2000	270991	289796	224533	-65263	0.77	-3.74	-4.58	-8.61
2001	258413	278334	213885	-64449	0.77	-4.64	-3.96	-4.74
2002	233029	243826	190654	-53172	0.78	-9.82	-12.40	-10.86
2003	219319	219936	167222	-52714	0.76	-5.88	-9.80	-12.29
2004	200140	203720	160154	-43566	0.79	-8.74	-7.37	-4.23
2005	183794	187710	148318	-39392	0.79	-8.17	-7.86	-7.39
2006	155961	161231	138288	-22943	0.86	-15.14	-14.11	-6.76
2007	139828	143788	130472	-13316	0.91	-10.34	-10.82	-5.65
2008	135845	146414	134125	-12289	0.92	-2.85	1.83	2.80

Source: Chiho Zaisei Yoran (Local Finance Handbook)

Notes: Deviation = Settled accounts - Revised program, Execution rate = Settled accounts / Revised program

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Table 3: Execution and Adjustment of Subsidized Expense

Fiscal year	Initial program (100 million yen)	Revised program (100 million yen)	Disparity between programs (100 million yen)	Settled accounts	Deviation	Execution rate	Initial program (rate of increase)	Revised program (rate of increase)	Settled accounts (rate of increase)
1985	73358	75506	2148	79677	4171	1.06			
1986	74335	77578	3243	80286	2708	1.03	1.33	2.74	0.76
1987	74941	90900	15959	90506	-394	1.00	0.82	17.17	12.73
1988	81220	83025	1805	83803	778	1.01	8.38	-8.66	-7.41
1989	81600	83564	1964	85265	1701	1.02	0.47	0.65	1.74
1990	81408	83735	2327	85730	1995	1.02	-0.24	0.20	0.55
1991	83748	86088	2340	87545	1457	1.02	2.87	2.81	2.12
1992	85596	101534	15938	104486	2952	1.03	2.21	17.94	19.35
1993	91280	130585	39305	132262	1677	1.01	6.64	28.61	26.58
1994	94199	105105	10906	102664	-2441	0.98	3.20	-19.51	-22.38
1995	97208	140796	43588	140149	-647	1.00	3.19	33.96	36.51
1996	97780	112355	14575	111173	-1182	0.99	0.59	-20.20	-20.68
1997	97477	102275	4798	102145	-130	1.00	-0.31	-8.97	-8.12
1998	87329	141835	54506	139336	-2499	0.98	-10.41	38.68	36.41
1999	89258	111964	22706	110729	-1235	0.99	2.21	-21.06	-20.53
2000	86772	106003	19231	101964	-4039	0.96	-2.79	-5.32	-7.92
2001	84278	104741	20463	100212	-4529	0.96	-2.87	-1.19	-1.72
2002	76463	87799	11336	84762	-3037	0.97	-9.27	-16.18	-15.42
2003	71552	72178	626	69656	-2522	0.97	-6.42	-17.79	-17.82
2004	66419	70294	3875	66585	-3709	0.95	-7.17	-2.61	-4.41
2005	61153	65316	4163	61232	-4084	0.94	-7.93	-7.08	-8.04
2006	56194	61516	5322	56922	-4594	0.93	-8.11	-5.82	-7.04
2007	54675	58705	4030	53567	-5138	0.91	-2.70	-4.57	-5.89
2008	53210	60057	6847	55876	-4181	0.93	-2.68	2.30	4.31

Source: Chiho Zaisei Yoran (Local Finance Handbook)

Note: Disparity between programs = Revised program - Initial program, Deviation = Settled accounts - Revised program, Execution rate = Settled accounts / Revised program

Table 4: Execution and Adjustment of Non-subsidized Expense

Fiscal year	Initial program (100 million yen)	Revised program (100 million yen)	Disparity between programs (100 million yen)	Settled accounts	Deviation	Execution rate	Initial program (rate of increase)	Revised program (rate of increase)	Settled accounts (rate of increase)
1985	83760	83760	0	66195	-17565	0.79			
1986	86861	86861	0	70367	-16494	0.81	3.70	3.70	6.30
1987	91204	91204	0	81261	-9943	0.89	5.00	5.00	15.48
1988	102948	102948	0	99259	-3689	0.96	12.88	12.88	22.15
1989	112451	112451	0	113049	598	1.01	9.23	9.23	13.89
1990	120328	120328	0	132550	12222	1.10	7.00	7.00	17.25
1991	132387	133840	1453	149184	15344	1.11	10.02	11.23	12.55
1992	147595	163095	15500	173622	10527	1.06	11.49	21.86	16.38
1993	165371	188063	22692	183496	-4567	0.98	12.04	15.31	5.69
1994	184832	184926	94	172495	-12431	0.93	11.77	-1.67	-6.00
1995	194287	196377	2090	176835	-19542	0.90	5.12	6.19	2.52
1996	200062	199536	-526	170315	-29221	0.85	2.97	1.61	-3.69
1997	200273	199726	-547	157990	-41736	0.79	0.11	0.10	-7.24
1998	192302	191785	-517	154254	-37531	0.80	-3.98	-3.98	-2.36
1999	192251	191734	-517	134953	-56781	0.70	-0.03	-0.03	-12.51
2000	184219	183793	-426	122569	-61224	0.67	-4.18	-4.14	-9.18
2001	174135	173593	-542	113673	-59920	0.65	-5.47	-5.55	-7.26
2002	156566	156027	-539	105892	-50135	0.68	-10.09	-10.12	-6.85
2003	147767	147758	-9	97566	-50192	0.66	-5.62	-5.30	-7.86
2004	133721	133426	-295	93569	-39857	0.70	-9.51	-9.70	-4.10
2005	122641	122394	-247	87086	-35308	0.71	-8.29	-8.27	-6.93
2006	99767	99715	-52	81366	-18349	0.82	-18.65	-18.53	-6.57
2007	85153	85083	-70	76905	-8178	0.90	-14.65	-14.67	-5.48
2008	82635	86357	3722	78249	-8108	0.91	-2.96	1.50	1.75

Source: Chiho Zaisei Yoran (Local Finance Handbook)

Note: Disparity between programs = Revised program - Initial program, Deviation = Settled accounts - Revised program, Execution rate = Settled accounts / Revised program

Table 5: Correlation with the Indexes of Business Conditions

(a)Whole Sample

	CI	DI	t1	t2	t3	h1	h2	h3	sum1	sum2	sum3
CI	1.0000										
DI	0.8767	1.0000									
t1	-0.0502	-0.1131	1.0000								
t2	-0.2359	-0.2690	0.9216	1.0000							
t3	-0.0268	-0.0705	0.6955	0.7700	1.0000						
h1	0.0565	-0.0832	0.8397	0.7760	0.5633	1.0000					
h2	-0.4663	-0.4266	0.2512	0.3850	0.4036	0.1018	1.0000				
h3	-0.4852	-0.4524	0.2642	0.4131	0.4194	0.1174	0.9946	1.0000			
sum1	-0.0335	-0.1159	0.9907	0.9118	0.6705	0.9042	0.2250	0.2390	1.0000		
sum2	-0.4360	-0.4304	0.6828	0.8163	0.6913	0.5071	0.8436	0.8550	0.6608	1.0000	
sum3	-0.3520	-0.3531	0.5364	0.6772	0.8058	0.3626	0.8621	0.8726	0.5041	0.9265	1.0000

(b)Excluding FY1995

	CI	DI	t1	t2	t3	h1	h2	h3	sum1	sum2	sum3
CI	1.0000										
DI	0.8805	1.0000									
t1	-0.0600	-0.1125	1.0000								
t2	-0.2460	-0.2693	0.9208	1.0000							
t3	-0.0291	-0.0702	0.6972	0.7714	1.0000						
h1	0.0420	-0.0826	0.8387	0.7749	0.5688	1.0000					
h2	-0.5593	-0.4688	0.2251	0.3813	0.4355	0.0204	1.0000				
h3	-0.5981	-0.5090	0.2401	0.4179	0.4627	0.0300	0.9945	1.0000			
sum1	-0.0457	-0.1155	0.9910	0.9114	0.6738	0.9025	0.1822	0.1959	1.0000		
sum2	-0.4902	-0.4512	0.6871	0.8329	0.7217	0.4793	0.8248	0.8423	0.6561	1.0000	
sum3	-0.3968	-0.3674	0.5301	0.6826	0.8379	0.3253	0.8505	0.8685	0.4884	0.9186	1.0000

Notes: t1: Non-subsidized (initial program), t2: Non-subsidized (revised program), t3: Non-subsidized (revised settled accounts), h1: Subsidized (initial program), h2: Subsidized (revised program), h3: Subsidized (revised settled accounts), sum1: Ordinary construction expenditure (initial program), sum2: Ordinary construction expenditure (revised program), sum3: Ordinary construction expenditure (revised settled accounts)

Table 6: Public Investment Function Estimation Results (FY1992-FY1999)

Model	$\Delta \ln$ (subsidized expense)		$\Delta \ln$ (non-subsidized expense)	
	(I)	(II)	(I)	(II)
Constant	19.900***	3.502***	18.599***	2.698***
	(2.396)	(0.367)	(2.766)	(0.222)
Prefectural-level variable:				
$\Delta \ln$ (gross prefectural product)	−0.160	0.238	0.454	0.164
	(0.188)	(0.283)	(0.316)	(0.180)
Great Hanshin-Awaji	39.470***	32.275***	9.772***	2.457
Earthquake dummy	(2.730)	(4.190)	(3.332)	(3.814)
National-level variable:				
$\Delta \ln$ (gross domestic product)	−3.213***	——	−0.268	——
	(1.096)		(1.462)	
$\Delta \ln$ (government debt ratio)	−1.963***	——	−2.443***	——
	(0.229)		(0.354)	
Observations	376	376	376	376
R^2	0.503	0.635	0.553	0.615

Notes: *, ** and *** show the null hypothesis rejected at significant levels of 10%, 5% and 1%, respectively. Figures in parentheses indicate White's standard error.

Table 7: Public Investment Function Estimation Results (FY2000-FY2007)

Model	$\Delta \ln$ (subsidized expense)		$\Delta \ln$ (non-subsidized expense)	
	(I)	(II)	(I)	(II)
Constant	−6.816*	−11.271***	−13.042***	−10.167***
	(3.849)	(0.370)	(3.220)	(0.359)
Prefectural-level variable:				
$\Delta \ln$ (gross prefectural product)	0.257	−0.115	0.786***	0.853***
	(0.311)	(0.264)	(0.256)	(0.256)
National-level variable:				
$\Delta \ln$ (gross domestic product)	−2.773**	——	0.782	——
	(1.327)		(1.325)	
$\Delta \ln$ (government debt ratio)	−0.158	——	0.227	——
	(0.318)		(0.216)	
Observations	470	470	470	470
R^2	0.149	0.260	0.105	0.120

Notes: *, ** and *** show the null hypothesis rejected at significant levels of 10%, 5% and 1%, respectively. Figures in parentheses indicate White's standard error.

Table 8: Correlation Coefficient between Ordinary Balance Ratio and Non-subsidized Expense by Group

Group	
1 (Tokyo)	-0.0797
1 (Tokyo, except FY2000)	-0.8142
2 (Osaka)	0.4837
3 (Large)	-0.2725
4 (Medium)	-0.4128
5 (Small)	-0.6864

Table 9: Reaction of Public Investment to Economic Fluctuation

| | Economic fluctuation | |
	Country as a whole	Prefectures
Subsidized expense	Countercyclical	
Non-subsidized expense		Procyclical