

Appearance Process of Relationship between Public Financial Reports and Local Government Bond Market: A Statistical Study Using U.S. States' Data

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Abstract

The purpose of this study is to examine the time-dependent relationship between the financial conditions and bond ratings of local governments and construct hypotheses about the process. To achieve this purpose, this study investigates the time-series behavior of the relationship between financial indicators calculated from net asset information of Public Financial Reports (PFRs) prepared under the Governmental Accounting Standards Board (GASB) Statement No. 34 and state bond ratings, referred to herein as the NA-BR relationship. Results of the empirical analysis show that the NA-BR relationship appears gradually, not immediately, after the implementation of GASB Statement No. 34. The gradual appearance suggests that the NA-BR relationship is caused by gradually increasing factors, such as the variance of the financial conditions of U.S. states.

Keywords:

Public Accounting, Local Government, Financial Condition, Local Government Bond

(1) Introduction

In 2015, the Japanese central government's Ministry of Internal Affairs and Communications (MIC) released uniform accounting standards for local governments, which required that public financial reports (PFRs) be prepared on a full accrual basis no later than the fiscal 2017 (MIC, 2015). This implementation of uniform, full accrual-based accounting standards for

local governments is an important event in the history of Japanese local autonomy for several reasons. Prior to the early 2000s, Japanese local governments operated solely with a cash-based accounting system. In addition, PFRs lacked comparability among local governments even after the MIC published its first accounting guidelines in 2001.

Several studies have pointed out

that accrual-based PFRs are useful for assessing the financial condition of local governments (Wang *et al.*, 2007; Rivenbark *et al.*, 2010). Of particular importance is that PFRs enable us to measure stock-based financial conditions that are difficult to be measured using a cash-based accounting system. Thus, with the implementation of accrual-based PFRs in Japan, investors in bond markets are able to obtain information of comparable stock-based financial conditions.

The main focus of our research is the usefulness of accrual-based PFRs for assessing the financial condition of local governments. In this study, we focus on the relationship between government financial condition and credit risk, which is typically represented by bond ratings. Previous studies on U.S. local governments shed light on the relationship between PFRs and bond ratings and showed that financial indicators calculated using information in the PFRs of U.S. local governments have a significant effect on bond ratings (Plummer *et al.*, 2007; Johnson *et al.*, 2012; Pridgen and Wilder, 2013; Callahan and Waymire, 2015). Haraguchi (2018a) pointed out that although the relationship between the net asset information from PFRs and bond ratings (NA-BR relationship) was apparent for U.S. states, there was no NA-BR relationship in Japan in 2012

(before the implementation of the uniform accounting standards).

We would like to emphasize that uniform accrual-based PFRs were fully implemented in the U.S. in 1999 by the Governmental Accounting Standards Board (GASB), and the NA-BR relationship appeared in 2012. This suggests the possibility of the future appearance of the NA-BR relationship in Japan⁽¹⁾.

Japanese interest rates significantly depend on bond ratings (Nakazato, 2008). The possibility of the future appearance of the Japanese NA-BR relationship indicates that Japanese local governments with lower net asset ratios should immediately assess the risk of decreasing bond ratings. The investigation of the possibility of the appearance of the NA-BR relationship is very important in Japan, where the uniform accrual-based accounting standard was just implemented in 2017.

Clarifying the factors that cause the appearance of the NA-BR relationship (hereafter, appearance factors) is necessary to investigate the possible appearance of such a relationship. No studies have ever tried to clarify these factors. This study uses a time-series analysis of the NA-BR relationship for clarification. If the relationship appears immediately after the implementation of the uniform accounting standards, the factors must

⁽¹⁾ It should be also noted that the accurate prediction of this appearance is difficult because there are many differences between Japan and the

U.S. in terms of autonomy and the local government bond markets.

be ones that are sufficiently present at the time of implementation. On the other hand, if the relationship appears gradually, the factors must be ones that are not present at implementation but gradually increase over time. Therefore, it is necessary to elucidate whether the relationship appears immediately or gradually after implementation in order to clarify the appearance factors. Subsequently, we must develop the hypothesis to explain the appearance process (appearance hypothesis) and verify it. However, as no studies have ever tried to conduct a time-series analysis of the NA-BR relationship, the appearance hypothesis has never been developed.

The purpose of this study is to develop the hypothesis through a time-series analysis of the NA-BR relationship in U.S. states and obtain implications for Japan. The reason to conduct this investigation in the U.S. are as follows. First, U.S. states are appropriate for the benchmark because the appearance of the NA-BR relationship has already been clearly observed. Second, sufficient data is available as the uniform accounting standard of PFRs was implemented 20 years ago, according to Statement No. 34 of the GASB (GASB34). Third, there are several studies that have investigated the relationship between PFRs and bond ratings, and the accumulated knowledge is helpful for developing the hypothesis.

⁽²⁾ “Restricted and Unrestricted net assets” is equivalent with “Net assets- (Invested in

(2) Method

We define a financial indicator and a bond rating indicator to numerically evaluate the net asset information of U.S. states and bond ratings in order to analyze the NA-BR relationship.

1. Financial Indicators

There is little agreement on what indicators definitively represent financial condition (Wang *et al.*, 2007, p.4). We use net asset ratio (NAR) to investigate the NA-BR relationship, as defined in Wang *et al.* (2007, p.8) and also used in Haraguchi (2018a). The definitions of NAR are given below:

Net asset ratio (NAR)

= Restricted and Unrestricted

net assets / Total assets

= (Net assets – (Invested in capital assets, net of related debt))/Total assets⁽²⁾

There are several reasons to use NAR in this study, the first of which is the importance of NAR in U.S. states. To detect the NA-BR relationship, we have to select financial indicators that significantly affect bond ratings. NAR is adequate since the significance of the effect of NAR on bond ratings has been already detected in a past study (Haraguchi, 2018a). Second, as the purpose of this study is to obtain implications for Japan through the time-series behavior of the NA-BR relationship in the U.S., the

capital assets, net of related debt)” (GASB, 1999).

international comparability of NAR is important. Our analysis requires us to use indicators with sufficient international comparability between the two countries because the results of this study should be able to be compared with Japanese results. Thus, in order to confirm comparability, the indicators in this study must be verified to determine whether modification is necessary considering the characteristics of autonomy in each country. Using NAR allows us to develop an argument more efficiently than selecting (or developing) a new indicator, since the comparability of NAR has been already established in Haraguchi (2017). Third, Wang *et al.* (2007) was one of the representative studies that developed the method to measure the financial condition of states using PFRs. This particular study has been described as “the first large-scale study since the adoption of GASB34” (Stone *et al.*, 2015, p.95), and a number of studies have since made reference to it (see Kravchuk and Stone, 2010; Johnson *et al.*, 2012; Clark, 2015; Tantardini *et al.*, 2017).

2. Bond Ratings

We introduce a new indicator to numerically evaluate bond ratings, “RATING.” Table 1 shows the definition of RATING.

Table 1 Definition of RATING

| bond rating by S&P | AAA | AA+ | AA | AA- |
|--------------------|-----|-----|----|-----|
| RATING | 8 | 7 | 6 | 5 |
| | A+ | A | A- | BBB |
| | 4 | 3 | 2 | 1 |

The ratings of general obligation bonds issued by S&P are used to calculate RATING. A higher RATING indicates a state’s greater ability to issue bonds.

3. Evaluation of the NA-BR relationship

We calculate Pearson’s correlation coefficients for each year to evaluate the NA-BR relationship using NAR and RATING (COR_NAR). The correlation coefficients between financial indicators and bond rating indicators have been calculated in previous studies (Plummer *et al.*, 2007; Pridgen and Wilder, 2013; Callahan and Waymire 2015); however, none of these studies examined the time-series behavior of states’ COR_NAR. The NARs of each year are calculated using the PFRs of the respective fiscal years. The RATINGS of each year are calculated using bond ratings at the end of each year.

4. Data

To examine the time-series behavior of the NA-BR relationship over the long term, we selected 613 PFRs from U.S. states for a 14-year period (2002–2015) in which S&P issued bond ratings for general obligation bonds. Table 2 shows a list of PFRs and bond ratings; the former have been collected from state government websites, and the latter from the S&P website “History of U.S. State Ratings.” The bond ratings at the end of each year (after PFRs of each year are published and publicly released) are used to

calculate COR_NAR. All these PFRs are based on GASB34 and have comparability.

Table 2 List of PFRs used in this study

| States | BBR | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | n |
|----------------|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|
| Alabama | G1 | | | | • | • | • | • | • | • | • | • | • | • | • | 11 |
| Alaska | G2 | | • | • | • | • | • | • | • | • | • | • | • | • | • | 13 |
| Arizona | G1 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| Arkansas | G2 | | • | • | • | • | • | • | • | • | • | • | • | • | • | 13 |
| California | G2 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| Colorado | G2 | | | | | | • | • | • | • | • | • | • | • | • | 9 |
| Connecticut | G2 | | | | | | | | • | • | • | • | • | • | • | 7 |
| Delaware | G2 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| Florida | G2 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| Georgia | G2 | | | | | | | | | | | • | • | • | • | 4 |
| Hawaii | G2 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| Idaho | G2 | | | | | | | • | • | • | • | • | • | • | • | 8 |
| Illinois | G2 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| Indiana | G2 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| Iowa | G2 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| Kansas | G2 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| Kentucky | G2 | | | | | • | • | • | • | • | • | • | • | • | • | 10 |
| Louisiana | G2 | | | | | | | | | • | • | • | • | • | • | 6 |
| Maine | G2 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| Maryland | G2 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| Massachusetts | G2 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| Michigan | G2 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| Minnesota | G2 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| Mississippi | G1 | | • | • | • | • | • | • | • | • | • | • | • | • | • | 13 |
| Missouri | G2 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| Montana | G1 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| Nebraska | G2 | | | | | • | • | • | • | • | • | • | • | • | • | 10 |
| Nevada | G2 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| New Hampshire | G2 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| New Jersey | G2 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| New Mexico | G2 | | • | • | • | • | • | • | • | • | • | • | • | • | • | 13 |
| New York | G2 | | • | • | • | • | • | • | • | • | • | • | • | • | • | 13 |
| North Carolina | G1 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| North Dakota | G2 | | | • | • | • | • | • | • | • | • | • | • | • | • | 12 |
| Ohio | G2 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| Oklahoma | G2 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| Oregon | G2 | | | | | • | • | • | • | • | • | • | • | • | • | 11 |
| Pennsylvania | G2 | | | | | • | • | • | • | • | • | • | • | • | • | 11 |
| Rhode Island | G2 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| South Carolina | G1 | | | | | | • | • | • | • | • | • | • | • | • | 9 |
| South Dakota | G2 | | | | | • | • | • | • | • | • | • | • | • | • | 11 |
| Tennessee | G2 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| Texas | G1 | | | | | | • | • | • | • | • | • | • | • | • | 9 |
| Utah | G2 | | | | | • | • | • | • | • | • | • | • | • | • | 10 |
| Vermont | G2 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| Virginia | G2 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| Washington | G2 | | | | | • | • | • | • | • | • | • | • | • | • | 11 |
| West Virginia | G2 | | | | | | | | • | • | • | • | • | • | • | 7 |
| Wisconsin | G1 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| Wyoming | G2 | • | • | • | • | • | • | • | • | • | • | • | • | • | • | 14 |
| n | | 28 | 33 | 34 | 39 | 42 | 45 | 46 | 48 | 49 | 49 | 50 | 50 | 50 | 50 | 613 |

(4) Results and Hypothesis

Development

For further analysis, we statistically examine the time-series behavior of the NA-BR relationship using the confidence intervals of COR_NAR and COR_OR . The confidence intervals are calculated using Fisher's Z transformation. The results are shown in Figure 1. The error bars show the 95% confidence intervals of COR_NAR (Figure 1). The broken horizontal lines show the minimum value of the 95% confidence interval of COR_NAR in 2015.

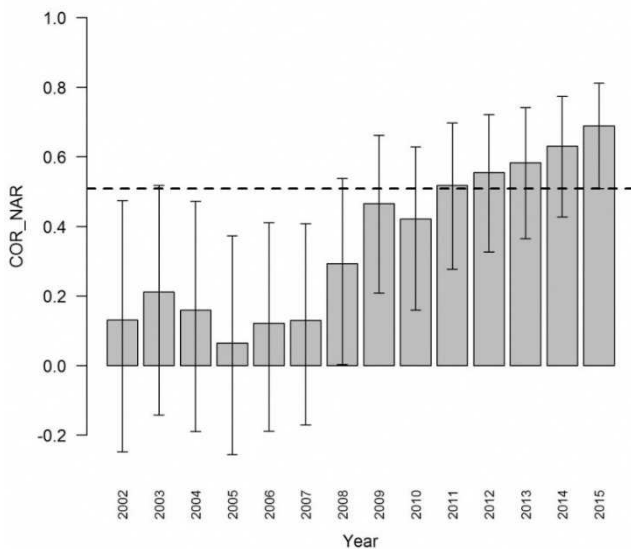


Figure 1 Time-Series Analysis of COR_NAR

In Figure 1, COR_NAR in 2002 is not significant because the minimum value of COR_NAR is less than zero. In addition, all of variation widths of COR_NAR in one year are not significant because all error bars overlap with the following year.

On the other hand, COR_NAR increases gradually over time; this

long-term increase is significant because COR_NAR in 2015 is significantly larger than all COR_NAR values prior to 2008, with the exception of 2003 (i.e., the minimum value of the confidence interval of COR_NAR in 2015 is larger than the maximum value of the confidence interval of COR_NAR in 2007 and earlier).

From these results, we develop the hypothesis that the relationship (i.e., the correlation coefficient between the stock measurement (NAR) and the bond rating measurement (RATING)) appears gradually, not immediately. We call this hypothesis the “gradual-appearance hypothesis.”

The gradual-appearance hypothesis insists that the appearance of the NA-BR relationship has been caused by gradually increasing appearance factors. This implication (i.e., “gradual increasing of the appearance factors”) is an important key to clarifying the appearance factors. As previously noted, as Japan has only recently completed the implementation of full-accrual PFRs, clarifying the appearance factors is very important because they can indicate the future Japanese NA-BR relationship.

(5) Discussion

1. Variance of NAR

We focus on the NAR variances to clarify appearance factors because of their importance to the relationship-appearance. When the differences in the financial conditions (i.e., NARs) among local governments are small, they will

have little effect on bond ratings because the ratings are not continuous; they are discrete values. In addition, rating agencies would not reflect NARs in bond ratings if the NAR variances are not material enough. That is to say, a sufficient variance of PFR indicators among local governments is necessary for the appearance of the NA-BR relationship. We also note that the NAR variances indicate the differences in the financial conditions of the individual states, and these are very interesting values to discuss policies related to autonomy. Other appearance factors will be discussed in Section 6 as areas for future research.

If the NAR variances have increased gradually over time, the gradual-appearance hypothesis and the assertion that NAR variances cause the

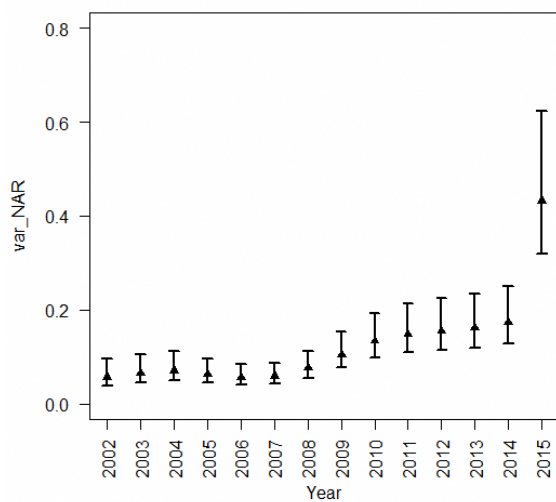


Figure 2: Time-series analysis of var_NAR
 NA-BR relationship can be explained self-consistently. Figure 2 shows the time-series analysis of the NAR variances.

The variance “var_NAR” in each year is shown as ▲, and the error bars show the 95 % confidence intervals. Figure 3 shows the plots of NARs and RATINGS in each year. The confidence intervals of var_NARs are calculated using the chi-square distribution.

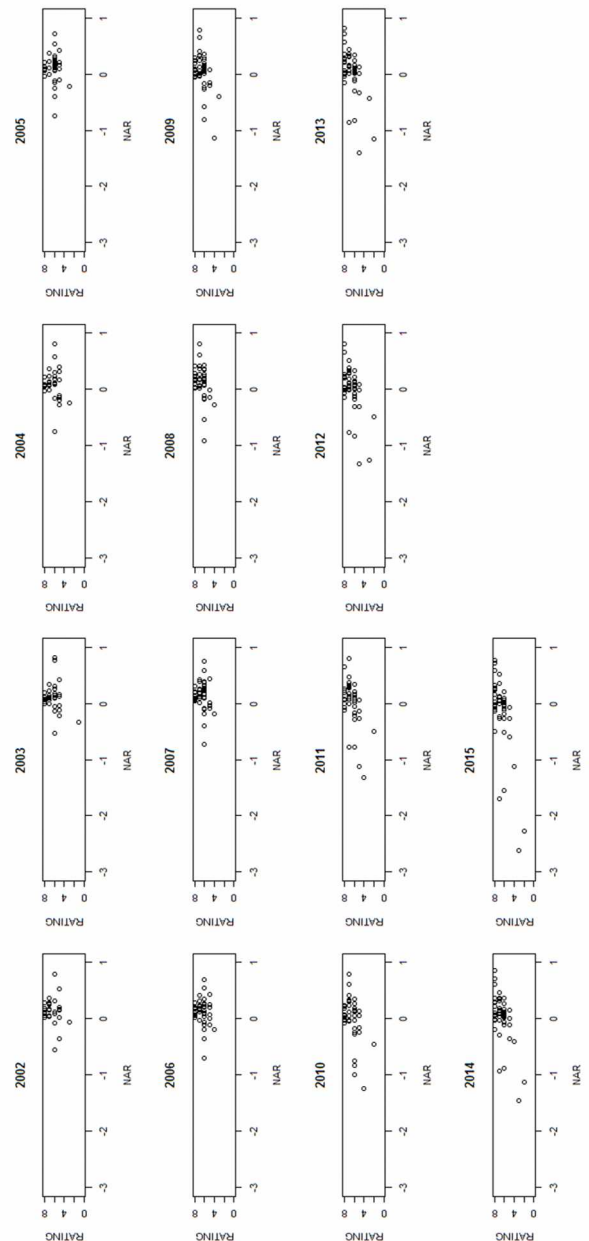


Figure 3 Plots of NAR and RATING

Figures 2 and 3 illustrate the following observations. First, var_NARs

in the U.S. tend to increase over time (i.e., the divergence of NARs). This result indicates that the stability of the stock-based financial condition tends to gradually decrease, and states with both higher and lower NARs have existed simultaneously in recent years. As shown in Figure 3, there are several states in which NARs have decreased significantly over time, and these states (with much lower NARs) have driven the divergence of NARs in the U.S.

Second, the differences in var_NARs for each consecutive two-year period are not significant between 2002 and 2014; however, the difference in var_NARs between 2002 and 2014 is significant. This result shows that NARs in U.S. states have diverged over the long term (over ten years) (hereafter, the long-term divergence of NARS). On the other hand, the difference in var_NARs between 2014 and 2015 is significant, unlike in other time periods. The divergence of NARs between 2014 and 2015 is assumed to be caused by the restatement of the net asset information for the beginning value of 2015 PFRs according to the adoption of GASB68, which changed the accounting rule for defined-benefit pension plans.

We recalculate NARs and var_NARs by adding (subtracting) the decreased (increased) value of net assets derived from these restatements to the numerator of the NARs in 2015 and verify the effect of these restatements. The difference in recalculated var_NARs between 2014 and 2015 is not significant. This result strongly

suggests that the significant difference between 2014 and 2015 is caused by the restatements of GASB68 (hereafter, the restatement-caused divergence).

The restatements pertained to the accounting treatment of the related debts derived from all activities since the establishments of local governments according to the change of the accounting rules. This resulted in the identification of hidden debt. The restatement-caused divergence is a result of reflecting the financial conditions of each state more appropriately following the PFR restatements (i.e., the identification of hidden debt according to the adoption of GASB68). S&P incorporated GASB68 for analyzing pension liabilities and deciding credit bond ratings for states according to S&P (2013).

Both of these two types of divergences are caused by long-term NAR variations (greater than one year). This means that the significant increase of var_NAR in the U.S. was caused by the long-term accumulation of NAR variations between 2002 and 2015.

The fact that the differences in var_NARs over the long term (short term) are significant (not significant) means that the short-term variations of NARs are significantly lower than long-term variations. The smaller differences in short-term var_NARs (the larger differences in long-term var_NARs) arose from the fact that there are few (several) states in which their NARs varied drastically.

States receive cash inflows from tax revenues each year. This is consistent with our results suggesting that short-term variations in stock-based financial conditions (NARs) are small. On the other hand, it is interesting that the accumulation of these small short-time variations (i.e. long-term variations) seriously worsened states' financial conditions.

As stated above, the correlation coefficients of NARs and RATINGS have been significantly positive in recent years. The change in financial conditions significantly affects states' financial management, as rating agencies tend to decrease the bond ratings of states with worsened financial conditions.

Following the previous discussion, we would like to emphasize the importance of PFRs in contrast to the cash-based financial statements historically used in Japan. Financial statements of local governments are divided into cash-basis financial statements and accrual-basis financial statements (i.e., PFRs in this study). Cash-basis financial statements are able to measure single-year variations in financial conditions. However, they are not able to measure the cumulative value of these variations. As stated above, the single-year variations of states' financial conditions are generally small, and the measurement of the accumulated variations over a longer period is necessary to detect any serious deterioration of financial conditions.

Therefore, cash-basis financial statements are not able to detect material deterioration in financial conditions. On the other hand, accrual-basis financial statements (PFRs) might be able to detect them. Our findings suggest the necessity of PFRs to measure stock-based financial conditions of local governments and the difficulty of measuring them without PFRs. The measurability of PFRs is important for rating agencies in deciding bond ratings.

It should be noted that there are some restrictions for PFRs and their usefulness for rating agencies. PFRs must have sufficient accuracy and comparability between each state since credit bond ratings are relative valuations. Without these, PFRs cannot be used for deciding bond ratings, particularly in cases where PFRs are based on different (not uniform) models.

PFRs based on the uniform accounting standards with sufficient accuracy and comparability provide information on stock-based financial conditions and variances (i.e., detection of states where NAR has deteriorated). This information contributes to the bond rating decision of rating agencies and should result in downgrades for states with worsened financial conditions and the appearance of the NA-BR relationship.

This result sheds light on the importance of measuring the stock-based financial condition of states and the decision-usefulness of PFRs. In addition, the gradual increase of

var_NAR self-consistently explains our findings; NAR variance is one of appearance factors of the NA-BR relationship, and the NA-BR relationship appears gradually over time.

2. Implications for Japan

With specific reference to the relevance to Japan, Haraguchi (2018b) revealed that the NAR variance of Japanese local governments was significantly smaller than that of U.S. states in 2012. Haraguchi (2018b) also pointed out that strict balanced budget requirements among Japanese local governments, as defined by Japanese laws, can decrease the NAR variance. The Japanese Local Autonomy Law states that the expenses in each fiscal year shall be financed with the revenues of the current fiscal year. In addition, the Japanese Local Finance Law asserts that the purpose of issuing debt is limited, in principle, to the purchase or maintenance of infrastructure. These pieces of legislation effectively restrict all Japanese local governments from carrying over deficits into the next fiscal year and signify that the balanced budget requirements of Japanese local governments are very strict. Haraguchi and Oishi (2019) investigated NAR variances in Japan and the U.S. They found that the NAR variance in Japanese local governments is much smaller than in U.S. states in both 2012 (before implementation of uniform accounting standards) and 2017 (after

implementation). These results suggest that the variances of NARs in Japan are generally smaller than in the U.S. However, the possibility of future divergence of NARs in Japan cannot be denied.

We should also focus on the significant effect of the restatements by GASB68 in the U.S. There is no possibility for similar restatements in Japan since Japanese local governments do not owe debts related to defined benefit pension plans; however, there are several possibilities for other hidden debts unique to Japan. For example, Japanese uniform accounting standards allow local governments to account for obligations of lump-sum payments as the total value of lump-sum payments assuming that all employees retire at the end of the year. The amount of these obligations may vary significantly when the accounting standards require the use of the discounted cash flow method.

Another example is an obligatory assurance (OA) for a multi-year project of Japanese local governments. The Japanese Local Autonomy Law states that a local government must obtain a local assembly's approval for OAs when there is a possibility of future payments from the local government. Japanese uniform accounting standards require local governments to count only defined OA amounts as obligations, and undefined amounts of OA are not included. This means that amounts of future payments that can vary slightly, such as payments for construction

projects continuing for several years, may not be accounted for as obligations. These unaccounted future payments may cause obligation amounts to vary when accounted for using adequate estimations.

Our results suggest that future amendments of Japanese accounting standards that result in PFR restatements may cause variations in stock-based financial indicators of local governments. As stated above, we note that single-year variations in financial conditions of U.S. states are generally small, and those of Japanese local governments may be similar because of the stabilizing mechanisms used in local government finance, such as tax allocations from the national government. Thus, the possibility of the future divergence of Japanese NARs may be decreased but cannot be denied, suggesting the possible appearance of the NA-BR relationship in Japan.

The implementation of Japanese uniform PFR accounting standards reveals the stock-based financial condition of Japanese local governments with sufficient comparability and can provide useful information to rating agencies for bond rating decisions. As stated above, our results suggest that the variances in stock-based financial conditions, observed through the implementation of the uniform standards, caused the gradual appearance of the NA-BR relationship in U.S. Not only can PFRs based on uniform accounting standards bring useful information for the ratings

decision, they form a core part of the information infrastructure of the bond market in Japan.

(6) Summary and Future Research

This study investigated the time-series behavior of the NA-BR relationship in U.S. states in order to construct a hypothesis that explains the appearance process of the relationship. We built the “gradual-appearance hypothesis” stating that the NA-BR relationship appears gradually, not immediately, after the implementation of the uniform accounting standards. In addition, we revealed the possibility that the gradual appearance of the NA-BR relationship is caused by the gradual increase of the NAR variance by confirming that the variance of NARs in the U.S. increased over time. Our results suggest that PFRs based on the uniform standard bring information to rating agencies that is useful in deciding bond ratings. It is also noted that these results imply the possibility of future appearance of the NA-BR relationship in Japan and contribute to establishing the significance of the implementation of the uniform standards. This study offers a new perspective on time-series behavior for this topic, and the evidence we provide will contribute to clarifying the utility of PFR information in bond markets.

However, additional studies are needed for further verification of the gradual-appearance hypothesis. First, a time-series analysis of the Japanese NA-BR relationship is needed,

especially after the implementation of the uniform PFR standard, to verify the applicability of the hypothesis. This study only investigated the NA-BR relationship in U.S. states. The classification analysis in the U.S. can be also useful to verify our conclusion that the NAR variance causes the NA-BR relationship. By classifying the states into two groups, states with lower NAR variance and states with higher NAR variance, we can investigate the appearance process of the NA-BR relationship for each of the respective groups over time.

Second, further clarification of the appearance factors is important. There can be several appearance factors other than NAR variance. The cancellation of divergence between a financial indicator evaluation and a bond rating evaluation is an example. The NA-BR relationship will not appear without the cancellation of divergence. A state with a lower financial indicator evaluation (i.e., NAR of the state is lower than that of other states) and higher bond rating evaluation (i.e., RATING of the state is higher than that of other states) contributes to decreasing COR_NAR for that year, according to Pearson's correlation coefficient. The cancellation of divergence can be caused by rating agencies' recognition of the importance of NARs. In addition, the increase in PFRs' reliability and the accumulation of knowledge, including academic studies and rating agencies' practical knowledge of evaluating financial conditions, also contribute to the

cancellation. However, we cannot clearly identify the reason for the cancellation, and theoretical and statistical analyses are needed for further investigation.

Finally, the effect of other PFR-based financial ratios should be also investigated to verify whether the gradual-appearance theory can be applicable to ratios other than NARs.

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