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Relationships between Diversity and Changes in Municipal Tax Revenue: Empirical Results from Japan's municipalities

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Relationships between Diversity and Changes in Municipal Tax Revenue:

Empirical Results from Japan's municipalities

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Abstract

This paper explores two relationships between revenue structures and revenue changes in Japan's municipal taxes during the period of FY2009 to FY2013. First is the revenue diversity hypothesis; the short-term relationship between the diversity and stability of the total tax revenues in municipalities. Second is the fiscal illusion hypothesis; the long-term relationship between the complexity and growth of the total tax revenues in municipalities. The HHI (a Hirschman-Herfindahl Index) is used to measure both revenue diversity and revenue complexity. The short-term stability of total tax revenues is measured by the income elasticity in the short-term using an error correction model. The long-term growth of total tax revenue is measured by the income elasticity of tax revenue in the long-term using ordinary level model. This paper's main findings are as follows: (1) in the short-term, the total tax revenues are stable and the diversity can improve the stability of the total tax revenues, (2) in the long-term, the total tax revenues are high-growth and the complexity can grow the total tax revenues. These findings imply that both the tax revenue diversity hypothesis and the fiscal illusion hypothesis hold in the short-term and the long-term, respectively.

Key words: Revenue Diversity Hypothesis, Revenue Stability, Fiscal Illusion Hypothesis, Revenue Complexity, Income Elasticity of Tax Revenue

INTRODUCTION

This paper explores relationships between diversities of tax revenue structures and changes of total tax revenues in Japan's municipalities, and shows the effect of tax revenue diversity on the growth and stability of total tax revenues in municipal governments. Does a diversification of local tax revenue structure improve a stability of municipal governments' total tax revenue in the short-term perspective and then expand local governments' expenditures in the long-term perspective? The purpose of this paper is to answer these research questions.

<Figure 1>

Figure 1 shows tax revenue structures, which is aggregated at national level, of Japan's municipal governments from FY2009 to FY2013. On average during this period, the share of the property tax revenues of total tax revenues is accounted for 43.8 percent, the share of the personal income tax revenues is accounted for 34.8 percent, the share of the corporate income tax revenues is 8.5 percent, and the share of the other taxes' revenues is accounted for 12.9 percent. Figure 1 indicates that Japan's municipal governments use multiple tax system to collect their tax revenues and largely depend on two tax sources; the property taxes and personal income taxes.

The issue of relationships between changes of tax revenues and diversification of tax revenue structures in local governments has been a classical topic in local government finance and studied from two different perspectives.

First perspective is the revenue diversity hypothesis, which states that revenue diversities improve stabilities of total tax revenues and is advocated mainly by public administrators. One of the most famous statements advocating this hypothesis is the seminal report, "Principles of a High-Quality State Revenue System," which was published in 1992.

This report argued that a diversification of local tax revenue structure contributed to collect local tax revenue stably because “All taxes have their advantages and disadvantages, but reliance of a diverse assortment can cancel out their biases” (NCSL 1992, 8). A lot of literatures studied the verification of the diversity hypothesis. Today’s common suggestion from dominated findings in a lot of previous studies is that diversifications of revenue structures improve a stability of total revenue (Carroll 2009; Kwak 2013).

Second perspective is the fiscal illusion hypothesis, which states that using multiple sources to collect revenues makes a budget process more complex, and this complexity expands public expenditures through the fiscal illusion and leads to inefficient public management such as overproduction of public services. The representative perspective favoring this hypothesis is that of public choice group (Buchanan 1949). Contrary to the findings in the revenue diversity hypothesis, the suggestions from previous empirical works on the fiscal illusion issue does not reach consensus (Carroll 2009): some literatures suggested that the revenue complexity leads to expansion of revenues and expenditures, and other literatures, however, suggested that revenue complexity has no impact on changes of revenues and expenditures.

A lot of studies on these two hypotheses have been accumulated. Although, in most of previous papers, the relationship between the revenue diversity hypothesis and the fiscal illusion hypothesis might be ambiguous, it is important to clear the relationship between the diversity hypothesis and the fiscal illusion hypothesis. Therefore, as the first contribution of this paper, this paper examines the revenue diversity hypothesis from the short-term perspective and the fiscal illusion hypothesis from the long-term perspective. An advantage of this approach is to be able to explain the compatibility of two hypotheses without contradiction; local governments can improve the stabilities of their tax revenues in the short-term, at the same time, local governments will expand their tax revenues and expenditures in the long-term. A lot of previous literatures consider that the revenue stability is the short-term perspective. Moreover, this paper considers that it is acceptable intuitively to capture the phenomenon of the fiscal illusion in the

long-term perspective.

This paper uses a different measurement from most of previous papers studying the revenue diversity hypothesis. Most of recent previous studies (White 1983; Carroll and Stater 2008; Carroll 2009; Kwak 2013) measured tax revenue stabilities using the method of White (1983), which is called as “the deviation-from-trend-approach” in Kwak (2013, 45). Although the method of White (1983) is easy to understand intuitively and has no disadvantage in measuring tax revenue stabilities, this paper uses the short-term income elasticity of total tax revenue as a measurement of tax revenue stability. This methodology follows the suggestions of Sobel and Holcombe (1996).

In the estimation of the fiscal illusion hypothesis, this paper considers a tax revenue growth as a proxy variable of government’s revenue and expenditure expanding. The tax revenue growth is measured by the long-term income elasticity of total tax revenue, which also follows the methodology of Sobel and Holcombe (1996).

The last contribution of this paper is to include an interaction term in estimated equations verifying the hypotheses. Although there are a lot of empirical works on the revenue diversity and the fiscal illusion, a few studies explore the interactive effect (Carroll 2009). However, interaction terms are useful because they can directly indicate whether an increase of diversity improves the tax revenue stability in the short-term, and whether an increase of complexity expands government’s revenues and expenditures through the revenue growth in the long-term.

This paper is organized as follows. The next section describes the hypotheses verified in this paper and explains the data and method used in estimations. The third section shows the results from estimations and discusses the implications. The last section concludes.

DATA and METHOD

This paper tests two following hypotheses focusing on Japan's municipal tax revenues. First hypothesis is the diversity hypothesis; whether the diversification of municipal tax revenue structures improves the stability of total tax revenue in the short-term. Second hypothesis is the fiscal illusion hypothesis; whether the complexity of municipal tax revenue structures increases a degree of the growth level of the total tax revenue in the long-term.

In order to test two hypotheses, this paper practices two estimations. First, the revenue diversity hypothesis is tested by estimating the stability of total tax revenues in municipal governments and an effect of the diversity of tax revenue structures on the tax revenue stability. Second, the fiscal illusion hypothesis is tested by estimating the revenue growth of total tax revenues in municipal governments and an effect of the complexity of tax revenue structures on the tax revenue growth.

This paper uses the data of municipal tax revenues and prefectural GDP in Japan from FY2009 to FY2013. The data of municipal tax revenues are from the Ministry of Communication and Public Affairs[1], and the prefectural GDP s are from the Cabinet Office of Japan[2]. This paper uses these data as panels.

Most of recent studies used a Hirschman-Herfindahl Index (HHI) as a measurement of tax revenue diversity (Suyderhoud 1994; Hendrick 2002; Carrol, Eger and Marlowe 2003; Carroll 2005; Jordan and wager 2008; Carroll 2009; Carroll and Johnson 2010). According to these previous studies, this paper also uses the HHI in order to measure the diversity of total tax revenue structures. The HHI for the tax revenue diversity is defined as follows,

$$\text{HHI} = \frac{1-\sum_{i=1}^{n} S_i^2}{1-\frac{1}{n}} \quad .$$

[1] Shichoson-Betu Kessann Jyokyo Shirabe
[2] Kenmin Keizai Keisan

S_i is the share of tax *i*'s revenue of total tax revenues, *n* is the number of taxes used by each municipality. As shown in Figure 1, this paper divides municipal taxes into four groups; personal income tax, corporate income tax, property tax, and the other taxes. Accordingly, the number of municipal taxes is four. The HHI ranges from zero to one. The HHI reaches the maximum number of one when each tax has the equal share of tax revenues. On the other hand, the HHI reaches the minimum number of zero when only one tax collects all tax revenues.

Table 1 summarizes descriptive statistics of three variables; the total tax revenues, the prefectural GDP, and the HHI. This paper uses the total tax revenues as a dependent variable, the prefectural GDP and the HHI as independent variables in estimations.

<Table 1>

The diversity hypothesis is tested by estimating the following error collection model[3],

$$\Delta lnR_{it} = \alpha + \beta_1 \Delta lnY_{it} + \beta_2 \Delta HHI_{it} + \beta_3 \Delta lnY_{it} * \Delta HHI_{it} + \varepsilon_{it} + u_{it}. \quad (1)$$

R_{it} is a dependent variable and demotes a municipal *i*'s tax revenue in fiscal year *t*, Y_{it} is an independent variable and denotes a prefectural GDP in municipal *i*'s area in fiscal year *t*, HHI_{it} is an independent variable and denotes a municipal *i*'s revenue diversity in fiscal year *t*. Considering two way fixed effects, this equation includes ε_{it} as unobserved fixed effects. u_{it} is an error terms with zero means.

A coefficient of ΔlnY_{it}, β_1, is the short-term income elasticity of tax revenue, which is a measurement of tax revenue stability. When β_1 less than one, the change rate of the total tax revenue is smaller than that of prefectural GDP in the short-term perspective; the total tax

[3] "An error correction model allows us to study the short-term dynamics in the relationship between (two variables). (Wooldridge, 643)

revenue is considered to be stable. On the other hand, when β_1 is larger than one, the change rate of the total tax revenue is larger than that of prefectural GDP in the short-term perspective; the total tax revenue is considered to be instable. When β_1 is equal to one, the volatility of the total tax revenue is considered to be neutral to the changes of prefectural GDP in the short-term perspective. This methodology follows the suggestions of Sobel and Holcombe (1996) and is the same as Ishida (2011, 2013).

A coefficient of ΔHHI_{it}, β_2, means the percentage change in total tax revenue given one additional change of HHI. A positive β_2 indicates that the increasing of HHI will increase the total tax revenue in the short-term perspective. On the other hand, a negative β_2 indicates that the increasing of HHI will decrease the total tax revenue in the short-term perspective.

A β_3 is a coefficient of the interaction term of prefectural GDP and the diversity of total tax revenue. The interaction term denotes an interaction effect of the diversity of the total tax revenues on the stability of the total tax revenues. Equation (2), which is from Equation (1), can explain the meaning of the interaction term.

$$\Delta lnR_{it} = \alpha + (\beta_1 + \beta_3 \Delta HHI_{it})\Delta lnY_{it} + \beta_2 \Delta HHI_{it} + \varepsilon_{it} + u_{it}. \quad (2)$$

When the coefficient β_3 is positive, increasing of tax revenue diversity increases the $\beta_1 + \beta_3 \Delta HHI_{it}$, which means the short-term income elasticity of total tax revenues including the effect of the diversity of total tax revenues. Therefore, a positive β_3 means that total tax revenue diversification decreases the stability of total tax revenues in the short-term perspective. On the other hand, when the coefficient β_3 is negative, increasing of tax revenue diversity decreases the short-term income elasticity of total tax revenues with including the effect of the diversity of total tax revenues. Therefore, a negative β_3 means that total tax revenue diversification increases the stability of total tax revenues in the short-term perspective.

The fiscal illusion hypothesis is tested by estimating the following ordinary level

model,

(3) $$lnR_{it} = \alpha + \beta_1 lnY_{it} + \beta_2 HHI_{it} + \beta_3 lnY_{it} * HHI_{it} + \varepsilon_{it} + u_{it}.$$

Notations of each variable, R_{it}, Y_{it}, ε_{it}, u_{it}, in Equation (3) are the same as Equation (1). However, Equation (3) interprets the HHI_{it} as denoting the complexities of total tax revenue structures.

A coefficient of lnY_{it}, β_1 ,is the long-term income elasticity of total tax revenue, which is a measurement of tax revenue growth. When β_1 less than one, the growth rate of the total tax revenue is smaller than that of prefectural GDP in the long-term perspective; the total tax revenue is considered to be low-growth. On the other hand, when β_1 is larger than one, the growth rate of the total tax revenue is larger than that of prefectural GDP in the long-term perspective; the total tax revenue is considered to be high-growth. When β_1 is equal to one, the growth rate of the total tax revenue is equal to that of prefectural GDP in the long-term perspective. This methodology also follows the suggestions of Sobel and Holcombe (1996) and is the same as Ishida (2011, 2013).

A coefficient of HHI_{it}, β_2, means the percentage change in total tax revenue given one additional change of HHI. A positive β_2 indicates that the increasing of HHI will increase the total tax revenue in the long-term perspective. On the other hand, a negative β_2 indicates that the increasing of HHI will decrease the total tax revenue in the long-term perspective.

A β_3 is a coefficient of the interaction term of prefectural GDP and the complexity of total tax revenue. The interaction term denotes an interactive effect of the complexity of total tax revenues on the expanding of total tax revenues. Equation (4), which is from Equation (3), can explain the meaning of the interaction term.

(4) $$lnR_{it} = \alpha + (\beta_1 + \beta_3 HHI_{it}) lnY_{it} + \beta_2 HHI_{it} + \varepsilon_{it} + u_{it}$$

When the coefficient β_3 is positive, increasing of tax revenue complexity increases the $\beta_1 + \beta_3 HHI_{it}$, which means the long-term income elasticity of total tax revenues including the effect of the complexity of total tax revenues. Therefore, a positive β_3 means that the more complicated structures of total tax revenues grow total tax revenue more rapidly in the long-term perspective. On the other hand, when the coefficient β_3 is negative, increasing of tax revenue complexity decreases the long-term income elasticity of total tax revenues with including the effect of the complexity of total tax revenue structures. Therefore, a negative β_3 means that more complicated structures of total tax revenues grow total tax revenue more slowly in the long-term perspective.

Because this paper uses the total tax revenue growth as a proxy of municipal government's expenditure growth, the effect of an interaction term implies that the effect of total tax revenue complexity on the government's revenue growth. Accordingly, a positive coefficient β_3 means that more complicated structures of the total tax revenue increases an expanding of the government's expenditure in the long-term perspective. On the other hand, a negative coefficient β_3 means that more complicated structures of the total tax revenue decrease an expanding of the government's expenditure in the long-term perspective.

The results from the two way fixed effects estimation of Equation (1) and (3) are summarized in Table 2 and 3, respectively.

RESULTS and DISCUSSIONS

Table 2 summarizes the estimated results of Equation (1), which tests the revenue diversity hypothesis. The coefficient β_1 is 0.55, which is significant at 1 percent level. The estimated β_1 is less than one, and then the total revenue of municipal taxes are stable in the short-term. The estimated coefficient β_2 is positive with significant at 1 percent level. The

positive β_2 suggests that the increasing of the HHI increases the total tax revenue in the short-term perspective. The estimated coefficient β_3 is negative with significant at 1 percent level. The estimated negative β_3 suggests that an increasing of the diversity of total tax revenue decreases the income elasticity of total tax revenue in the short-term. Accordingly, more diversified structure of the total tax revenue improves the stability of total tax revenue in the short-term.

The implications from Table 2 are summarized as follows; the total tax revenues are stable; the increase of the diversity of the total tax revenues increases the total tax revenues; the increase of the diversity of the total tax revenues increases the stability of total tax revenues.

<Table 2>

Results showed in Table 2 suggests that Japan's local tax system can achieve more stability of total tax revenue by diversifying total tax revenue structure. This suggestion is consistent with that of a lot of previous studies, which suggested that the revenue diversity can improve the revenue stability.

In the HHI, more diversified structure of total tax revenue means more balanced structure of the total tax revenue. Seeing from Figure 1, it is necessary to increase the share of corporate income tax in order to achieve the more diversification of the total tax revenue of municipal taxes. Therefore, this paper's results can state such an implication that increasing the share of corporate tax revenues in total municipal tax revenues can improve the stability of total tax revenues.

Although such an implication is consistent with the findings in a lot of previous studies, the actual tax reform in Japan has been oriented the opposite direction: the local corporate tax has been decreased and the property tax has been increased. These local tax policies are based on the reasoning that the property tax revenues seem stable and the corporate

tax revenues seem instable. Japan's government considers that in order to improve the stabilities of total tax revenues it is desirable to increase the share of stable tax revenues and to decrease the share of instable tax revenues; the former tax is the property tax, the latter tax is the local corporate tax. However, this paper's results suggest that such a Japan's tax policy leads the stabilities of municipal tax revenues into the opposite direction.

Table 3 summarizes the estimated results of Equation (3), which tests the fiscal illusion hypothesis. The estimated coefficient β_1 is 0.15, which is significant at 1 percent level. The estimated β_1 with less than one mean that total revenues of municipal taxes grow more slowly than the prefectural GDP in the long-term. The estimated coefficient β_2 is negative with significant at 1 percent level. The negative β_2 indicates that the increasing of HHI decreases the total tax revenue in the long-term perspective. The estimated coefficient β_3 is positive with significant at 1 percent level. The positive coefficient β_3 means that the increasing complexity of total tax revenues in municipalities expands the total tax revenue in the long-term. Accordingly, the result suggests that there exists the fiscal illusion in municipal taxes.

The implications from Table 3 are summarized as follows; the total tax revenues are high-growth; the increase of the complexity of the total tax revenues decreases the total tax revenues; the increase of the complexity of the total tax revenues increases the growth rate of total tax revenues.

<Table 3>

It should be cautious to interpret the results of Table 3 as evidence for testing the fiscal illusion hypothesis. This paper's explorations use the growth of total tax revenues as a proxy of the expanding of municipal expenditures. This means that the results suggests an indirect effect of the complexity of the total tax revenue on the change of expenditures through the total tax revenues' expanding, instead of indicating a direct impact of the complexity of the total tax

revenues on the expenditure's expanding. However, because it is reasonable to consider that there is a certain relationship between the changes of the total tax revenues and the changes of the municipal expenditures, it can be acceptable to interpret the results of Table 3 as evidence of the existence of the fiscal illusion.

This paper uses a single measurement both for diversity and complexity of tax revenues. This means that more diversified revenue structure is, at the same time, more complexed revenue structure. Therefore, this paper can get the implication that increasing the share of corporate tax in total municipal tax and decreasing the share of property tax revenue will lead the municipal tax revenues to be stable in the short-term and the municipal tax revenues and expenditures to grow and expand in the long-term.

Although it is widely dominated that the tax revenue stability is desirable, there are different views among the desirability of the tax revenue growth. The growth of tax revenues is not desirable from the perspective of a fiscal illusion; however, it can be desirable for managing the budget flexibly, especially for local public administrators. This paper does not step in this issue of the desirability of the tax revenue's growth. Therefore, this paper does not suggest normatively that the share of the corporate tax revenue should be increased and the share of the property tax revenue should be decreased. Instead of such normative suggestions, this paper suggests positively that more balanced tax revenue structure will cause to grow the total tax revenue and to expand government's expenditure in the long-term.

CONCLUSION

This paper explores two relationships between the total tax revenue structures and the total tax revenue changes in Japan's municipal taxes during the period of FY2009 to FY2013. First relationship is the revenue diversity hypothesis; the short-term relationship between the diversity of the total tax revenues and the stability of that. Second relationship is the fiscal

illusion hypothesis; the long-term relationship between the complexity of the total tax revenues and the growth of that. Both revenue diversity and revenue complexity are measured by the HHI as a single measurement. The short-term stability of the total tax revenues is measured by the income elasticity of total tax revenues in the short-term using an error correction model. The long-term growth of the total tax revenues is measured by the income elasticity of total tax revenues in the long-term using ordinary level model.

This paper's main findings are as follows: (1) in the short-term, the total tax revenues are stable and the diversity has an effect of improving the stability of the total tax revenues, (2) in the long-term, the total tax revenues are high-growth and the complexity has an effect of growing the total tax revenues. These findings imply that both the revenue diversity hypothesis and the fiscal illusion hypothesis hold in the short-term and the long-term, respectively.

These findings and suggestions are consistent with those of the previous papers. Accordingly, these are not new in themselves. However, this is the first paper dealing with this issue using Japan's municipal taxes. Moreover, there are few papers to use the interaction term testing the diversity hypothesis. Although there are some issues to be developed in the future, this paper seems to contribute the issue of the diversity and the change of tax revenues.

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Figure 1. Structuers of Municipal Tax Revenues
(% is a share of total revenue)

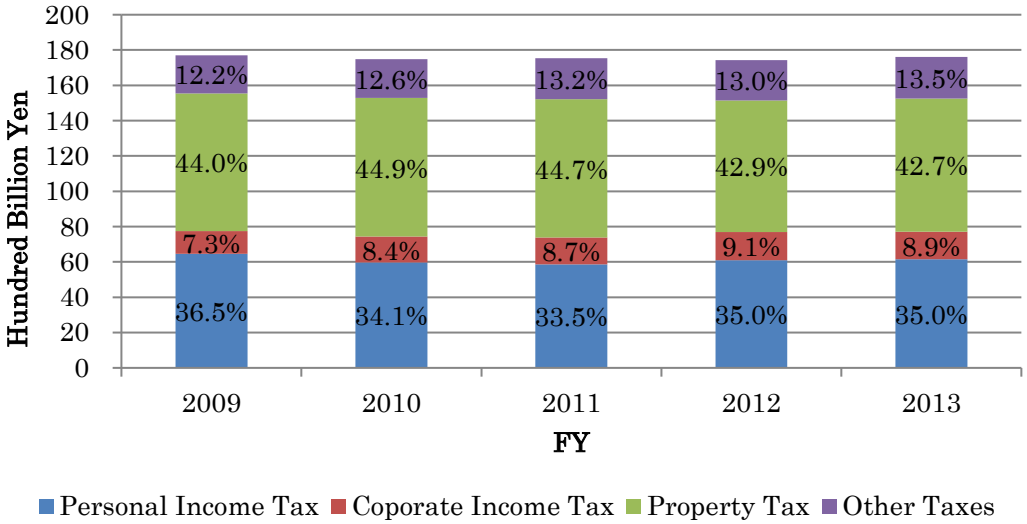

TABLE 1

Descriptive Statistics

	Mean	Max.	Min.	Std. Dev.	Obs.
Dependent Variable					
Tax Revenue	10,191,231	7.14E+08	23,187	33,694,714	8,611
Independent Variable					
Prefectural GDP	12,957,179	93,128,268	1,756,551	14,918,042	8,611
Revenue Diversity	0.814539	0.968148	0.059782	0.094703	8,611

TABLE 2

Estimations of Equation (1)

Variable	Coefficient
ΔlnY_{it}	0.548230*** (0.035941)
ΔRD_{it}	0.649568*** (0.036897)
$\Delta lnY_{it} * \Delta RD_{it}$	-14.26819*** (0.922388)
Total panel (unbalanced) observations are 6875.	
Adjusted R-squared is 0.022268. Prob(F-statistic) is 0.013199.	

Note: Parenthesis is a standard error. * is p<0.1, ** is p<0.05, *** is p<0.01.

TABLE 3

Estimations of Equation (3)

Variable	Coefficient
lnY_{it}	0.149067*** (0.049542)
RD_{it}	-3.951719*** (0.695747)
$lnY_{it} * RD_{it}$	0.258266*** (0.044290)
Total panel (unbalanced) observations are 8611.	
Adjusted R-squared is 0.998907. Prob(F-statistic) is 0.000000.	

Notes: Parenthesis is a standard error. * is p<0.1, ** is p<0.05, *** is p<0.01.