An Estimation of Price Elasticity of Medical Care Demand
Evidence from Japanese Policy Reforms During 40 Years*

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1. Introduction

During the 1990s, the growth rate of medical care expenditure has exceeded the economic growth rate. The ratio of national medical expenditure to GDP has increased from 4.7 percent in 1990 to 5.7 percent in 1997. The expanding payments to medical institutions caused financial troubles to the public insurance groups and the national and local governments, who subsidize the health insurance system. Responding to this situation, the policymaker has recently made several reforms that raise out-of-pocket expenses of medical care; for example, the coinsurance rate of employees was raised from 10 percent to 20 percent in September 1997, and the deductible paid by the elderly has been successively increased during the last decade.

How the medical care expenditure responds to such policy changes is an important policy debate. In assessing the behavioral response, researchers have faced a difficulty caused by the fact that Japan has achieved the universal health insurance since 1961. Since every Japanese citizen is covered by one of public health insurance systems, it is difficult to get sufficient variation in medical prices to estimate the response of expenditure accurately.† A social experiment like Newhouse and the Insurance Experiment Group (1993), is practically

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† Although the legislation states the enrollment of public health insurance system is compulsory, a small share of citizens refuse to pay a premium, and are not covered by the health insurance. The number has been growing recently, reflecting stagnant economic conditions and a rise in premium.
difficult or infeasible in Japan, where the universal health insurance has already been offered.

This paper aims to develop another way of estimating the price elasticity of medical care in Japan by gathering events of natural experiment in nearly forty years. Our empirical method utilizes the peculiar features of the Japanese health insurance market. First, the Japanese health insurance system consists of many subsystems, which are operated separately, mainly due to its historical developments. A subsystem sometimes applies a different rule and changes a rule independently. We thus find 19 cases of health insurance reforms that changed the out-of-pocket payment rule of subset of population. These reforms make it possible for us to find a control group, who is not affected by the policy change. The availability of control group gives us an opportunity of employing the difference-in-difference method, which has now been widely employed in many areas of empirical study. Second, since the public health insurance system is a single payer of the medical care market, comprehensive monthly data of payments to medical institutions has been compiled. Although they are aggregated, their coverage of long period helps us gather many natural experiments, which are not provided by micro data or survey data. Third, the health insurance subsystems employ the same rule of coverage of medical care and of reimbursement to providers. This fact saves us controlling for these aspects, which can be a serious concern under the market with private health insurances.

The rest of this paper is organized as follows. Section 2 overviews the characteristic of Japanese public health insurance system and the existing literature of medical care demand. Section 3 explains our estimation methods. Section 4 presents results. Our major finding is that the reasonable range of elasticity of outpatient care is between –0.1 and –0.3, which is consistent with the consensus estimates in other nations. Some discussions are appeared in Section 5. Section 6 concludes the paper.
2. Backgrounds

2.1 Overview of the Public Health Insurance System

Since our research needs the knowledge of institutional details of Japanese public health insurance system, we begin with briefly summarizing the characteristic of our health insurance system.

The universal health insurance means that Japanese citizens belong to one of eight public health insurance systems. Which system they belong to is determined automatically by their working status or residential location. There is no freedom to choose a health insurance system. Eight systems are roughly classified to (1) insurance for employees and their dependents, (2) insurance for the self-employed, retirees and their dependents, and (3) insurance for the elderly who aged 70 and over.\(^2\)

(1) The first type of insurance is Employee’s Health Insurance (EHI), which consists of the following subsystems.

   (a) Government-managed Health Insurance (Seikan): The workers employed by small and medium companies are enrolled with this system. The national government operates it as an insurer.

   (b) Society-managed Health Insurance (Kumiai): Large firms can organize their own insurance group instead of making their employees enrolled with Government-managed HI (Health Insurance). Premiums vary with financial conditions of society.

   (c) Seaman’s Insurance (Sen-in): The national government operates an insurance for the seamen and their dependents.

   (d) Mutual Aid Associations (Kyosai): This is a collection of insurance groups for national and local public employees and private school teachers and staff.

(2) The second type of insurance is called National Health Insurance (NHI, Kokuho). There are three types of NHI.

   (a) General (Ippan): Municipals operate an NHI for the persons who do not belong to other health insurance system.

   (b) NHI associations (Kokuho Kumiai): A group of the self-employed (for example, doctors, carpenters) assemble their insurance group in the NHI system.

   (c) Retirees formerly under Employees’ Health Insurance (Taishokusha Iryo): This system

\(^2\) In discussing health insurance, the elderly is commonly defined by those aged 70 and over.
was established in October 1984. Retirees formerly under EHI (aged under 69) form a special group, whose rule is different from other parts of NHI. Their partial cost-sharing rule is the same as EHI’s. Their medical expenditure is paid from a fund whose sources are premiums of the numbers and of the EHI. From the viewpoint of health care financing, they are effectively a part of EHI.

(3) The third type of insurance is Health Services for the Elderly (Roken): The cost-sharing rule of those aged 70 and over are subject to this system, which was established in February 1983. The elderly pays a lower share of medical costs per visit. Before the current system was established, total medical costs of the elderly had been financed by the insurance premium and from the government since January 1973. The payments from the insurance are made mainly of the transfers from other insurances and subsidies of the government.

Coverage of medical care and reimbursement to providers are the same among the health insurance system. Benefits of the public health insurance cover about 93 percent of total national medical care expenditure in 1997. Reimbursement to health care providers is based on a fee-for-service schedule, which is uniform across regions. The schedule is revised every other year. Roughly speaking, the patient can purchase most of available medical treatments at the publicly determined price through the public health insurance.

Contrary to the benefit side, the insurance systems take a different way of financing medical costs. Premium rates are different among groups, reflecting the difference in income level and in average medical expenditure of enrollees. NHI and Health Services for the Elderly receive subsidies from the national and local governments, while EHI does not. Since the focus of our paper is on cost sharing, we do not discuss details of financing issues here.

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3 This does not imply the elderly pay less on average, because they visit doctors more often than the non-elderly.
4 The number is the sum of reimbursements from the insurance and out-of-pocket expenses. The data source does not give the exact number, because the patient’s cost sharing are mixed with other items.
5 When we handle cross-section data, we do not have to worry very much about differences of coverage and reimbursement. The analysis of time series data has to deal with a legislative change in these aspects. Since this kind of change affects the insurance system uniformly, the assumption that it is an aggregate shock is not a bad approximation. As shown below, the difference-in-difference method can control for the aggregate shock.
2.2 Literature Review

The response of medical care costs to coinsurance rate has long been known as “Nagase effect” by Japanese health policy professionals. Nagase pointed out in 1935 that the medical care costs, \( y \), is a quadratic function of coinsurance rate, \( x \), like

\[
y = 1 - 1.6 x + 0.8 x^2.
\]

When the coinsurance rate is 10 (20, 30) percent, the price elasticity implied by the Nagase effect is \(-0.17 (-0.36, -0.57)\). While Nagase and older earlier studies (for example, Maeda, 1978\(^6\)) addressed the price effect of medical care demand, they had not calculated the price elasticity itself.

The estimation of price elasticity is an emerging new industry in Japanese health policy research. Previous studies employ three different ways of identifying a variation in medical prices; (1) time series changes due to policy reforms, (2) cross-sectional differences in rules among insurance systems, (3) a dedicated survey which asks people how to behave under hypothetical prices.

Nakanishi (2000) used aggregated time series data of quarterly medical expenses and their prices from Household Expenditure Survey. The sample period is from 1971 to 1997. His estimates of price elasticity ranges between \(-0.53\) and \(-0.68\). Sawano (2001) was based on aggregated prefectural data pooled from 1983 to 1998. A dependent variable is per capita outpatient visit of the insured of government-managed HI. He focused on two policy changes. The first one is an event of October 1984, when the cost-sharing schema of insured of HI was changed from a deductible to 10 percent coinsurance rate. The second is on September 1997, when the coinsurance rate of employees was raised from 10 percent to 20 percent. His estimates of price elasticity are between \(-0.04\) and \(-0.08\).\(^7\)

Using micro data, Ii and Ohkusa (1999a) estimated a multinomial probit model, where the alternatives for the people complaining of symptoms were going to see a doctor or the over-the-counter drags. Using the cross-sectional difference in coinsurance rate between

\(^6\) Maeda (1978) compared a trend growth line before and after the reforms of coinsurance rate. Since he focuses only on the behavior of the treatment groups, aggregate time-varying effect is not controlled for.

\(^7\) Yoshida and Ito (2000) used a set of claims from medical institution to society-managed HI, and compared the behavior of visits before and after the reform of September 1997. Although they did not calculate the price elasticity, they found the dependents of HI changed their behavior while behavioral changes of treatment group are not detected. Using micro data, they could control for a type of deceases.
insurance systems as an independent variable, they estimated the price elasticity of the office visits, and find the elasticity is between \(-0.144\) to \(-0.149\). Sawano (2000) focused on the outpatient visit and numbers of days per episode of the elderly. The variation of the policy variable was taken from the cross-sectional variation between Roken and Taishokusha Iryo. He estimated the elasticity of outpatient visit was between \(-0.08\) and \(-0.13\).

Ii and Ohkusa (1999b) conducted an original survey, which asked whether to seeing a doctor under hypothesized cost situations if the respondent catches a cold. They estimated the price elasticity was between \(-0.23\) and \(-0.36\).\(^8\)

\(^8\) Suzuki and Ohkusa’s (2000) study is based on another original survey, which uses a conjoint method. They reported the response of the demand for health care demand becomes higher than obtained by Ii and Ohkusa (1999b), which does not employ a conjoint method.
3. Methods

3.1 Difference-in-difference method

We estimate the price elasticity of the demand for health care with a difference-in-difference method. This method is applicable only when a reform of cost-sharing rule with patients affects only a subgroup of the insured. We call the treatment group those who are affected by a policy change, and the control group those who are not affected. A typical grouping is the insured of Employee’s Health Insurance, the dependent of EHI, the NHI, and the elderly, while a slightly different grouping may be employed if it is required by the characteristic of policy reforms and data sources. There may be plural control groups in some reforms.

We calculate the price elasticity of medical care demand as follows. The percent change in the price, which is the denominator of the elasticity formula, is obtained from

\[
\frac{\text{price after the reform} \ - \ \text{price before the reform}}{\text{price before the reform}} \times 100\%.
\]

where price is the coinsurance rate. When the cost-sharing rule adopts a deductible, the ratio of total out-of-pocket payments to total medical costs are used.\(^9\) The percent change in medical demand are calculated for the treatment and control groups with

\[
\frac{\text{medical expenditure after the reform} \ - \ \text{medical expenditure before the reform}}{\text{medical expenditure before the reform}} \times 100\%.
\]

The numerator of the elasticity formula is a difference of (2) between the treatment group and the control group.

A merit of difference-in-difference method can be explained as the following way. Let \( x \) be the policy variable, \( y \) the dependent variable, \( i \) the index for group, \( t \) the unit of time. The dependent variable of each group is governed by

\[
y_{it} = a_i + b_t + \epsilon_{it},
\]

where \( a \) is an group-specific factor (constant over time) and \( b \) an aggregate shock (same across group). We should estimate \( \epsilon \), which represents the effect of policy on the dependent variable.

When we take a difference between groups with cross-sectional data, (3) becomes

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\(^9\) We do not include time costs of office visits, because it is difficult to obtain a reliable estimate. Ogura (1990) presented a preliminary analysis of estimating time costs.
where \( e \) represent a treatment group, \( c \) a control group, \( \Delta \) the change in variables between the policy shift, which occur at period 1. The method of looking at cross-sectional difference can eliminate aggregate shocks, but the group-specific factor should be controlled for through other careful procedures. On the other hand, looking at the change in the variable of a treatment group, we obtain

\[ \Delta y_e \equiv \Delta b \equiv \pi x. \]  

Unless a variation in the aggregate shock is identified, we cannot obtain the estimate of \( \pi \). The difference-in-difference method focuses on the difference in the variable between the treatment and control groups in the difference between before and after the policy change. For a control group, it holds

\[ \Delta y_c \equiv \Delta b. \]  

Subtracting (6) from (5) yields

\[ \Delta y_e - \Delta y_c \equiv \pi x. \]

The difference-in-difference method can control for the group-specific factor and the aggregate shock, without knowing their details.

3.2 Data

We use medical expenditure per capita as a dependent variable, the ratio of out-of-pocket expenses to the total expenditure as an independent variable. Although the ideal form of dependent variable is in terms of quantity, we use the value data. When the change in price is the same between the treatment and control groups, it can be eliminated by the difference-in-difference method. Therefore, using the value data is not a serious drawback.

Good data of the medical expenditure paid by the insurance system has been available, partially because the Japanese government plays an important role in operating the universal health insurance. We therefore focus on the medical expenditure covered by the public insurance system. The data source classifies them into three parts; outpatient medical care, inpatient medical care, and dental care. We focus primarily on outpatient care, while we also report the price elasticity of inpatient medical care.

The insurance groups pay the medical expenditures to medical institutions (doctor’s offices, clinics, or hospitals) through either the Kikin or the Kokuhoren. The monthly data are available through these two payment organizations. The Ministry of Health, Labour and
Welfare provides a comprehensive data since August 1997, on the World Wide Web. The system is called “MEDIAS (Medical Information Analysis System).” We obtain MEDIAS data staring 1984 from the Ministry of Health, Labour and Welfare. The data for further past months are available from the annual reports of Kikin and Kokuhoren.

The monthly data of number of enrollees are available from the annual reports of each insurance group.

In some policy reforms, the available monthly data are not well disaggregated to construct a treatment or control group. For example, the data by age group are necessary during the periods when the expenditures of the elderly aged 70 and over were fully covered by the insurance system. Unfortunately, monthly data of the expenditure by age group are not available. In such a case, we use reports of special sample survey, which gives move disaggregated data in a specific month each year. The surveyed month is April for government-managed HI and seaman’s insurance, October for society-managed HI, and May for NHI. Since there is no counterpart of Mutual Aid Associations, they cannot be used in several cases.

When monthly data are available, we take one-year average as the medical expenditure variable in equation (2), in order to eliminate the seasonality of medical care demand. When we have to rely on the data from an annual sampling survey, the medical expenditure during a surveyed month is used.

3.3 Identification of Natural Experiments

Table 1 summarizes the history of coinsurance rate of the four groups in the insurance system. The groups are (1) the employees (insured by EHI), (2) the family members of the employees (dependent of EHI), (3) the National Health Insurance, (4) the health insurance for the elderly. The forth group starts from 1973. Before then they had been included into either of the other three groups. When the Health Insurance Act was created in 1927, this insurance covered all expenditures of the employees. In 1939, the HI started to cover the half of the expenditure of dependents as their voluntary benefit. The coverage of dependents was mandated in 1943 with the coinsurance rate of 50 percent. When the universal health insurance was achieved in 1961, the coinsurance rate of the NHI was 50 percent.

[Insert Table 1 around here]
There are 19 cases of health insurance reforms that affect the out-of-pocket payments of patients, as summarized in Table 2.\textsuperscript{10} We classify them into three subgroups. The group A (7 cases) is the reforms that the coinsurance rate was changed. They are the most suitable to examine the effect of price change. The group B (6 cases) is the reforms that the fixed amount of out-of-pocket payment was changed. The group C (7 cases) is the reforms of the insurance system for the elderly.

[Insert Table 2 around here]

Due to the data limitations, we could not estimate the elasticities for 5 cases, which are A.2, A.5, A.6, B.1 and B.2. Appendix describes why we gave up these cases and how we construct the data in other cases. We also drop cases C.4 and C.5, because we suspect very small price changes in these cases may cause a difficulty in getting a reliable result.

\textsuperscript{10} The legislation has introduced a cap of out-of-pocket expenses since 1973. Although marginal payment becomes zero in an episode of large medical costs, we do not control for such episodes due to data limitations. Since they have only a tiny share, we do not expect our estimation will suffer seriously from the presence of the cap.
4. Results

4.1 Preliminary Analysis

We plot the time series data of each group’s per capita medical expenditure in Figure 1.\textsuperscript{11} If the trend line of expenditure growth varies among groups, a difference-in-difference method may have misleading results. Figure 1 checks out this possibility. During 80’s and thereafter, the NHI group and the elderly have a higher growth trend. We do not see a noticeable difference in trend among other groups. Those findings imply that we have to be careful to interpret the estimation using the group of NHI or the elderly.

[Insert Figure 1 around here]

One possible method alleviating the problem in trends is to shorten time periods of data. We will therefore conduct an alternative estimation, which compares three-month average before and after reforms.

4.2 Baseline Results

Table 3 reports the price elasticity for outpatient medical care. We take a closer look at cases of Group A, which is most suitable for our estimation strategy. Figure 2 though 4 show the monthly movements of per-capita medical care expenditure of the treatment and control groups before and after the reforms of Case A.1, A.3 and A.7 respectively.

In case A.1 of October 1963, coinsurance rate of household head of NHI was reduced from 50 percent to 30 percent. We can use dependents of NHI, insured of EHI, and dependents of EHI as a control group. The estimated elasticity is around -0.3, which resembles the estimate of Newhouse et. al. (1993) for outpatient care, -0.31 with the coinsurance rate of 25-95 percent.

[Insert Figure 2 around here]

In the Case A.3 of October 1973, coinsurance rate of dependents of EHI was reduced from 50 percent to 30 percent. Insured of HI and NHI can be used as a control group. Since the

\textsuperscript{11} The data are nominal. The normalization with some price deflator is not a necessary task here, because we are concerned with relative growth patterns.
out-of-pocket payments of the elderly became free since 1973, we have to exclude the elderly from the treatment and control groups. After this procedure, we obtain –0.19 and –0.25 as the elasticity.

[Insert Figure 3 around here]

In Case A.7 of September 1997, coinsurance rate of the insured of EHI was raised from 10 percent to 20 percent. The estimated elasticity in this case is –0.11 and –0.13, which becomes smaller than the previous cases.

[Insert Figure 4 around here]

Since only three cases in A group are available for our study, we supplement the estimates from 4 cases in B group. Among cases in A and B groups, we obtain 15 estimates, of which median is –0.15. 9 estimates concentrate on a range between –0.1 and –0.3, which has been considered reasonable in the previous literature (for example Newhouse et. al. [1993], Zweitel and Newhouse [2000]). Smaller estimates are obtained in C group, which focuses on the response of the elderly.

4.3 Additional Examinations

(1) Estimates with a shorter period average.

Table 3 also reports the estimation results that are based on three-month average before and after the reform. They are qualitatively similar to the baseline estimates in A and B groups, but larger values of elasticity are obtained in cases of group C.

(2) Estimates by Age Group

Since per capita medial expenditure varies dramatically with ages, a change in the population structure of each insurance group will affect the per-capita medical expenditure. This effect may cause an estimation bias, because the population of NHI is aging more rapidly than those of other groups. To deal with this problem, we also estimate the price elasticities by age group. Since the data classified by age group are available only from the special sample survey, we compare the data for one month with one year interval, which contains the policy reform. Table 4 reports the estimated price elasticities by age group for cases A.3 and A.7. Overall results resemble what we see in the baseline estimates.
(3) The elasticities of other indexes

Our data source also provides the information for the utilization (the number of cases). We report the price elasticities of the utilization in Table 5. The median is –0.06. 13 out of 21 estimates ranges from –0.02 to –0.12.

Table 6 reports the price elasticities of inpatient medical care. The median is –0.06. 13 out of 21 estimates ranges between –0.01 and –0.09. The inpatient medical care seems less sensitive to out-of-pocket expenses than the outpatient care.
5. Discussion

5.1 How Reasonable are the Estimated Elasticities?

The most important point to be discussed is whether we can get a reliable result from our analysis. Since we use the aggregate data, we could not control possible factors that might be determinants of medical care received by patients. However, we think a collection of estimations poses coherent evidence about the price elasticity. The estimated elasticities in cases in A group range between −0.11 and −0.36 with the median of −0.2.

When the estimates of B group are combined with those of A group, the median becomes −0.15. About half of estimates concentrate on the range between −0.1 and −0.2. We suspect there are two reasons why the estimates of B group exhibit a less response to the price change than those of A group. First, since the marginal out-of-pocket payment is, strictly speaking, zero under the deductible, our calculation of price change might overestimate the price change patients actually face. The second reason is that the burden of the treatment group (the insured of HI) is very small. Newhouse et al. (1993) observed the price elasticity becomes large in the absolute value with the higher coinsurance rate. Their elasticity estimates were −0.17 with the coinsurance rate of 0-25 percent range and −0.31 with the 25-95 percent range. Our estimates for the non-elderly match roughly with the RAND results.

The cases for the elderly showed apparently problematic results in our baseline estimates. It accords with the previous studies, which pointed out the medical care demand of the elderly did not decrease with the rise of the out-of-pocket expenses (for example, Nishimura, 1997). The fact that the response of the elderly is small is puzzling because their time cost is considered to be small. It may be explained by the same reasons that are applied to B groups above. In addition, the estimated elasticities are biased upward, because the treatment group (the elderly) has a higher growth trend than the control group, as shown in Figure 1. The estimates using a three-month average show more reasonable results in C.3, thus supporting this explanation.

In the absence of evidence that changes a coinsurance rate of the elderly, it is premature to

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12 The real cost of medical care is the sum of out-of-pocket payment and opportunity costs of time devoted to taking medical care. When the share of time cost is small, the same percent change in out-of-pocket payment leads to a higher percent change in total costs. Even if the elasticity with respect to the real costs is the same, the estimated elasticity with respect to out-of-pocket payments becomes large.
determine whether the behavior of medical care demand is coherent between the elderly and the non-elderly.

The only earlier study that focused on the response of medical costs is Nakanishi (2000). His study were based on the aggregate time series data, and showed a higher response than our estimates. Since the scope of medical expenditure and prices is far different, his study and ours are not directly comparable. It has been known that the analyses using the aggregate time series data leads to a wide range estimate because the aggregate time series data may not provide enough variation of prices. We think our estimates are more reliable because we employed a more careful method of identifying price changes and controlling for unobserved factors.

5.2 Endogeneity Issues

Another concern is how serious the endogeneity problem of the policy variable is in our estimation procedure. A treatment group may not be selected randomly, because a change in policy variable happens to be endogenously. A possible scenario is that an increase in the health care expenditure due to a group-specific reason may force the insurance system to raise the out-of-pocket payments of patients. The endogeneity problem had been a major problem in the analyses using nonrandomized data. People who expect a higher medical expenditure will purchase an insurance plan, which offers a lower out-of-pocket cost sharing. Their behavior causes a negative relationship between cost sharing and medical expenditure. The endogeneity problem we face has a different character, however, because the group who spends more in medical care will eventually face an insurance plan that has a higher cost sharing. The relationship between cost sharing and medical expenditure is then positive, thus leading to an upward bias. Since we obtain the negative value of elasticity, the possibility of upward bias will reinforce our conclusion.

One should also worry about the possibility that natural experiments may cause a movement of people between the treatment group and the control group. A merit of our procedure is that this type of endogeneity bias is not likely to be serious because of the following reasons. First, the policy change has constantly aimed at narrowing the out-of-pocket payments among insurance systems. When a legislative change reduces a coinsurance rate, a new lower rate is not favorable for the control group (A.2 and A.3). By the same token, when the policy change raised the burden of patients, a new higher burden is still favorable for the treatment group (A.1 and all cases in B group). Secondly, since the
eligibility of the insurance for the elderly is determined solely by age, the treatment group is invariant in all cases in C group. In A.5, since the treatment group was defined by the past working history, no one could manipulate the enrollment of the treatment group.

The remaining three cases contain the incentive to shift between groups. In A.1, the dependent of NHI had an incentive to become the household head of NHI. In A.4, the insured of NHI had an incentive to become a dependent of EHI. In case A.6, the insured of NHI had an incentive to become a dependent of Retirees formerly under HI. We think that it was very costly to utilize the favor given by these policy changes because one had to change the family structure.13

13 In a future version of this paper, we will check the inflow or outflow caused by policy changes by looking at the number of enrollees of insurance subsystems before and after reforms.
6. Conclusion

Evidence from a variety of natural experiments spanning a wide range of time horizon shows an empirical regularity. The medical care expenditure responds to how much an patients pay out of their pockets. We estimated the elasticity of medical care with respect to the money price range from –0.1 to –0.3. The Japanese behavioral response is roughly comparable with other countries.
Appendix

This appendix gives a brief sketch of policy reforms that we focus on in this paper. We also explain specific notices of our estimation methods.

A.1 Changes in Coinsurance Rate (Group A)

A.1 (October 1963)

Treatment group: household head of NHI

Control group: (1) dependents of NHI, (2) insured of EHI, or (3) dependents of EHI

Coinsurance rate of household head of NHI was reduced from 50 percent to 30 percent. Unfortunately, monthly data are not disaggregated into household head and dependents. The sampling survey on member of NHI is conducted in each May. It reports the medical expenditure of household head and of dependents. We construct the relative weight by using this data, and then estimate monthly data with this ratio. The ratio of May 1963 is applied up to the data before the reform, and the ratio of May 1964 is applied to the data after October 1963.

A.2 (January 1968)

Treatment group: dependents of HI.

In 1964, the reform of the NHI Act required that each municipal reduce the coinsurance rate of dependents of NHI from 50 percent to 30 percent within 4 years. Since the date of adoption of the new rules varies among municipals, we could not construct a suitable treatment group in this case.

A.3 (October 1973)

Treatment group: dependents of government-managed HI

Control group: (1) insured of government-managed HI, or (2) NHI (non-elderly)

Coinsurance rate of dependents of EHI was reduced from 50 percent to 30 percent. Note the elderly aged 70 and over did not have to pay out-of-pocket expenses during January 1973 to January 1983. We have to separate the elderly from other enrollees. We obtain necessary data from Maeda’s (1978) Figures.

A.4 (March 1981)
Treatment group: insured of government-managed HI
Control group: (1) dependent of government-managed HI, or (2) NHI

Treatment group: insured of society-managed HI
Control group: (1) dependent of society-managed HI, or (2) NHI

Inpatient coinsurance rate of the treatment group changed from 30 percent to 20 percent. Monthly data do not separate the elderly, who do not have to pay out-of-pocket expenses. We calculate the share of the elderly to the total medical expenditure by using an annual special survey. With this ratio, the medical care expenditures of the non-elderly are estimated.

A.5, A.6 (October 1984)

Treatment group: retirees formally under HI (A.5), and dependents of retirees formally under HI (A.6)

The System for Retirees formally under Employee’s Health Insurance was established in October 1984. Before this reform retirees formally under HI were a part of NHI. The coinsurance rate of the applicable insured was changed from that of the NHI to that of EHI. Since their expenditure before the reform cannot be separated from those of other enrollees, we give up an estimation of these two cases.

A.7 (September 1997)

Treatment group: insured of EHI
Control group: (1) dependents of EHI, or (2) NHI

Coinsurance rate of the insured of EHI was raised from 10 percent to 20 percent. Among group A, this is the only case where we can use monthly data without any problem.

A.2 Changes in Deductible (Group B)

There are 6 policy reforms that change a deductible. All of them affect the insured of HI. We use the average ratio of out-of-pocket expenses to total medical care expenditure. There are two ways of estimating the average rate; (1) obtained from the rules defined, and (2) obtained from actual observations. We choose the latter. Out-of-pocket expenses are reported on annual reports of Kikin. The total medical care expenditure is estimated 10 times the point reported on the same source. Since this ratio becomes negative in B.4 and B.5, however, we use the ratio obtained from the policy rule for these two cases.
B.1 (May 1949)

*Treatment group:* insured of EHI

This reform introduced deductible to the employees’ health insurance system. The insurance had paid medical costs fully before that time. The amount of deductible is set around the first visit fee, which varies with episodes. Since this reform is too early, there is not sufficient data available. We do not consider this case.

B.2 (July 1957)

*Treatment group:* insured of EHI

The fixed amount of out-of-pocket payment of insured of the EHI was changed in July 1957. New rule is 100 yen for the first visit and 30 yen per day of inpatients (up to one month, no more payment for a additional stay). Since the former scheme is difficult to translate into the burden ratio, we could not calculate the price change due to this reform. We are still working on this case. We hope outcomes will appear in future version of this paper.

B.3 (September 1967)

*Treatment group:* insured of society-managed HI  
*Control group:* dependents of society-managed HI

The deductible became 200 yen for the first visit and 60 yen per day of inpatients (up to one month). We use monthly data.

B.4 (January 1978)

*Treatment group:* insured of government-managed HI  
*Control group:* (1) dependents of government-managed HI, or (2) NHI  
*Treatment group:* insured of society-managed HI  
*Control group:* (1) dependents of society-managed HI, or (2) NHI

The deductible became 600 yen for the first visit. The impatient out-of-pocket expenses per day became 200 yen (up to one month). Since the elderly aged 70 and over did not have to pay out-of-pocket expenses during this period, we use the data from a sampling survey.

B.5 (March 1981)

*Treatment group:* (1) insured of government-managed HI, or (2) insured of society-managed HI
Control group: NHI

The deductible of outpatient became 800 yen. The out-of-pocket expenses of inpatient per day became 500 yen. Since we have to separate the elderly who are enrolled in HI, we use the data from the sampling survey. Dependents of HI cannot be a control group in this case, because their cost-sharing rule was changed at the same time.

B.6 (October 1984)
Treatment group: insured of society-managed HI
Control group: dependents of society-managed HI

The deductible was repealed, and the coinsurance rate of 10 percent was introduced. The average burden ratio increased by 118 percent. We use monthly data.

A.3 Changes Affecting the Elderly (Group C)

There are four policy changes in Group C.

C.1 (January 1973)
Treatment group: NHI (elderly)
Control group: NHI (non-elderly)

The out-of-pocket payments of the elderly aged 70 and over became free in January 1973. We use the data from a special survey on NHI.

C.2 (February 1983)
Treatment group: NHI (elderly)
Control group: NHI (non-elderly)

The Health Services for the Elderly was established in February 1983. Their cost sharing changed from null to deductible of 400 yen per month for outpatient and 300 yen per day for inpatient.

Since the monthly data of NHI had been divided into the elderly and the non-elderly before the policy reform, we use them. Unfortunately, we cannot use the monthly data of EHI, because they do not provide such a classification.

C.3 (October 1992)
Treatment group: Health Services for the Elderly
Control group: (1) insured of EHI, (2) dependents of EHI, or (3) NHI

The deductible of outpatient per month changed from 400 yen to 900 yen. The deductible of inpatient per day changed from 300 yen to 600 yen. We use monthly data.

C.4 (April 1993)
Treatment group: Health Services for the Elderly
Control group: (1) insured of EHI, (2) dependents of EHI, or (3) NHI

The deductible of outpatient per month changed from 900 yen to 1,000 yen. The deductible of inpatient per day changed from 600 yen to 700 yen. We use monthly data.

C.5 (April 1996)
Treatment group: Health Services for the Elderly
Control group: (1) insured of EHI, (2) dependents of EHI, or (3) NHI

The deductible of outpatient per month changed from 1,000 yen to 1,020 yen. The deductible of inpatient per day changed from 700 yen to 710 yen. We use monthly data.

C.6 (September 1997)
Treatment group: Health Services for the Elderly
Control group: NHI

The deductible of outpatient changed to 500 yen per visit (up to 4 visits per month. No additional visits are charged to outpatients). The deductible of inpatient per day changed to 1,000 yen. At the same time, it was determined to increase gradually in the following years; 1,100 yen in April 1998 and 1,200 yen in April 1999. We use monthly data.
References


