Channels of Stabilization in a System of Local Public Health Insurance: The Case of the National Health Insurance in Japan*

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Abstract
There are more than 1,700 municipalities serving as insurers in Japan’s system of National Health Insurance (NHI). The NHI has several institutional routes to buffer local premiums from abrupt changes in regional health demands that destabilize the NHI benefit expenditures. After briefly introducing the system of public health care in Japan, this study elaborates on the methods for quantifying the degree of stabilization of local public health care expenditures by critically evaluating the methods that have been utilized in the related literature and proposes a modified method appropriate for this study. It then quantifies the channels and degrees of stabilization using municipal NHI data in the 2000s.

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1. Introduction

The system of public health insurance is broadly classified into two groups: single-payer and multi-payer systems (Hussey and Anderson 2003). The Japanese system of public health insurance may be categorized as a non-competitive multi-payer system with two schemes of public health insurance: employment-based and residence-based. The National Health Insurance (NHI) is a residence-based system of public health insurance where individual municipalities insure their residents that are excluded from the employment-based scheme. This regional scheme may be comparable to the pre-1992 regional sickness funds in Germany and to the pre-2000 health insurance societies for the self-employed in Korea, both of which Hwang (2008) categorizes as the “traditional” German model. However, Germany made its system “competitive” in 1992 so that the insured can choose among different sickness funds, and reduced the number of regional funds from 269 in 1993 to only 17 in 1999. Meanwhile, Korea transformed its multi-payer system into a single-payer system in 1999. Therefore, Japan’s NHI is arguably the only non-competitive multiple payer system based on the traditional German model.

A multi-payer system has its own disadvantages over a single-payer system (Hussey and Anderson 2003). The system would be less effective in collecting revenues, controlling costs, and subsidizing health care for low-income individuals. In particular, it is less effective in pooling risks, since the law of large numbers dictates that risks, albeit unpredictable at the individual level, become more predictable as the group size becomes larger (Boadway and Bruce 1980). However, a number of municipalities tend to have smaller enrollment. Out of 1,722 insurers in fiscal year (FY) 2010, the numbers of municipalities with enrollments less than 1,000, 2,000, and 3,000 are respectively 106, 269, and 419. Furthermore, the smallest enrollment was 88! Smaller municipalities could not thus effectively spread risks within their jurisdictions by their own. In addition, the municipal NHI enrolls a riskier population than that in the other employment-based scheme. Such a riskier population includes self-employed non-professionals, the retired, and the unemployed. To counteract these disadvantages of the NHI system, therefore, there are both a system of inter-institutional transfers from the employment-based public health schemes and a system of inter-regional transfers within the NHI system that involves multiple layers of the government. Such fiscal transfers are expected to
smooth changes in municipal NHI premiums imposed on the insured local population—changes caused by shocks to local health demand.

One of the purposes of this study is to examine how such systems of transfers work in favor of spreading risks among the NHI insurers. I do so by measuring the degree of such smoothing effects of the transfers on the nexus between the changes in the NHI medical benefits (which reflect regional health care demand) and changes in the NHI premiums (which reflect fiscal burdens on the insured in a particular municipality). In particular, I examine how the volatility in regional health care demand is tamed through fiscal transfers and cost-sharing schemes at different levels of the government. Meanwhile, it is possible to argue that volatile municipal health demand may not be a serious issue even without the fiscal transfers, since municipalities as NHI insurers can borrow and lend to offset such adverse effects. To see how this argument applies to the Japanese case, I also examine the extent to which such inter-temporal adjustments contribute to smoothing changes in the NHI premiums.

The smoothing effects of interregional fiscal transfers has been a key focus of empirical studies of fiscal federalism (Bayoumi and Masson 1995; Asdrubali et al. 1996; Doi 2000; Buettner 2002; Decressin 2002; Mélitz and Zumer 2002; Andersson 2004, 2008; Borge and Matsen 2006; Jüßen 2006; Ramos and Coimbra 2009; Arachi 2010; Furceri 2010; Hepp and von Hagen 2011; Balli et al. 2011). The current study distinguishes itself from these studies in the following respects. First, while the literature concerns the nexus between gross income and disposal income (or consumption), I focus on the relations between health care demands and premium collections. In this study, the “risk variable” to which shocks occur is the NHI medical expenditures, and the “target variable” to be smoothed is the NHI premiums. Therefore, “stabilization” or “smoothing” here involves providing localities with more stable flows of revenues, and preventing large changes in premium collections imposed on local residents. To the best of my knowledge, no study has examined the role of fiscal transfers for locally managed health care expenditures as such, nor quantified their stabilizing effects within a system of health care system. Note that I use “stabilization” instead of “risk sharing,” because a substantive portion of the transfer payments in the NHI system is financed from outside of the system. In other words, risk-sharing is
incomplete within the NHI system, since risk-sharing in health care should concern all the insured enrolled not only in the NHI but also in the other health care programs.

Second, I offer an alternative measure of the stabilization effects by examining the relation between two strands in the previous studies that quantify the degree of stabilization effects. I start with the method by Asdrubali et al. (1996), which has been applied in a number of studies (Doi 2000; Buettner 2002; Andersson 2004; Borge and Matsen 2006; Jüßen 2006; Ramos and Coimbra 2009; Furceri 2010; Balli et al. 2011). This method, which uses two types of identity, decomposes the variance of a risk variable into its sub-factors that measure their respective contributions in buffering the target variable from the effects of the volatile risk variable. I then elaborate on the other strand in the literature. Such studies, in a somewhat ad-hoc manner, regressed the target variable on the risk variable to obtain a measure of stabilization (Bayoumi and Masson 1995; Mélitz and Zumer 2002; Decressin 2002; Andersson 2008; Arachi 2010; Hepp and von Hagen 2011). I then present the cases where this manner of quantification is identical to that of Asdrubali et al. (1996) and the cases where it is not so. Given the examination of these two strands of analysis, I propose a decomposition that synthesizes the two strands in the literature and that, I believe, is more straightforward and easier to interpret. I then apply this decomposition to answer the first question in this study, i.e., the stabilizing effects within the NHI system in Japan.

The paper proceeds as follows. Section 2 provides an institutional background of the Japanese public health insurance in general, and the NHI system in particular. Section 3 formally elaborates on the method that quantifies the smoothing effects after reviewing the methods by the previous studies. Section 4 implements the decomposition analysis to examine the stabilization effects of fiscal transfers, and discusses the results. Finally, Section 5 presents the conclusions of the study.
2. Institutional Background

In Japan, every person receives standardized medical services at identical prices, regardless of the type of public health insurance he or she is enrolled in. There are no gatekeepers hindering the choice of medical services. The insured are free to choose among the many medical service providers (clinics or hospitals, private or public) regardless of the providers’ locations, facility types, or other factors such as having a referral or not. The insured pay 30% of the medical fees as co-payments.1 Payments to the providers are mainly fee-for-service.2 The insurers reimburse 70% of the insurance-covered service costs to the providers. Each month, bills and insurance claims on medical treatments and drugs are examined by the Social Insurance Medical Fee Payment Fund (SIMFPF) for the employment-based public health insurance and the National Health Insurance Federation (NHIF) for the NHI.3 The range of medical services to be covered, rates of co-payment, and fee schedules of medical services are identical and standardized by law throughout the nation for all insurance programs. These standardized elements are reviewed every two years.

The public health care in Japan may be broadly categorized as employment-based public health insurance, residence-based public health insurance, and another residence-based scheme especially for the elderly. Table 1 summarizes the schemes along with the total population covered by each system in 2009. The employment-based insurance is called the Employees’ Health Insurance (EHI) in general, and is further categorized into the (i) association-managed health insurance for employers in large companies, (ii) Japan Health Association Insurance (JHAI) for employers in small and medium enterprises (SMEs), (iii) Mutual Aid Association Health Insurance for school and public sector employees, and (iv) Seamen’s Health Insurance managed by the JHAI. These insurances cover employees and their dependents. On the other hand, the NHI is a residence-based scheme for those aged below 75 years and are excluded from the EHI. The NHI is further divided into two categories: the municipal NHI whose insurers are municipalities, and the NHI associations for professionals such as doctors and lawyers.

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1 The co-payments rate for those aged 70 years and above is 20%, except for the high-income.
2 The 2006 Reform, however, introduced a package payment system for the treatment of the elderly to circumvent the possible adverse effects of this fee-for-service system.
3 While their local offices are supposed to inspect all bills, their capacity is limited. Intensive reviews conducted by medical experts are limited only to high-cost cases or specified suspicious facilities.
There is an additional scheme for the elderly population. The NHI previously covered the entire elderly population unless they were dependents of EHI subscribers until 1983, when a new financing scheme, the Elderly Health Care Service (EHCS), was introduced to enable municipalities to disburse medical benefits for all those aged 70 years or above (and those aged between 65 and 70 years who are bedridden or seriously disabled). The benefits are financed by transfers from central and local governments, those from the public health care insurers, and co-payments by the elderly. The elderly continued to be enrolled in their previous social insurance programs by paying their premiums until 2008, when the current Elderly Health Care Service for the Old-Old (EHCSOO) started. In 2008, the EHCSOO began separating those aged 75 years and above (i.e., the “old-old”) from the public health insurance schemes. All municipalities within a prefecture formed an organization that disburses the medical benefits to the old-old, financing them from premiums paid by the old-old (10%) and fiscal transfers from the public health care insurers (40%) and central and local governments (100/3% by the center; 25/3% by the prefecture; and 25/3% by the municipalities).

**Table 1**

The focus of the current study is the municipal NHI. Since the municipal NHI covers those who are excluded from the EHI, the insured typically include riskier and less wealthy groups in the population, including the retired, those aged less than 75 years, self-employed non-professionals, farmers, employees of unincorporated business with less than 6 full-time employees, college students aged 20 years and above, and the unemployed. The insurers are the municipalities. Every municipality sets up and manages its own NHI insurance association. Revenues and expenditures in the NHI are accounted for in a special account apart from the municipal general account.

The benefit expenditures of a municipal NHI are financed from premiums contributed by its subscribers, a variety of fiscal transfers paid by different level of government and institutions, and inter-temporal adjustments such as borrowings and savings. First, municipalities have discretions over their premium schedules. They are usually based on factors such as household income and asset, and household size and composition. Municipalities arguably set their premium schedules so that their NHI

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4 The benefit expenditures consist of medical benefits paid to medical service providers, administration costs, and screening costs for the NHIF to examine medical insurance claims.
special accounts close, given the fiscal transfers as well as the other revenue items. While the premium schedules are fixed within a fiscal year, they are likely to change over time in response to the fiscal status of the special accounts.

Second, the regional transfer totals more than 20 items which may be bundled into those from the (i) central government (central transfers),\(^5\) (ii) prefectural government and institutions (prefectural transfers),\(^6\) (iii) inter-institutional schemes among all public health care insurers (inter-institutional transfers),\(^7\) and (iv) the general account of the municipality in question (intra-municipal transfers). The last item is further categorized into (v) transfers specified by national laws\(^8\) (statutory intra-municipal transfers), and (vi) transfers disbursed at the municipality’s discretion (discretionary intra-municipal transfers). Note that the net transfers (ii) and (iii) can be negative, since they include municipal contributions to, rather than grants from, the cost-sharing schemes.

Third, inter-temporal fiscal instruments are supposed to adjust deficits (surplus) in the NHI account. Under the current system as described above, medical benefits are defined by the medical needs of the insured, which clearly municipalities cannot either ration or reduce, for example, simply due to deficits in the NHI special accounts.\(^9\) In terms of the items in the NHI accounting, the inter-temporal adjustments consist of provisions from reserves and bond issues, net of additions to reserves, advance appropriations, and debt-service payments.

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5 The central government matches 34% of medical benefits, 25% of catastrophic expenses, and 33% of designated health checks and promotion. It also provides lump-sum birth allowance. In addition, there is a Fiscal Adjustment Grant (FAG) that covers about 9% of medical benefits, and has two components: the Ordinary FAG (80% of the total FAG), which intends to equalize fiscal capacities among municipalities, and the Special FAG, which saves the remaining 20% for unexpected health care demands.

6 Prefectural governments match 25% of catastrophic medical expenses, and 33% of health promotion expenses. They also provide the Prefectural Adjustment Grant (PAG), which is analogous to the FAG, and which constitutes 7% of relevant medical costs. Six percent of the PAG is distributed according to a fixed rule, and the remaining 1% is used for unexpected local demands. Prefectural transfers here also include two types of prefecture-wide cost sharing schemes, the Catastrophic Medical Expense Grants which cover expenses above JPN¥80,000 per receipt, and the Fiscal Stabilization Grants which compensates expenses above JPN¥300,000 per receipt. The amount included here is the sum of these two grants net of municipal contributions to them.

7 The insurers in the NHI and the EHI contribute funds to the EHCSOO based on the size of their subscribers. An equalizing scheme is also in place for the expenses of those aged between 65 and 75 years (‘the young-old’) in each public health insurance insurers. Furthermore, the Medical Benefit Grants are disbursed for the retired employees enrolled in the NHI.

8 Transfers from the general budgets prescribed by national laws have several categories. The first is for premiums abatement measures for low-income subscribers, which is further categorized into three subcategories. The second is for medical needs that are not controlled by the insurers. There are also subsidies for lump-sum birth allowance and management costs.

9 A health promotion measure may influence medical needs in the long run, but not in the short term.
I examine how regional medical risks, reflected in changes in the NHI medical benefits, are smoothed. The key relation is between the medical benefits and the premiums within a municipality. For example, assume a change in regional medical needs. If there were no revenue sources other than the premiums, municipalities would have to change their premiums to match the change in medical benefits caused by the change in regional medical needs. Then, they must introduce multiple layers of fiscal transfers to the municipal NHI, which should help the municipalities control the changes in the premiums caused by the changes in local medical needs. I thus pay a special attention to the roles of fiscal transfers in smoothing premium payments.

For every municipality in each fiscal year, the municipal NHI accounts allow us to derive the following relation:

\[
\text{Medical benefits} = \text{Central transfers} + \text{Provincial transfers} + \text{Institutional transfers} + \text{Statutory intra-municipal transfers} + \text{Discretionary intra-municipal transfers} + \text{Inter-temporal adjustments} + \text{Other net revenues} + \text{Premiums}. \quad (1a)
\]

Note that “other net revenues” consist of the remaining miscellaneous revenues minus the remaining miscellaneous expenditures. The remaining revenue items for the NHI account include the premium collections for the Long-term Care Insurance (LTCI) program, another municipality-based regional social insurance in Japan, levied on those who are covered by the NHI along with their NHI premiums. Naturally, the remaining expenditure items include the corresponding contributions to their LTCI accounts. Possibly due to the timing for transactions across different special accounts over fiscal years, the LTCI premium collections and the LTCI contributions do not balance within a given fiscal year, and, along with other miscellaneous items, the “other net revenue” amount to around six percent (negative) of the medical expenditures.

Table 2 lists the shares of the revenue items above. As it shows, the shares change along the years, with institutional changes taken in the decade. Before I discuss such changes, however, the following section explains how the current study measures the smoothing effects of the items described above, improving on the methods provided in the related literature.
3. Measuring Stabilization Effects

Let $x_{it}$ be the “risk” variable of region $i$ in year $t$. In the current case, this is the per capita NHI medical benefits to which shocks occur. Assume that the risk variable $x_{it}$ can be decomposed into $J$ elements $\{y_{j,it}\}$ as

$$x_{it} = \sum_{j=1}^{J} y_{j,it} + y_{J,it} \quad (1b)$$

where $y_{J,it}$ is the “target” variable, an outcome variable brought about as a smoothed-risk variable. The identity $(1b)$ allows us to decompose the variance of $x_{it}$ into indicators for the degree of contributions of $y_{j,it}$ for $j = 1, \ldots, J-1$ in buffering $y_{J,it}$ from shocks in $x_{it}$. Note that $(1b)$ is comparable to $(1a)$ where $x_{it}$ and $y_{J,it}$ are respectively NHI medical benefits and premiums, both in per subscriber terms.

3.1. Standard decomposition using differenced-log variables

I start the discussion with the method developed by Asdrubali et al. (1996), which I call “the ASY method” hereafter. This method has been utilized by, among others, Doi (2000), Buettner (2002), Andersson (2004), Borge and Matsen (2004), Jüßen (2006), Ramos and Coimbra (2009), Furceri (2010) and Balli et al. (2011). The ASY method takes advantage of the following identity:

$$x_{it} = x_{it} - \sum_{j=1}^{J-1} y_{j,it} \quad (2)$$

where $y_{J,it} = x_{it} - \sum_{j=1}^{J-1} y_{j,it}$ by $(1b)$. Note that $y_{j,it}$ can be negative or positive for $j \neq J$ but $x_{it} - \sum_{j=1}^{J} y_{j,it}$ and $y_{J,it}$ are always positive. Taking the log of $(2)$ and differencing the resulting terms yield

$$\Delta \ln x_{it} = \Delta \ln \left[ \frac{x_{it}}{(x_{it} - y_{i,it})} \right] + \sum_{k=1}^{J-2} \Delta \ln \left[ \frac{x_{it} - \sum_{j=1}^{k} y_{j,it}}{(x_{it} - \sum_{j=1}^{k+1} y_{j,it})} \right] + \Delta \ln y_{J,it} \quad (3)$$

Note that the differenced log ratio $\Delta \ln [(x_{it} - \sum_{j=1}^{k} y_{j,it})/(x_{it} - \sum_{j=1}^{k+1} y_{j,it})]$ is the difference between the growth rates of $(x_{it} - \sum_{j=1}^{k} y_{j,it})$ and $(x_{it} - \sum_{j=1}^{k+1} y_{j,it})$. The literature then interprets this difference as a change in the growth rate that is attributable to element $y_{k+1,it}$. Meanwhile, the ASY method decomposes the variance of the growth rate of the risk variable $\Delta \ln x_{it}$ as
\[ \text{var}(\Delta \ln x_{it}) = \text{cov}\left\{ \Delta \ln x_{it}, \Delta \ln \left[ \frac{x_{it}}{(x_{it} - y_{1,it})} \right] \right\} + \sum_{k=1}^{J-2} \text{cov}\left\{ \Delta \ln x_{it}, \Delta \ln \left[ \frac{x_{it} - \sum_{j=1}^{k} y_{j,it}}{(x_{it} - \sum_{j=1}^{k+1} y_{j,it})} \right] \right\} + \text{cov}\left\{ \Delta \ln x_{it}, \Delta \ln y_{J,it} \right\} \] (4)

It obtains this expression by subtracting from each term in (3) its expectation, multiplying (3) in deviation-from-expectation form by \[ \Delta \ln x_{it} - \mathbb{E}(\Delta \ln x_{it}) \], and taking expectations of the resultant products. To obtain shares of the variations in the growth rate of the risk variable that are attributable elements \[ y_{j,it} \], the ASY model divides both sides of (4) by var(\Delta \ln x_{it}) to obtain:

\[ 1 = \frac{\text{cov}\left\{ \Delta \ln x_{it}, \Delta \ln \left[ \frac{x_{it}}{(x_{it} - y_{1,it})} \right] \right\}}{\text{var}(\Delta \ln x_{it})} + \sum_{k=1}^{J-2} \frac{\text{cov}\left\{ \Delta \ln x_{it}, \Delta \ln \left[ \frac{x_{it} - \sum_{j=1}^{k} y_{j,it}}{(x_{it} - \sum_{j=1}^{k+1} y_{j,it})} \right] \right\}}{\text{var}(\Delta \ln x_{it})} + \frac{\text{cov}\left\{ \Delta \ln x_{it}, \Delta \ln y_{j,it} \right\}}{\text{var}(\Delta \ln x_{it})} \] (4)

where the first item is the share of the variation attributable to \[ y_{1,it} \], and the \( k \)-th item in the summation in the second line is the share of the variation attributable to \[ y_{k+1,it} \] for \( j = 1, \ldots, J-1 \).

Note that each term on the right-hand side of (4) is an ordinary least squares (OLS) estimator for a coefficient on \( \Delta \ln x_{it} \) in a linear regression model that regresses \( \Delta \ln \left[ x_{it} - \sum_{j=1}^{k} y_{j,it} \right] / \left( x_{it} - \sum_{j=1}^{k+1} y_{j,it} \right) \) on a constant and \( \Delta \ln x_{it} \). In particular, the last term is an OLS estimate obtained from a linear regression of \( \Delta \ln y_{J,it} \) on a constant and \( \Delta \ln x_{it} \). This term must be zero if the growth rate of the target variable does not correlate with that of the risk variable, showing that the variations in the risk variable are perfectly absorbed by the terms other than \( \Delta \ln x_{J,it} \). It is then natural to define the index of smoothing (or stabilization) as

\[ 1 - \gamma = \frac{\text{cov}\left\{ \Delta \ln x_{it}, \Delta \ln \left[ \frac{x_{it}}{(x_{it} - y_{1,it})} \right] \right\}}{\text{var}(\Delta \ln x_{it})} + \sum_{k=1}^{J-2} \frac{\text{cov}\left\{ \Delta \ln x_{it}, \Delta \ln \left[ \frac{x_{it} - \sum_{j=1}^{k} y_{j,it}}{(x_{it} - \sum_{j=1}^{k+1} y_{j,it})} \right] \right\}}{\text{var}(\Delta \ln x_{it})} \] (5)
where $\gamma \equiv \frac{\text{cov}(\Delta \ln x_{it}, \Delta \ln y_{it})}{\text{var}(\Delta \ln x_{it})}$. This also shows that the smoothing effect $1 - \gamma$ is decomposed into a series of covariance-variance ratios that appear in the right-hand side of (5), each of which shows its relative contribution in buffering the target variable from the risk variable.

### 3.2. Ordering problem

The literature that adopts the ASY model typically decomposes the variance of gross products (risk variable) into its covariance with elements of the system of economic accounts, and measures the contributions of such elements in preventing personal disposable income or consumption (target variable) from shocks in the gross products. In such studies, the order of the components of $x_j$ may be obvious as the system of economic accounts simply suggests their order. For example, consider a case where we treat personal income $x$ as the risk variable. If we define $x - y_1$ as disposal income and $y_3 = x - y_1 - y_2$ as consumption, these definitions make $y_1$ net taxes and $y_2$ net savings. Then, the estimation of (5) requires the following regressions:

$$\Delta \ln (x) - \Delta \ln (x - y_1) = \alpha_1 + \beta_1 \cdot \Delta \ln x + u_1,$$
$$\Delta \ln (x - y_1) - \Delta \ln (x - y_1 - y_2) = \alpha_2 + \beta_2 \cdot \Delta \ln x + u_2 \quad \text{and}$$
$$\Delta \ln y_3 = \alpha_3 + \beta_3 \cdot \Delta \ln x + u_3 \quad (6)$$

where the $it$ subscripts are dropped for expositional convenience. The OLS estimates for $\beta_1$ and $\beta_2$ are interpreted to capture the buffering effects of $y_1$ and $y_2$, respectively, and that for $\beta_3$ is used to construct the stabilization effect $1 - \beta_3$.

This decomposition, however, may become problematic if its elements have no natural order among themselves. For example, I could use the following regressions to estimate $\phi_1$ and $\phi_2$, which respectively capture the buffering effects of $y_2$ and $y_1$:

$$\Delta \ln (x) - \Delta \ln (x - y_2) = \delta_1 + \phi_1 \cdot \Delta \ln x + u_1,$$
$$\Delta \ln (x - y_2) - \Delta \ln (x - y_2 - y_1) = \delta_2 + \phi_2 \cdot \Delta \ln x + u_2 \quad \text{and}$$
$$\Delta \ln y_3 = \delta_3 + \phi_3 \cdot \Delta \ln x + u_3 \quad (7)$$

It is then evident that, while the OLS estimate for $\phi_3$ in (7) is identical to that for $\beta_3$ in (6), the OLS estimates for $\phi_1$ and $\phi_2$ in (7) are generally different from those for $\beta_1$ and $\beta_2$ in (6). While the two estimates for the stabilization effect are identical ($1 - \beta_3 = 1 - \phi_3$), the estimates for the contribution of $y_i$ to the stabilization effect are not. This then
raises a concern that the ASY method will not work for the current case where the order of the components of a risk variable is not “obvious” or “natural.”

3.3. Decomposition in differenced level

Since the items in the NHI account do not have a predetermined order in the same way that the system of national accounts implies, I have to forego the ASY method. The alternative decomposition then has to be independent of the order of the items in the NHI accounts as the decomposition I propose below is. Furthermore, the method is more straightforward to interpret.

The procedure is analogous to the standard decomposition, but dispenses with (2) and only utilizes (1b) as follows. By differencing (1b), we obtain

$$\Delta x_{it} \equiv \sum_{j=1}^{J-1} \Delta y_{j,it} + \Delta y_{J,it}$$  \hspace{1cm} (8)

which yields the deviations from expectations

$$\Delta x_{it} - E(\Delta x_{it}) \equiv \sum_{j=1}^{J-1} [\Delta y_{j,it} - E(\Delta y_{j,it})] + [\Delta y_{J,it} - E(\Delta y_{J,it})].$$

Then, multiplying this expression with \([\Delta x_{it} - E(\Delta x_{it})]\), taking the expectation of the resulting products, and dividing the expectations by \(\text{var}(\Delta x_{it})\) yield

$$1 = \sum_{j=1}^{J-1} \frac{\text{cov}(\Delta x_{it}, \Delta y_{j,it})}{\text{var}(\Delta x_{it})} + \frac{\text{cov}(\Delta x_{it}, \Delta y_{J,it})}{\text{var}(\Delta x_{it})}. \hspace{1cm} (9)$$

Again, each term on the right-hand side of (9) is obtained as an OLS estimate for a coefficient on \(\Delta x_{it}\) from a linear regression of \(\Delta y_{j,it}\) on a constant and \(\Delta x_{it}\). Again, if the target variable does not correlate with the risk variable where shocks occur, the last term in (9) will be zero, which implies that the variations in the risk variable are perfectly absorbed by the terms other than \(y_{J,it}\) in (8). Then, the index of stabilization is defined as

$$1 - \beta_j = \sum_{j=1}^{J-1} \frac{\text{cov}(\Delta x_{it}, \Delta y_{j,it})}{\text{var}(\Delta x_{it})} = \sum_{j=1}^{J-1} \beta_j \hspace{1cm} (10)$$

where \(\beta_j \equiv \text{cov}(\Delta x_{it}, \Delta y_{j,it})/\text{var}(\Delta x_{it})\). The interpretation is simpler and more intuitive. The stabilization effect \(1 - \beta_j\) is decomposed into \(\beta_j\)'s for \(j = 1, \ldots, J - 1\), which are the covariance between changes in the risk variable and those in each of the components except the target variable \(y_{J,it}\). More importantly, the \(\beta\) coefficients are now independent of the order of \(y_{j,it}\) for \(j = 1, \ldots, J-1\).
3.4. Comparison with the existing studies

Keeping (5) and (10) in mind, I examine another strand in the literature on “risk sharing” among regions. This literature typically regresses some form of the target variable \( y_{J, it} \) (regional gross output) on a constant and the corresponding form of the risk variable \( x_{it} \) (regional consumption) to estimate the coefficient estimate \( \theta \) on the latter variable (Bayoumi and Masson 1995, Mélitz and Zumer 2002, Decressin 2002, Andersson 2008, Arachi et al. 2010; Hepp and von Hagen 2011). It then argues that \( 1 - \theta \) expresses the degree of stabilization. While the literature has not explicitly stated, we can relate the stabilization effect obtained in the second strand of the literature to the two measures of stabilization effect (\( \gamma \) and \( \beta_J \)) as formulated in (5) and (10).

First, Andersson (2008) employs a differenced log of variables, and normalizes the pre-logged variables by their national averages to net out an aggregate shock in a given year. In this case, the OLS estimate for \( \theta \) is identical to that for \( \gamma \) in (5) if we use cross-section data. Let us define \( a_i = 1/N_{-1} \sum x_{it} \) and \( b_i = 1/N_{-1} \sum y_{J, it} \), where \( N^{-1} \sum y_{J, it} \) and \( N^{-1} \sum x_{it} \) are national averages with \( N \) being the number of regions. Since \( \Delta \log a_i \) and \( \Delta \log b_i \) take on common fixed values across the regions in a given period \( t \), we obtain

\[
\frac{\text{cov}(\Delta \log a_i, \Delta \log b_i)}{\text{var}(\Delta \log a_i)} = \frac{\text{cov}(\Delta \log x_{it} + \Delta \log a_i, \Delta \log y_{J, it} + \Delta \log b_i)}{\text{var}(\Delta \log x_{it} + \Delta \log a_i)} = \frac{\text{cov}(\Delta \log x_{it}, \Delta \log y_{J, it})}{\text{var}(\Delta \log x_{it})} = \gamma.
\]

In other words, since normalizing the variables with their national averages does not change the covariance with a cross section of data, we see that the OLS estimate for \( \theta \) with a cross section of differenced logged variables is identical to that for \( \gamma \) in (5).

Second, Bayoumi and Masson (1995), Mélitz and Zumer (2002), Decressin (2002), and Arachi (2010) use differenced levels of variables normalized by their averages —\( \Delta (y_{J, it}/N^{-1} \sum y_{J, it}) \) and \( \Delta (x_{it}/N^{-1} \sum x_{it}) \)— to estimate \( \theta \). In this case, however, the OLS estimate for \( \theta \) is not identical to that for \( \beta_J \) in (10) even with a cross section of data because

\[
\frac{\text{cov}(\Delta a_i, \Delta b_i y_{J, it})}{\text{var}(\Delta a_i)} = \frac{\text{cov}(a_i x_{it} - a_{i-1} x_{it-1} , b_i y_{J, it} - b_{i-1} y_{J, it-1})}{\text{var}(a_i x_{it} - a_{i-1} x_{it-1})} \neq \frac{\text{cov}(\Delta x_{it}, \Delta y_{J, it})}{\text{var}(\Delta x_{it})} = \beta_J.
\]
I argue, however, that we do not need to normalize the variables by their national averages to net out an aggregate shock in a given year if we use a cross section of data. This is because the constant term in a regression analysis with a cross section of data can control an aggregate shock in the same way that time dummies take care of such shocks in a regression analysis with panel data. Then, if the level variables are not normalized by their respective national averages, we see that the OLS estimate for $\theta$ equals that for $\beta_J$ in (10), since $\theta = \frac{\text{cov}(\Delta x_{i,t}, \Delta y_{J,t})}{\text{var}(\Delta x_{i,t})} = \beta_J$. The stabilization measure used in the current study can thus be seen as a variation of the measure used in Bayoumi and Masson (1995), Mélitz and Zumer (2002), Decressin (2002), and Arachi (2010). Note however that the analysis in these previous studies could not decompose the stabilization effect into proportions that are attributable to the items that constitute the risk variable. Meanwhile, the current analysis goes one step further and explicitly analyzes the sources of the stabilization effect.

4. Empirical Implementation

In the following empirical analysis, I thus utilize the decomposition (10) with a cross section of differenced data for each of fiscal years from FY 2002–2010. For the reason I argued in Section 3.1, I do not use the decomposition with differenced logged data as the previous studies had done so far. In addition, for the reason I explained in Section 3.2, I do not normalize the variables in level by their respective national averages either.

4.1. Sample and Data

I obtained all the data from the municipal special accounts for the NHI for FY2001–2010. They are available at the e-Stat (http://www.e-stat.go.jp), a portal site of the government statistics in Japan. I used the municipal data to construct the variables that appear in (1a), namely (a) medical benefits, (b) central transfers, (c) provincial transfers, (d) institutional transfers, (e) statutory intra-municipal transfers, (f) discretionary intra-municipal transfers, (g) inter-temporal adjustments, (h) other revenue items and (i) premiums. All variables are expressed in per-subscriber terms. In addition, the variables are not deflated by a price index because the estimation utilizes a cross
section of data. Table 2 shows the shares of elements (b)–(i) among the medical benefits from FY 2001–2010. The shares of premiums and central transfers, and inter-institutional transfers occupy larger portions. At the same time, their values have changed over time. As time passed, while the shares of premiums and central transfers have decreased, the share of inter-institutional transfers has increased from negative values to positive values. The changes in the inter-institutional transfers suggest that, on average, the NHI insurers which were net contributors in the inter-institutional cost sharing scheme in the early years in the decade have turned to be net beneficiaries toward the end of the period. In addition, the share of provincial transfers has also increased from around 1% in the early years to over 6% after FY 2006. All of these changes are apparently due to institutional changes that happened almost every year during the period as listed in Table 3.

Tables 2 and 3

For the estimation, I use a cross section of differenced values of the medical benefits as $x_{it}$ and each of the nine variables listed in Table 2 as $y_{jit}$. The sample statistics for the nine annually differenced variables are listed in Table 4, along with those for the all-period observations. In contrast to the current study, the previous studies utilized a panel data of regions, assuming constant coefficients or covariance-variance ratios over the period.\textsuperscript{10} This may be because, with the exception of Andersson (2004) and Jüßen (2006), who respectively used samples of 279 municipalities in Sweden and 439 counties in Germany, they examined cases where the number of regional units tends to be too small for conducting a reasonable cross-section analysis.\textsuperscript{11} On the other hand, the sample sizes of differenced cross-sectional units in this study are over 1,700, which should be large enough for performing a reasonable cross-sectional analysis.

\textsuperscript{10} The only exception is Asdrubali et al. (1996), who, in addition to a constant-coefficient panel analysis, also performed a cross-sectional analysis with 48 contiguous US states and examined how channels of risk sharing change over time, as I do in this study.

\textsuperscript{11} For example, there are 10 provinces in Canada (Bayoumi and Masson 1995, Mélitz and Zumer 2002, Balli et al. 2011), 21 regions in France (Mélitz and Zumer 2002), 16 Länder in Germany (Buettner 2002, Hepp and von Hagen 2011), 20 regions in Italy (Decressin 2002, Arachi et al. 2010), 47 prefectures in Japan (Doi 2000), 19 counties and 5 regions in Norway (Borge and Matsen 2006), 30 regions in Portugal (Ramos and Coimbra 2009), 21 regions in Sweden (Andersson 2008), 21 regions in the UK (Mélitz and Zumer 2002), and 50 states in the US (Asdrubali et al. 1996, Bayoumi and Masson 1995, Mélitz and Zumer 2002). In practice, most of the studies utilized even smaller number of regions than those listed here due to data limitations.
In addition, it may not be appropriate to assume that the covariance-variance ratios are constant over the periods for the current study, since such ratios are likely to have changed almost every fiscal year for the following reasons. First, due to the mergers in the 2000s, which peaked in 2004 and 2005, the number of municipalities has decreased from about 3,200 to 1,700. These changes in the number of municipalities plausibly affect the stabilization effects of the channels of the NHI financing. In addition, such mergers are interpreted as elements of shocks to local health demand in municipalities that have annexed other municipalities, since their medical benefits per subscriber must have changed due to such mergers (annexations).\(^{12}\) Second, there has been a series of institutional changes in the NHI in the 2000s as has already shown in Table 3, which mainly, but not exclusively, includes changes in the transfer systems. These changes affected the difference data for every period in the 2000s, since they affected the variables in level for in period \(t\) or period \(t - 1\), or in both periods \(t\) and \(t - 1\) that constitute the corresponding variables in difference.

### Table 4

#### 4.2. Estimation and Econometric Issues

The regression model that I estimate is therefore

\[
\Delta y_{j,i} = \alpha_j + \beta_j \cdot \Delta x_{i} + u_{it}
\]

for a given single fiscal year \(t\) that runs from 2002 to 2010. Subscript \(i\) indexes municipalities (insurers) and \(j\) indexes each of the eight components (all in per-subscriber values) of the right-hand side of identity (1a). What we are interested in are the estimates for \(\beta_j\) and their change over time.

There may be two views on how to conceptualize (11). The first view regards (11) as the data generating process (GDP) for \(\Delta y_{j}\), while the second view considers (11) a convenient artificial regression to produce the covariance-variance ratios defined in (9) or (10). If we take the first view, it is understandable that the literature concerns the endogeneity of the regressors (e.g., Asdrubali et al. 1996, Andersson 2004), since they typically regressed a target variable that includes taxes or transfers on a constant and a

\(^{12}\) Note that, as I use a cross section of differenced variables over two adjacent fiscal years, \(t\) and \(t - 1\), I had no choice but to exclude municipalities that merged to form new municipalities or were annexed by other municipalities in period \(t\) from the sample for that year.
risk variable (gross product or personal income). It is indeed plausible that taxes or transfers are determined by gross product or personal income, causing a reverse causation and endogeneity.

However, the current case may be different from the previous studies. Since the medical benefits depend on the health status of the insured, it would be hard to imagine that causation runs from the fiscal variables to the health status or medical benefits. Still, it might be possible that, say, transfers for local health promotion expenditures improve health status, thereby decreasing medical benefits. Even if they do, however, it should take time for the effects to be realized. Therefore, unless the error term in regression model (11) has a long memory, the endogeneity should not be much of a concern in terms of reverse causation. Even if so, there may be yet another type of endogeneity, i.e., unobserved heterogeneity. If there are unobserved elements that affect the dependent variable and are correlated with at least one of the regressors, then such regressors are correlated with error terms. Again, the unobserved heterogeneity may not be a major concern either. Note that (11) is a static model where the unobserved heterogeneity has already been differenced out, if it is, as conventionally assumed, constant over the period.

If we continue to hold the first view of (11), there is another issue of the non-spherical error term. Differencing a regression model results in serial correlation among the differenced error terms $u_t = e_t - e_{t-1}$, unless $e_t$, the error term before differencing, follows the unit-root process $e_t = e_{t-1} + u_t$, and $u_t$ is serially independent. In addition, $u_t$ may be heteroskedastic. Therefore, even if we use a cross-section data, we still have the issue of the non-spherical error term. Indeed, Asdrubali et al. (1996) discussed the possibility that variances of the error term change over time across the cross-sectional units. With a panel data, I could have allowed for such an issue by the method of clustering. Although the feasible generalized least squares (FGLS) may still be applicable to the current analysis, the functional form of the conditional variance of the error term is rarely known in practice, as argued by Stock and Watson (2010). If the functional form is not correct, the FGLS standard errors are invalid in the sense that they lead to incorrect statistical inferences. Therefore, if I take the first view of (11) at all, I use OLS to estimate the $\beta$s along with the heteroskedasticity-consistent standard errors.
In fact, the current study takes the second view, regarding (11) as an artificial regression to produce the covariance-variance ratios in (9) or (10). What we aim to obtain is the descriptive statistics for $\text{cov}(\Delta x, \Delta y_j)/\text{var}(\Delta x)$, not the other quantities, since the decomposition method is based on the quantity defined as such in the analytical formulation of (9) and (10). Regression model (11) is thus a convenient tool for calculating $\beta_j \equiv \text{cov}(\Delta x, \Delta y_j)/\text{var}(\Delta x)$, in which I emphasize identity “≡.” Note that we can validly perform only OLS to (11). We should not apply other methods such as FGLS or instrumental variable (IV) estimation, since they yield quantities for $\beta_j$ that are numerically different from $\text{cov}(\Delta x, \Delta y_j)/\text{var}(\Delta x)$. Therefore, the issues of endogeneity or non-spherical errors would be irrelevant to this second view. However, in what follows, I also effectively take the first view when I mention the statistical significance of the estimates obtained from the OLS on (11).

4.3. Results and Interpretation

The estimation results are shown in Table 5 and Figure 1. The results are summarized as the following. First, the varying values of the coefficients over the years corroborate the fact that the institutional aspects of the NHI system have changed almost every year. In particular, there were relatively large disruptions in the trends of the share estimate in FY 2008. This should be due to the introduction of the Health Care Service for the Old-Old (HCSOO) as briefly mentioned in Section 2 and Table 3. Starting in FY 2008, those aged 75 years and above (“old-old”) who had been enrolled in the NHI have been separated from the NHI to become covered by the HCSOO which is managed by prefectures. At the same time, NHI insurers started to contribute funds to the HCSOO to finance the medical benefits of the “old-old” through a new system of inter-institutional transfers. In addition, the government also introduced a new institutional transfer system to finance the expenses of those aged between 65 and 75 years (“young-old”) in all public health insurance schemes (including the NHI). Furthermore, the central government changed the medical fee system, which inevitably affects the medical benefits provided through the NHI programs.

Second, nonetheless, the premiums have maintained very small percentages throughout the periods. This then indicate that the stabilizing effect (10) is very large, albeit with some little variations over the period. Notice that they are negative except in
FY 2002, FY 2008 and FY 2010, which implies over-smoothing in that a shock to the medical benefits reduces the change in the premiums. However, as mentioned, these values are so small that the effect is negligible. Among the other three years when the values are positive, the effect is the largest in FY 2008 at 4.3 percent, which may be due to the major institutional change in that year. I therefore argue that the degree of risk sharing or the buffering effects on the premiums from changes in medical demands has been almost perfect during the period.

Third, this high degree of smoothing effects can be attributed to the combined effects of the five transfer payments (central, prefectural, inter-institutional, statutory municipal and discretionary municipal transfers), which ranges from 68.8 percent in FY 2009 to more than 100 percent (due to negative values of the other items) in FY 2008. The effects among the transfers are different. Among the five categories, the central transfers have maintained its large shares throughout period, with some variations. Prefectural and inter-institutional transfers exhibit some general trends with the former increasing and the latter decreasing toward the end of the period (expect FY 2008 for former and FY 2007 and FY2008 for the latter). While statutory intra-municipal transfers have minor effects, the discretionary counterpart displays rather large effects before FY 2007 ranging from about 7 to 20 percent. The discretionary transfers desmoothed the changes in the medical benefits in the three periods starting FY 2007, with a relatively large negative value (−11.7) in FY 2009.

Fourth, these changes in the discretionary transfers are suggestive of a popular theoretical claim and the effect of an institutional change in public accounting system in Japan. Indeed, this is an interesting result given that it is often argued that municipalities use their discrentional transfers as an ex-post instrument to cover the deficits in their NHI special accounts, and therefore they are a source of a lack of fiscal discipline in municipal fiscal management. The result for the discretionary transfers in Table 2 suggests that such forces were in place before FY 2007. In addition, the sudden changes of the effect since FY 2007 corroborate with an institutional change in the accounting system of local public finance in that fiscal year. Since that year, an early warning system for local fiscal solvency has started to extend its scope from local general accounts to ones that also include local special accounts such as the NHI account in measuring the degree of solvency of local governments in Japan. It is plausible that this
change has made municipalities more discreet in providing intra-municipal transfers to their NHI special account ex post.

Fifth, the inter-temporal adjustments also exhibit relatively high shares as a single revenue item. Except FY 2008 when the major changes in the system were set in place, the inter-temporal adjustments exhibit relatively high coefficient values ranging from 16.3 to 23.9 percent. The contributions of the other net revenues are smaller. The latter coefficients are not statistically significant for the first four periods, implying that their smoothing effects are nil. For the last three periods, the item’s contribution is at most 9.2% with a negative value of −2.7% in FY 2008.

Table 5 and Figures 1

4.4. The Effect of the Size of Subscribers

The law of large numbers suggests that the degree of volatility in the NHI medical benefits (in per subscriber term) would be smaller as the size of the NHI subscribers increases. To see if this is the case, I group municipalities into four categories according to the size of their subscribers, and perform analysis analogous to what I performed in the previous subsection. The groups consist of municipalities with NHI subscribers less than 3,000 (small), between 3,000 and 7,000 (lower middle), between 7,000 and 17,000 (upper middle), and more than 17,000 (large). Figure 2 shows the standard deviations of per subscriber NHI benefits of the four groups. Indeed, the NHI benefits of small municipalities have always been more volatile than those of other types of municipalities, and so have been lower-middle sized municipalities than those in the two groups of larger municipalities. However, the volatilities of two larger groups of municipalities are against our expectation as the upper middle sized municipalities has been more volatile than large municipalities. Note also that the volatilities have changed over time. In particular, the volatilities of the small and lower-middle sized

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13 To obtain three thresholds that divide the four groups, I referred to the quartiles of the distributions of municipalities by the size of their subscribers. Since the number of municipalities is different from one year to another due to municipal mergers which peaked in mid-2000s, the quartiles of municipal distributions are also different over the years as Table A1 in appendix shows. To obtain the thresholds that are constant throughout the period, I then used the arithmetic means of the quartiles calculated for each of the 10 fiscal years. The three average values, listed in the far-right column of Table A1, approximate the three thresholds (3,000, 7,000, 17,000). Table A2 shows the distribution of these municipalities over the decade.
municipalities seem to have been on increasing trends, whereas those of the upper-middle sized and larger municipalities have relatively been stable except in FY 2008.

The seven panels in Figure 3 show changes in the contribution to stabilization by the seven revenue items. I may characterize the changing effects of each revenue item on stabilization as follows. First, while the central transfers constitute a large proportion of the stabilizing effect, their effects may be different over the size of municipality. For the small and middle-sized (lower and upper) municipalities, the effects seem to be on a slightly decreasing trend toward the end of the period. For the large municipalities, the effects seem to have gradually increased from FY 2003. Second, the prefectural transfers exhibit trends which are opposite to the effects of the central transfers. While the effects of prefectural transfers have decreased for large municipalities, the effects are increasing for smaller-sized municipalities in the other three groups. These observations suggest that the roles of the central and prefectural transfers have been substituted between smaller and larger municipalities.

Third, the effects of the inter-institutional transfers have been volatile being large in the period before FY 2008 and quite small after FY 2008 for municipalities smaller than and equal to lower-middle sized municipalities. On the other hand, the effects have gradually been increasing from a relatively low value among large municipalities.

Fourth, while the statutory intra-municipal transfers have done little in smoothing the changes in the NHI benefits, the discretionary counterparts have exerted some effects before FY 2007 (when new measures of local fiscal solvency were introduced). In particular, the stabilization effects were rather large among small municipalities in FY 2005 and FY 2006. This would suggest that smaller municipalities were used to prone to make ex-post transfers to cover the deficits, at least before the change of the local fiscal accounting in FY2007.

Fifth, the effects of inter-temporal adjustments have been larger for small municipalities, for which the effects have evolved around 20 percent with frequent ups and downs. On the other hand, the effects tend to dwindle toward the end of the period for the other types of municipalities. In other word, while there are a few exceptions, smaller municipalities tend to rely more on inter-temporal adjustments than larger municipalities do.
Lastly, the effects of premiums are again quite small except larger municipalities in FY 2005 and FY 2006. This suggests that, as we have seen in Figure 1, the shocks to the NHI benefits are almost perfectly smoothed among smaller municipalities. The rather large effects (around five percent) of premiums for large municipalities in the two fiscal years may be due to the fact that the NHI subscribers are relatively robust to accept a hike in the NHI premiums in larger municipalities.

5. Concluding Remarks

In this study, I measured the degree of stabilization in the NHI in Japan. In the NHI, there are currently more than 1,700 municipalities as insurers and several institutional routes to buffer asymmetric shocks in regional health demands among municipalities. In the process of conducting the empirical analysis, I elaborated on the methods utilized in the literature on regional risk sharing (i.e., stabilization or smoothing) and deciphered the relation between the two strands in the risk-sharing literature. I then developed my own decomposition method to conduct analysis in this study. Then, using the accounting data for the municipal NHI in the 2000s, I quantified the effects of revenue items in stabilizing the NHI premiums. I then found that the NHI premium collections are almost perfectly smoothed. In particular, the system of transfers in the NHI system plays a major role in stabilization. As mentioned in the introduction, Japan is the only country that maintains a non-competitive multiple payer system based on the traditional German system. The Japanese NHI is comparable to the regional sickness funds that once existed in Germany and the health insurance societies for the self-employed in Korea. This study implies that despite the fact that these two countries have now departed from the traditional model, Japan still follows the traditional system mainly because of the strong role of fiscal transfers. Although comparable historical studies have to be done, I suspect that the stabilization function in the NHI would be the strongest among the comparable public health insurance schemes all over the world.

Even if such fiscal transfers are effective in smoothing changes in local burdens, they may not necessarily be so in equalizing the level of the burdens. This study only examined the stabilizing effect and left out the issue of regional redistribution, which
most of the previous studies have considered. I forego the redistribution analysis because most of the transfer payments in the NHI system are financed *outside* of the system. Regional redistribution is incomplete *within* the NHI system; regional redistribution in health care concerns all the insured who are enrolled not only in the NHI but also in the other public health care programs. In fact, there is much to improve in terms of regional redistribution in the Japanese health care finance (Hayashi 2010). For example, the annual municipal premium collection per subscriber ranged from JPN¥34,724 to JPN¥142,260 in FY 2009. This also implies that the horizontal equity is compromised since households enrolled in the NHI with comparable characteristics (e.g., health risk or income) face different premium levels depending on the municipality of their residence. For example, Kitaura (2007) showed that a couple with an annual income of approximately JPN¥2.3 million, depending on their place of living, faced a variety of annual premiums ranging from below JPN¥ 60,000 to above JPN¥400,000 in FY 2003. This may imply weak equalizing effects of the transfer systems in the NHI system. Of course, measuring the weakness of the equalizing effect requires another empirical analysis, which can be a future topic for research.

References


Figure 1. Trends of decomposed stabilization effects
Figure 2. Trends of volatility (standard deviation) of per capita benefits by size
Figure 3. Trends of decomposed stabilization effects by size

Panel a. Central Transfers
Panel b. Prefectural Transfers
Panel c. Inter-institutional Transfers
Panel d. Statutory Intra-municipal Transfers
Panel e. Discretionary Intra-municipal Transfers
Panel f. Inter-temporal Adjustments
Panel g. Premiums

<3000 3000=<x<7000 7000=<x<17000 17000=<
Table 1. Public health care insurance in Japan

<table>
<thead>
<tr>
<th>Institutional Types</th>
<th>Insurer/Managing Organization</th>
<th>Population Covered</th>
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</thead>
<tbody>
<tr>
<td>Employees’ Health Insurance (EHI)</td>
<td>JHIA-managed</td>
<td>Japan Health Insurance Association (JHIA)-managed JHIA</td>
</tr>
<tr>
<td>Association-managed</td>
<td>EHI Associations</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Seamen’s Health Insurance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mutual Aid Associations</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>National Health Insurance (NHI)</td>
<td>Municipal NHI</td>
<td>Municipalities</td>
</tr>
<tr>
<td></td>
<td>NHI Association-managed</td>
<td>NHI Associations</td>
</tr>
<tr>
<td>Health Care Service for the Old</td>
<td>prefecture-based large area unions</td>
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</table>

Source: Author’s construction based on various government documents.

Table 2. Shares of revenue items in the National Health Insurance (NHI) special accounts

<table>
<thead>
<tr>
<th></th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
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<tr>
<td>Premiums</td>
<td>49.2</td>
<td>53.9</td>
<td>45.6</td>
<td>43.7</td>
<td>41.7</td>
<td>40.8</td>
<td>38.4</td>
<td>24.1</td>
<td>23.2</td>
<td>21.9</td>
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<tr>
<td>Central transfers</td>
<td>64.1</td>
<td>66.9</td>
<td>60.2</td>
<td>57.0</td>
<td>48.5</td>
<td>44.4</td>
<td>41.5</td>
<td>37.9</td>
<td>37.5</td>
<td>37.2</td>
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<td>Provincal transfers</td>
<td>1.6</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>5.9</td>
<td>7.5</td>
<td>7.3</td>
<td>7.0</td>
<td>6.6</td>
<td>6.8</td>
</tr>
<tr>
<td>Inter-institutional transfers (net)</td>
<td>−23.1</td>
<td>−32.0</td>
<td>−18.4</td>
<td>−10.2</td>
<td>−3.4</td>
<td>1.6</td>
<td>5.1</td>
<td>26.6</td>
<td>26.9</td>
<td>28.1</td>
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<td>Statutory municipal transfers</td>
<td>10.9</td>
<td>12.1</td>
<td>11.7</td>
<td>10.7</td>
<td>10.2</td>
<td>10.1</td>
<td>9.6</td>
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<td>Discretionary municipal transfers</td>
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<td>2.1</td>
<td>2.4</td>
<td>2.7</td>
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<td>2.4</td>
<td>2.1</td>
<td>2.4</td>
<td>2.7</td>
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<td>Inter-temporal adjustment</td>
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<td>1.4</td>
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<td>1.7</td>
<td>−0.7</td>
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<td>0.5</td>
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<tr>
<td>Other revenues (net)</td>
<td>−6.5</td>
<td>−6.0</td>
<td>−5.6</td>
<td>−6.3</td>
<td>−7.0</td>
<td>−6.9</td>
<td>−6.0</td>
<td>−5.0</td>
<td>−5.0</td>
<td>−5.7</td>
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<tr>
<td>Number of municipalities</td>
<td>3,235</td>
<td>3,224</td>
<td>3,144</td>
<td>2,531</td>
<td>1,835</td>
<td>1,818</td>
<td>1,804</td>
<td>1,788</td>
<td>1,723</td>
<td>1,722</td>
</tr>
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</table>

Source: Author’s calculation based on data obtained from the Ministry of Health, Labour and Welfare.
<table>
<thead>
<tr>
<th>Year</th>
<th>Changes in NHI</th>
<th></th>
</tr>
</thead>
</table>
| FY 2002 | • The matching rate of central transfers for catastrophic medical expenses has changed to the current 25%.  
        • Copayments for the insured aged less than 3 years were increased to 20% of actual medical fees.  
        • The Ministry of Health, Labour and Welfare (MHLW) changed the medical fee system. |
| FY 2003 | • The ceiling of catastrophic medical expenditures to which both central and prefectural transfers are paid was reduced from JPN¥800,000 to JPN¥700,000, resulting in a decrease in such transfers. |
| FY 2004 | • The MHLW changed the medical fee system. |
| FY 2005 | • The matching rate of central transfers for medical benefits decreased from 40% to 36%.  
        • The aggregate coverage of the Central Adjustment Grant (a central transfer) for medical benefits was reduced from 10% to 9%.  
        • The Prefectural Adjustment Grants was introduced.  
        • The matching rate of a prefectural grant for one type of municipal transfer to the NHI special account was increased from 25% to 75%. |
| FY 2006 | • The central matching rate for medical benefits decreased from 36% to 34%.  
        • The matching rate for the Prefectural Adjustment Grants increased from 5% to 7%.  
        • The medical benefits for hospital stays and meals were reduced.  
        • The co-payments for the elderly with income above a certain level were increased from 20% to 30%.  
        • The within-prefecture cost sharing scheme for catastrophic medical expenditures more than JPN¥300,000 was introduced.  
        • The MHLW changed the medical fee system. |
| FY 2008 | • Those aged 75 years and above who had been enrolled in the NHI became covered by the Health Care Service for the Old-Old (HCSOO), where each NHI insurer contributes funds to the HCSOO to finance the medical benefits of the “old-old” through a new system of inter-institutional transfers.  
        • A new equalizing scheme for the expenses of those aged between 65 and 75 years in social insurance schemes (including the NHI) was introduced (inter-institutional transfers).  
        • The MHLW changed the medical fee system. |

Source: Author’s descriptions based on various government documents.
## Table 4. Sample statistics: municipalities

<table>
<thead>
<tr>
<th>Variables</th>
<th>2002 (N = 3,223)</th>
<th>2003 (N = 3,129)</th>
<th>2004 (N = 2,470)</th>
<th>2005 (N = 1,756)</th>
<th>2006 (N = 1,816)</th>
<th>2007 (N = 1,803)</th>
<th>2008 (N = 1,788)</th>
<th>2009 (N = 1,721)</th>
<th>All periods (N = 19,429)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NHI medical benefits</td>
<td>-13,071</td>
<td>11,800</td>
<td>-318,239</td>
<td>112,986</td>
<td>16,936</td>
<td>11,698</td>
<td>-117,652</td>
<td>190,684</td>
<td></td>
</tr>
<tr>
<td>Premium</td>
<td>-716</td>
<td>3,059</td>
<td>-31,852</td>
<td>30,284</td>
<td>-2,535</td>
<td>3,725</td>
<td>-34,752</td>
<td>18,207</td>
<td></td>
</tr>
<tr>
<td>Central transfers</td>
<td>-5,051</td>
<td>10,456</td>
<td>-256,288</td>
<td>106,775</td>
<td>2,051</td>
<td>11,317</td>
<td>-111,839</td>
<td>140,878</td>
<td></td>
</tr>
<tr>
<td>Prefectural transfers</td>
<td>-947</td>
<td>1,606</td>
<td>-21,800</td>
<td>13,230</td>
<td>113</td>
<td>1,774</td>
<td>-12,426</td>
<td>22,348</td>
<td></td>
</tr>
<tr>
<td>Inter-institutional transfers</td>
<td>-7,940</td>
<td>12,326</td>
<td>-109,438</td>
<td>79,103</td>
<td>13,494</td>
<td>12,268</td>
<td>-73,823</td>
<td>131,104</td>
<td></td>
</tr>
<tr>
<td>Statutory municipal transfers</td>
<td>-17</td>
<td>2,592</td>
<td>-26,664</td>
<td>39,554</td>
<td>1,600</td>
<td>2,983</td>
<td>-49,900</td>
<td>30,603</td>
<td></td>
</tr>
<tr>
<td>Discretionary municipal transfers</td>
<td>-65</td>
<td>4,046</td>
<td>-101,197</td>
<td>57,101</td>
<td>106</td>
<td>4,139</td>
<td>-51,184</td>
<td>53,291</td>
<td></td>
</tr>
<tr>
<td>Inter-temporal adjustments</td>
<td>334</td>
<td>10,552</td>
<td>-78,204</td>
<td>87,906</td>
<td>2,468</td>
<td>10,651</td>
<td>-63,356</td>
<td>105,144</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>1,331</td>
<td>6,043</td>
<td>-64,319</td>
<td>104,182</td>
<td>-361</td>
<td>5,891</td>
<td>-109,118</td>
<td>81,370</td>
<td></td>
</tr>
</tbody>
</table>

### Notes:
- All variables are differenced, measured in JPN¥, and in per subscriber terms.
Table 5. Contributions to stabilization

<table>
<thead>
<tr>
<th>Revenue sources</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central transfers</td>
<td>50.1</td>
<td>41.7</td>
<td>35.6</td>
<td>41.3</td>
<td>45.1</td>
<td>24.5</td>
<td>19.8</td>
<td>33.1</td>
<td>40.6</td>
</tr>
<tr>
<td>Prefectural transfers</td>
<td>5.1</td>
<td>4.1</td>
<td>5.1</td>
<td>2.9</td>
<td>7.2</td>
<td>19.4</td>
<td>9.3</td>
<td>32.5</td>
<td>26.6</td>
</tr>
<tr>
<td>Inter-institutional transfers (net)</td>
<td>17.0</td>
<td>21.4</td>
<td>19.8</td>
<td>16.7</td>
<td>14.1</td>
<td>34.8</td>
<td>69.9</td>
<td>14.1</td>
<td>-1.3</td>
</tr>
<tr>
<td>Intra-municipal transfers (statutory)</td>
<td>0.6</td>
<td>1.0</td>
<td>0.8</td>
<td>1.7</td>
<td>1.6</td>
<td>-1.2</td>
<td>3.6</td>
<td>0.7</td>
<td>2.4</td>
</tr>
<tr>
<td>Intra-municipal transfers (non-discretionary)</td>
<td>8.5</td>
<td>6.9</td>
<td>15.4</td>
<td>20.1</td>
<td>15.3</td>
<td>-3.4</td>
<td>-1.9</td>
<td>-11.7</td>
<td>1.7</td>
</tr>
<tr>
<td>Intertemporal transfers</td>
<td>16.1</td>
<td>23.9</td>
<td>23.8</td>
<td>13.6</td>
<td>16.3</td>
<td>17.4</td>
<td>-0.4</td>
<td>23.2</td>
<td>22.1</td>
</tr>
<tr>
<td>Others (net)</td>
<td>1.6</td>
<td>1.8</td>
<td>-0.0</td>
<td>3.9</td>
<td>1.6</td>
<td>10.3</td>
<td>-4.7</td>
<td>8.5</td>
<td>6.7</td>
</tr>
<tr>
<td>Premiums</td>
<td>1.0</td>
<td>-0.7</td>
<td>-0.5</td>
<td>-0.2</td>
<td>-1.1</td>
<td>-1.7</td>
<td>4.3</td>
<td>-0.5</td>
<td>1.4</td>
</tr>
<tr>
<td>The number of municipalities</td>
<td>3,223</td>
<td>3,129</td>
<td>2,470</td>
<td>1,759</td>
<td>1,816</td>
<td>1,803</td>
<td>1,788</td>
<td>1,721</td>
<td>1,720</td>
</tr>
</tbody>
</table>

Notes: *** p ≤ .01, ** .01 < p ≤ .05; * .05 < p ≤ .10 (based on the robust standard errors). The unit is in percentage.
## Appendix

### Table A1. Thresholds of quartiles in the distribution of municipalities by the NHI subscribers' sizes

<table>
<thead>
<tr>
<th>Fiscal Years</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>10-year average</th>
</tr>
</thead>
<tbody>
<tr>
<td>50%</td>
<td>4,277</td>
<td>4,375</td>
<td>4,568</td>
<td>6,165</td>
<td>10,035</td>
<td>10,118</td>
<td>10,214</td>
<td>7,461</td>
<td>7,923</td>
<td>7,804</td>
<td>7,294</td>
</tr>
<tr>
<td>75%</td>
<td>9,763</td>
<td>10,025</td>
<td>10,790</td>
<td>15,157</td>
<td>24,388</td>
<td>24,408</td>
<td>24,305</td>
<td>18,628</td>
<td>19,492</td>
<td>19,198</td>
<td>17,615</td>
</tr>
<tr>
<td>The number of municipalities</td>
<td>3,235</td>
<td>3,224</td>
<td>3,144</td>
<td>2,531</td>
<td>1,835</td>
<td>1,818</td>
<td>1,804</td>
<td>1,788</td>
<td>1,723</td>
<td>1,722</td>
<td>2,282</td>
</tr>
</tbody>
</table>

Notes: The numbers shown in the table is the size of NHI subscribers in a municipality at a given percentile of the distribution.

### Table A2. The number of municipalities by the NHI subscribers’ sizes

<table>
<thead>
<tr>
<th>Fiscal Years Sizes</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>1,119</td>
<td>1,046</td>
<td>654</td>
<td>321</td>
<td>323</td>
<td>322</td>
<td>441</td>
<td>409</td>
<td>416</td>
</tr>
<tr>
<td>Lower middle</td>
<td>990</td>
<td>956</td>
<td>705</td>
<td>386</td>
<td>382</td>
<td>373</td>
<td>410</td>
<td>386</td>
<td>391</td>
</tr>
<tr>
<td>Upper middle</td>
<td>616</td>
<td>612</td>
<td>561</td>
<td>461</td>
<td>485</td>
<td>484</td>
<td>440</td>
<td>424</td>
<td>419</td>
</tr>
<tr>
<td>Large</td>
<td>498</td>
<td>515</td>
<td>550</td>
<td>591</td>
<td>626</td>
<td>624</td>
<td>497</td>
<td>502</td>
<td>494</td>
</tr>
</tbody>
</table>
Table A3. Contributions to stabilization: small municipalities with less than 3,000 subscribers

<table>
<thead>
<tr>
<th>Revenue sources</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central transfers</td>
<td>49.5</td>
<td>42.6</td>
<td>36.6</td>
<td>46.2</td>
<td>47.7</td>
<td>18.5</td>
<td>22.2</td>
<td>27.0</td>
<td>39.6</td>
</tr>
<tr>
<td>Prefectural transfers</td>
<td>5.3</td>
<td>4.1</td>
<td>5.1</td>
<td>1.0</td>
<td>4.8</td>
<td>18.5</td>
<td>12.6</td>
<td>33.2</td>
<td>24.4</td>
</tr>
<tr>
<td>Inter-institutional transfers (net)</td>
<td>16.0</td>
<td>18.6</td>
<td>23.1</td>
<td>13.0</td>
<td>7.9</td>
<td>36.1</td>
<td>57.5</td>
<td>16.4</td>
<td>-1.9</td>
</tr>
<tr>
<td>Intra-municipal transfers (statutory)</td>
<td>0.7</td>
<td>1.3</td>
<td>0.6</td>
<td>2.1</td>
<td>1.6</td>
<td>-2.3</td>
<td>3.9</td>
<td>0.1</td>
<td>2.4</td>
</tr>
<tr>
<td>Intra-municipal transfers (non-discretionary)</td>
<td>8.1</td>
<td>4.3</td>
<td>2.0</td>
<td>21.0</td>
<td>18.6</td>
<td>-7.3</td>
<td>-0.9</td>
<td>-14.7</td>
<td>0.7</td>
</tr>
<tr>
<td>Inter-temporal transfers</td>
<td>18.2</td>
<td>26.5</td>
<td>34.2</td>
<td>12.4</td>
<td>19.3</td>
<td>26.9</td>
<td>6.4</td>
<td>27.0</td>
<td>27.2</td>
</tr>
<tr>
<td>Others (net)</td>
<td>1.6</td>
<td>3.4</td>
<td>1.1</td>
<td>4.7</td>
<td>1.9</td>
<td>11.4</td>
<td>-2.3</td>
<td>10.7</td>
<td>6.5</td>
</tr>
<tr>
<td>Premiums</td>
<td>0.7</td>
<td>-0.8</td>
<td>-2.7</td>
<td>-0.4</td>
<td>-1.8</td>
<td>-1.9</td>
<td>0.5</td>
<td>0.2</td>
<td>1.0</td>
</tr>
<tr>
<td>The number of municipalities</td>
<td>1,119</td>
<td>1,046</td>
<td>654</td>
<td>321</td>
<td>323</td>
<td>322</td>
<td>441</td>
<td>409</td>
<td>416</td>
</tr>
</tbody>
</table>

Notes: *** $p \leq .01$, ** $.01 < p \leq .05$; * $.05 < p \leq .10$ (based on the robust standard errors). The unit is in percentage.
Table A4. Contributions to stabilization: medium-sized municipalities with subscribers between 3,000 and 7,000

<table>
<thead>
<tr>
<th>Revenue sources</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central transfers</td>
<td>52.8</td>
<td>45.9</td>
<td>33.0</td>
<td>26.4</td>
<td>39.2</td>
<td>34.1</td>
<td>15.3</td>
<td>41.6</td>
<td>43.4</td>
</tr>
<tr>
<td>Prefectural transfers</td>
<td>4.2</td>
<td>3.4</td>
<td>4.1</td>
<td>4.8</td>
<td>15.6</td>
<td>21.4</td>
<td>8.7</td>
<td>28.4</td>
<td>32.9</td>
</tr>
<tr>
<td>Inter-institutional transfers (net)</td>
<td>18.3</td>
<td>21.1</td>
<td>11.2</td>
<td>19.5</td>
<td>39.6</td>
<td>35.9</td>
<td>75.4</td>
<td>6.6</td>
<td>-3.2</td>
</tr>
<tr>
<td>Intra-municipal transfers (statutory)</td>
<td>-0.1</td>
<td>0.7</td>
<td>0.7</td>
<td>0.1</td>
<td>0.7</td>
<td>-1.7</td>
<td>2.7</td>
<td>3.2</td>
<td>3.8</td>
</tr>
<tr>
<td>Intra-municipal transfers (discretionary)</td>
<td>11.3</td>
<td>14.1</td>
<td>44.1</td>
<td>22.7</td>
<td>0.7</td>
<td>8.0</td>
<td>-1.0</td>
<td>-3.4</td>
<td>8.8</td>
</tr>
<tr>
<td>Inter-temporal transfers</td>
<td>10.1</td>
<td>18.0</td>
<td>6.0</td>
<td>23.7</td>
<td>0.2</td>
<td>-0.8</td>
<td>-0.2</td>
<td>24.1</td>
<td>3.4</td>
</tr>
<tr>
<td>Others (net)</td>
<td>2.6</td>
<td>-2.3</td>
<td>-2.7</td>
<td>2.9</td>
<td>3.2</td>
<td>*</td>
<td>2.6</td>
<td>-3.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Premiums</td>
<td>0.8</td>
<td>-0.9</td>
<td>3.5</td>
<td>-0.2</td>
<td>0.8</td>
<td>0.6</td>
<td>2.6</td>
<td>*</td>
<td>-1.9</td>
</tr>
<tr>
<td>The number of municipalities</td>
<td>990</td>
<td>956</td>
<td>705</td>
<td>386</td>
<td>382</td>
<td>373</td>
<td>410</td>
<td>386</td>
<td>391</td>
</tr>
</tbody>
</table>

Notes: *** $p \leq .01$, ** $0.01 < p \leq .05$; * $0.05 < p \leq 0.10$ (based on the robust standard errors). The unit is in percentage.
Table A5. Contributions to stabilization: medium-sized municipalities with subscribers between 7,000 and 17,000

<table>
<thead>
<tr>
<th>Revenue sources</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central transfers</td>
<td>46.4 ***</td>
<td>20.4 ***</td>
<td>43.9 ***</td>
<td>41.6 ***</td>
<td>31.2 ***</td>
<td>32.6 ***</td>
<td>-1.6</td>
<td>50.5 ***</td>
<td>48.6 ***</td>
</tr>
<tr>
<td>Prefectural transfers</td>
<td>7.2 ***</td>
<td>8.4 ***</td>
<td>10.6 ***</td>
<td>10.6 ***</td>
<td>19.1 ***</td>
<td>20.8 ***</td>
<td>-3.3 ***</td>
<td>30.4 ***</td>
<td>37.8 ***</td>
</tr>
<tr>
<td>Inter-institutional transfers (net)</td>
<td>25.4 ***</td>
<td>46.0 ***</td>
<td>24.6 ***</td>
<td>30.0 ***</td>
<td>37.2 ***</td>
<td>36.9 ***</td>
<td>14.2 ***</td>
<td>3.1</td>
<td>1.4</td>
</tr>
<tr>
<td>Intra-municipal transfers (statutory)</td>
<td>2.0</td>
<td>-0.1</td>
<td>2.0</td>
<td>2.7</td>
<td>1.8</td>
<td>0.5</td>
<td>-0.9</td>
<td>1.7</td>
<td>1.8</td>
</tr>
<tr>
<td>Intra-municipal transfers (discretionary)</td>
<td>2.5</td>
<td>-0.8</td>
<td>-1.3</td>
<td>5.2 *</td>
<td>5.1 *</td>
<td>0.1</td>
<td>3.1 ***</td>
<td>-2.2</td>
<td>0.3</td>
</tr>
<tr>
<td>Inter-temporal transfers</td>
<td>6.1</td>
<td>21.5 ***</td>
<td>18.7 ***</td>
<td>4.7</td>
<td>11.3 *</td>
<td>6.2</td>
<td>79.3 ***</td>
<td>24.3 ***</td>
<td>4.6</td>
</tr>
<tr>
<td>Others (net)</td>
<td>2.3</td>
<td>2.9</td>
<td>2.4</td>
<td>4.8 *</td>
<td>-4.9</td>
<td>4.6 **</td>
<td>-3.3 ***</td>
<td>-2.9</td>
<td>5.2</td>
</tr>
<tr>
<td>Premiums</td>
<td>8.1 ***</td>
<td>1.7</td>
<td>-0.8</td>
<td>0.5</td>
<td>-0.8</td>
<td>0.0</td>
<td>5.6 ***</td>
<td>-4.8 *</td>
<td>0.2</td>
</tr>
<tr>
<td>The number of municipalities</td>
<td>616</td>
<td>612</td>
<td>561</td>
<td>461</td>
<td>485</td>
<td>484</td>
<td>440</td>
<td>424</td>
<td>419</td>
</tr>
</tbody>
</table>

Notes: *** \( p \leq .01 \), ** \( .01 < p \leq .05 \), * \( .05 < p \leq 0.10 \) (based on the robust standard errors). The unit is in percentage.
Table A6. Contributions to stabilization: large municipalities with more-than 17,000 subscribers

<table>
<thead>
<tr>
<th>Revenue sources</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central transfers</td>
<td>46.4</td>
<td>20.4</td>
<td>43.9</td>
<td>41.6</td>
<td>31.2</td>
<td>32.6</td>
<td>-1.6</td>
<td>50.5</td>
<td>48.6</td>
</tr>
<tr>
<td>Prefectural transfers</td>
<td>7.2</td>
<td>8.4</td>
<td>10.6</td>
<td>10.6</td>
<td>19.1</td>
<td>20.8</td>
<td>-3.3</td>
<td>30.4</td>
<td>37.8</td>
</tr>
<tr>
<td>Inter-institutional transfers (net)</td>
<td>25.4</td>
<td>46.0</td>
<td>24.6</td>
<td>30.0</td>
<td>37.2</td>
<td>36.9</td>
<td>14.2</td>
<td>3.1</td>
<td>1.4</td>
</tr>
<tr>
<td>Intra-municipal transfers (statutory)</td>
<td>2.0</td>
<td>-0.1</td>
<td>2.0</td>
<td>2.7</td>
<td>1.8</td>
<td>0.5</td>
<td>-0.9</td>
<td>1.7</td>
<td>1.8</td>
</tr>
<tr>
<td>Intra-municipal transfers (discretionary)</td>
<td>2.5</td>
<td>-0.8</td>
<td>-1.3</td>
<td>5.2</td>
<td>5.1</td>
<td>0.1</td>
<td>3.1</td>
<td>-2.2</td>
<td>0.3</td>
</tr>
<tr>
<td>Inter-temporal transfers</td>
<td>6.1</td>
<td>21.5</td>
<td>18.7</td>
<td>4.7</td>
<td>11.3</td>
<td>6.2</td>
<td>79.3</td>
<td>24.3</td>
<td>4.6</td>
</tr>
<tr>
<td>Others (net)</td>
<td>2.3</td>
<td>2.9</td>
<td>2.4</td>
<td>4.8</td>
<td>-4.9</td>
<td>4.6</td>
<td>-3.3</td>
<td>-2.9</td>
<td>5.2</td>
</tr>
<tr>
<td>Premiums</td>
<td>8.1</td>
<td>1.7</td>
<td>-0.8</td>
<td>0.5</td>
<td>-0.8</td>
<td>0.0</td>
<td>5.6</td>
<td>-4.8</td>
<td>0.2</td>
</tr>
<tr>
<td>The number of municipalities</td>
<td>498</td>
<td>515</td>
<td>550</td>
<td>591</td>
<td>626</td>
<td>624</td>
<td>497</td>
<td>502</td>
<td>494</td>
</tr>
</tbody>
</table>

Notes: *** $p \leq .01$, ** $0.01 < p \leq .05$; * $0.05 < p \leq 0.10$ (based on the robust standard errors). The unit is in percentage.