The effect of user charges on the elderly: substitution and offset effect

John Tayu Lee*

Centre for Health Economics, University of York

Peter C. Smith

Centre for Health Economics, University of York

Likwang Chen

Centre for Health Policy Research and Development, National Health Research Institute, Miaoli County, Taiwan

Abstract

To improve efficiency and increase appropriateness in choice of medical care, in July 2005, the National Health Insurance (NHI) in Taiwan increased user charges with the purpose of widening the gap in outpatient co-payment rates between the lower and higher levels of providers. Since veterans and their dependents are exempt from user charges, the causal effect of this policy was estimated using longitudinal data contains 800,000 patients' medical records from 2004-2006 released from NHI, based on a comparison between a control and a treatment group, using three different models: the difference-in-difference, the difference-in-difference with matching and the propensity score matching with difference-in-difference models. While the results suggest that user charges have a significant effect on total health utilisation, results of this study also found a substitution effect between the medical centres and regional hospitals. Furthermore, the results in this study also indicate that patients who respond to user charges more prominently earlier may also have a larger increase in the inpatient service utilisation later on. After adopting a preliminary policy simulation, a large offset effect was found which suggest that the NHI could not reduce the total health expenditure through imposing a higher level of demand side cost sharing.

*** Tel.: +(44) 01904 321448**

E-mail address: tl520@york.ac.uk

Introduction

In 2005, Taiwan's National Health Insurance (NHI) increased user charges in outpatient services for medical centres and regional hospitals by 71 percent, by 60 percent for district hospitals and did not change charges for clinics. As patients have an unrestricted choice on the types of providers when visiting doctors, the user charges policy could have had an effect on both health utilisation and the types of providers patients visited.

This study aims to investigate the policy effect in 2005 on the elderly for two reasons: firstly, because the elder population are the most intensive consumers of health care in most of the health insurance system, understanding how the elderly respond to demand side cost sharing is crucial. Secondly, the health status of the elderly may be more easily influenced by the reduction of utilisation as a result of increasing user charges.

We estimate the effect of this policy mainly based on three models: difference-in-difference (DID) and difference-in-different using matched observations (DID matching) and propensity score matching with difference-in-difference (PSM-DID). As veterans and their dependents are exempt from user charges, this study investigates this quasi-experiment based on a comparison between a control and a treatment group.

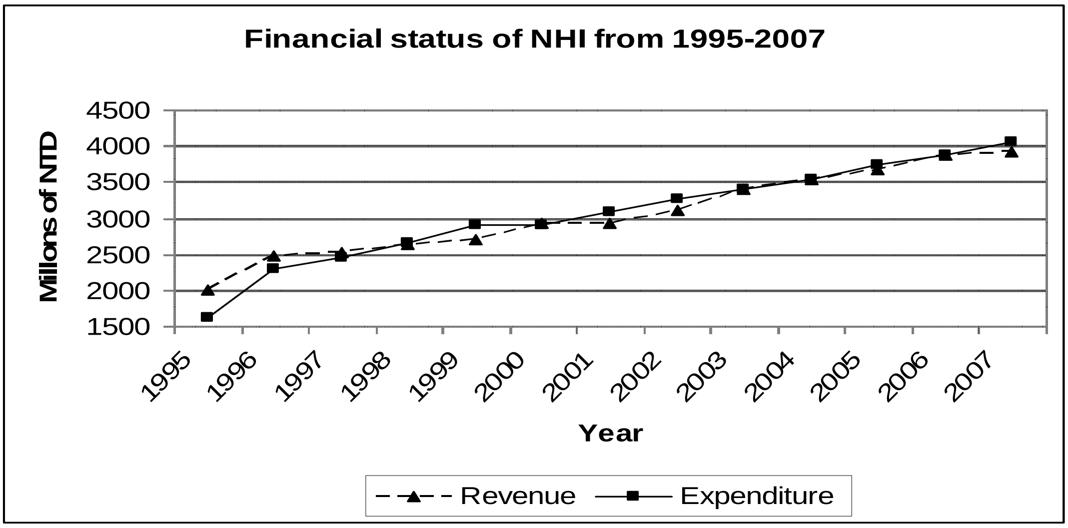
This study also examines the offset effect: whether raising the cost of outpatient services, and therefore reducing outpatient utilisation caused adverse effects on health and increased inpatient services (Chandra et al., 2007). By doing so, this study investigates whether the government can reduce the total health expenditure by imposing a higher level of demand side cost sharing.

2. National Health Insurance in Taiwan

In March 1995, Taiwan implemented the NHI which provides compulsory and comprehensive health care insurance to every citizen in Taiwan. It is funded mainly by premium payments which are proportionally shared by the public, employers and the government and supplemented by general tax revenue. Since joining the NHI is mandatory for every citizen in Taiwan, recent statistics from the Department of Health (DoH) show that 99 percent of citizens are enrolled in the NHI (the remaining 1% is composed of those living outside Taiwan, and those who have "fallen through the net"). Furthermore, their figures also show that the NHI contracts with most of the health care providers in Taiwan with 93 percent of providers contracted with the NHI, according to recent statistics (DoH Report 2008).

Three years after the implementation of the NHI, the NHI faced severe financial crisis and had deficits in most of the years after 1998 (see figure 1). As a result, the NHI began implementing several policies providing both the supply side and demand side incentives to maintain the financial sustainability. Such incentives included raising user charges, using global budget system, and increasing premium etc.

Figure 1 Financial status of NHI from 1995-2007



Note: 60 NTD is approximately equivalent to 1 pound

Physicians in the NHI are mainly reimbursed by fee-for-service under a global budget system. Under the global budget system, a certain amount of budget was allocated in advance in each year for six NHI regions. These are: Taipei region, Northern region, Central region, Southern region, Kao-Ping region and Eastern region.

Some patients in Taiwan also have private insurance on top of the NHI, in general, private insurance constitutes about 8.9 percent of total health expenditures in Taiwan. Because the benefit package covered by the NHI is comprehensive including preventive and medical services, prescription drugs, dental services, Chinese medicine and home visits, supplemental private insurance mainly serves as a function where people want treatment in a luxurious setting or in a private hospital or wish for drugs and treatments which are considered too expensive to be generally available on the

NHI. Therefore, it is considered that the use of private insurance will not affect the results of this research.

One of the major characteristics of Taiwan's NHI is that patient choice of type of provider is unrestricted, since there is no general practitioner in charge of referring patients to specialists. There are four main types of provider in Taiwan: medical centres, regional hospitals, district hospitals and local clinics, and patients have the freedom to visit any of them. As a result, the system has been criticized for the phenomena of doctor shopping and a lack of appropriateness in visiting doctors, with patients not always choosing the correct providers according to their health situation.

Patients have to pay user charges for both outpatient and inpatient services. User fees for outpatient services were determined by level of care. This might partly be due to the fact that it is commonly believed that there is a hierarchy of health care providers, with the best quality of care provided by medical centres, followed by regional hospitals, then district hospitals, with the quality of care in clinics held in least esteem.

Until now, there have been three changes made to the amount of co-payments for outpatient services. In the recent reforms of July 2005, the NHI increased user charges for outpatient services (excluding Chinese medicine and Dental treatment) with the purpose of widening the gap in user charges between the lower and higher levels of providers (see table 1). Therefore, there was an increase in co-payment in medical centres of 71 %, regional hospitals of 71%, 60% for district hospitals, and no variation in charges for clinics. The purpose of the reform was to improve efficiency in the market by both reducing the total health utilisation and incentivizing patients to self-refer and select the most suitable providers for treatment based on the severity of their illness.

Table 1 Policy change of user charges for outpatient services

	Medical Centre	**Regional Hospital**	**District Hospital**	**Clinics**
01/05/1995	100	100	50	50
01/05/1997	150	100	50	50
01/09/2002	210	140	50	50
15/07/2005	360 (71%)	240 (71%)	80 (60%)	50 (0%)

Note: percentage in the bracket is the percentage change of copayment amount in the July 2005 policy compared to it since 2002.

Patients also need to pay user charges for inpatient services. This is a proportion of their health expenditure, depending on how many days stay and the types of inpatient service (see table 2) with a cap on the expenditure based on an amount which should not exceed 10% of average income. (In 2004 this was 40,000 NTD, 41,000 in 2005 and 43,000 in 2006). No changes were made to inpatient co-payment rates during the time of this study.

In order to lessen the negative effect of user charges on health inequalities, some patients are exempt from user charges in Taiwan. For example: patient with catastrophic illnesses, veterans and their dependents, those who live offshore. As well as this, some preventive treatments are free of charge in NHI such as adult physical exams, cervical cancer screening, and physical exams for pregnant women etc (NHI 2006).

Table 2 Co-insurance rate for inpatient service in NHI

Ward	Proportional co-payment			
	5%	10%	20%	30%
Acute	--	30 days or less	31-90 days	61 days and over
Chronic	30days or less	31-90 days	91-180 days	181 days and over

4. The dataset

The data used in this study is from the National Health Research Institute Database (NHIRD). Each year, NHIRD collects data from NHI and sorts it into data files, including registration files and original claim data for reimbursement. The longitudinal Health Insurance Database this study uses was released in 2005 and is updated each year (currently from 1995-2008). The longitudinal dataset contains all the original claim data of 800,000 beneficiaries, randomly sampled from the year 2005 Registry for Beneficiaries of the NHIRD. Besides, the sample selected were representative of the whole population in Taiwan[1].

Within the longitudinal dataset, four different files were linked to construct a complete set of data for patients' outpatient and inpatient medical records for each type of provider: (1) The Registry for beneficiaries (ID) file, which contains patients' demographics and detailed information on their enrollment history. (2) The Registry for contracted medical facilities (HOSB) file, which contains the providers' characteristics including the level of providers. (3) The Ambulatory care expenditures

[1] According to NHIRD: http://w3.nhri.org.tw/nhird//date_01.html

by visits (CD) file, which contains each provider's claims for outpatient services from the NHI as well as the amount of the claim. (4) The Inpatient expenditure by admissions (DD) file: which contains individual provider's claim for inpatient services as well as the amount of the claim, the length of stay, and the diagnosis.

As this study aims to investigate the effect of user charges on health utilization on the elderly, only patients aged 65 or more were included (exclude 89.98% of the patients from our sample). This leaves us with only 80160 patients. After that, we linked to their medical record one year before and after the user policy.

Since the policy was implemented on the 15th July 2005, the pre-policy period was from the 1st July 2004 to the 30th June 2005, and the post-policy period was from the 1st Aug 2005 to the 31st July 2006. However, patients' outpatient record on Chinese medical and dental treatments were not included since the copayment rates for these services were not changed. We also excluded treatments without user charges for everyone and the emergency treatments because patients' demand on these treatments may be different from other treatments.

Besides, the original dataset is an unbalanced panel with for only completed record for ever patients in 2005. Therefore, if a patient drops from NHI in the following year, the dataset will not have his/her records in 2006. In order to perform random effect model in the panel data to control for the individual heterogeneity, we only include patients who enrolled in NHI without changing their enrolment status from 1st July 2004 to 31 July 2006 (11.24% of patients were excluded).

We also excluded patients who are on low income, with catastrophic diseases, live in an offshore island and use inpatient services for more than one month in a year as these patients' are a high percentage of exempt from user charges due to their demographic or health status. Besides, their demand for health may also different from those normal patients. As the result, a further 12.91% of patients were excluded in our sample.

After these criteria were taken into account, there are 59730 patients in our dataset with 8562 are veterans and their dependents in the control group and 51,168 non-veterans who pays user charges in the treatment group.

We also constructed some covariates to control for the effect on demand for health utilisation. For example, we use patients' postcode in their ID file to identify which region the patient lives as well as the urbanisation level of the place[2]. There are eight different urbanisation levels, patients with higher urbanisation level (such as 1 or 2) suggests that they live in a city with the highest population density and where the transportation cost is less in general.

To control for the health status on demand for health, Weighted Charlson Co-morbidity Index was established for each patients from their inpatient record two years before the policy intervention (1st July 2003~30th June 2005). The Charlson index predicts the risk of death from comorbid disease, and it is used as a proxy for patient's health status prior to the policy (Charlson et al 1987). The higher the index, the worse patient's health is and the vice versa. We use the weighted Charlson index with three different levels: 0, 1~ 3, and more than three.

5. Methodology

To examine the effect of user charges on this quasi-experiment setting, this study aims to estimate the average treatment effect on the treated (ATT).Therefore, three models in the literature of policy evaluation were adopted on this longitudinal dataset: difference-in-difference (DID), difference-in-difference using matched observations matching (DID matching), and propensity score matching with difference-in-difference (PSM-DID).

The first model used in this study is the Difference-in-Difference methodology (DID). This method is based on the comparison between before and after policy for both the control and the treatment groups which allows isolating the ATT by removing the unobservable individual's characteristics and the time trend. For example, if y is the outcome of interest, d_i denotes the treatment status, d_i =1 if the patient is in the treatment group, d_i =0 if the patient is in the control group. t_0 denotes before the policy, t_1 denotes after the policy. The ATT or the DID estimator can be expressed as follows:

$$\hat{\alpha}^{DID} = \left[\bar{y}^{1}_{t_1} - \bar{y}^{1}_{t_0}\right] - \left[\bar{y}^{0}_{t_1} - \bar{y}^{0}_{t_0}\right]$$

[2] We linked patients' zip code with the statistics of the urbanisation level in Taiwan which is documented in the Institute of occupational safety and health.

if Y^1 represent health utilisation for individual i if exposed to the policy intervention

Y^0 represent health utilisation for individual i if not exposed to the policy intervention.

As the above equation shows, the conventional DID estimator requires that in absence of the treatment, the average outcomes for treated and controls would have followed a parallel path over time. Therefore, DID method only be suitable where the patient being in the treatment group is through a randomly selected process and the control and treatment groups are comparable. Since we found there is a difference between the control and treatment group in terms of their characteristics before the policy, two other empirical methods were applied to make patients in both groups more comparable.

The second model used is DID matching which is a combination of DID and propensity score matching in the way the DID matching estimator is obtained as DID on the observations that lie on this common support. The essence of this method is to use propensity score as a selection tool to choose observations in the sample that make patients in the control and treatment groups has the most similar in terms of their pre-policy characteristics. This method is used increasingly in health economics to for example: Galiani et al., (2005), Dawson et al., (2007) Marini et al., (2008).

We identify control and treatment group observations on a common support as follows. We exclude all control observations whose propensity scores are less than the propensity score of the treatment group at the five percentile of the treatment propensity score distribution and exclude al treatment observations whose propensity score is greater than the propensity score of the control observation at the ninety-five percentile of the control distribution. Then, our DID matching estimator is obtained as DID on the observations that lie on this common support (Galiani et al. 2005).

We estimate the propensity scores from logit model of conditional probability of being a veteran and spouse given the pre-treatment values of the x.

$$p(x) = \Pr\{d = 1 | x\} = E\{d | x\}$$

where x is the multidimensional vector of pre-treatment characteristics which includes patient's age, location, and gender. The following explanation of this method is from Marini et al., (2008).

Given the propensity score, the DID matching estimator can be written as follows:

$$
\begin{aligned}
ATT &= E\left(Y_1 - Y_0 \middle| d = 1\right) = E\left\{E(Y_1 - Y_0 | d = 1, p(x))\right\} \\
&= E\left\{\left[E(Y_1 | d = 1, p(x) - E(Y_0 | d = 0, p(x)\right] - \left[E(Y_0 | d = 1, p(x)) - E(Y_0 | d = 0, p(x))\right]\right\} \\
&= E\left\{E(Y_1 | d = 1, p(x)) - E(Y_0 | d = 0, p(x))\right\}
\end{aligned}
$$

where Y_1 and Y_0 are the potential outcomes in the two counterfactual situations of treatment and no treatment. Given the conditional mean independence assumption where $E\left[y_0 \middle| d = 1, p(x)\right] = E\left[y_0 \middle| d = 0, p(x)\right] = E\left[y_0 \middle| p(x)\right]$, the second line of the equation can be derived to the third line. Besides, $E\{\bullet\}$ is computed over the distribution of pre-policy variables x in the treated population, $p(x)|d = 1$.

The first two model specification is as follows:

$$
Y_i = B_0 + B_1 Policy_i + B_2 Pay_i + B_3 policy_i * Pay_i + B_4 X_i + \varepsilon
$$

Y_i denotes the number of visits, number of inpatient days, and whether or not the patient made at least on visit for both inpatient and outpatient services. Policy is a time dummy which denotes the time that the policy was implemented. Pay is a binary variable where 1 indicates the patient pay user charges are in the treatment group, and 0 indicates the patient is exempt from user charges and in the control group. In addition, X_i 's are covariates that control for the demand for health utilisation. These covariates include patient's gender, age, age squared, health status, which region they live and the urbanisation level of the place. To control for the effect of global budget dummy variables were used for six regions. As well as dummy variable for eight different urbanisation levels to control for potential transportation cost of visiting doctors. Dummy variables for the weighted Charlson index were also used to control for patient's health status prior to the implementation of the policy.

We estimate the DID and DID matching models with both non-linear and linear models. Non-linear models such as negative binomial and Poisson model were used to estimate the number of utilisation for outpatient services in each type of provider as well as the days of inpatient stay. It is because there is a large proportion of zero utilisation in terms of visiting each of these providers. Furthermore, Generalised Least Squared (GLS) model was used for the total utilisation of all types of providers on outpatient service because the majority of observations visit doctors had made at least one visit in term of total utilisation in any type of provider.

The Logit model was adopted for binary variables such as whether the patients having any visit at least once. To control for the individual heterogeneity, random effect model is also applied in the panel data.

In the DID and DID matching model, the ATT is the interaction term, even for non-linear model (Puhani 2008). The explanation for the estimator in the DID method can be found in table 3.

Since bias of estimation on ATT may be reduced when the control and treatment groups are becoming more comparable, the intuition of this model is to choose comparable observations in both control and treatment groups using propensity score.

The third model specification is the propensity score matching with difference in difference (PSM-DID). As DID model, we compare the average changes in outcomes before and after the user charges policy, using PSM to control for the initial heterogeneity. The essence of this method is to create a counterfactual group who are similar to the treatment group as measured by the propensity score. By this way, the bias of estimation due to observable factors could be eliminated (if not totally) after adopting propensity score matching, and the bias due to unobservable factors could be eliminated (if not totally) by taking the first difference of the outcome of interest. The differences between DID matching and PSM-DID matching is that while DID matching estimator is derived using a linear parametric model, the PSM-DID using a non-parametric identification.

Table 3 The explanation for the estimator in the DID and DID matching method

	The difference-in-difference methodology	
	Has user charges (Treatment Group)	No user charge (Control Group)
Before	$B_0 + B_2$	B_0
After	$B_0 + B_1 + B_2 + B_3$	$B_0 + B_1$
Difference	$B_1 + B_3$	B_1
Difference-in-difference	B_3	

This method has been increasing common in health literature such as, Galiani et al.,(2005), Wagstaff and Yu (2007), Wagstaff, (forthcoming) to obtained the ATT by matching propensity score with different matching algorithms.

Let t_0 indicate the period before the implementation user charges policy (pre-policy), t_1 indicate the period after the policy (post-policy). The first assumption behind PSM-DID is conditional independence:

$$Y_{it1} - Y_{it0} \perp d_{it1} | p(x)$$

where Y is health utilisation, d is an indicator variable for whether or not the patient is in the treatment group. This condition states that whether patients are in the control or treatment group has no effect on their health utilisation if all the factors influencing being in a treatment group and health utilisation are included in x

The ATT can be represented as follows:

$$ATT = E(Y^1_{i,t1} - Y^0_{i,t0} | d_i = 1) - E(Y^0_{i,t1} - Y^0_{i,t0} | d_i = 1)$$

where Y_i^1 represent health utilisation for individual i if exposed to the policy intervention Y_i^0 represent health utilisation for individual i if not exposed to the policy intervention. The subscript, t_0, t_1, stand for pre-and post-user charges policy. The problem is that $E(Y^0_{i,t0} | d_i = 1)$ is not observed, however, if the conditional independence assumption $E(Y^0_{it1} - Y^0_{it0} | d_i = 1)$ can be replace by $E(Y^0_{it1} - Y^0_{it0} | d_i = 0)$. As a result ATT can be rewritten as the following:

$$ATT = E(Y^1_{i,t1} - Y^0_{i,t0} | d_i = 1) - E(Y^0_{i,t1} - Y^0_{i,t0} | p(x), d_i = 0)$$

Where the first term can be estimated from the treatment group and the second term can be estimated from the outcomes of the matched (on $p(x)$) control group (Wang et al., forthcoming).

In this study, kernel weights (Gaussian) are chosen using all the of control group within common support. The standard errors of the ATT are given by bootstrapping with 50 replications since the analytical standard errors are not available. Therefore, this study use all of the three models are used to evaluate the effect of user charges policy.

6. Result

6.1 Effect on outpatient utilisation

The first empirical model estimates the effect of user charges on the variation in total utilisation of all types of providers. The results show that, after the policy, there is a significant decrease in total utilisation for the treatment group in all of the models (see table 4). Furthermore, this decrease is more prominent for women than men. In general, the coefficient in PSM-DID model is the largest coefficient of the three models. The second largest is found in the DID matching model, and the smallest is in the DID model.

Since the user charges policy was introduced in July 2005, there has been an increase in the co-payment rate in all types of providers except clinics. The reduction in total utilisation can be explained as the income effect due to the policy.

The results from covariates showed that female or people in the control group use outpatient service more than their counterparts. The coefficient in age is positive and negative in age square which indicates age is associated in a positive relationship with utilisation and age square has a negative relationship.

As coefficients in regional dummies are mostly significant, it suggests the global budget system has an influence on the level of outpatient utilisation. It also suggested that patients with worse a health status visit outpatient services more than the healthy ones. The results also provide evidence of the significant effect of the non-monetary cost (transportation cost) on health utilisation, since the coefficients in urbanisation levels are significant.

Table 5 and 6 shows the effects of the policy on the level of outpatient health utilisation and the probability of having at least one visit to medical centre, regional hospital, district hospital, and clinics estimated by negative binomial and logit models. In general, the ATT are significantly negative in medical centres and district hospitals, however, not significant in regional hospitals and clinics. Even with a 71% increase in the price for visiting regional hospitals, the insignificance in the ATT of regional hospitals may suggest there exists a substitution effect between providers in NHI, especially between medical centres and region hospitals. In other words, patients who used to visit medical centres choose to go to regional hospitals if these two types of hospitals provide the most similar types of services compared to other levels of providers.

The results in PSM-DID model also show a similar effect of this policy to the previous two models. The ATT in PSM-DID model suggests the policy has a negative effect on all types of providers but is economic insignificant in regional hospital and clinics as a result of small numbers of reduction after the policy. Also as found previously, the results confirm the policy has larger effects on females than males.

The results (see table 7) also suggest that the price elasticity of demand without considering the substitution effect between providers estimated by each of the three models are: -0.0954 ~ -0.1634 for the population as a whole, -0.1674 ~ -0.1909 for women, and -0.0627 ~ -0.1433 for men[3].

Table 7 The price elasticity of demand

	All	Female	Male
DID	-0.0954	-0.1674	-0.0627
DID Matching	-0.1104	-0.1909	-0.0692
PSM-DID	-0.1634	-0.1806	-0.1433

Finally, the interaction terms in the logit model as well as the ATT in the PSM-DID for whether patients have made any contact with providers are mostly insignificant. This suggested this policy did not influence patient's decision on whether to make any initial visits or not. Therefore, the reduction in utilisation rate overall is due to a decrease in the number of follow up checks instead of a decrease in patients making an initial visit.

6.2 Effect on inpatient utilisation

The reduction of outpatient services for patients might have a negative effect on their health due to the lack of necessary and essential treatment or delay in seeking treatment. Therefore, it is reasonable that an increase in inpatient services utilisation could be found as a result of the decrease in health outcomes. The dependent variable for inpatient utilisation consists of two types of services: emergency and non-emergency inpatient service. The total inpatient utilisation is the sum of these two types of service. We estimate the RE models presented previously and the results can be found on table 8 and 9[4].

The results suggest, for the population as a whole, there is a significant increase in both the emergency inpatient days staying in hospital and the probability of using any emergency inpatient services, a decrease for non-emergency inpatient service, and an increase on the total inpatient service. However, this result is mainly contributed to by

[3] The price elasticity of demand is calculated by the percentage change of total outpatient utilisation divided by the percentage change of price for female, male, and the population as a whole. The percentage change in price is calculated by taking into account of the proportion of utilisation in each types of provides and the percentage of changes in price for each provider. The number of decreasing in outpatient utilisation is the ATT of all of the three models.

[4] The ATT in table 8 and 9 using DID and DID matching models was estimated using Poisson model

the large response of women to the policy, whereas the men's response was not significant alone. The results in the DID and DID models are supported by PSM-DID model where the ATT for the days of inpatient service for is 0.202 compared to 0.096 for the men.

The results showing an increase in the use of inpatient services in women was we predicted, since the earlier results showed that women had much more of a response to the introduction of user charges than men. Therefore, the decrease in outpatient utilisation earlier may cause a decrease in health status which leads to an increase in the inpatient service utilisation later on. Therefore, our results suggest that an increase in outpatient user charges has a positive effect on patients' inpatient utilisation, especially for women. It is posited that the increase in user charges would have a big effect on patient on women.

7. The magnitude of offset effect

We estimated the percentage of the offset effect of user charges. The percentage of the offset effect is found from the cost of increased inpatient claims divided by the cost of reduced outpatient claims. The average claim from all types of providers for outpatient services for our sample (before matching) is NTD 813.33 per visit. The average claim from providers for inpatient services per day is NTD 6,541.52. The results in table 10 show the offset effects. The result in this table excludes the results for males because as shown above, men's use of inpatient services (in days) did not significantly change after the policy was introduced.

Table 10 The offset effect for the NHI

	DID		DID matching		PSM-DID	
	all	female	all	female	all	female
Saving from the Outpatient claim for the NHI	415.61	765.34	480.68	872.70	745.67	825.53
Additional cost on Inpatient claim for the NHI	307.45	1242.89	444.82	1223.26	987.77	1321.39
Offset (percent)	73.98 %	162.40	92.54	140.17	132.47	160.07

If the percentage of the offset effect is higher than 100, it means that the saving to the NHI from the reduction of outpatient costs is not enough to cover the increase in cost to the NHI for inpatient services. Since most of the offset effects found are higher than 100 percent, it implies that the introduction of the user charges policy did not save money for the NHI in Taiwan (see table 10).

The results also indicate the offset effect is larger for women than the combination of both men and women. The result is comparable to that found by Chandra et al. (2007). They also found the offset effect to be more prominent for the group that decreased their use of outpatient services more in response to an increase in user charges.

8. Discussion and Conclusion

This paper investigated the effect of user charges on the elderly in Taiwan, considering both substitution and offset effects. We also estimated the causal effect of this policy by adopting DID, DID matching and PSM-DID models.

The results of this study found that total utilisation decreased after the increase of user charges, which shows the income effect of this policy. The price elasticities of demand are in the range of -0.10 to -0.16 for all of the samples, -0.17 to -0.19 for females and -0.06 to -0.14 for males. This may due to the reason that men have higher disposable income than women in Taiwan[5]. Therefore, male respond less to the increase of user charges than female. While user charges had a negative influence on the numbers of visits to medical centres and district hospitals, the policy did not effect patients' utilisation of regional hospitals, which may suggest there is a substitution effect between providers in Taiwan, especially between medical centres and regional hospitals. This finding sheds light on how to design an optimal user charges policy in a system where patients have unrestricted choice of types of provider. For example, maybe patients could be guided to choose the most suitable provider, taking into consideration the severity of their illness, by the NHI increasing the provider cost appropriately to the market.

In addition, we also estimate the offset effect of the demand side cost sharing. As patients who reduced their outpatient utilisation more also have larger increase in the days of inpatient service, we found that increasing user charges was not able to reduce the total health expenditure. Therefore, more consideration on the effect of offset effect is needed for policy makers to implement user charges.

Acknowledgements

---

[5] According to the statistics from Directorate-General of Budget, Accounting and Statistics, Executive Yuan, R.O.C, http://win.dgbas.gov.tw/fies/index.asp

This study is based on data from National Health Insurance Research Database provided by the Bureau of National Health Insurance, Department of Health and managed by National Health Research Institutes in Taiwan. We are greatly thankful to Nigel Rice, Hugh Gravelle for their perceptive comments. The findings, interpretations and conclusions expressed in this paper are entirely those of the authors.

References

Chandra A., Gruber J., McKnight R., (2007) Patient cost sharing, hospitalization offsets, and the design of optimal health insurance for the elderly. NBER Working Paper 12972

Charlson ME, Pompei P, Ales KL, MacKenzie CR.(1987) A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. Journal of Chronic Disease. 40: 373-383

Dawson, D., Gravelle, H., Jacobs, R., Martin, S., Smith, P., (2007) The effects of expanding patient choice of provider on waiting times: evidence from a policy experiment. Health Economics 16, 113-128

Department of Health Annual Report on Health Statistics (2008), Taiwan

Galiani S., Gertler P., Schargrodsky E., and (2005) Water for life: the impact of privatization of water services on child mortality. Journal of Political Economy 113, 83-119

Marini G., Miraldo M., Jacobs R., Goddard M., (2008) Giving greater financial independence to hospital-does it make a difference? The case of English NHS Trust. Health Economics 17, 751-775

National Health Insurance (NHI) handbook, Department of Health, the Executive Yuan, 2006

Puhani P., (2008) The treatment effect, the cross difference, and the interaction term in nonlinear difference-in-differences models. IZA Discussion Papers 3478, Institute for the Study of Labor (IZA)

Wagstaff A., Yu S., (2007) Do health sector reforms have their intended impacts? The World Bank's health VIII project in Gansu province, China. Journal of Health Economics 26, 505-535

Wagstaff A., (forthcoming) Estimating health insurance impacts under unobserved heterogeneity: the case of Vietnam’s health care fund for the poor. Health Economics.

Table 4 Effect of user charger on outpatient utilisation estimated by DID, DID matching and PSM-DID models

Number of outpatient utilisation	***DID***			***DID Matching***			***PSM-DID***		
	Whole (1)	*Female (2)*	*Male (3)*	*Whole (4)*	*Female (5)*	*Male (6)*	*Whole (7)*	*Female (8)*	*Male (9)*
Policy	-0.736***	-0.404	-0.807***	-0.700***	-0.404	0.775***			
Non-Veternas	-6.399***	-4.613***	-6.749***	-6.432***	-4.526***	-6.905***			
Non-Veterans*Policy	**-0.511*** **	**-0.941*** **	**-0.314***	**-0.591*** **	**-1.073*** **	**-0.347***	**-0.875**	**-1.015**	**-0.718**
Female	2.558***			2.384***					
Age	4.707***	4.843***	4.371***	4.938***	4.711***	4.440***			
Age Square	-0.030***	-0.032***	-0.028***	-0.032***	-0.031***	-0.028***			
Northern Region Branch	-0.826***	-1.598***	-0.173	-0.664**	-1.508***	-0.184			
Centre Region Branch	0.583	0.257	0.904**	0.680**	0.320	0.915**			
Southern Region Branch	1.882***	1.253***	2.540***	2.071***	1.395***	2.553***			
Kao-Ping Branch	2.862***	2.827***	2.920***	2.887***	2.873***	2.918***			
Eastern Region Branch	0.336	0.934	-0.275	0.062	0.564	-0.288			
Urbanization Level 2	1.488***	1.752***	1.267***	1.164***	1.750***	0.985**			
Urbanization Level 3	1.584***	1.279***	1.889***	1.405***	1.343***	1.605***			
Urbanization Level 4	1.254***	1.335**	1.187**	0.989**	1366**	0.904			
Urbanization Level 5	1.028***	1.408***	0.680	0.660*	1.300**	0.413			
Urbanization Level 6	0.584*	0.663	0.559	0.353	0.738	0.315			
Urbanization Level 7	1.474***	1.471***	1.540***	1.316***	1.667***	1.300**			
Urbanization Level 8	1.759***	2.111***	1.440**	1.234**	1.644**	1.195*			
Weighted Charlson Index 1-3	10.006***	9.421***	10.562***	9.928***	8.976***	10.674***			
Weighted Charlson Index>3	14.537***	14.722***	14.314***	14.656***	14.823***	14.468***			
R Square	0.0638	0.0486	0.0788	0.0673	0.0474	0.0808			
Observations	59730	30170	29560	50495	21986	28509	50495	21986	28509

Notes: R Square: Overall R Square

Standard errors for the kernel matching estimate are bootstrapped standard errors using 50 replications.

Standard error for the interaction term in column (7)=0.263, in column(8)=0.342 , in column(9)=0.213

* Statistically different from zero at the 0.1 level of significance.

** Statistically different from zero at the 0.05 level of significance.

*** Statistically different from zero at the 0.01 level of significance.

Table 5 Results for the ATT on number of outpatient visits

	Total outpatient utilisation			*Medical Centre*			*Regional Hospital*			*District Hospital*			*Local Clinics*		
	All	*Female*	*Male*	*All*	*Female*	*Male*	*All*	*Female*	*Male*	*All*	*Female*	*Male*	*All*	*Female*	*Male*
DID	-0.511***	-0.941***	-0.314*	-0.064***	-0.131***	-0.040**	-0.012	-0.065*	0.014	-0.050***	-0.060	-0.058***	0.001	0.001	0.001
DID matching	-0.591***	-1.073***	-0.347*	-0.094***	-0.150***	-0.062***	0.005	-0.053	0.025	-0.061***	-0.068	-0.064***	-0.008	-0.005	-0.008
PSM-DID	-0.875	-1.015	-0.718	-0.472	-0.586	-0.375	0.040	-0.060	0.145	-0.277	-0.293	-0.257	-0.056	-0.071	-0.044

Table 6 Results for the ATT on whether or not visiting any outpatient service at least once

	Any visit in four types of providers			*Any visit in Medical Centre*			*Any visit in Regional Hospital*			*Any visit in District Hospital*			*Any visit in Local Clinics*		
	All	*Female*	*Male*	*All*	*Female*	*Male*	*All*	*Female*	*Male*	*All*	*Female*	*Male*	*All*	*Female*	*Male*
DID	0.022	0.127	0.045	0.042	-0.114	0.105*	0.061	0.060	0.086	-0.014	-0.041	-0.002	0.016	-0.037	0.049
DID matching	0.017	0.122	0.020	0.021	-0.127	0.086	0.098*	0.088	0.108*	-0.031	-0.054	-0.016	-0.030	-0.065	0.002
PSM-DID	-0.001	0.007	-0.007	0.000	-0.012	0.010	0.020	0.014	0.023	-0.007	-0.007	-0.007	-0.007	-0.002	-0.009

Notes: * Statistically different from zero at the 0.1 level of significance.
** Statistically different from zero at the 0.05 level of significance.
*** Statistically different from zero at the 0.01 level of significance.

Table 8 Results for the ATT on number of inpatient days

	Emergency Inpatient Days			*Non-Emergency Inpatient Days*			*Total Inpatient Days*		
	All	*Female*	*Male*	*All*	*Female*	*Male*	*All*	*Female*	*Male*
DID	0.052***	0.188***	-0.009	-0.296*	0.821	-0.360**	0.047***	0.190***	-0.014
DID matching	0.074***	0.186***	0.021	-0.313*	0.756	-0.350*	0.068***	0.187***	0.015
PSM-DID	0.156	0.197	0.108	-0.005	0.005	-0.012	0.151	0.202	0.096

Notes: * Statistically different from zero at the 0.1 level of significance.
** Statistically different from zero at the 0.05 level of significance.
*** Statistically different from zero at the 0.01 level of significance.

Table 9 Results for the ATT on whether or not visiting any inpatient service at least once

	Any Emergency Inpatient visit			*Any Non-Emergency Inpatient visit*			*Any Inpatient visit*		
	All	*Female*	*Male*	*All*	*Female*	*Male*	*All*	*Female*	*Male*
DID	0.113**	0.229**	0.072	-0.167	0.550	-0.242	0.113**	0.246**	0.072
DID matching	0.132***	0.250**	0.083	-0.143	0.541	-0.220	0.132***	0.266**	0.082
PSM-DID	0.023	0.025	0.020	-0.001	0.001	-0.002	0.023	0.027	0.019

Notes: * Statistically different from zero at the 0.1 level of significance.
** Statistically different from zero at the 0.05 level of significance.
*** Statistically different from zero at the 0.01 level of significance.