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Fiscal Adjustment in Japanese Municipalities*

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Abstract

This paper studies how Japanese municipalities restore their fiscal balance after a budget shock. The results show that fiscal adjustments to a shock are mainly made by subsequent changes in government investment and government consumption: about 80-89% (21-24%) of a permanent unit innovation in grants and own revenue is adjusted by changes in government investment (consumption). The contribution of government expenditure in balancing local budgets is much larger in Japan than in other countries. In contrast to the role played by the expenditure side, the municipalities' own-source revenue plays a limited role in the adjustment process of local budget balancing. In addition, it is observed that government investment is highly volatile in Japan than in other countries. However, the magnitude of volatility in municipalities' own revenue and grants is small, implying that the municipalities face restrictions in adjusting their fiscal balance by own-source revenue and the higher-level government provides grants rigidly. This paper additionally analyzes a sample based on population size and time period.

JEL Classification. H70; H72; H77

Keywords. Dynamic fiscal adjustment, municipal policy

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1 Introduction

Regional governments have to cope with various fiscal shocks caused by economic downturns, national fiscal reforms, and the disappearance of a tax base owing to natural disasters. It is only recently, starting from the pioneering work of Buettner and Wildasin (2002, 2006; hereafter, BW), that studies have attempted to quantify the dynamics of regional fiscal adjustments. Using a balanced panel data set on 1270 cities in the United States from 1972 to 1997, based on a vector error-correction model (VECM), they measure how these cities adjust to various exogenous fiscal shocks. While the VECM was developed to describe the dynamic interrelationship between stationary variables, mainly in macroeconomic fields, they were the first to apply it to analyze impulse-response functions at the municipal level. A critical feature when applying the VECM to municipalities is the substantial grants they receive from the national governments. This may play a crucial role in maintaining fiscal balance in the municipalities. One of the findings of the BW analysis is that to maintain intertemporal budget balance, cities adjust to shocks in own-source revenue and grants mainly through adjustments in public expenditure. By decomposing the sample, they confirm that the pattern is more or less robust with respect to city size.

Several subsequent studies apply the BW approach to other countries. Using a panel data set for 1983-1993 on 25 local governments in the Sør-Trøndelag county in Norway, Rattsø (2004) finds that, as with the United States, local public investment is the main shock absorber in Norway's local finance system: one-third of Norway's budget surplus shock is adjusted by investment in the following year. Further, Navon (2006) applies the BW approach to a 1996-2002 panel data set of 193 local authorities in Israel and shows that a reduction in grants from the government leads to a cutback in services to residents and increased deficits. The study further shows that the adjustment process differs considerably across regions; the budget adjustment process for the non-Jewish local authorities is, for example, twice as long as that for the Jewish ones. Buettner (2009) applies the BW approach to examine how German municipalities adjust to fiscal shocks. Using a sample of 1102 jurisdictions for 1974-2000, the study finds that a substantial part of fiscal adjustment to revenue shocks occurs by offsetting the changes in grants and equalization transfers. In a recent study, Solé -Ollé and Sorribas-Navarroa (2012) apply the BW approach to examine the fiscal adjustments in Spain. Using a panel data set of 258 municipalities in the Catalonia region for 1988-2006, they observe that, as with the German municipalities, government grants play a more important role in the

adjustment process. The results of the preceding studies show that while the municipalities in some countries cope with exogenous fiscal shocks by controlling public spending, the fiscal shocks that hit the municipalities of some other countries are adjusted by grants, suggesting that further research on various countries is needed to understand the differences and similarities in their fiscal adjustment processes.

This paper adopts the same approach, VECM, to estimate the municipal fiscal adjustments in Japan. We use a sample of 3210 municipalities for 1977-2010, covering more than a quarter century. Our analysis has the advantage of using a rich data set compared with previous studies. Specifically, the distinguishing feature differentiating our analysis from the preceding studies is that we separate and categorize the government spending into government investment and government consumption. Buettner (2009) breaks down the revenue side into grants and fiscal equalization transfers, and thus, succeeds in determining the role of interregional fiscal equalization in Germany. By contrast, in this paper we divide the expenditure side. The trade-off faced by regional governments in deciding the allocation of public expenditure between investment and consumption is subject to intensive study, and the decision has a great impact on the efficiency, welfare, and growth of regions.[1] The changes in the composition of public spending have attracted the attention of several researchers because while a decrease in public investment may correspondingly affect the long-run regional growth negatively, the short-run welfare of a region might increase from an increase in public consumption replacing public investment. Our analysis thus contributes to clarifying the substitutability/complementarity between government investment and government consumption, and further, we try to ascertain the policy instruments used to adjust fiscal imbalances.

In addition, applying the analysis to Japanese municipalities, we clarify the similarities and differences in the adjustment process between unitary and federal nations, since the Japanese government system considerably contrasts with the more decentralized systems of the United States and Germany. More practically, in Japan, the local tax laws place a limit on the free choice of municipal tax rates and the central government is involved in local loan programs. Instead, the municipalities actively engage in public investment to improve their social capital, which was less advanced in Japan

[1] See Keen and Marchand (1997), Matsumoto (2000), and Borck et al. (2007) for the effects of changes in the allocation of public spending in the framework of interregional competition, and Lau (1995), Devarajan et al. (1996), Rivas (2003), Chen (2006), and Giovanni and Tervala (2010) for the impact of changes in public spending composition on long-run growth.

than in Europe and the United States during the 1970s and 1980s. Our analysis finds out how these features affect the dynamic adjustment of local budgets.

Our main findings can be summarized as follows. First, government investment plays the most important role in the adjustment process, with 54-61% of the budget shocks adjusted through government investment in the following year. This magnitude is roughly threefold or more the magnitude of government consumption. For instance, a 1-yen decrease in grants is covered by reduction of government investment by 0.612 yen and of government consumption by 0.185 yen. Similarly, a 1-yen decrease in own revenue is followed by a reduction in government investment by 0.540 yen and of government consumption by 0.128 yen. In addition, from a cross-country comparison, these figures show that government expenditure (the sum of government investment and government consumption) in Japan plays a fairly large role in adjusting the local budgets. Second, government investment is highly volatile. A 1-yen increase in government investment is fraught with a reduction in government investment by 1.129 yen in the following year, which is quite high when compared with those of other countries. In contrast, the magnitude of volatility in own revenue and grants is small, implying that the municipalities face restrictions in adjusting their fiscal balance through own revenue sources and the higher-level government provides the grants rigidly. Third, in contrast to the role played by the expenditure side, the municipalities' own-source revenue plays a limited role in the adjustment process of local budget balancing. This is in contrast to the case of other country, e.g., the United States, where the own revenue has a role to play in adjusting fiscal imbalances. In addition, grants from the central government do not play a significant role in the Japanese municipalities. This is in contrast to other countries such as Spain and Germany, where inter-governmental transfers have a role in adjusting fiscal imbalances through central grants in the former and in adjusting fiscal shocks through equalization transfers in the latter.

We then break down our sample. We divide our sample based on the population size to find whether the adjustment process depends on the size of municipalities. Second, we provide further details of the adjustment process by dividing our sample into two time periods. The Japanese governments experienced distinctly different situations before and after 1990, the year that the economic boom collapsed, and were forced to manage their fiscal budgets differently. We study how the municipal governments changed their adjustment patterns. The additional analysis enables us to make mention of flypaper effects, soft-budget problem, and substitutability/complementarity

between the government investment and consumption, based on the municipal size and the sampling period.

The rest of this paper is organized as follows. In Section 2, we introduce our analytical model and data. In Section 3, we present our preliminary results to ensure the model is specified correctly. In Section 4, we show the results. An international comparison is also presented in this section. In Section 5, we perform two additional analyses. In the final section, we conclude the paper.

2 Framework and Data

2.1 Analytical framework

The analytical framework employed in this paper is the vector error-correction model, similar to that used in Buettner and Wildasin (2006), Buettner (2009) and Solé-Ollé and Sorribas-Navarro (2012). Denoting own-source revenues (mainly tax revenues) as R_{it}, government investment as G^I_{it}, expenditures excluding public investment and debt service (hereafter government consumption) as G^C_{it}, net intergovernmental transfers as Z_{it}, debt service as S_{it} and fiscal deficit as D_{it}, the government's budget constraint is represented as

$$D_{it} = G^I_{it} + G^C_{it} + S_{it} - R_{it} - Z_{it}. \tag{1}$$

Buettner (2009) considers two types of intergovernmental transfers– fiscal equalization transfers and grants. The Japanese municipalities receive various kinds of intergovernmental transfers, some of which are matching grants and others, block grants. Here, we group the various types of intergovernmental transfers into one component for the reasons explained in the next subsection. From the government's budget constraint, we express the VECM (p) of the five variables as follows:

$$\Delta Y_{it} = \gamma D_{i,t-1} + \sum_{j=1}^{p} \Gamma_j \Delta Y_{i,t-j} + u_{it}, \tag{2}$$

where $Y_{it} = (G^I_{it}, G^C_{it}, S_{it}, R_{it}, Z_{it})'$ and $b = (1, 1, 1, -1, -1)$ and thus $D_{it} = b'Y_{it}$. γ and Γ_j are the parameter matrices to be estimated. In (2), p denotes the lag length.

The VECM estimation generates a number of coefficients, from which we compute the present value of the impulse response of each variable with

respect to innovations, to interpret the estimation results.[2]

2.2 Data

We use two panel data sets of Japanese municipalities. The first set (Panel A) covers a 25-year period (1977-2001), and the second (Panel B) covers a 34-year period (1977-2010). A reason why we prepare two data sets is the Heisei municipal mergers. The number of municipalities had been stable during the period that the first set covers: 3,280 in 1971 and 3,249 in 2001. The Heisei municipal merger reduced the number from 3,241 on April 1, 2002 to 1,750 on this day of 2010. Therefore, the first set covers a shorter period but is immune to the municipal mergers, while the second set covers a longer period but can be contaminated by the mergers.

To purge the effects of municipal mergers, we exclude the municipalities that were merged during the period of the first data set. This could create a sample bias, but the bias would be quite small because the number of municipalities was almost stable, as mentioned above. The second data set covers the same municipalities included in the first set, and we merge the data retrospectively based on the municipal boundaries as on March 31, 2011.[3] The number of municipalities in the first data set is 3,210, while that in the second set is 1,726.

We aggregate the fiscal data for our analysis into five variables consistent with the framework described in the previous section. Our data are based on the settlement of the ordinary accounts. The net intergovernmental transfers (Z_{it}) include the central and prefectural government subsidies (CGS) , local transfer tax (LTT) grants, and local allocation tax (LAT) grants. CGS and LTT grants are matching and purpose-specific grants, while LAT grants are supposed to be block and general grants. We group these transfers into one component for the following two reasons. First, the Japanese central and local governments are highly integrated (e.g., Muramatsu et al. 2001), and LAT grants are also utilized to mobilize the local governments by revising the LAT grants formula.[4] Second is the data availability. We do not have

[2]See Appendix. For details, see also Appendix C in Buettner (2009).

[3]The Japanese fiscal year is from April 1 to March 31. Almost all municipal mergers were made without dividing the municipalities, but there was one exception. Kamikuisshiki village was divided into two areas in 2006. The northern area merged with Kofu city and the southern area merged with Fuji-Kawaguchiko town. We assume that the proper Kamikuisshiki village merged with Kofu city.

[4]The tendency for high integration between local and central governments in Japan is captured by the *Integrated Model* of Muramatsu et al. (2001), in which local governments are assigned a large range of tasks, competencies of the central and local governments are

Lag order(p)	1		2		3	
Own revenues	-2.664	***	-2.204		-2.285	
Gen. expend.	-3.177	***	-2.978	***	-2.665	***
Gov. investment	-3.337	***	-3.091	***	-2.498	*
Gov. consumption	-2.855	***	-2.667	***	-2.554	**
Grants	-2.573	**	-2.343		-2.076	
Debt service	-2.427		-2.157		-2.093	
Deficit	-3.545	***	-3.152	***	-2.740	***
Δ Own revenues	-3.933	***	-2.680	***	-2.309	
Δ Gen. expend.	-4.130	***	-3.497	***	-3.223	***
Δ Gov. investment	-4.220	***	-3.746	***	-2.949	***
Δ Gov. consumption	-4.095	***	-3.233	***	-3.264	***
Δ Grants	-4.006	***	-3.258	***	-3.055	***
Δ Debt service	-3.783	***	-2.873	***	-2.743	***

Table 1: Panel Unit Root Test (1977-2001, 3210 municipalities)

Note. *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

data on how much CGS and LTT are transferred for government investment and consumption in the municipality level. The own-source revenues (R_{it}) include tax revenues, fees, donations and miscellaneous revenue. The fiscal deficits (D_{it}) are calculated as $G^I_{it} + G^C_{it} + S_{it} - R_{it} - Z_{it}$, where G^I_{it} is the expenditures for public investment, G^C_{it} stands for expenditures excluding public investment and debt service, and S_{it} the debt service. All the variables are deflated and expressed in per capita terms as in the literature.

3 Specification

Prior to our estimation using the VECM, we need to verify whether the fiscal deficit (D_{it}) and the first-order differences of the other fiscal variables ($G^I_{it}, G^C_{it}, S_{it}$,

intertwined, and the central government steers local governments through partnerships. A typical example of a highly integrated or closed partnership between the local and central governments is the various public work projects implemented on the initiative of local authorities, with the central government monitoring day-to-day operations.

Lag order(p)	1		2		3	
Own revenues	-2.322		-2.045		-2.267	
Gen. expend.	-3.320	***	-2.973	***	-2.805	***
Gov. investment	-3.535	***	-3.199	***	-2.951	***
Gov. consumption	-2.891	***	-2.515	*	-2.379	
Grants	-2.616	**	-2.243		-2.094	
Debt service	-2.350		-2.059		-1.960	
Deficit	-3.270	***	-2.801	***	-2.567	**
Δ Own revenues	-4.775	***	-3.746	***	-3.200	***
Δ Gen. expend.	-5.045	***	-4.024	***	-3.518	***
Δ Gov. investment	-5.147	***	-4.215	***	-3.610	***
Δ Gov. consumption	-5.044	***	-3.812	***	-3.374	***
Δ Grants	-4.644	***	-3.598	***	-3.197	***
Δ Debt service	-4.380	***	-3.350	***	-2.867	***

Table 2: Panel Unit Root Test (1977-2010, 1726 municipalities)

Note. *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

R_{it}, Z_{it}) are stationary. We employed a panel unit root test developed by Pesaran (2007), which allows for serially correlated errors and cross-section dependence. The results, shown in Tables 1 and 2, suggest that the fiscal deficit is stationary and that the first-order differences of the other fiscal variables are also stationary for both of our data sets.[5] The result that the fiscal deficit is stationary could suggest that the fiscal deficits of the Japanese municipalities are not explosive, at least in the long run.

For estimations using the VECM, we need to determine the lag length. Considering the limited time dimension of our data (25 and 34 years), we begin with a lag of 4 years and proceed to a likelihood ratio test for possible reduction in the number of lags in all the equations at the same time. The test statistics obtained are shown in Tables 3 and 4. Since a reduction of the lag length is rejected for all the cases, we use a model with four lags.[6]

[5]We conduct the same panel unit root test for the sub-samples divided by population size, and obtain the same results.

[6]Buettner and Wildasin (2006) also employ the lag length of 4 years, while Solé-Ollé and Sorribas-Navarro (2012) use the lag length of 3 years. Buettner (2009) employs a model with six lags, but reports that the estimates of models with four or five lags do not

Lag order(p)	4→ 3	3→ 2
$\chi^2(16)$	124231.8 [0.000]	125032.8 [0.000]
Municipality-fixed effects?	with lag length = 4	with lag length = 3
$\chi^2(12836)$	20880.4 [0.000]	20715.6 [0.000]

Table 3: Specification Test (1977-2001, 3210 municipalities)

Note. The log-likelihood statistics on cross-equation restrictions are reported. The p-values are in parentheses.

Lag order(p)	4→ 3	3→ 2
$\chi^2(16)$	69049.6 [0.000]	69529.4 [0.000]
Municipality-fixed effects?	with lag length = 4	with lag length = 3
$\chi^2(12836)$	11305.4 [0.000]	11338.0 [0.000]

Table 4: Specification Test (1977-2010, 1726 municipalities)

Note. The log-likelihood statistics on cross-equation restrictions are reported. The p-values are in parentheses.

In panel data analysis, municipality-fixed effects are typically taken into account. The VECM uses the variables with the first-order differences and individual effects differentiated out in levels, but we use the fiscal deficit variable in levels. Thus, following the literature, we test whether the municipality-fixed effects should be included according to a likelihood ratio test. Unlike in Buettner and Wildasin (2006), Buettner (2009), and Solé-Ollé and Sorribas-Navarro (2012), the Japanese municipality data cannot reject the null hypothesis that municipality-fixed effects exist, as shown in Tables 3 and 4. Thus, we estimate the individual equations of the system separately using the typical fixed-effect model. To compare the results in the literature, we also conduct equation-by-equation estimations with ordinary least squares (OLS) estimation.

show major differences.

4 Main Results

The dynamic adjustment features can be traced out by impulse-response functions. Figure 1, for instance, depicts the response to a 1-yen increase in grants for Panel A, which shows that the grants (pZZ) decreases sharply in the next period and the year after the next, but it recovers to a certain degree by the five years later. Government investment (pGI) grows sizably after one year later and government consumption (pGC) progressively increases. The own revenues (pRR) and the debt services (pDS) give no indication of major reaction.

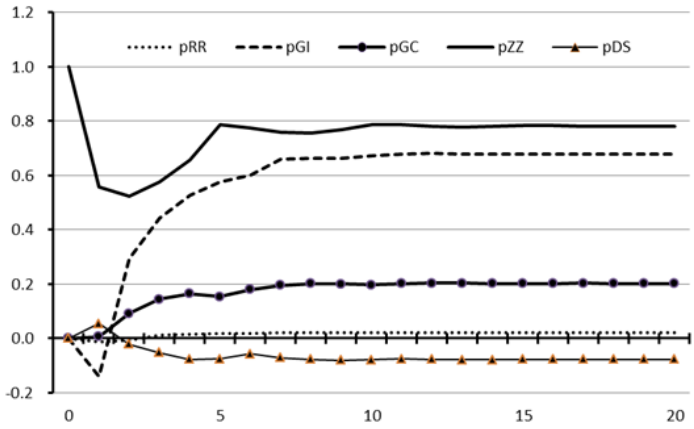

Figure 1: Impulse Response to a Decrease in Grants (1977-2001, 3210 municipalities)

The dynamic adjustment of other variables can be obtained in a similar way, but, to save spaces, we here show the total fiscal responses of all variables in present value terms. The results shown in Table 5 are based on the VECM estimation with municipality-fixed effects for Panel A (1977-2001, 3210 municipalities), while Table 6 gives the results for Panel B (1977-2010, 1726 municipalities). We assume a discount rate of 3% to calculate the present value for both panels.[7]

The difference between the results based on the two data sets does not

[7]Previous studies also employ a discount rate of 3% and indicate that the qualitative results are not sensitive to the different discount rates, because most of the fiscal adjustments occur during the first few years.

seem to be large, except for the response of grants shown in the fourth row.[8] This could indicate that the municipalities did not change their fiscal adjustment behavior with regard to their own revenue, government investment, government consumption, and debt service before and after the Heisei municipality mergers. Therefore, we focus on the results of Panel A (1977-2001, 3210 municipalities), which has a fund of data, and can avoid the possible bias caused by municipal decisions on consolidation.

We summarize the results by referring to some topics mentioned in the existing evidence for the United States [Buettner and Wildasin (2006)], Germany [Buettner (2009)], and Spain [Solé -Ollé and Sorribas-Navarroa (2012)].

Subsequent adjustments. The columns in Table 5 show how innovations in any one variable affect the subsequent adjustments of other variables, including itself. For example, the first column reveals how a 1-yen change in own-revenue in one period affects the subsequent evolution of own-revenue itself, government investment, government consumption, grants, and debt service. The figures show that a 1-yen decrease in own revenue leads to an increase in future own revenue by 0.395 yen, a decrease in government investment and consumption by 0.540 yen and 0.128 yen, respectively, and a decrease in grants by 0.081 yen. Grants do not play a significant role in offsetting own-revenue losses; the magnitude is small, and it even aggravates the fiscal balance against negative own-revenue shock. The role of grants in adjusting a shock in own revenue differs from that evidenced in the United States, but is somewhat similar with that observed in Spain and Germany, where grants do not have a constructive role in offsetting negative own-revenue shocks.

The results in all columns show innovations in the components of the budget tending to be partly offset by future changes in the same component. For instance, in response to a 1-yen decrease in own revenue, an adjustment of 0.540 yen comes from an offsetting change in the present value of future own revenue. Following precedent studies, it is, hence, instructive to calculate the response to a permanent 1-yen increase in each variable. The lower part of Table 5 reports the corresponding figures. In the first row, for

[8]The difference in response of grants between the two panels would stem from the special measures taken by the national government for municipal mergers on the lines of the Heisei municipal mergers. Since the national government could not legally force municipal mergers, it provided municipalities with fiscal incentives to induce mergers. The reduction of intergovernmental transfers and the provision of grants are two major incentives offered to each municipality.

	Innovation to				
Response of	Own Revenue	Gov. Invest.	Gov. Consump.	Grants	Debt Service
Own Revenue	-0.395	-0.023	-0.070	0.019	-0.001
	(0.005)	(0.003)	(0.004)	(0.004)	(0.006)
Gov. Invest.	0.540	-1.129	-0.529	0.612	-0.585
	(0.012)	(0.008)	(0.011)	(0.009)	(0.018)
Gov. Consump.	0.128	-0.162	-0.615	0.185	-0.097
	(0.007)	(0.004)	(0.006)	(0.004)	(0.009)
Grants	0.081	-0.258	-0.088	-0.234	-0.174
	(0.013)	(0.008)	(0.013)	(0.009)	(0.019)
Debt Service	-0.049	0.076	0.069	-0.069	-0.486
	(0.003)	(0.002)	(0.003)	(0.002)	(0.005)
Response to permanent increase					
Own Revenue		0.179	-0.182	0.025	-0.002
		(0.019)	(0.010)	(0.005)	(0.012)
Gov. Invest.	0.894		-1.372	0.798	-1.138
	(0.017)		(0.040)	(0.007)	(0.029)
Gov. Consump.	0.212	1.260		0.241	-0.189
	(0.012)	(0.079)		(0.004)	(0.018)
Grants	0.134	2.007	-0.229		-0.339
	(0.022)	(0.080)	(0.035)		(0.034)
Debt Service	-0.082	-0.591	0.179	-0.090	
	(0.005)	(0.029)	(0.009)	(0.003)	

Table 5: Present Value Responses (with fixed effect; 1977-2001, 3210 municipalities)

Note. The standard error is in parentheses.

	Innovation to				
Responce of	Own Revenue	Gov. Invest.	Gov. Consump.	Grants	Debt Service
Own Revenue	-0.365	0.012	-0.068	-0.019	-0.110
	(0.006)	(0.004)	(0.005)	(0.005)	(0.009)
Gov. Invest.	0.810	-1.141	-0.617	0.683	-0.859
	(0.019)	(0.013)	(0.016)	(0.016)	(0.029)
Gov. Consump.	0.318	-0.227	-0.748	0.268	-0.195
	(0.010)	(0.006)	(0.008)	(0.007)	(0.013)
Grants	0.500	-0.399	-0.321	0.006	-0.443
	(0.026)	(0.017)	(0.020)	(0.020)	(0.037)
Debt Service	-0.071	0.039	0.054	-0.020	-0.445
	(0.003)	(0.002)	(0.003)	(0.002)	(0.005)
Response to permanent increase					
Own Revenue		-0.084	-0.271	-0.019	-0.199
		(0.034)	(0.024)	(0.005)	(0.016)
Gov. Invest.	1.276		-2.448	0.679	-1.547
	(0.028)		(0.124)	(0.006)	(0.044)
Gov. Consump.	0.501	1.617		0.267	-0.352
	(0.015)	(0.123)		(0.004)	(0.022)
Grants	0.787	2.835	-1.276		-0.798
	(0.040)	(0.157)	(0.112)		(0.063)
Debt Service	-0.112	-0.279	0.214	-0.020	
	(0.005)	(0.022)	(0.015)	(0.002)	

Table 6: Present Value Responses (with fixed effect; 1977-2010, 1726 municipalities)

Note. The standard error is in parentheses.

example, the figures show that 0.894 yen of the balancing adjustment to a permanent unit change in own revenue comes from government investment.

The second column shows how a shock to government investment is adjusted. A 1-yen increase in government investment is followed by a 0.162-yen decrease in government consumption. A unit innovation in government investment causes the amount of grants to change by -0.258 yen. While government consumption has a role to play in balancing the budget in response to an innovation in government investment, own revenue and grants respond negatively to balancing the budget. The distinctive feature is that a 1-yen increase in government investment is followed by a 1.129-yen decrease in future investment. Thus, future government investment has an excessively important role to play in offsetting innovations to investments because own revenue and grants do not function to adjust local budget shocks caused by changes in government investment.

A 1-yen innovation in government consumption (third column) is followed by a decrease in future consumption by 0.615 yen and in government investment by 0.529 yen. The role of grants in balancing the budget in response to a change in government consumption is limited and negative (-0.088).

An innovation in grants (fourth column) is mainly balanced by investment, explaining 79.8% of permanent increases. The response of own-revenue increases is very low, explaining, at a maximum, less than 3% of permanent increase, thus suggesting the existence of strong flypaper effects, which we discuss later. The response of own-source revenue is low in Spain as well, explaining 6.6% of permanent increase. However, this result differs from the evidence for the United States, where the response of own-source revenues to a 1-dollar innovation in central grants is one digit larger than in the case of Japan and Spain; here, 0.144 dollar explains 27.3% of the permanent increase. The responses in the German municipalities resemble those in Spanish municipalities; the responses of own-source revenue to a 1-euro innovation in central grants and equalization transfers are 0.02 euro and 0.04 euro, explaining 4.3% and 8.8% of the permanent increase, respectively.

The fifth column shows the responses to innovations in debt service. A 1-yen increase in debt service follows a 0.486-yen decrease in future debt service. Grants play a very small role and even make the fiscal balance worse. This financial deterioration is covered by significant decreases in government investment (-0.585) and in government consumption (-0.097). However, fiscal imbalances are not fully covered by these responses, and thereby, the primary surplus is affected, which is discussed later.

Responsiveness. If we examine the row of Table 5 for any one variable, we see how responsive it is to a change in other variables, including itself. The second row is noteworthy in that government investment responds most significantly, adjusting 0.529-0.612 yen of unit innovation in other fiscal variables. The responsiveness of government investment is two to three times larger than that of government consumption. The responsiveness of government expenditure (the sum of government investment and consumption) in Japan is quite large, with a magnitude of 0.668-0.797 yen, compared with that in the United States, Germany, or Spain. For instance, government expenditure adjusts about 0.338-0.508 dollars of a 1-dollar change in the United States. This figure is 0.274-0.531 euros in Germany and 0.261-0.289 euros in Spain.

While government investment is highly responsive to fiscal shock in Japan, the country's own revenue is less responsive. In the first row, Japan's own revenue does not work to adjust fiscal imbalances caused by exogenous innovations in other variables; the absolute values range between 0.001 and 0.070 yen . Own revenue in other countries plays a more aggressive role, adjusting 0.144-0.162 dollars to an innovation in other variables in the United States, 0.085-0.515 euros in Spain, and 0.020-0.185 euros in Germany. Compared with other countries, the revenue side in Japan is not flexible and does not balance the municipal budget, as pointed out by Mochida (2001, pp.96-97).

Flypaper effect. The fourth column in Table 5 shows the flypaper effect, by which the local government expenditure increases significantly, with some estimates going up to almost 100% when the local government receives a grant from the central government. A study on Spain shows that the response of own-source revenue to a 1-euro innovation in central grants is low (just 0.018 euro, explaining 6.6% of the permanent increase), providing evidence of flypaper effect. This result differs from the evidence obtained for the United States, where the response of own-source revenue to a 1-dollar innovation in central grants is one digit larger than the Spanish case, 0.144 dollars, explaining 27.3% of the permanent increase. As explained previously, the responses of own-source revenue to innovations in central grants in Germany resemble the case of Spain, showing possible evidence of flypaper effects.

In comparison with these countries, Japan provides evidence of fairly strong flypaper effects.[9] The figures in the fourth column show that the

[9]The flypaper effect has been observed in Japanese municipalities by using different methods. See Nagamine (1995) and Doi (1996, 2000).

response of own-source revenue to a 1-yen innovation in central grants is just 0.019 yen, explaining 2.5% of the permanent increase. These figures are one digit smaller than the figures for the United States but almost the same as those for Spain and Germany, implying that an increase in grants-in-aid strongly sticks to government investment and government consumption; the response of government investment and consumption explains 79.8% and 24.1% of permanent increase, respectively. In sum, the response of government investment and government consumption explains just about everything (103.9%) of a permanent unit increase in grants.

Soft-budget constraints. The fourth row in Table 5 is related to discussions of soft-budget constraints. In the United States, grants from a higher-level government respond significantly to innovations in municipal own-source revenue and expenditure. A 1-dollar innovation in own-source revenue and public expenditure results respectively in a 0.086-dollar decrease and a 0.082-dollar increase in grants from the higher-level government. The response of grants to innovations in debt service is quite modest, just half of that for the other variables. These results imply that municipalities have the potential to induce transfers from higher-level governments through their own-source revenue and local expenditure decisions. Similar evidences on government expenditure are reported in the case of Spain: a 1-euro increase in public expenditure increases government grants by 0.158 euro. In addition, government grants in Spain respond quite significantly to innovations in debt service: a 1-euro increase in debt service results in an increase in grants by 0.229 euro. However, higher-level government grants do not respond significantly to innovations in own-source revenue. The evidence for Germany gives different results: government grants do not respond to innovations in own-source revenue and public expenditure, and the German municipalities do not induce grants from higher-level governments by expanding their expenditure.

The response of government grants in Japan has different features compared to that in Spain and the United States. A 1-yen increase in government investment results in a 0.258-yen decrease in grants; the opposite sign indicates the non-existence of a soft-budget problem. A 1-yen increase in government consumption also leads to a 0.088-yen decrease in grants, suggesting that the municipalities do not induce grants by expanding government expenditure.[10] Furthermore, a 1-yen increase in own-source revenue increases

[10]The soft-budget problem in Japan is currently a controversial topic. While some studies point to the existence of the soft-budget phenomena, others do not. For instance, see Akai et al. (2003), Nishikawa and Yokoyama (2004), and Doi and Ihori (2006).

the grants by 0.081 yen, implying that the municipalities are motivated to increase their own-source revenue by grants from higher-level governments.

Primary Surplus. Summing up the first four rows in Table 5, we calculate the adjustments in primary surplus to innovations in policy variables. In the United States, a 1-dollar increase in own-source revenue results in an offsetting change by 0.94 dollars in primary surplus, showing that the primary balance improves by fractions of a percentage (0.06 dollar). The adjustments in primary surplus to an innovation in public expenditure and grants are not much: -0.041 dollars and +0.045 dollars, respectively. The changes in primary surplus to innovations in policy variables in Spain are only half of those in the United States and may be negligible; a 1-euro innovation in own revenue, government expenditure, and grants each changes the primary surplus by +0.023 euro, -0.028 euro, and +0.033 euro, respectively. The absolute value of changes in Germany is also close to unity ; a unit innovation in own-source revenue, government expenditure, grants, and equalization transfers each results in an offsetting change by -0.993, 0.989, -0.986, and 0.984 euro, respectively.

The size of adjustments in primary surplus in Japan denotes a tendency similar to that in other countries. From Table 7, obtained by adding the fiscal responses of the first four rows of Table 5, we see that the absolute value of the changes is close to unity for all variables, except for debt service, implying that the response of primary surplus is satisfactory-to-negligible in most cases.[11]

Volatility. More than 70% of adjustments in Spain are reported to be held by the future value of the fiscal variables that experienced the shock. Specifically, public expenditure is the most volatile among the other variables: 72.9% of adjustments to shock in public expenditure are held by the future value of public expenditure. Much of this is true for the volatility of public expenditure in the United States (0.716) and Germany (0.851).

Government investment is the most volatile among the other policy variables in Japan. However, we observe a unique feature for Japanese experiences: the band of fluctuations is much wider. In Table 5, government

[11] From Table 7, it seems that fiscal balance is not restored by innovations in debt service. However, as Buettner (2009) mentions, this reflects temporal fluctuations in debt service. With regard to Japan, since the estimate of present value of future changes in debt service in response to a 1-yen increase in debt service is -0.486 yen, 0.514 yen out of a unit innovation in debt service is permanent. Since the present value of a change in primary surplus is 0.507 yen, the figures conform closely to the predictions from intertemporal budget constraints.

	Innovation to				
	Own Revenue	Gov. Invest.	Gov. Consump.	Grants	Debt Service
Change in PS	-0.982	1.010	0.986	-1.012	0.507

Table 7: Present Value of Change in Primary Surplus (with fixed effect; 1977-2010, 1726 municipalities)

investment is highly volatile (-1.129), showing an even possibility of divergence. Government consumption is less volatile than government investment (-0.615), but it takes larger values than the other variables. Japan's own-source revenue is less volatile compared with that of Germany (-0.569) and Spain (-0.709), taking the value of -0.395, and has almost the same value of that of the United States (-0.348). The volatility of grants (-0.174) is about half of that of the other countries, and is the lowest, implying that the higher-level government provides grants more rigidly.

Complementarity and substitutability. In our analysis, we divide public expenditure into government investment and government consumption; this enables us to examine whether government investment complements or substitutes government consumption and vice versa. Evidence shows that the two items constituting government expenditure substitute each other, although the magnitude of substitutability is asymmetric; on the one hand, a 1-yen increase in government investment reduces government consumption by 0.162 yen, and on the other hand, a 1-yen increase in government consumption reduces government investment by 0.529 yen.

5 Additional Results

5.1 Municipal Size

The process of adjustments can be conditioned by the size of municipality associated with the fiscal institution. Thus, we replicate this analysis by classifying the municipalities into four categories: cities, including Tokyo's wards, and towns/villages with large, medium, and small populations. Cities are defined as having a population of not less than 50 thousand and are jurisdictions satisfying certain prerequisites; towns/villages are jurisdictions

		Innovation to				
		Own	Gov.	Gov.	Grants	Debt
Responce of	Size	Revenue	Invest.	Consump.		Service
Own	City	-0.126	-0.191	-0.183	0.045	-0.228
Revenue	Large	-0.222	-0.046	-0.121	0.007	0.059
	Medium	-0.422	-0.019	-0.060	0.021	0.003
	Small	-0.402	-0.020	-0.058	-0.008	0.041
Gov.	City	0.738	-1.112	-0.418	0.599	-0.874
Invest.	Large	0.630	-1.102	-0.505	0.609	-0.523
	Medium	0.506	-1.136	-0.530	0.610	-0.576
	Small	0.596	-1.121	-0.532	0.665	-0.615
Gov.	City	0.130	-0.102	-0.519	0.125	-0.320
Consump.	Large	0.134	-0.135	-0.544	0.188	-0.199
	Medium	0.121	-0.161	-0.619	0.181	-0.079
	Small	0.153	-0.181	-0.614	0.204	-0.119
Grants	City	-0.030	0.003	0.259	-0.341	-0.470
	Large	-0.001	-0.177	0.052	-0.226	-0.218
	Medium	0.071	-0.266	-0.102	-0.243	-0.157
	Small	0.163	-0.284	-0.111	-0.124	-0.231
Debt	City	-0.092	0.088	0.080	-0.077	-0.466
Service	Large	-0.062	0.069	0.075	-0.060	-0.463
	Medium	-0.040	0.078	0.069	-0.073	-0.490
	Small	-0.060	0.068	0.061	-0.048	-0.465

Table 8: Present Value Responses (1977-2001)

Note. The first upper row in each cell stands for the response of cities. The figures in the following rows stand for the response of large, medium, and small towns/villages.

with a population of less than 50 thousand. The fiscal institutions conditioned on the municipalities vary between cities and towns/villages. For instance, cities are delegated a part of the authority for urban planning and welfare policies, but towns/villages are not given such authority. Specifically, ordinance-designated cities have broader tax bases and wider authority, for example, the right to operate a public lottery, compared to towns/villages.

We now discuss the points of differences and similarities across the four categories. The clearest feature, as shown in Table 8, is that government investment is the main policy instrument for adjusting fiscal shock without reference to municipality size. It is therefore not surprising that government investment is highly volatile in all categories. Hence, some of our main results discussed in the previous section do not depend on the size of municipalities.

We observe some different responses among the municipalities to innovations in policy variables based on size. First, a notable difference is the higher response of government investment and government consumption to innovations in grants in smaller municipalities. For instance, in response to a 1-yen increase in grants, while the cities increase their investment and consumption by 0.599 yen and 0.125 yen, respectively, a small municipality increases them by 0.665 yen and 0.204 yen, respectively. This implies that grants are likely to stick to public spending more in smaller municipalities.

Second, the substitutability between government investment and government consumption also varies slightly according to the size of municipalities. As shown in the third column, while a 1-yen increase in government consumption reduces government investment in the cities and Tokyo wards by 0.418 yen, it reduces government investment in the towns/villages by 0.505-0.532 yen. Similarly, from the figures in the second column, we find that a 1-yen increase in government investment reduces the government consumption in cities by 0.102 yen but reduces the government consumption in towns/villages by 0.135-0.181 yen. These results imply that the substitutability between government investment and government consumption becomes lower as the population of the municipalities increase.

Third, the smaller the municipalities, the larger are the fluctuations in own revenue and the smaller the fluctuations in grants. We find that a 1-yen increase in own revenue reduces the future own revenue in the cities by 0.126 yen and that in towns/villages by 0.222-0.422 yen; further, a 1-yen increase in grants reduces the future grants in the cities by 0.341 yen and that in towns/villages by 0.124-0.243 yen. This might be related to the reliance of the local tax base on property tax; larger municipalities tend to be blessed with a stable property tax base. The larger fluctuations in own

revenue in small municipalities might be partly covered by the relatively stable responses of the higher-level government's grants.

Fourth, the second column in Table 8 gives little evidence that the municipalities can induce grants from a higher-level government by expanding government investment. However, there might be the case in which a municipality with a large population has an incentive to increase its consumption excessively since that will be financed by the central government; the third column in Table 8 shows that a 1-yen increase in government consumption increases the grants in cities by 0.259 yen. The reason behind this observation could be that increases in fiscal needs in a municipality facing urban growth are adjusted by grants from the higher-level government.

5.2 A Change of Sampling Period

In our sample period, the Japanese economy demonstrated an average annual growth rate of over 4.6% from 1977 to 1989, with the growth performance in the subsequent period remaining dismal. From 1990 to 2009, this was 0.8%, showing a negative growth five times. The year 1990, recognized as the year the *economic bubbles* collapsed, is also a diverging point for the country's public finance. The tax revenue of the central government steadily increased prior to 1990, with an average annual tax revenue growth rate of 10.2% from 1977 to 1990. After 1990, the country's tax revenue started declining, with an average annual growth rate of -1.8% during 1991-2010. The Japanese governments experienced distinctly different situations before and after 1990 and were forced to resort to different fiscal management strategies. Therefore, we study the fiscal adjustment in the Japanese municipalities by dividing the period into two, the first half constituting 1977-1989, and the second half constituting the period that followed. The results are shown in Table 9.

The major differences between the periods before and after 1990 are in the response of grants to innovations in own revenue, government consumption, and debt service. During 1977-1989, a 1-yen decrease in own revenue was offset by an increase in grants by 0.102 yen. However, during 1990-2001, the sign turns opposite: a 1-yen decrease in own revenue is fraught with a reduction in grants by 0.077 yen. This suggests that grants do not balance the budget against a revenue shortage caused by a negative own-revenue shock. This tendency can be confirmed by examining the response of grants to innovations in government consumption. During 1977-1989, a 1-yen increase in government consumption leads to an increase in grants from the higher-level government by 0.297 yen, indicating that the grants have a role

		Innovation to				
		Own	Gov.	Gov.	Grants	Debt
Responce of	Period	Revenue	Invest.	Consump.		Service
Own	77-89	-0.497	-0.008	-0.034	0.007	0.071
Revenue	90-01	-0.529	0.000	-0.025	0.003	0.002
Gov.	77-89	0.369	-1.040	-0.215	0.545	-0.977
Invest.	90-01	0.428	-1.068	-0.459	0.489	-0.459
Gov.	77-89	0.025	-0.108	-0.506	0.110	-0.653
Consump.	90-01	0.102	-0.057	-0.649	0.061	0.017
Grants	77-89	-0.102	-0.141	0.297	-0.342	-1.166
	90-01	0.077	-0.118	-0.092	-0.466	-0.048
Debt	77-89	-0.026	0.031	0.018	-0.024	-0.454
Service	90-01	0.004	0.030	0.008	-0.034	-0.586

Table 9: Present Value Responses (1977-1989 and 1990-2001, 3210 municipalities)

Note. Note. The upper row in each cell stands for the response for 1977-1989, and the lower row for 1990-2001.

to play in restoring fiscal balance. However, during 1990-2001, an increase in government consumption by 1 yen led to a decrease in grants by 0.092 yen.

Another distinct feature is the response of grants to innovations in debt service. During 1977-1989, an innovation in debt service leads to significant responses in grants: a 1-yen increase in debt service reduces the grants by 1.166 yen. This should put the brakes on municipalities depending on debts for fiscal management. However, the response of grants to innovations in debt service after 1990 is very low and almost negligible, implying that it became easy for municipalities to issue debt. This could be because after the drastic economic downturn, the national governments induced the municipalities to employ the classic Keynesian policy to boost their economy within a given period. Therefore, the national governments might not reduce their grants even when the debt service increased.

6 Concluding Remarks

In this paper, we studied the dynamic adjustment of municipal budgets in Japan using the VECM and compared the results with those obtained for the United States, Germany, and Spain. Our main findings are summarized below.

First, the Japanese municipalities respond to fiscal shocks mainly by adjusting their expenditure. Specifically, government investment plays a more prominent role than government consumption. About 80-90% of a permanent unit innovation in grants and own revenue is adjusted through government investment. In addition, government consumption has a role to play in balancing the local budget; 21-24% of shock in own revenue and grants is offset by government consumption. The magnitude of responsiveness of government expenditure (the sum of investment and consumption) in Japan contrasts significantly with the situation in the United States, Germany, and Spain.

Second, in contrast to the role played by the spending side, the municipalities' own-source revenue plays a limited role in the adjustment process of local budget balancing. This is in contrast to the case of the United States, where the own revenue has a role to play in adjusting fiscal imbalances. In addition, grants from the central government do not play a significant role in the Japanese municipalities. This is in contrast to the cases of Spain and Germany, where intergovernmental fiscal transfers have a role in adjusting fiscal imbalances through central grants in the former and in adjusting fiscal

shocks through equalization transfers in the latter.

Third, government investment is highly volatile compared to that observed in other countries. In contrast, the magnitude of volatility in own revenue and grants is small, implying that the municipalities face restrictions in adjusting fiscal balances through own-revenue sources and the higher-level government provides grants rigidly.

Fourth, we find that while government investment and government consumption are substitutable, the magnitude of substitutability is asymmetric. On the one hand, a 1-yen increase in government investment leads to a reduction of 0.162 yen in government consumption, and on the other hand, a 1-yen increase in government consumption leads to a reduction of 0.529 yen in government investment.

Fifth, an international comparison shows that municipalities are likely to have soft budgets in some countries, but in Japan, it is not so in most cases. However, an additional analysis shows that while the towns and villages have no incentives to expand their government consumption and induce grants from the higher-level government, the cities in Japan might do so. This might be because the grants system has a tendency to allocate central grants to larger cities facing population growth in order to satisfy their growing fiscal needs.

Sixth, the responses of government investment and consumption explain just about everything about permanent unit increases in grants, providing evidence supporting the flypaper effect. Specifically, grants are likely to stick to government expenditure more in smaller municipalities.

Finally, in the second part of our sample, grants are not used to restore fiscal imbalances caused by negative revenue shocks. In addition, the responses of grants to innovation in debt services change sharply in our subsample. While in the first period, a unit increase in debt service reduces grants significantly, that puts a break on debt-driven fiscal management. The response of grants to innovation in debt service becomes negligibly small in the second period, implying that after 1990, the municipalities reduced their costs (in the form of grants cut) when they increase their debt service.

Appendix

We compute present value of impulse responses following Buettner (2009). Our estimation equations are

$$\Delta Y_{it} = \gamma D_{i,t-1} + \sum_{j=1}^{p} \Gamma_j \Delta Y_{i,t-j} + u_{it}, \tag{3}$$

where $Y_t = (G_t^I, G_t^C, S_t, R_t, Z_t)'$, $b_t = (1, 1, 1, -1, -1)$ and thus $D_t = b_t' Y_t$. The transition of fiscal deficit is:

$$D_{i,t-1} = b' \Delta Y_{i,t-1} + D_{i,t-2} \tag{4}$$

Following Bohn (1991) and Buettner (2009), the VECM can be represented as a first-order VAR:

$$X_{it} = \mathbf{B} X_{i,t-1} + v_{it}$$

where

$$\mathbf{B} \equiv \begin{bmatrix} \Gamma_1 + \gamma b' & \Gamma_2 + \gamma b' & \Gamma_3 + \gamma b' & \Gamma_4 + \gamma b' & \gamma \\ \mathbf{I} & \mathbf{0} & \mathbf{0} & \mathbf{0} & 0 \\ \mathbf{0} & \mathbf{0} & \mathbf{I} & \mathbf{0} & \vdots \\ \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{I} & 0 \\ 0 & 0 & 0 & b' & 1 \end{bmatrix},$$

$$X_{it} \equiv \begin{bmatrix} \Delta Y_{it} \\ \Delta Y_{i,t-1} \\ \Delta Y_{i,t-2} \\ \Delta Y_{i,t-3} \\ D_{i,t-4} \end{bmatrix}, \quad v_{it} \equiv \begin{bmatrix} u_{it} \\ 0 \\ \vdots \\ \vdots \\ 0 \end{bmatrix}.$$

Based on this rearrangements, the prediction of k-period ahead value created by an innovation to period t can be written as:

$$\hat{X}_{i,t+k} = \mathbf{B}^k v_{it}.$$

When we set v_{it} as v_k, whose k-th element is unity and others are zero, to represent a unit innovation, the present value of the impulse response in m-th budget component is:

$$\hat{\pi}(m,k) = \sum_{n \geq 1} h_m \rho^n \mathbf{B}^n v_k = h_m \rho \mathbf{B} [1 - \rho \mathbf{B}]^{-1} v_k,$$

where h_m is a selection vector with unity as its m-th element and zeros elsewhere, and ρ is a discount factor.

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