ESTIMATING PRICE ELASTICITY OF DEMAND FOR MEDICAL CARE SERVICES IN THAILAND

by

Yuthapoom Thanakijborisut
School of Economics, University of the Thai Chamber of Commerce
E-mail: anovaoad@hotmail.com

UTCC International Journal of Business and Economics IJBE

ESTIMATING PRICE ELASTICITY OF DEMAND FOR MEDICAL CARE SERVICES IN THAILAND

by

Yuthapoom Thanakijborisut
School of Economics, University of the Thai Chamber of Commerce
E-mail: anovaoad@hotmail.com

Abstract

This paper estimates price elasticities of demand for medical care services of inpatient and outpatient in Thailand. The variation in prices comes from six different medical insurance plans. A price of the medical care services faced by an individual holding an insurance plan is measured by the average out-of-pocket medical care costs of patients who hold the same medical insurance plan. I estimate the price elasticities by using a probit regression model. The price elasticities of demand for all inpatient care services range from -0.06 to -0.10 while the price elasticities of demand for all outpatient care services range from -0.15 to -0.22. These findings are in line with the available literature. They are also consistent with the hypothesis that inpatient care services are less price-responsive to the demands for medical care services than outpatient care services.

Keywords: demand for medical care services, price elasticity, Thailand

1. Introduction

In this study, I estimate the price elasticities of demand for medical care services for both inpatient and outpatient care services. Price of the medical care services faced by an individual holding an insurance plan is measured by the average out-of-pocket medical care costs of patients who hold the same medical insurance plan. I use patient information from the National Statistical Office in the series of the Health and Welfare Survey (HWS) and use a probit regression model to find the results. The survey sample includes the demographic and social economic characteristics of nearly 68,000 people for each year, which represents a form of medical care utilization for all nations.

Moreover, on the basis of this study, the price elasticity is crucial to evaluating the welfare gains from government intervention through social (health) insurance. Following Chetty and Saez (2009), the model derives from a welfare formula that depends on functions of reduced form parameters, e.g. price elasticity of medical care services and consumption insurance. This elasticity reflects a moral hazard distortion created by insurance policies. Thus, in order to evaluate the welfare benefits of medical care services, the results of the price elasticity of demands for medical care services in the welfare calculations for Thailand are needed for empirical study here.

Several studies estimated the elasticity for medical care services using different measurements for the price of medical care services: e.g. for developed countries, Manning et

al. (1987), Bhattacharya et al. (1996), Eichner (1998), Van Vliet (2001), Cockx and Brasseur (2003), and for developing countries, Duarte (2012), Sauerborn et al. (1994), Lindelow (2005), and Sahn et al., (2003). Many of these have focused on the elasticity of how individuals respond to changes in prices. This is important in proceeding with health policies, especially those subsidized through social health insurance.

Earlier studies estimated the demand for medical care by focusing on price elasticity of medical care services with different measurements for developed countries. In a seminal paper, Manning et al. (1987) studied the impact of co-insurance on the demand for medical care services. The estimations were based on a randomized controlled experiment by using different measures of medical care prices in six sites of the United States by the RAND Health Insurance Experiment. The RAND Experiment randomly assigned household into five different insurance plans with different co-insurance rates ranging from 0 to 95 percent. The estimation results imply that price elasticity was -0.10 for all medical care services and -0.13 for outpatient care services when considered co-insurance rates from 0 to 25 percent while price elasticity was -0.14 for all medical care services and -0.21 for outpatient care services when considered co-insurance rates from 25 to 95 percent. These results are widely used by researcher and policy maker to evaluate or design health policies in the United States until now.

Unfortunately, there was no experimental data in other countries. Therefore, most of studies need to rely on non-experimental data and econometric techniques. For example[1], Bhattacharya et al., (1996), Eichner (1998), Van Vliet (2001), Cockx and Brasseur (2003) measured prices of medical care services by co-payment rates. Their estimation results imply that price elasticity was a relatively inelasticity and a negative relationship between utilization and price of medical care services.

Duarte (2012) estimated the price elasticity of expenditures for medical care services across different groups in Chile. He used a single price for medical care services by calculating the expected effective co-insurance rate by plan from a combination of insurer payment cap and co-insurance rates. He found the price elasticities to be from -0.028 to -0.07 for acute care services. In developing countries, For instance[2], Sauerborn et al. (1994) and Lindelow (2005) examined pecuniary cost of medical care services (out-of-pocket expenditures) and the time cost of medical care services to represent the prices to obtain health care. Sahn et al. (2003) used the quality of health care resources in a nation for estimating price elasticity. Consequently, the prices of medical care services may reflect the various methods of measurement for estimating price elasticity, depending on the characteristics of the health care system in each country.

For this paper, I measure the prices of medical care services by classifying into 6 major health welfare plans as a proxy for the cost of an individual's decision in seeking medical care. In this study, prices are computed by the average out-of-pocket expenditure per night when an individual purchased the medical care utilizing a health welfare plan. Even though this measurement presents the variations of only six prices, it can show suitable consistency with the behavior of Thai patients seeking medical care according to the data set.

[1] Order to literature: Japan (1996), USA (1998), Netherlands (2001) and Belgium (2003).

[2] Order to literature: Burkina Faso (1994), Mozambique (2005) and Tanzania (2003).

The paper is organized as follows: Section 2 describes the theoretical model; Section 3 presents the empirical analysis and econometric approach; Section 4 provides the data and samples; Section 5 shows the results; and Section 6 presents the conclusions.

2. Model framework

This section outlines a simple model as a guideline for the empirical specification employed in this paper. Following Grossman (1972), I have modeled medical care services as a commodity and enter directly into the utility function. The utility function of an individual is given by

$$U(C_i, H_i) \tag{1}$$

where C_i is consumption of non-medical care goods and H_i is the health status of individual *i* in current period.

The health status of an individual *i* depends on his or her initial health status H_{0i} and the amount of medical care services M_i. I assume the production function is linear as following:

$$H_i = H_{0i} + M_i \tag{2}$$

where H_{0i} is the initial health status, which potentially depends on individual characteristics and actions before obtaining medical care services, e.g, the H_{0i} is low when he or she acquires an illness. Individual characteristics and actions such as age, sex, work and education translate into different levels of initial health status. This production function captures an idea that an individual can improve in his or her health status in current period by using medical care services.

The individual's budget constraint and non-negatively conditions are given by

$$Y_i = C_i + P_i M_i \tag{3}$$
$$C_i,\ M_i \geq 0 \tag{4}$$

where Y_i is the income of individual *i*. The price of non-medical consumption goods is normalized to one and P_i is the (expected) price of the medical care services faced by the individual *i*. Equation (4) is the non-negativity conditions on consumption C_i and on medical care services M_i, which state that the individual cannot sell his or her health.

2.1 Individual decision

Consider the individual's problem of choosing the consumption of non-medical care goods as *C*, and medical care services as *M*, to maximize utility

$$\underset{C_i, M_i}{Max}\ U(C_i, H_i) \tag{5}$$

subject to medical care production (2), budget constraint (3), and non-negativity conditions (4).

For expositional purposes, I assume that the utility function is a utility function as follow: constant elasticity of substitution (CES) for the representative individual to derive the demand function given by

$$U(C_i, H_i) = [\alpha C_i^{\rho} + (1-\alpha) H_i^{\rho}]^{1/\rho} \qquad (6)$$

where $\rho = 1 - 1/\sigma$ is the elasticity of substitution and $\sigma > 0$. $\alpha \in (0,1)$ is the preference weight between non-medical care consumption goods and health status.

The demand for medical care services in this case is as follow:

$$M_i^* = \frac{Y_i - H_{0i}\left[\frac{\alpha}{1-\alpha} P_i\right]^{\sigma}}{P_i + \left[\frac{\alpha}{1-\alpha} P_i\right]^{\sigma}} \qquad (7)$$

Equation (7) states that the demand for medical care services is a function of the (expected) price of medical care services P_i, individual income Y_i and the initial health status H_{0i}. For example, when the initial health status of individual falls, the demand for medical care services will increase with treatments needed to improve his or her health status. The initial health status depends on different individual characteristics and actions such as gender, age, working and education. These variables cause different degrees of illness in the initial health status of the individual. Therefore, I add these individual characteristics and actions to regressions to studying the demand for medical care services in order to control for heterogeneity in the initial health status.

3. Empirical Analysis

This paper primarily uses a binary choice model, namely a probit model. The main estimating equation is a linear function from (7) as follows:

$$M_i^* = \beta_1 \log P_i + \beta_2 Y_i + \beta_N X_i + e_i \qquad (8)$$

where M_i^* is amount of medical care services required by an individual *i* and is an unobserved latent variable. The observed choice is a dummy variable defined by

$$\left.\begin{array}{l} D_i = 1 \ \ if \ \ M_i^* > 0, \\ D_i = 0, \ \ otherwise. \end{array}\right\} \qquad (9)$$

This observed is discrete choice variable and is taken as 1 when individual utilized medical care services, and 0 otherwise as in (9). The study uses the self-reported medical care services in the Health and Welfare Survey (HWS), which are differently classified as inpatient and outpatient care to represent amount of medical care service variable.

A special interest, $\log P_i$ represents the expected price of medical care services for an individual who holds an insurance plan *i*. Based on the estimated coefficient of this variable, I then can estimate the price elasticity of demand for medical care services, $\varepsilon_{M,P} < 0$, which is calculated at the mean price of the expected price of the medical care services. For empirical study, Y_i is represented by household income per capita because I assume that the medical

care services are joint decisions within the household. The explanatory variable X_i includes the control variables for individual characteristics, consisting of gender, age, education, and work.

In individual level data, the parameters β of the equation (8) are estimated jointly by the maximum likelihood method (ML)[3]. To fit a probit regression, I conduct hypothesis tests; the null hypothesis is that the coefficients are all zero. This hypothesis, checked by a Wald test, examines the slope of coefficients affecting the model so that the results are consistent parameter estimates and correct predictions.

4. Data source

In 2001, Thailand began to introduce social health insurance that provided the universal health insurance coverage (known as 30-Baht Scheme) to access the basically medical care services for nation. Thus, in this paper, I use data during initial periods of introducing the universal health insurance coverage to estimate price elasticity of demand for medical care services in Thailand which data are available limitedly and completely for 3 years. This study uses the Health and Welfare Survey (HWS) conducted annually by the National Statistical Office (NSO) from 2003 to 2005. The survey collected data of 68,000 individuals from every province in the kingdom, both inside and outside the municipal areas. This HWS survey was conducted during the month of April of each survey year. The survey collected information on the demographic characteristics of individuals and households, individual income, employment status, the types of medical care service provider to visit, the methods of treatment at the last time of illness, the out-of-pocket expenditure of each individual for each type of medical care services, the date when last cured at a medical provider, the primary welfare of individuals, etc. The survey therefore is a representative sample of all patients for public health in Thailand.

This study categorizes health welfare plans into 6 main plans. I report the utilization rates for both inpatient and outpatient care services. The portion of patients utilizing these plans is provided in Table 1. Note that individuals are generally assigned to a health welfare plan based on their place of employment. (*i*), Plan NO (nothing plan) is a group of patients who did not utilize any health welfare plans when getting health care services. (*ii*), Plan G is for government officials, state enterprise employees and pensioners covered by the government welfare plans. It covers about 15-19% of the population. (*iii*), Plan SS is for the private sector employees covered by their firms and accompanied with the government fund. It covers less than 8% of the population. Next, the universal coverage for health care is for anyone who did not otherwise qualify for health welfare plans. It covers more than 70% of the Thai population. Classified by (*iv*), Plan UC is for individuals utilizing health welfare from the UC card plan but who did not pay any fee. (*v*), Plan UC30 is for individuals utilizing the health welfare from the UC card plan but paid a fee of 30 baht. Finally (*vi*), Plan OT is for individuals utilizing with private health insurance, employer welfare, and all others. In all of these, an individual may freely decide to utilize them for treatment or not use.

[3] The likelihood function can be written as: $L = \prod_{M_i=0} F(-x_i'\beta) \prod_{M_i=1} [1 - F(-x_i'\beta)]$ where F is the cumulative distribution function for e that is the normal distribution. x is a vector of factors explaining the decision for medical care. β is the set of parameters reflecting the impact of changes in x on the probability.

Table 1 ion of patient utilizing health insurance plans.

Insurance	Inpatient: percent			Outpatient: percent		
Plans	2003	2004	2005	2003	2004	2005
NO	2.78	3.56	2.41	3.18	3.71	2.86
G	16.82	18.95	18.82	14.57	15.33	15.87
SS	6.80	7.64	7.65	5.43	5.44	5.55
UC	36.25	33.45	31.99	45.06	43.58	43.05
UC30	35.46	36.31	36.82	30.48	31.87	31.18
OT	1.88	0.10	2.31	1.28	0.07	1.50

From: HWS 2003 to 2005.

4.1 Measuring the medical price variable with the health insurance plans

One of the most challenging parts of this study is to measure prices of medical care services faced by individuals in each plan. There are many studies using different measurements for the price of medical care services and each study was able to obtain the price in limited setting. For example, Manning et al. (1987) used percent co-insurance rates, Bhattacharya et al. (1996) used the average cost and co-payment rates of a patient visit with insurance plan, Sauerborn et al. (1994) used time and the pecuniary costs of medical care services and Duarte (2012) used the out-of-pocket expenditure as a combination of cap and co-insurance rates as the price of medical care services. For this study, the suitable price variable is the average value of the out-of-pocket expenditure per nights of the individual who was treated by service providers. Therefore, price variable can be summarized into a single price in each plan by calculating the expected price of medical care services to estimate the price elasticity.

In particular, I calculated the expected price of medical care services for each plan by using the average value of the out-of-pocket expenditure per nights (number of days stay at the service provider) of all patients in the group. That is, I assume the number of nights at the service provider reflects the quantity of the medical care services. More formally, the expected price of medical care services for plan *j* is as follows:

$$P_j = \frac{\sum_{i \in N_j} opc_i \Big/ d_i}{N_j}$$

where P_j is the expected price of medical care services of insurance plan *j*. opc_i is the out-of-pocket expense of patient *i* who is in plan *j*. d_i is the number of days of services acquired by patient *i* when staying at service provider. N_j is the number of patients who hold the same plan j. Meanwhile, the expected price of medical care services of outpatient uses the number of 1 day to calculation.

Note that I did not use the disease variable when I calculated the expected price of medical care services because I could not observe about the diseases of some individuals who were sick, however, they might not go or not admit to the service providers. Thus, I did not calculate the expected price of medical care service from diseases variable to estimation. Moreover, I assume that there are homogeneous diseases of patient, however, I separated as inpatient and outpatient to describe the level of acute illness of patient.

This study needed to assign all individuals to these expected prices. Although an individual may not utilize them, I assume that he or she know the prices before making his/her choice to treatments. Within the same insurance plan, the individuals face the same expected price. The expected prices of medical care services from the calculation are shown in Table 2. All of these expected prices are represented as a price proxy for analyzing the demand for medical care services to estimate price elasticity.

Table 2 The expected prices of medical care services by health insurance plans: (Baht).

Insurance Plans	Prices of inpatient			Prices of outpatient		
	2003	2004	2005	2003	2004	2005
NO	2,388.61	2,747.18	3,324.44	222.48	224.38	250.02
G	285.07	224.62	258.14	58.21	84.71	93.94
SS	241.96	216.00	214.31	27.26	48.78	17.55
UC	14.38	23.82	33.81	7.03	9.92	3.99
UC30	53.48	100.66	85.04	40.39	45.44	41.29
OT	742.12	923.17	807.76	313.83	407.71	236.31

Calculated from HWS 2003 to 2005

In addition, the analysis includes control economic independent variables from a series of variables: *Household income per capita* - it is expected that demand for medical care services increases with higher income. For the initial health status, individual characteristics consist of the following. *Age* affects the rate of depreciation, since health status can decline with age. *Gender* is also included and represented by 1 dummy for male. It is expected that the rate of depreciation will be higher for men since they usually have somewhat shorter lives. *Work* is reflected by a dummy measure that equals to 1 for white-collar work who performs as administrative work or non-labor work. It is expected to increase in demand for medical care services. Finally, *Education* is represented by an individual's education level divided into two groups, if 1 is dummy for less than a bachelor's degree otherwise a bachelor's degree or higher. I expect that demand for medical care services increases with a higher education. The list of all variables is used for estimates in a probit regression.

Table 3 Sample descriptive statistics during 2003 to 2005 and Pooled data.

Variables	2003	2004	2005	Pooled
Dependent				
Inpatient	0.06	0.06	0.06	0.06
	[0.24]	[0.24]	[0.24]	[0.24]
Outpatient	0.12	0.12	0.12	0.12
	[0.33]	[0.33]	[0.32]	[0.32]
Independent				
Price of inpatient	210.18	268.19	255.30	244.54
	[463.26]	[599.01]	[608.52]	[561.48]
Price of outpatient	48.04	55.77	51.32	51.70
	[56.29]	[46.35]	[54.65]	[52.72]
Household income per capita	5,892.44	6,643.62	7,049.49	6,037.67
	[31,726.3]	[38,543.0]	[35,246.7]	[33,332.2]
Age	40.48	40.40	40.92	40.60
	[13.13]	[13.13]	[13.25]	[13.17]

Variables	2003	2004	2005	Pooled
Male	0.51	0.51	0.50	0.51
	[0.50]	[0.50]	[0.50]	[0.50]
Work	0.39	0.40	0.42	0.40
	[0.49]	[0.49]	[0.49]	[0.49]
Education	0.90	0.89	0.88	0.89
	[0.30]	[0.31]	[0.32]	[0.31]
Separate service providers of inpatient				
Inpatients visit at public	0.05	0.05	0.05	0.05
	[0.22]	[0.23]	[0.23]	[0.22]
Price of public	173.68	191.51	230.16	198.55
	[372.90]	[300.20]	[547.79]	[421.29]
Inpatients visit at private	0.01	0.01	0.01	0.01
	[0.10]	[0.10]	[0.09]	[0.10]
Price of private	472.15	534.10	604.28	537.04
	[891.21]	[959.59]	[884.45]	[913.80]
	N = 37,534	N = 37,313	N = 37,850	N = 112,697

Note: The table presents mean and standard deviation is in brackets that used in the regression.

4.2 Sample Statistics

Table 3 provides the descriptive statistics of explanatory variables for using in the regression during the years from 2003 to 2005 and pooled data. Overall, 6 percent of the sample utilized inpatient care in the 12 months prior to the interview. The average expected prices of inpatient care varied from 210 to 268 baht per person. On the other hand, the number of outpatients made up 12 percent of the sample in the 1 month prior to the interview and the average expected prices of outpatient care ranged from 48 to 56 baht. Other characteristics of the sample are similar in terms of demographics and consist of the following. The mean household income per capita is approximately 5,892 baht for 2003, and 6,038 baht for the pooled set. The sample is middle-age with an average age of 41 years. The ratio of gender is nearly 51 percent for men all three years. The average of white-collar workers is around 40 percent. The level of education, measured by the highest achieved, shows approximately 89 percent had less than a bachelor degree. Moreover, considering the dependent variables for the separate service providers of inpatient care, 5 percent of the inpatients were treated by public providers, and just 1 percent by private providers. The mean price of medical care at public providers is three times lower than from private providers.

5. Empirical results

This section presents empirical results regarding the demand for medical care services based on the equation (8). The variation in prices comes from six different medical insurance plans. I estimate the price elasticity by using a binary choice model with a probit regression model. The price elasticity is calculated at the mean price of the expected price of medical care services. The results of the model are presented in two parts. The first estimates the own price elasticity of inpatient care services. Moreover, I estimate the own price elasticity categorized the sample by gender, area, age, household income and types of provider, which also include to estimating the cross price elasticity between public and private inpatient care services. The second shows the own price elasticity of outpatient care services.

5.1

5.1.1 Own price elasticity of inpatient care services

As discussed, the dependent variable in this model is a dummy variable if an individual *i* used an inpatient service during the twelve months preceding the interview. I compare this in three periods and a pooled cross section to examine the effects of change over time of the price elasticity of inpatient care services (see on Table 4).

The estimated effects of the expected price on the demand for medical care services are statistically significant and the coefficients of expected price are negative in all years. They showed that the increasing expected price would reduce the probability of demand for medical care services. Table 4 also shows that the price elasticities (calculated at the mean price of the expected price of medical care services) in these three periods for inpatient care services are low, significant, and tend to rise. These results imply that individuals are inelastically responsive to changes in the price. For example, the results imply that a 1 percent increase in inpatient charges would reduce the probability of demand for medical care services by only 6.20, 8.27, and 10.22 percent in each year, and 6.88 percent for the pooled data, respectively.

Table 4 The estimated coefficients of the model and own price elasticity of inpatient care services with probit regressions.

Variables	2003 Inpatient	2004 Inpatient	2005 Inpatient	Pooled Inpatient
Logprice	-0.0130*	-0.0263**	-0.0509***	-0.0346***
	(0.00696)	(0.0108)	(0.0179)	(0.00903)
Household income	1.54e-07	-6.27e-07*	1.18e-06***	-4.61e-06
	(2.16e-07)	(3.58e-07)	(2.10e-07)	(2.97e-06)
Age	0.00776***	0.0139***	0.00198	0.00404***
	(0.00281)	(0.00115)	(0.00127)	(0.000732)
Male	-0.0762**	-0.123***	-0.219***	-0.224***
	(0.0311)	(0.0345)	(0.0323)	(0.0188)
Work	0.106	0.0129	0.0159	0.0203
	(0.0760)	(0.0214)	(0.0372)	(0.0220)
Education	0.497**	0.0328	0.129**	0.119***
	(0.244)	(0.0426)	(0.0565)	(0.0376)
Constant	-1.404***	-1.388***	-1.389***	-1.557***
	(0.153)	(0.0994)	(0.129)	(0.0719)
Wald $\chi 2$	455.79	589.32	114.65	245.94
Prob > $\chi 2$	< 0.000	< 0.000	< 0.000	< 0.000
Observations	37,447	37,184	37,704	112,290
Price elasticities	-0.0620**	-0.0827***	-0.1022***	-0.0688***

Standard errors in parentheses, ***p<0.01, **p<0.05, *p<0.1

Note: - A generalized Wald test is run to determine whether these properties are violated. The testing rejects a null hypothesis that coefficients are all zero.

- The price elasticities are measured by the percentage point change in the probability at the mean price of the expected price of medical care services. For binary regressors using the marginal effect at mean are calculated as elasticities.

These results are in line with the past results in the literature. Manning et al (1987) found that price elasticities varied from -0.14 to -0.17 for hospital care in the USA. Nyman (1989) found that the price elasticity of private patients was -1.7. For Eichner (1998), price elasticities of medical expenditures of employees ranged between -0.62 and -0.75. Van Vliet (2001) examined the effects of price and deductibles on medical care demand and estimated it at -0.079 in Netherlands. In the developing country of Burkina Faso, Sauerborn et al (1994) examining adults more than 14 years had inelastic around -0.27. Sahn et al (2003) found the own price elasticity in rural Tanzania to be -1.69 for private clinics, with private hospitals at -1.64 and public hospitals -1.86. In China, Naci Mocan et al (2004) estimated the price elasticity at around -1.04 in a two-part model and -0.81 using the discrete factor method. To sum up, the price elasticity of demand for medical care services is in line with these earlier studies.

For other control variables, the estimated effects of household income per capita on the demand for medical care are statistically significant in 2004 and 2005. The relative direction is both negative and positive in during these years but household income is expected for positive. However, the relationship between income and medical care services can fluctuate to negative or positive, depending on the context and covariates from study. This is similar to Fuchs (2004) in that if individual works hard, he/she will be higher income but it would not be surprising if health care were lower. The estimated effects of age are statistically significant in all years except 2005. The coefficients of age are positive in all periods, which means with increasing age one is more likely probability to be treated at service provider, since growing older is a fundamental fact of human life. Gender is statistically significant and as expected is negative in all periods, since the probability of rate of reduction is higher for men. It is consistent with the United Nations study (2011) that showed the life-expectancy of women has increased in every country. The coefficients of work are positive and indicate that probability of individuals with a low risk from their work increases in demand for medical care services. In addition, the estimated effects for education have a positive correlation between education and health. However, they indicate that probability of individuals with a less education can take better care of their health as well.

5.1.2 Own price elasticity of inpatient care services classified by gender, area, age and household income

In this section, I show an alternative analysis the own price elasticity of inpatient care services by estimating the main regression (8) classified the sample of gender, area, age and household income. The results highlight the importance of individual demographic variables in explaining variations with price responsiveness (presenting only the own price elasticities see results on table 5).

- Gender

I classify the sample into two groups based on gender. The explanation of gender for demand for medical care services indicates the impact of lifestyle on utilization decisions. The results show that the coefficients of own price elasticities have expected sign. Men are more responsive to changes in the price than women. It implies that women prefer to seek medical care for protecting and treating their health more often than men. Similarly, in developed countries Hunt-Mccool et al. (1995) in the USA and Cockx and Brasseur (2003) in Belgium, found that women utilize more medical services than men when examining gender differences for variations in price.

- Area

A second specification considers the area of residence. I classify the sample into two groups, divided into urban and rural. The area of residence reflects the impact of decisions in terms of healthcare utilization, access, and costs of individuals for urban and rural health care.

The estimations show that individuals living in urban areas have a higher response to changes in the price than those in rural areas. This result suggests that urban areas are more likely to have differences in socioeconomic backgrounds. This is not surprising, since rural areas have fewer alternatives to access public or private health service providers due to the fact that most health service providers are generally located in the cities. In other words under Thai context, individuals in rural areas rarely go to service providers for treatments as inpatient, alternate with treatments as outpatient instead. Hence, the demand for medical care services of urban area is more elastic to changes in the price than in rural areas.

Table 5 Own price elasticity of inpatient care services with probit regressions classified by gender, area, age and household income.

Variables	2003 Inpatient	2004 Inpatient	2005 Inpatient	Pooled Inpatient
Gender				
Male	-0.0730*	-0.0988**	-0.2057***	-0.0785***
Female	-0.0521	-0.0588	-0.0572	-0.0485**
Area				
Urban	-0.0585	-0.1084**	-0.1486***	-0.0845***
Rural	-0.0240	-0.0832	-0.0655	-0.0467*
Age				
I ≤ 30	-0.1220	-0.0542	-0.2419***	-0.0996***
31 ≤ II ≤ 45	-0.0471	-0.1398**	-0.0368	-0.0750**
46 ≤ III ≤ 60	-0.0514	-0.0509	-0.0861	-0.0592*
IV ≤ 61	-0.0201	-0.1457**	0.0440	-0.0191
Household income				
Quartile I	-0.1045	-0.0297	-0.0048	-0.0638*
Quartile II	-0.0638	-0.0383	-0.099	-0.0493
Quartile III	-0.0146	-0.0998	-0.0588	-0.0329
Quartile IV	0.0716	-0.1180**	-0.1295	-0.0301

***p<0.01, **p<0.05, *p<0.1

Note: I classify the sample of gender, area, age and household income to estimate the own price elasticities with the main regression (8), separately. The price elasticities are measured similarly on table 4.

- Age

A third specification brings age into analysis. I classify the sample into four groups based on age. For the first group, individual age is from infants to adults under 30 years. The second group is set from 31 to 45 years, and third group is for 46 to 60 years. Finally, the

oldest group is for those more than 61 years. In all years, the price elasticities of age specification did not move in a set direction among age groups. However, for the pooled cross section, the first age group's price elasticity is the highest at -0.10 for inpatient care services. The oldest group is the least sensitive to changes in the price, from -0.02 and less than five times of the youngest group.

These results suggest that older individuals may be less responsive to changes in the price because they are aware that medical care will probably allow them to live longer. They are also concerned about the quality of life in old age and do not want to lose their ability and health. This could be caused by the fact that older individuals have a strict incentive to spend for prevention in medical care. Thus, they are less elastic to change in the price.

- Household Income

A fourth specification considers household income per capita as a factor. I classify the sample into four groups based on quartiles, which are by different ranges of household income per capita in each year.

The results show that the price elasticities of the highest household income quartile have more responsive to changes in the price than the lower household income groups in 2004 and 2005. For example, the highest household income quartile of inpatient care services has elasticity of more than four times (-0.12 and -0.03 in 2004) and manifold (-0.13 and -0.005 in 2005) that of lowest household income quartile, respectively. This could be explained by the fact that a higher household income family can easily move to expensive services and expect to manage the out-of-pocket expense of better health service providers for medical care much more than one on a lower household income. Alternatively, lower household income groups spend less on medical care simply because they do not have as many resources as higher income households.

5.1.3 Own price elasticity and cross price elasticity of inpatient care services between public and private service providers

- Own price elasticity of types of provider

For this section, I alternatively show the own price elasticity of inpatient care services by estimating the main regression (8) classified the sample of types of provider. This specification considers the types of medical provider (presenting only the own price elasticities see on Table 6). I classify the sample into two groups, based on an inpatient's utilization of public and private service providers and re-calculate the expected price rate by separating types of provider to find out each of the own price elasticity. Note that the expected prices between public and private service providers might not cover the services at the same rate because of service quality.

The price elasticities of inpatients utilizing a public provider associate with the expected price rate range from -0.17 to -0.19 and are statistically significant. In contrast, the price elasticities for inpatient care services utilizing at private provider is not expected sign and not statistically significant in 2003 and 2005. The estimations show that inpatient utilizes at public service providers has a higher responsive to changes in the price than at private service providers.

Table 6 Own price elasticity of inpatient care services with probit regressions classified by types of provider.

Variables	2003	2004	2005	Pooled
Types of provider				
Public	-0.1911***	-0.1923***	-0.1932***	-0.1693***
Private	0.1637***	-0.2056	0.0564	-0.0119

***p<0.01, **p<0.05, *p<0.1

Note: I classify and re-calculate the expected price rate by the sample of types of provider to estimate the own price elasticities with the main regression (8), separately. The price elasticities are measured similarly on table 4.

This could be caused by some facts evident in the sample. First, Thais prefer to seek medical care at a public rather than a private provider in accordance with the restrictions in each insurance plan. Second, the fraction of the total sample for inpatient visits at private providers is only an average of 1 percent. Finally, the cost of private providers is almost three times higher than public providers (see on Table 3). Therefore, this evidence shows that those seeking inpatient care services forgo medical care at private providers more often than at public providers.

As the result, the price elasticities in this estimate are not explicitly obviously. Thus, I also use cross price elasticity to explain the elasticity. The cross price elasticity reveals that the utilization of inpatient care services between public and private providers is a substitute for treatment options. This method is illustrated in the next section.

- Cross price elasticity of types of provider

This section, I re-estimate the previous section to find out the cross price elasticity of types of provider, (measured at the mean price). I classify the estimations into two cases between public and private of inpatient care providers (see on Table 7).

Table 7 Cross price elasticity in the case of inpatient of public provider and private provider with probit regressions.

Variables	Inpatient public provider				Inpatient private provider			
	2003	2004	2005	Pooled	2003	2004	2005	Pooled
LogPrice of public provider	-0.165***	-0.0642***	-0.162***	-0.110***	0.347***	0.316***	0.103***	0.206***
	(0.0246)	(0.0158)	(0.0349)	(0.0122)	(0.0708)	(0.112)	(0.0259)	(0.0256)
LogPrice of private provider	0.0772***	0.0337**	0.112***	0.0732***	-0.136***	-0.228***	-0.0836***	-0.128***
	(0.0202)	(0.0152)	(0.0348)	(0.0108)	(0.0473)	(0.0790)	(0.0281)	(0.0238)
Household income	1.01e-06	-6.33e-07	1.39e-06***	1.38e-05***	-2.00e-06*	-2.80e-06	1.73e-07	-7.49e-06***
	(6.67e-07)	(4.49e-07)	(1.21e-07)	(5.54e-07)	(1.13e-06)	(2.19e-06)	(2.96e-07)	(2.60e-06)
Age	0.00243*	0.0137***	0.00136	0.00301***	-0.0136	-0.0257	0.0180***	0.00390**
	(0.00138)	(0.00142)	(0.00137)	(0.000734)	(0.0172)	(0.0243)	(0.00162)	(0.00167)
Male	-0.237***	-0.120***	-0.229***	-0.203***	-0.0766	-0.249**	-0.0580	-0.124***
	(0.0338)	(0.0357)	(0.0338)	(0.0182)	(0.0875)	(0.111)	(0.0396)	(0.0382)
Work	-0.0178	-0.0346	-0.0768**	-0.00782	0.197**	-0.612	0.198***	0.219***
	(0.0410)	(0.0247)	(0.0389)	(0.0215)	(0.0943)	(0.733)	(0.0553)	(0.0427)
Education	0.354***	0.121**	0.222***	0.104***	-0.175	-0.320	-0.0333	-0.00341
	(0.0706)	(0.0505)	(0.0654)	(0.0375)	(0.149)	(0.210)	(0.0609)	(0.0782)

Variables	Inpatient public provider				Inpatient private provider			
	2003	2004	2005	Pooled	2003	2004	2005	Pooled
Constant	-1.678***	-1.575***	-1.648***	-1.589***	-3.617***	-2.228***	-2.159***	-2.880***
	(0.125)	(0.117)	(0.163)	(0.0700)	(0.271)	(0.644)	(0.197)	(0.159)
Wald $\chi 2$	167.46	625.21	259.62	1200.81	76.44	25.4	345.08	135.17
Prob > $\chi 2$	< 0.000	< 0.000	< 0.000	< 0.000	< 0.000	< 0.000	< 0.000	< 0.000
Observations	37,447	37,184	37,704	112,335	37,447	37,184	37,704	112,335
Cross price elasticities								
Public provider	-0.3534***	-0.2024***	-0.3400***	-0.2517***	0.6797***	0.5845***	0.4790***	0.5456***
Private provider	0.1651***	0.1062**	0.2353***	0.1668***	-0.2658***	-0.4232***	-0.3881***	-0.3392***

***p<0.01, **p<0.05, *p<0.1

Note: The dependent variables show as inpatient visiting at public provider on the first panel and as inpatient visiting at private provider on the second panel. The price elasticities are measured similarly on table 4.

The range of cross price elasticity suggests that public providers and private providers are substitutes. In case of a dependent with public inpatient care providers, the cross price elasticities during study years and pooled regression are both significant at a 95% and 99% confidence level. The price elasticities of public inpatient care services with respect to the price of a public provider range from -0.20 to -0.35 and a private provider ranges from 0.11 to 0.24. For instance in 2003, the results indicate that a 1 percent increase in price change for a public provider results in a 16.51 percent increase in the probability of visiting a private provider instead.

Similarly, in case of a dependent with private inpatient care providers, an increase in price change by a private provider in 2003 results in a 67.97 percent increase in the probability of visiting a public provider. Comparing both providers indicates that inpatient care services of public providers are more sensitive to changes in their price than private providers in this study.

5.1.4 Robustness checks for the own price elasticity of inpatient care services

For robustness checks (e.g. full estimations in 2003 see on appendix table 10), I estimate additional probit regression model by using different variables to check the own price elasticity (see on tables 8) of inpatient care services to compare with the previous section 5.1.1.

- Price of private plan

In this section, there are seven plans to estimate the price elasticity. I re-calculate the expected price rate by adding the price for private plan, separated from plan (OT), faced by individuals entering the main regression (8), to check how private plan impact on the elasticity of inpatient care services. The result in 2003, -0.07, is similar to using the main six plans. The private plan data in 2004 is not available. However, in 2005 the price elasticity, -0.07, seems to be less responsive to changes in the price compared with the main results in section 5.1.1.

- Price per visit

I calculate price per visit by using only the average value of the out-of-pocket expense of inpatient care services (not divided by the number of days) divided the number of

inpatients who hold the same plan. Price per visit replaced the expected price variable in the main regression (8). Currently, there are the other six plans to run the regression to estimate the price elasticity. The results for the price elasticities are close to those found in section 5.1.1, except that those of 2005 differ by approximately 3 percent.

- Individual income

I assume that the decision to seeking medical care services depends on an individual's income, not a household's income. I ran a probit regression by using only individual income. The price elasticities are quite different to the main results in section 5.1.1 of this paper. The results for the price elasticities by individual income are less responsive to changes in the price than household income, except in the year 2003. The price elasticities range from -0.07 to -0.09 during the year study.

Table 8 Robustness checks show own price elasticity of inpatient care services with probit regressions.

Robustness Variables	2003	2004	2005	Pooled
Price of private plan	-0.0675**	-	-0.0708**	-
Price per visit	-0.0526**	-0.0657**	-0.0709**	-0.0459***
Individual income	-0.0881***	-0.0752**	-0.0757*	-0.0688***
Exercise	-0.0629**	-	-	-
Drinking water	-0.0434	-0.1173***	-0.0779	-0.0555***
Lavatory	-0.0635**	-0.1176***	-0.0726	-0.0637
Chronic	-0.0453	-0.0591*	-0.0806**	-0.0658***
Drop working	-0.0416**	-0.0449**	-0.0579**	-0.0459***

***p<0.01, **p<0.05, *p<0.1

Note: - Price of private plan data is not available in 2004.
- Exercise data is not available in 2004 and 2005.

- Prevention by exercise, drinking water and using the lavatory

Prevention is hypothesized to decrease the rate of depreciation in health status. Exercise refers to whether an individual in the sample engaged in any sporting activities during the month prior to the interview. Drinking water refers to the types of water to consumed, such as bottled water, piped water, and underground water. Lavatory refers to types of using toilet, such as flushed toilets, molded bucket latrine toilets, and pits toilets. Thus, I use three dummy variables and add them separately into the main regression (8) for estimating the price elasticity of inpatient care services.

The result for sporting activities in 2003 is similar to the result of section 5.1.1. The exercise data for 2004 and 2005 is not available. The price elasticities range from -0.04 to -0.12 for drinking water, and from -0.06 to -0.12 for using lavatory. In these two dummy variables, the results for the price elasticities are similar and close to that of 2003 and the pooled data, but are quite different in 2004 and 2005 when compared to the main results in section 5.1.1.

- Chronic

The chronic variable refers to health status of an individual who had a chronic disease. I use it as a dummy variable measuring price elasticity for inpatient with chronic disease. The

results show that the price elasticities range from -0.05 to -0.08 and are less responsive to changes in the price than in section 5.1.1. This suggests that inpatient with chronic disease is more preventable, treatable and careful for long-lived than only inpatient case.

- Drop work

I add the working variable into the main regression (8), but the sample size is reduced around 50 percent. Now, I drop the working variable and run the regression by using the remaining variables. The results indicate that the price elasticities decrease double and less responsive to changes in the price compared with the main result in section 5.1.1. The price elasticities range from -0.04 to -0.06 in during year study.

5.2 Own price elasticity of outpatient care services

As discussed, the dependent variable in this model is a dummy variable if an individual *i* used as outpatient care services during the 1 month prior to the interview. Individual medicates illness by utilizing health service providers. The price elasticity is calculated at the mean price of the expected price of medical care services. I estimate during three periods and pooled cross section to examining the effects of changes over time of the price elasticity of outpatient care services (see on Table 9).

Table 9 The estimated coefficients of the model and own price elasticity of outpatient care services with probit regressions.

Variables	2003	2004	2005	Pooled
	Outpatient	Outpatient	Outpatient	Outpatient
Logprice	-0.247***	-0.100***	-0.0398**	-0.0968***
	(0.0835)	(0.0164)	(0.0160)	(0.00865)
Household income	4.03e-07	-3.54e-07	3.07e-07*	-3.89e-05***
	(5.81e-07)	(2.45e-07)	(1.83e-07)	(9.17e-06)
Age	0.0229***	0.0187***	0.00867**	0.0196***
	(0.00275)	(0.000801)	(0.00362)	(0.000656)
Male	-0.401***	-0.213***	-0.114**	-0.292***
	(0.0582)	(0.0281)	(0.0469)	(0.0170)
Work	-0.101**	-0.0820***	-0.0590**	-0.0883***
	(0.0418)	(0.0250)	(0.0268)	(0.0197)
Education	0.284***	0.0877*	0.783***	0.0975**
	(0.0879)	(0.0448)	(0.239)	(0.0392)
Constant	-1.673***	-1.259***	-1.438***	-1.506***
	(0.129)	(0.0850)	(0.0670)	(0.0594)
Wald $\chi 2$	146.62	590.68	832.66	1,378.09
Prob > $\chi 2$	< 0.000	< 0.000	< 0.000	< 0.000
Observations	37,447	37,184	37,704	112,335
Price elasticities	-0.1641***	-0.2170***	-0.1521***	-0.1570***

Standard errors in parentheses, ***p<0.01, **p<0.05, *p<0.1

Note: A generalized Wald test is run to determine if these properties are violated. The testing rejects the null hypothesis that coefficients are all zero. The price elasticities are measured similarly on table 4.

The estimations from the empirical analysis are based on a probit regression. The results indicate that determinants to seek outpatient care services include the expected price of outpatient medical care services, household income per capita, and individual characteristics. The coefficients of these variables have a positive and negative effect on the decision to seek medical care. The price elasticities of demand for medical care services with respect to outpatient charges are inelastic for all and range from -0.15 to -0.22 and are significant at the 99% level. The results predict that a 1 percent increase in the expected price is associated with a drop in the probability of seeking care for outpatients by 16.41, 21.70, and 15.21 percent in each year, and 15.70 percent for pooled data, respectively.

The findings are in line with the available literature. For example, Manning et al. (1987) estimated the range as -0.13 to -0.21 for outpatients. Bhattacharya et al. (1996) found elasticities in the range of -0.12 to -0.54, while Yoshida and Takagi (2002) found a range of -0.08 to -0.11 after the reform of the social medical insurance system in Japan. In this study, the results suggest that the own price elasticities of demands for medical care for outpatient care services are almost double demand for inpatient care services in response to changes in the price. Therefore, the results are consistent with the hypothesis that inpatient care services are inelastically responsive to changes in the price in the demand for medical care service than outpatient care services.

6. Conclusion

This paper estimates price elasticities of demand for medical care services with both inpatient and outpatient care services. I study individual level data from the Health and Welfare Survey (HWS) by a probit regression model. The findings indicate that inpatient care services are less price-responsive to the demands for medical care services than outpatient care services. The price elasticities for inpatient care services are inelastic and range from -0.06 to -0.10 while prices elasticities for outpatient care services are more elastic than inpatient care services, and rang from -0.15 to -0.22. These results are consistent with the range of elasticity of other studies e.g., Manning et al (1987), Eichner (1998) for USA, Van Vliet (2001) for Netherlands, Bhattacharya et al. (1996) for Japan and Duarte (2012) for Chile.

One limitation in this study should be highlighted is that Thailand's health care system does not have an appropriate co-insurance or co-payment rate for medical care services. The method used in this paper to estimate price elasticities is the expected price of medical care services measured by the average out-of-pocket medical care costs of patients who hold the same medical insurance plan. This is different from the literature, which usually used co-insurance or co-payment rates as the prices. Nevertheless, the outcomes of this study are in line with the literature. This similarity of the results from this study and the literature suggests that the measurement of the prices of medical care services using the average out-of-pocket medical care costs is quite sensible.

References

Bhattacharya, J., Vogt, W.B., Yoshikawa, A. & Nakahara, T.(1996), "The Utilization of Outpatient Medical Services in Japan", *Journal of Human Resources*, Vol. 31, pp. 450-476.

Chetty, R. & Saez, E. (2010), "Optimal Taxation and Social Insurance with Endogenous Private Insurance", *American Economic Journal*, Vol. 2, No. 2, pp. 85-116.

Cockx, B. & Brasseur, C. (2003), "The Demand for Physician Services: Evidence from a Natural Experiment", *Journal of Health Economics,* Vol. 22, pp. 881-913.

Duarte. F. (2012), "Price elasticity of expenditure across health care services", *Journal of Health Economics,* Vol. 31, pp. 824-841.

Eichner, M. (1998), "The demand for medical care: what people pay does matter", *The American Economic Review,* Vol. 88 (2): pp. 117-121.

Fuchs., V. (2004), "Reflections on the Socio-Economic Correlates of Health", *Journal of Health Economics,* Vol. 23, pp. 653-661.

Grossman, M. (1972a, "The Demand for Health: A Theoretical and Empirical Investigation", NBER, New York.

Grossman, M. (1972b), "On The Concept of Health Capital and The Demand for Health", *Journal of Political Economy,* Vol. 80, pp. 223-255.

Hunt-Mccool, J., KiKer, B.F. & Ying Chu NG. (1995), "Gender and The Demand for Medical Care", Applied Economics, No. 27, pp. 483-495.

Lindelow, M. (2005), "The Utilisation of Curative Healthcare in Mozambique: Does Income Matter?", *Journal of African Economy,* Vol. 14, No. 3, pp. 435-482.

Manning, W., Newhouse, J., Duan, N., Keeler, E., and Leibowitz, A. (1987), "Health Insurance and the Demand for Medical Care: Evidence from a Randomized Experiment", *The American Economic Review,* Vol. 77 (3): pp. 251-277.

Naci Mocan, H., Tekin, E. & Zax, J. S., (2004), "The Demand for Medical Care in Urban China", World Development, Vol. 32, No. 2, pp. 289-304.

Nyman, J, A. (1989), "The Private Demand for Nursing Home Care", *Journal of Health Economics,* No. 8, pp. 209-31.

Sahn, D.E., Younger S.D. & Genicoti, G. (2003), "The Demand for Health Care Services in Rural Tanzania", Oxford Bulletin of Economics and Statistics, Vol. 65, No. 2, pp. 305-9049.

Sauerborn, R., Nougtara, A. & Latimer, E. (1994), "The Elasticity of Demand for Health Care in Burkina Faso: Differences Across Age and Income Groups", Health Policy and Planning, pp. 185-192.

United Nations (2011), "World Population Prospects The 2010 Revision", Department of Economic and Social Affairs, Population Division.

Van Vliet, R. C. J. A. (2001), "Effects of Price and Deductibles on Medical Care Demand, Estimated from Survey Data", *Applied Economics,* Vol. 33, pp. 1515-1524.

Appendix

Table 10 Robustness checks estimated coefficients and own price elasticity of inpatient care services in 2003.

Variables	1	2	3	4	5	6	7	8
Logprice	-	-	-0.689***	-0.0208*	-0.00933	-0.0221**	-0.0455	-0.00973
			(0.246)	(0.0111)	(0.00665)	(0.0107)	(0.0304)	(0.00670)
LogPrice of private plan	-0.0235**	-	-	-	-	-	-	-
	(0.0110)	-	-	-	-	-	-	-
LogPrice per visit	-	-0.0110*	-	-	-	-	-	-
		(0.00632)						
Household income	1.70e-07	1.49e-07	-	5.07e-07	1.76e-07	1.69e-07	7.37e-07	5.38e-07*
	(3.53e-07)	(2.15e-07)		(3.91e-07)	(2.17e-07)	(3.52e-07)	(1.01e-06)	(3.14e-07)
Individual income	-	-	-7.79e-06	-	-	-	-	-
	-	-	(5.50e-06)	-	-	-	-	-
Age	0.0122***	0.00778***	0.00925***	0.0123***	0.00775***	0.0123***	-0.0529**	0.00615
	(0.00289)	(0.00283)	(0.00279)	(0.00218)	(0.00280)	(0.00271)	(0.0214)	(0.00413)
Male	-0.132***	-0.0756**	-0.298***	-0.116**	-0.0782**	-0.131***	-0.432***	-0.0668
	(0.0490)	(0.0307)	(0.0787)	(0.0452)	(0.0328)	(0.0474)	(0.129)	(0.0425)
Working	0.162	0.104	0.170*	0.111	0.122	0.157	0.00896	-
	(0.124)	(0.0752)	(0.0908)	(0.133)	(0.0788)	(0.122)	(0.0806)	
Education	0.108**	0.500**	0.319*	0.0912*	0.491**	0.109**	-0.261	0.672
	(0.0463)	(0.244)	(0.172)	(0.0488)	(0.245)	(0.0461)	(0.522)	(0.438)
				(0.0284)				
Drinking water	-	-	-	-	-0.0456**	-	-	-
					(0.0211)			
Lavatory	-	-	-	-	-	-0.0474	-	-
						(0.0972)		
Chronic	-	-	-	-	-	-	1.121***	-
							(0.227)	
Constant	-1.604***	-1.395***	-0.976*	-1.489***	-1.415***	-1.564***	-0.987**	-1.515***
	(0.127)	(0.153)	(0.506)	(0.132)	(0.160)	(0.153)	(0.493)	(0.122)
Wald $\chi 2$	279.94	455.01	29.91	269.12	462.48	283.33	106.75	707.76
Prob > $\chi 2$	< 0.000	< 0.000	< 0.000	< 0.000	< 0.000	< 0.000	< 0.000	< 0.000
Observations	37,447	37,447	29,177	26,901	37,447	37,447	37,447	62,806
Price elasticities	-0.0675**	-0.0526**	-0.0881***	-0.0629**	-0.0434	-0.0635**	-0.0453	-0.0416**

Standard errors in parentheses, ***p<0.01, **p<0.05, *p<0.1
Note: The price elasticities are measured similarly on table 4.