

Private Health Insurance and Hospitalization Under Japanese National Health Insurance

Tetsuji Yamada^{*1}, Chia-Ching Chen², Tadashi Yamada³, Haruko Noguchi⁴, and Matthew Miller⁵

¹*Department of Economics and Center for Children & Childhood Studies, Rutgers University, the State University of New Jersey, NJ, USA*

²*Department of Epidemiology and Community Health, New York Medical College, NY, USA*

³*Graduate School of Humanities and Social Sciences, University of Tsukuba, Tsukuba, Japan*

⁴*Department of Theoretical Social Security Research, National Institute of Population and Social Security Research, Tokyo, Japan*

⁵*Department of Economics, Rutgers University, the State University of New Jersey, NJ, USA*

Abstract: We empirically examine how the decision to purchase private health insurance and hospitalization are made based on labor income, socio-demographic factors, and private health insurance. The increase in household labor income and wealth has a positive effect on purchasing private health insurance. This suggests a supplementary effect for public health insurance under the strict control of a two-tier healthcare coverage system. Our results support the hypothesis that moral hazard presents for the costs paid to private health insurance by households. A strong positive association with the risk of hospitalization causes individuals to change their health behavior after purchasing private health insurance leading to lower costs in the ill health status and acquire less preventive measures. Thus, moral hazard exists in Japanese health insurance market. Unlike the previous study, adverse selection based on our results is not negligible in the case of hospitalization in Japan. The positive effect indicates that the higher the risk of illness with households, the more insurance policies a household possesses. The results support our hypotheses that the decision to purchase health insurance in case of death in an insured household in a hospital is attributed to the initial health stock of the household. This means that households purchase private health insurance when there is a high probability of hospitalization with claimed insurance on death. The benefits from private health insurance policies for hospitalization provide incentives for individuals to purchase health insurance that are a reflection of adverse selection against private health insurance.

INTRODUCTION

The decision to purchase health insurance stems from uncertainty about one's health. The number of years individuals work depends primarily on their health stock [1, 2]. The healthier the individual is, the higher his or her labor income will be due to a larger stock of health. Individuals generally face absolute risk aversion willing to purchase health insurance policies to avoid a sudden loss in labor income. Similarly, individuals with more financial capital invest more on health than those with lower endowments [3]. Accumulated wealth and labor income play important roles in purchasing private health insurance in reducing the uncertainty of an individual's health stock [4-9]. Correspondingly, high risk of being ill increases the demand for medical care [6, 10], and it follows that individuals with poor health may have an incentive to purchase health insurance. Previous research shows that individuals purchase more health insurance for preventive medicine when they are uncertain of their overall health [4, 9, 11, 12]. If individuals invested in their health earlier in life by using preventive

care, then medical expenditures should on average be lower at health-conscious individual's age.

Concerning the explicit motives of purchasing private health insurance under the national health insurance, the determinants are treated empirically rather than theoretically. The determinants of private health insurance are explored based on accessibility to healthcare services [7, 8, 13], labor income sensitivity [14-16], medication for chronic diseases [12], behaviors regarding preventive care [6], quality of healthcare services [17, 18], and supplemental roles of private health insurance for public health insurance [9].

Adverse selection and moral hazard take important roles in the private health insurance market. For issues of adverse selection, worse health, which is signified by age, results in adverse selection against the public health insurance program in Chile [15]; health risk is positively associated with private health insurance among low and middle income people [4]; individuals with chronic condition are willing to pay more for a good, reliable, and understandable health plans that may effectively reduce the problem of adverse selection in the Netherlands [19]; and there is a positive relationship between self-assessed health, private health insurance coverage, and a negative relationship predicted by adverse selection by using objective indicators of health in Australia [20]. For moral

*Address correspondence to this author at the Department of Economics and Center for Children & Childhood Studies, Rutgers University, the State University of New Jersey, NJ, USA; E-mail: tyamada@crab.rutgers.edu

hazards, Sapelli and Vial (2003) state a negligible case of hospitalization in moral hazard, but they highlight a quantitatively important moral hazard for medical visits in Chile [21]. Savage and Wright (2003) emphasize that moral hazard substantially increase the expected length of a hospital stay in Australia [22], while Kessler (2008) underlines an existence of risk of moral hazard and the long-term care insurance in France [23].

Unlike numerous European and U.S. studies, we have found two quantitative empirical Japanese studies. Shino (2000) and Sawano and Ohtake (2002) both confirmed that there was no evidence of adverse selection in Japan's private health insurance market [24, 25]. They also demonstrated that health status did not influence the decision to purchase private health insurance. Shino stated that earning income was not statistically significant while Sawano and Ohtake's results demonstrated a significant effect on demand for private health insurance among low income individuals and a negligible effect on demand for private health insurance among high income individuals. Furthermore, Shino did not find any substitution effects between private and public health insurance while Sawano and Ohtake (2002) found that private health insurance had a supplementary effect on public health insurance.

It is critical to understand the behaviors of individuals since the Japanese government in 2001 has lifted the ban on private insurance companies from entering health insurance markets already served by the national health insurance system [26, 27]. It is also imperative for policy makers to understand that the growing concerns of an aging society and rapidly increasing government healthcare expenditures with risk of adverse selection and moral hazard, while improving the efficiency and effectiveness of healthcare financing and delivery under the national healthcare system are vital [28]. From reviewing determinants of purchasing private health insurance which influences healthcare uses, the objectives of this empirical study are twofold. First, we examine how the decision of purchasing private health insurance is made under the nationally administered health insurance system and the influence private health insurance has on healthcare services. Second, we observe the existence of adverse selection and moral hazard in order to fill the gaps in the Japanese literature.

We present a method that includes a brief background of private health insurance benefits, data, and analytical framework in the next section. The third section provides the empirical results on the choice to purchase private health insurance and factors associated with hospitalization which is covered by private health insurance firms. The conclusions and implications of this study are reported in the final section.

METHODS

A Brief Background of Japan's Public and Private Health Insurance Systems

The Japanese government provides universal healthcare *via* the national health insurance system. Public health insurance includes healthcare insurance for "acute care" as well as "long-term care insurance" for institutional care for the elderly [29]. It also provides community-based homecare

as shown in Fig. (1). Japan's national health insurance provides healthcare for self-employed, government-managed insurance for small/medium firms, association-managed insurance for large firms, seaman's health insurance, aid association health insurance for civil servants and teachers, and retired persons. These programs are financed through the national tax system and patients' coinsurance payments. The long-term care insurance program is under the municipal jurisdiction (formal homecare services and long-term care at nursing homes and hospitals).

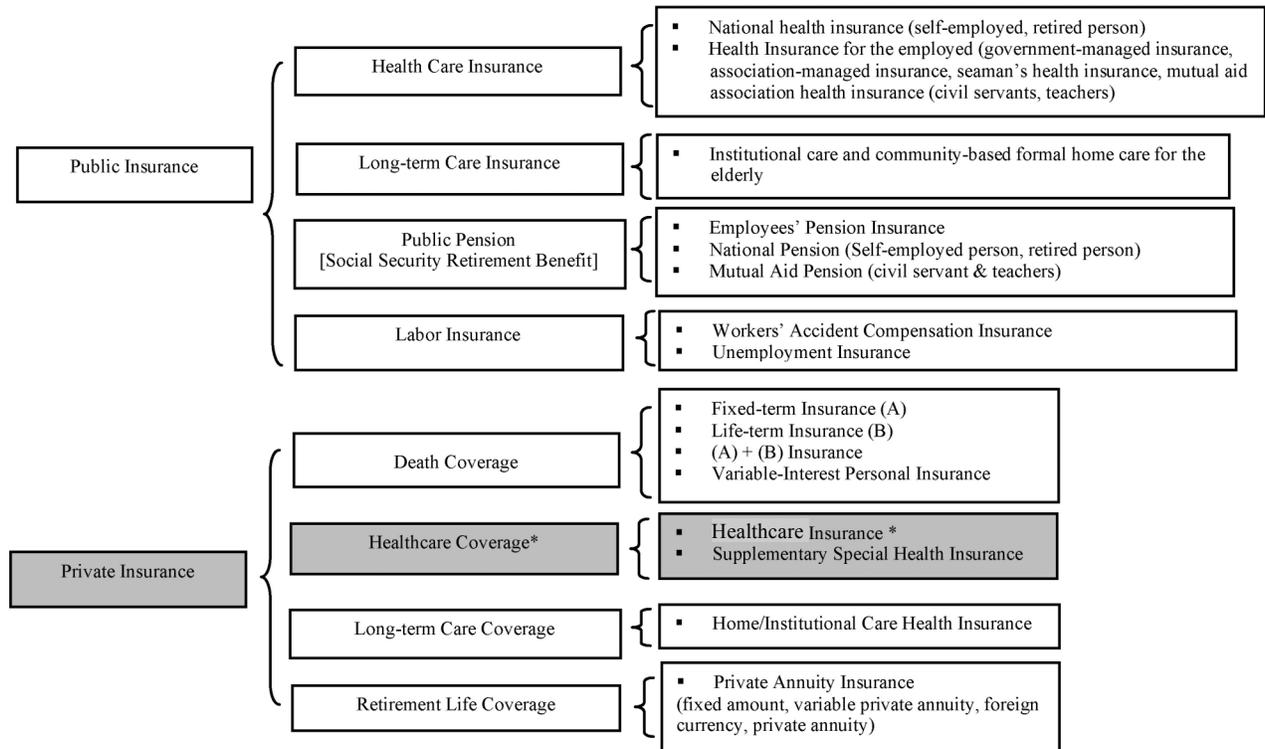
In Japan, there are two types of private healthcare insurance available for purchase: healthcare insurance and supplemental special health insurance for healthcare coverage. Private healthcare insurance is for hospitalization and surgical operations that insurance companies provide for a contracted amount of money. It also provides coverage for three leading illnesses: malignant neoplasm (cancer), acute myocardial infarction (heart disease) and cerebrovascular disease. Supplementary special health insurance includes short and long-term hospitalization, hospitalization caused by chronic illness, female specific illness, cancer, outpatient based treatment after hospitalization, etc.

Data Characteristics

The data set used in this study is published in the *National Survey on Life Insurance: Fiscal Year 2000* (Seimei Hoken ni kansuru Zenkoku Jittai Chosa: Heisei 12 nendo, in Japanese). 6,500 households were surveyed throughout Japan from May to June 2000 by the non-profit Life Insurance Culture Center, with 4,657 households responding. The questionnaires surveyed households that held private insurance, received hospitalization coverage from insurance firms, paid costs to private insurance, received daily payments made by private insurance, had private insurance claims on death, had private health insurance claims, the year that private insurance was bought, labor income, wealth, mortgage, occupational type, employment type, industry in which the head of the household is employed, age, gender, marital status, and total number of children in a household. However, the data does not contain subjective and objective health related information and any education data.

Within this data set, 73.1 percent of the 4,657 heads of household have private health insurance policies; 51.1 percent of spouses have private health insurance policies as well. The mean number of policies held by households with private health insurance is 3.1, while the means for a head of household and spouse are 1.6 and 1.3 policies respectively. Payment at the time of maturity for heads of households who have private health insurance policies is \$67,900 (6.79 million yen: 1 dollar = 100 yen), with the mean insurance claim for a head of household's death being \$256,100 (25.61 million yen)¹. On the other hand, the mean payments for

¹ All dollar values in this paper are calculated based on the exchange rate of \$1 = 100 yen, for brevity. We note that, according to OECD Health Data 2008, per capita health expenditures incorporate the purchasing power parity (PPP), \$1 = 116.3 yen, in calculation. However, ours use \$1 = 100 yen for two reasons: first, the dollar value in PPP seems to underestimate the reality in Japan because of the 0~1 per cent inflation rate; and second, the exchange rate is \$1 = 101 yen as of October 2008 in U.S. dollar value, and can be easily translated into the PPP value.



Note: * Private healthcare insurance coverage includes malignant neoplasm (cancer), acute myocardial infarction (heart disease), and cerebrovascular disease.

Fig. (1). Structure of public and private insurance system in Japan.

spouses are \$42,200 at maturity and \$107,900 for death claims. These statistics show that households hedge more heavily against the sudden loss of earnings rather than their spouses.

As an interesting statistic, 29.6 percent of the households that held private health insurance policies claimed hospitalization and/or medical procedure benefits after they had bought private health insurance policies. We divided each household into two groups to determine the average number of private health insurance policies per household by level of wealth based upon whether they were either "hospitalized" or "not hospitalized." Hospitalized households received payments from private insurance companies due to either hospitalization and/or had medical operations. The average number of private life insurance policies per household with net wealth under \$10,000 is 1.81. Households in the highest wealth category possess greater than \$300,000 and on average hold 3.13 private health insurance policies, demonstrating that increasing levels of wealth have a positive correlation with the number of private health insurance policies held. Interestingly, the average number of health insurance policies held by hospitalized households is larger than those of non-hospitalized households regardless of wealth category. Average private health insurance premiums paid per year by households are slightly larger among hospitalized households than non-hospitalized households regardless of wealth category. The difference in average premiums between the two groups is about 0.3 (= 1.27 - 0.97, or 300 dollars per year) for the lowest wealth category, with the

differential narrowing to 0.01 for the highest wealth category. These statistics illustrate that hospitalization prone households bought health insurance policies with higher premiums for hospital stays when they purchased insurance policies than the non-hospitalized households. For both household groups, wealthier households expect higher payments if family members are hospitalized than less wealthy households do.

Empirical Framework

This section presents the empirical framework used to analyze household decisions on purchasing private health insurance policies as well as hospitalization with insurance claims. In Japan, public universal healthcare insurance covers the entire population and is directly administrated by the government. The premium contribution for public health insurance depends on income. On the other hand, private and for-profit insurance organizations determine premiums based on the individuals risk factors, i.e. age, sex, number of dependents, smoking, etc. [30]. We assume that a household faces a higher risk of illness if that household possesses a lower health stock and that households maximize their expected utility by allocating discretionary earnings amongst health insurance policies and other areas of consumption. In our empirical study, a household is a single economic entity. Although a household consists of more than one family member, it is synonymous with the head of the household. This assumption is made for three reasons. First, heads of households typically purchase health insurance policies to cover healthcare expenditures, thereby holding household

age constant. Second, the basic empirical model can easily be extended to other members within the household. Third, the head of household regression model is far simpler than one that accounts for all of the household members – facing differing rates of risk and states of health due to differences in age. These extra data points create an overly complex model with minor marginal returns, and are therefore excluded.

An increase in hospitalization cost coverage by private health insurance directly affects a household's willingness to pay for a hospital coverage policy. A higher level of coverage (or compensation) on hospital costs from insurance companies in turn makes health insurance policies more attractive and produces disincentives for investing in health. This implies that demand for health insurance policies rises as the amount of health invested in decreases due to a change in alternative discretionary consumption. The relationship between coverage and health investment is negative. In other words, the insured household will have less incentive to keep oneself healthy, take fewer precautions, or invest less in health or preventive measures [20]. A household's behavior is a reflection of moral hazard [21].

Based on the preceding patterns, we might say that households whose family members face higher risks of becoming sick in the future are more likely to purchase better coverage from private health insurance than those households who expect lesser risks of sickness [15]. Their expected benefits are greater than their cost of purchasing health insurance [4]. This is partially a phenomenon of adverse selection due to asymmetric information between insurance holders and providers [23].

In this study, labor income, wealth, and socio-demographic factors are included as an explanatory variable [14, 20]. The three situations observed are as follows: (a) not purchasing health insurance policies and then being hospitalized, (b) purchasing health insurance policies then not being hospitalized, and (c) purchasing health insurance policies and then being hospitalized. We utilize a bivariate probit method to evaluate the impact of individuals' socio-economic characteristics on the probability of hospitalization; given that these individuals also purchased health insurance policies. (The full set of Heckman's procedures is available from the authors.)

Consider the following bivariate probit estimation equations:

- (1) Private health insurance = $f(\text{Economic factors, Health factor, Socio-demographic factors}) + \varepsilon_1$ and
- (2) Hospitalization = $\zeta(\text{Private insurance factors, Economic factors, Socio-demographic factors}) + \varepsilon_2$

where "Private health insurance" represents a household head who has private insurance, while "Hospitalization" represents a household that received coverage for hospitalization from insurance firms. The independent variables within the estimation equations to evaluate moral hazard and adverse selection are as follows: "Private insurance factors" are represented by several data points, including "cost paid to private health insurance," "daily

receipt for hospitalization from private health insurance," "private health insurance claim on death," "private health insurance total claim," and "year of private health insurance bought" as shown in Table 1. Economic factors represent labor income, wealth, mortgage, occupational types, employment type, and industry where the head of the household is employed [7, 8, 13]. Health factor corresponds to the proportion of people who became ill in previous year per hundred thousand persons by age cohort. Demographic factors characterize a vector of socio-demographic factors within the household including age, gender, marital status, and total number of children. ε_1 and ε_2 are unobserved errors, generally assumed to satisfy $E(\varepsilon_i|X_i)=0$, X_1, \dots, X_n . Since no information about educational level is available in the *National Survey on Life Insurance: Fiscal Year 2000*, we encounter the issue of the omitted variable bias in both equations. This study mitigates the possible bias by employing occupational types, employment type, and industry of household head employed to correct this deficiency [31, 32]. The results show that human capital is strongly associated with employment and occupation [2].

In our study, the bivariate probit model provides a way of dealing with two separate binary dependent variables. Essentially, the bivariate probit model takes the estimate of two independent binary probit models, allowing for a correlation between the error terms of the two equations [33]. We estimated the probability of someone reporting their decision of purchasing private health insurance together with the probability of their hospitalization (hospitalization coverage received from private insurer). Two equations correlating error terms show that unobservable characteristics may exist where an individual claims health insurance for hospitalization and the individual's decision to purchase private health insurance. In addition, we note that if endogeneity is an issue, then the coefficient estimates by a single univariate probit model based on the decision of purchasing private health insurance will be inconsistent [34]. Thus, we will employ the bivariate probit model.

EMPIRICAL RESULTS

The variable descriptions and statistics for the Japanese dataset are reported in Table 1. We use two methods: the regression results for the bivariate probit model are contained in Table 2, while the Heckman results can be found in Table 3. (The full set of Heckman's procedures is available from the authors.) For each method, the dependent variables include "Private health insurance" and "Hospitalization." The initial sample size was 4,657 households, however due to missing values the final sample size was reduced to 3,729. The information provided by the bivariate probit model is the estimate of ρ , the correlation coefficient for the two error terms. The estimate is 0.175 in Table 2. The 8.932 chi-squared test shows that the estimate is significantly different from zero. This result indicates that unobservable factors for making decisions to purchase private health insurance are positively related to the unobservable factors of hospitalization [34]. In addition, the likelihood-ratio test in Table 2 shows that hospitalization is statistically significant and positively related to the decision to purchase private

Table 1. Descriptive Statistics of Influential Factors Associated with Purchasing Private Health Insurance and Hospitalization Among Age < 65 (n= 3,729)

Variable	Variable Description	Mean	S.D.	Min	Max
Dependent Variables					
▪ Private health insurance	Household head has private health insurance=1; 0=otherwise.	0.83	0.38	0	1
▪ Hospitalization	Household received coverage of hospitalization from private insurance firms=1; 0=otherwise.	0.30	0.46	0	1
Independent Variables					
<i>Private Health Insurance Factors</i>					
▪ Cost paid to private health insurance	Amount paid per private health insurance policy held in ten thousands yen.	12.99	13.09	0	130
▪ Daily receipt for hospitalization from private health insurance	Receipt per day from private health insurance if household head is hospitalized in ten thousands yen.	4.75	4.89	0	100
▪ Private health insurance claim on death	Private insurance claim upon the death of the household head in millions yen.	21.52	22.42	0	280
▪ Private health insurance total claim	Total claim on household head's private insurance upon maturity in millions yen.	3.97	8.50	0	170
▪ Year of private health insurance bought	Year of latest private insurance policy bought: 1=1994 and before; 2=1995; 3=1996; 4=1997; 5=1998; 6=1999; 7=2000; 0=otherwise.	3.48	2.81	0	7
<i>Economic Factors</i>					
▪ Household labor income	Household labor income in the previous year (1999) in millions yen.	6.98	4.46	0	35
▪ Household labor income not reported	1= if household labor income is not reported; 0=otherwise.	0.05	0.21	0	1
▪ Total household wealth	Total household wealth in millions yen.	8.32	9.74	0	35
▪ Mortgage	1= Household has mortgage on house; 0=otherwise.	0.37	0.48	0	1
▪ White-collar worker	Household head is employed in managerial, professional and clerical positions=1; 0=otherwise.	0.40	0.49	0	1
▪ Blue-collar worker	1= Household head is employed in manual and manufacturing work; 0=otherwise.	0.28	0.45	0	1
▪ Self-employed	1= Household head is self-employed; 0=otherwise.	0.17	0.38	0	1
▪ Part-time	1= Household head is employed in part-time positions; 0=otherwise.	0.03	0.17	0	1
▪ Primary industries	1= Household head is employed in the primary industries; 0=otherwise.	0.04	0.20	0	1
<i>Health Factor</i>					
▪ Illness	Proportion of people who became ill in previous year per hundred thousands person by age cohorts.	0.05	0.02	0.02	0.1
<i>Demographic Factors</i>					
▪ Age of household head	Age of household head.	47.23	10.60	20	64
▪ Age of household head squared	Age of household head squared.	2343.29	978.27	400	4096
▪ Male household head	Household head is male=1; 0=otherwise.	0.95	0.21	0	1
▪ Married	Household head is married=1; 0=otherwise.	0.93	0.25	0	1
▪ Total number of children	Total number of children per household, including unemployed, employed and married children.	1.46	1.02	0	7

health insurance [33]. First, we will discuss the effects of income and wealth on purchasing private health insurance. Second, we will discuss the results of moral hazard and adverse selection in Tables 2 and 3.

For the “Private health insurance” regression results in Tables 2 and 3, household labor income and total household wealth are statistically significant and have positive effects on private health insurance. Grossman (1972) demonstrates that a large health stock increases the number of healthy days an

individual will have [1]. This in turn means that healthier individuals will have longer life spans than those with smaller stocks of health. If this is the case, then rational individuals will choose to maximize their health derived utility. They will do this by allocating discretionary labor income to purchase health insurance policies, and thereby increase access to healthcare services. Table 2 illustrates the fact that an increase in household labor income and wealth by 1 million yen (about \$10,000) directly raises the probability of purchasing private health insurance policies by 3.7 percentage points and 1

Table 2. Results of Bivariate Probit Estimation for Purchasing Private Health Insurance and Hospitalization Among Age<65 (n= 3,729)

	Bivariate Probit Estimation Results			Marginal Effect	
	Estimated Coefficient	Standard Error	P-Value	dy/dx	Standard Error
Dependent Variable: Private Health Insurance (Decision of purchasing private health insurance)					
Independent Variables					
<i>Economic Factors</i>					
▪ Household labor income	0.037	0.008	0.000	-0.001	0.002
▪ Household labor income not reported	0.215	0.144	0.135	-0.027*	0.040
▪ Total household wealth	0.010	0.003	0.002	0.002	0.001
▪ Mortgage	0.208	0.059	0.000	0.021*	0.015
▪ White-collar worker	0.351	0.107	0.001	-0.049*	0.029
▪ Blue-collar worker	0.161	0.105	0.123	-0.056*	0.029
▪ Self-employed	0.166	0.109	0.129	-0.063*	0.029
▪ Part-time	-0.134	0.156	0.389	-0.013*	0.046
▪ Primary industries	-0.616	0.133	0.000	-0.077*	0.033
<i>Health Factor</i>					
▪ Illness	5.339	6.051	0.378	0.280	0.318
<i>Demographic Factors</i>					
▪ Age of household head	0.081	0.030	0.008	0.027	0.007
▪ Age of household head squared	-0.001	0.000	0.018	0.000	0.000
▪ Male household head	0.221	0.164	0.177	-0.101*	0.054
▪ Married	0.451	0.130	0.001	0.101*	0.032
▪ Total number of children	0.061	0.028	0.027	0.022	0.007
Constant	-2.010	0.708	0.005	---	---
Dependent Variable: Hospitalization					
Independent Variables					
<i>Private Health Insurance Factors</i>					
▪ Cost paid to private health insurance	0.002	0.001	0.056	0.001	0.000
▪ Daily receipt for hospitalization from private health insurance	-0.004	0.005	0.493	-0.001	0.002
▪ Private health insurance claim on death	0.002	0.001	0.058	0.001	0.000
▪ Private health insurance total claim	-0.001	0.003	0.681	0.000	0.001
▪ Year of private health insurance bought	0.026	0.011	0.020	0.008	0.003
<i>Economic Factors</i>					
▪ Household labor income	-0.009	0.006	0.162	-0.001	0.002
▪ Household labor income not reported	-0.122	0.136	0.372	-0.027*	0.040
▪ Total household wealth	0.007	0.003	0.016	0.002	0.001
▪ Mortgage	0.035	0.049	0.470	0.021*	0.015
▪ White-collar worker	-0.223	0.097	0.022	-0.049*	0.029
▪ Blue-collar worker	-0.218	0.097	0.025	-0.056*	0.029
▪ Self-employed	-0.242	0.101	0.016	-0.063*	0.029
▪ Part-time	-0.018	0.155	0.906	-0.013*	0.046
▪ Primary industries	-0.139	0.134	0.300	-0.077*	0.033
<i>Demographic Factors</i>					
▪ Age of household head	0.076	0.022	0.000	0.027	0.007
▪ Age of household head squared	-0.001	0.000	0.002	0.000	0.000
▪ Male household head	-0.377	0.157	0.016	-0.101*	0.054
▪ Married	0.287	0.137	0.036	0.101*	0.032
▪ Total number of children	0.064	0.024	0.007	0.022	0.007
Constant	-2.051	0.478	0.000	---	---
Log-likelihood = -3718.941					
rho	0.175	0.057	0.002		
Likelihood-ratio test chi-square= 8.932 and Probability > chi-square= 0.0028					

Note: * dy/dx is for discrete change of dummy variable from 0 to 1.

percentage point respectively. The negative marginal sign shows that the probability of purchasing private insurance increases at a decreasing rate of 0.1 percentage point with every 1 million yen increment. Our results are slightly different from those of Sawano and Ohtake (2002), which showed an effect for low income individuals to only on purchase private health insurance [25]. Our results do not support the decreasing absolute risk aversion hypothesis [35, 36], as private health insurance in Japan is a normal good. This results in a supplementary effect, since public health insurance does not

cover some hospitalization or healthcare services. The availability of private health insurance in Japan improves the accessibility of uncovered healthcare services by the national health insurance program as Costa-Font and Font-Vilalta (2004) found in Spain [13] and Courbage and de Coulon (2004) found in the U.K. Japanese data shows a quasi-substitution effect under the strictly controlled two-tier healthcare coverage system of public and private health insurance [6]. This has also been proved by Costa-Font and Jofre-Bonet (2006) in Spain [18], and by Nolan (2006) in Ireland [9].

We now focus on the moral hazards of the regression results from hospitalization in Tables 2 and 3. The effect of cost paid to private health insurance is positive and statistically significant. That is, an increase in insurance premiums by ten thousand yen (about \$100) will raise the probability of hospitalization amongst household members by 0.2 percentage points as seen in Table 2 and 0.3 percentage points as seen in Table 3. Both positive marginal effects show that an increase in the cost paid to private health insurance raises hospitalization by 0.1 percentage point for every ten thousand yen increment, i.e. an increase at an increased rate. In theory, an increase in health insurance premiums will cause the head of household to choose an alternative behavior by substituting health investment for purchasing private health insurance policies. If this is the case, then the stock of health should rise and consequently lower the risks of illness. However, since there is a statistically significant positive coefficient of cost paid to private health insurance for hospitalization of claimed health insurance, individuals with high-premium private health insurance policies are more likely to be hospitalized than their low-premium counterparts. The evidence illustrates that the marginal cost of health insurance premiums are lower than the marginal benefit from both hospital services and compensation from insurance companies. Increases in the coverage of hospital costs from private health insurance policies make these policies more attractive to those with low amounts of health capital, and provide fewer incentives for health investment - a detrimental outcome indicating that as demand for health insurance policies increases, the demand for health investment decreases. This implies that if a household purchases health insurance policies that provide more generous hospitalization compensation, the insured within the household has less of an incentive to keep them healthy. The positive effect of coverage for hospital costs may appear to be typical of rational behavior for health insurance policyholders and evidence of moral hazard.

Concerning adverse selection, the coefficients of private health insurance claim on death while hospitalized are statistically significant for either regression in Tables 2 or 3. The results demonstrate that an increase in private health insurance claim on death by one million yen (about \$10,000) will raise the probability of household hospitalization by 0.2 percentage points as seen in Tables 2 and 3. Both positive marginal effects show that an increase in the private health insurance claim on death raises hospitalization by 0.1 percentage point for every one million yen increment, i.e. an increase at an increased rate. The positive effect indicates that the more insurance policies a household possess, the higher the risk of illness and death within that household. The results support our hypotheses that a decision to purchase health insurance in the case of a death of an insured household in a hospital attributes to the initial health stock of household. The benefits from private health insurance policies for a hospitalization give incentives for individuals to purchase health insurance, reflecting adverse selection.

Regarding another adverse selection, illness as a health factor shows a positive estimated coefficient, but the effect is not significant statistically. If the head of the household has a higher risk of getting sick, the head of the household would

buy life insurance policies more than those with less risk. The variable of illness does not present an illness history for the head of the household in our study. Adverse selection caused by the status of illness is negligible in the case of a decision to purchase private health insurance. The age of the head of the household is statistically significant and positively related to a purchase of private health insurance in Tables 2 and 3. Age is a proxy for long-run health capital depreciation - as individuals gets older they are more likely to become ill due to health capital erosion. Households purchase private insurance to hedge against this erosion in health capital to preserve health stock. However, a decrease in health stock due to aging raises hospitalization [2]. Although private health insurers adjust their premiums according to age, the results show a possibility of adverse selection under the national health insurance system [15, 20, 22].

Concerning the other factors in the regression results for private health insurance, marriage and total number of children show positive estimated coefficients, and are statistically significant as seen in Tables 2 and 3. The decision to purchase health insurance depends heavily upon the marital status of the head of household. This implies that the head of household is both risk averse to short-run loss of labor income for his/her spouse as well as uncertainty surrounding the health stock of the household. Our result from number of children is congruent with the findings of Liu and Chen (2002) in a Taiwan case. Absolute risk aversion is directly related to the number of household members (i.e. children and spouse), and is markedly higher in larger families [16]. Interestingly, the function of private health insurance is not only covering healthcare expenditures due to hospitalization, but also provides risk reduction for economic costs of raising children.

The mortgage results, for private health insurance estimation in Tables 2 and 3 are positive and statistically significant. Households purchase health insurance policies for the purpose of debt maintenance by averting unforeseen healthcare expenditures. Japanese health insurance has a risk reduction function for mortgage payment due to hospitalization [24]. The mortgage raises the probability of purchasing private health insurance, which is congruent with the findings by Shino (2000) [24]. The white-collar worker (i.e. managerial, professional and clerical position) variable is statistically significant, or has a positive influence on purchasing private health insurance policies. Both the bivariate and Heckman regression coefficients indicate that white collar workers are more than twice as likely to hold private insurance as blue collar workers (i.e. manual and manufacturing work). An individual with a white-collar occupation typically has a higher level of education, which leads to a more efficient production of health capital; hence, they have higher demands for large health capital stocks due to a more rapid accumulation of health stock [2], further supporting the supplementary effect of private health insurance *ceteris paribus*.

CONCLUSIONS AND IMPLICATIONS

The characteristics of individuals maximizing their utilities with respect to the decision to purchase private

health insurance under the national healthcare system are robust and worth considering when attempting to improve healthcare financing and delivery. Launching a new private health insurance initiative leveraging market-oriented principles in the finance and delivery of healthcare services is vital to improve the overall quality of care within the public healthcare system. Our findings show that household labor income has a strong positive effect on the decision to purchase private health insurance policies. This possesses significant policy implications, most notably revealing individuals' willingness to pay for healthcare. In other words, individuals generally face absolute risk aversion, not decreasing absolute risk aversion with increases in labor income and wealth. The results show a supplementary effect that augments public health insurance, as it does not cover certain medical expenses and procedures. The results of our empirical study coincide with previous studies by Sawano and Ohtake (2002) [25]. Accessibility to uncovered healthcare services is directly related to an increased probability of purchasing health insurance. This is a quasi substitution effect under the strictly controlled Japanese two-tier healthcare coverage system of public and private health insurance [9, 18].

Another noteworthy finding about moral hazard is that private health insurance costs positively affect the risk of hospitalization. This indicates that after purchasing private health insurance individuals change their health behavior by altering of their health investment. The insured individuals have lower costs in the ill health status and acquire less prevention for health investment measures. Insured individuals have lower costs in the ill health status and they acquire less preventive measures for health investment. They are more likely to be hospitalized, revealing a level of willingness to pay for services rendered. Our results provide a clear-cut evidence of moral hazard which is associated with the positive relationship between private health insurance purchasing behavior and individual's risky health behaviors. The significant statistical result for health status on private health insurance policies is congruent with the results by Savage and Wright (2003) [22] and Doiron, Jones, and Savage (2008) [20].

Our results for private health insurance claim on death clearly show the potential for adverse selection against private health insurance. Aging especially decreases health stock with increasing rates of health capital depreciation, households face greater uncertainties concerning health risks. This means that households purchase private health insurance when there is a high probability of hospitalization with claimed insurance on death. This may be due to an aversion to reporting their health status. Private insurers generally adjust premiums according to age; ageing is a higher risk factor under the national health insurance. The household's decision to purchase private health insurance depends on declining health stock with aging and risk of death caused by illness. The situation could result in adverse selection.

Our empirical study shows that both wealth and mortgage have positive influences on purchasing private health insurance implying that the purchase of private health

insurance is a hedge against short-run debt default and long-run wealth erosion. Wealth is accumulated savings while mortgage is debt. Given that private insurance is a normal good. Thus, an increase in wealth creates an incentive to purchase additional private health insurance. Mortgages must be paid even when households become ill in spite of loss of labor income due to by hospitalization. Japanese private health insurance functions as a risk reduction mechanism, as monetary compensation for hospitalizations reduces variations in labor income streams as well as preserves household accumulated savings.

A rapid increase in healthcare costs lead to an increased financial burden on households at an individual and national level under the national healthcare system. The national healthcare system effectuates a trend towards self-financing for healthcare services. Since the Japanese government lifted the ban on selling private health insurance policies in April 2001, the market has quickly expanded insurance products available for hospitalization, supplemental coverage for services, such as cancer, heart disease, stroke, long-term care, etc. This new environment has led to a variety of health insurance product choices for consumers. There are four advantages of the new environment: (1) a combination of treatments by national and private health insurance coverage, (2) a decrease in government health expenditures, (3) coverage for pharmaceutical products and medical technology that are not fully covered by the national health insurance, and (4) rewards to healthcare providers based on skill level. However, there are also unconstructive aspects of the new environment: (1) strict control for adverse selection and/or moral hazard are not clearly defined under the national health insurance system, (2) access disparities to healthcare services based on income/wealth level, (3) an increase in malpractice lawsuits, (4) an increase in demand for physician and hospital services, and (5) an overall rise in individual healthcare costs. The new environment will lead to reform in healthcare financing and delivery as well as create problems for those who demand for and supply of healthcare services, especially those individuals at the margins.

There are some limitations to this study and its result. First, choosing private health insurance is associated with individual health status, educational level, risk preference, etc. in addition to the other variables included in this study already. Thus, a lack of information on individual characteristics such as individual health status and educational level may lead to results suffering from omitted variable bias. Second, our study did not consider the government's lift on the ban on private health insurance products. The insurance industry can extend the health insurance policies offered to cover different types of healthcare services and would attract new consumers with existing private health insurance policies. The growing private health insurance market providing coverage alongside the current national health insurance program may compel the government to reassess resource allocations to the current system. This fundamental shift toward a market environment with corresponding changes in consumer behavior will encourage future studies once the data has been compiled.

Table 3. Results of Heckman Probit Estimation for Purchasing Private Health Insurance and Hospitalization Among Age < 65 (n=3,729)

	Heckman Probit Estimation Results			Marginal Effect	
	Estimated Coefficient	Standard Error	P-Value	dy/dx	Standard Error
Dependent Variable: Private Health Insurance (Decision of purchasing private health insurance)					
Independent Variables					
<i>Economic Factors</i>					
▪ Household labor income	0.038	0.008	0.000	-0.010	0.002
▪ Household labor income not reported	0.184	0.140	0.189	-0.060*	0.047
▪ Total household wealth	0.010	0.003	0.003	0.001	0.001
▪ Mortgage	0.202	0.058	0.001	-0.011*	0.018
▪ White-collar worker	0.321	0.105	0.002	-0.130*	0.036
▪ Blue-collar worker	0.145	0.103	0.159	-0.097*	0.035
▪ Self-employed	0.163	0.107	0.126	-0.115*	0.035
▪ Part-time	-0.120	0.154	0.436	0.057*	0.061
▪ Primary industries	-0.636	0.130	0.000	0.062*	0.051
<i>Health Factor</i>					
▪ Illness	4.790	4.776	0.316	0.000	0.000
<i>Demographic Factors</i>					
▪ Age of household head	0.076	0.027	0.005	0.002	0.008
▪ Age of household head squared	-0.001	0.000	0.010	0.000	0.000
▪ Male household head	0.252	0.155	0.105	-0.126*	0.058
▪ Married	0.438	0.126	0.000	-0.037*	0.048
▪ Total number of children	0.059	0.027	0.029	0.013	0.009
Constant	-1.919	0.621	0.002	---	---
Dependent Variable: Hospitalization					
Independent Variables					
<i>Private Health Insurance Factors</i>					
▪ Cost paid to private health insurance	0.003	0.002	0.077	0.001	0.000
▪ Daily receipt for hospitalization from private health insurance	-0.003	0.004	0.424	-0.001	0.002
▪ Private health insurance claim on death	0.002	0.001	0.017	0.001	0.000
▪ Private health insurance total claim	-0.001	0.002	0.536	-0.001	0.001
▪ Year of private health insurance bought	0.020	0.009	0.022	0.008	0.003
<i>Economics Factors</i>					
▪ Household labor income	-0.026	0.006	0.000	-0.010	0.002
▪ Household labor income not reported	-0.156	0.126	0.213	-0.060*	0.047
▪ Total household wealth	0.002	0.003	0.405	0.001	0.001
▪ Mortgage	-0.029	0.046	0.526	-0.011*	0.018
▪ White-collar worker	-0.335	0.093	0.000	-0.130*	0.036
▪ Blue-collar worker	-0.251	0.093	0.007	-0.097*	0.035
▪ Self-employed	-0.301	0.096	0.002	-0.115*	0.035
▪ Part-time	0.145	0.153	0.342	0.057*	0.061
▪ Primary industries	0.156	0.127	0.221	0.062*	0.051
<i>Demographic Factors</i>					
▪ Age of household head	0.005	0.020	0.788	0.002	0.008
▪ Age of household head squared	0.000	0.000	0.948	0.000	0.000
▪ Male household head	-0.316	0.147	0.032	-0.126*	0.058
▪ Married	-0.095	0.122	0.435	-0.037*	0.048
▪ Total number of children	0.034	0.023	0.135	0.013	0.009
Constant	0.362	0.433	0.403	---	---
Log-likelihood = -3458.648					
rho	-1.000	0.003	0.000		
Likelihood-ratio test of: chi-square= 2.39 and Probability > chi-square= 0.1217					

Note: * dy/dx is for discrete change of dummy variable from 0 to 1.

ACKNOWLEDGMENTS

We would like to thank Michael Grossman, seminar participants at Osaka University in Osaka, and those at the Institute of Statistical Research in Tokyo for their helpful comments on our previous version of this study. In addition, we gratefully acknowledge the research support provided by the Ministry of Education, Culture, Sports, Science and Technology, Japan: Japan Society for Promotion of Science for Scientific Research (Grant #14530042 (C)), the Nomura Foundation (Japan) and the Research Council of Rutgers University, the State University of New Jersey (Grants #202272 and #202361). We also would like to acknowledge the support from the SSJ Data Archive, Information Center for Social Science Research on Japan, Institute of Social Science, and the University of Tokyo for the health insurance data used in this study. The views presented here are those of the authors and do not necessarily represent those of the above-mentioned funding agencies and affiliated institutions.

REFERENCES

- [1] Grossman M. On the concept of health capital and the demand for health. *J Polit Econ* 1972; 80(2): 223-55.
- [2] Grossman M. The human capital model. In: Culyer A, Newhouse J. Eds. *Handbook of health economics*. Amsterdam: Elsevier 2007; pp. 347-408.
- [3] Dardanoni V, Wagstaff A. Uncertainty, inequality in health and the demand for health. *J Health Econ* 1987; 6 (4): 283-90.
- [4] Bundorf MK, Herring B, Pauly M. Health risk, income, and the purchase of private health insurance. NBER Working Paper 11677; New York, NY 2005.
- [5] Chang FR. Uncertainty and investment in health. *J Health Econ* 1996; 15(3): 369-76.
- [6] Courbage C, de Coulon A. Prevention and private health insurance in the UK. *The Geneva papers on risk and insurance. Issues Pract* 2004; 29 (4): 719-27.
- [7] Jofre-Bonet M. Public health care and private insurance demand: the waiting time as a link. *Health Care Manag Sci* 2000; 3: 51-71.
- [8] King D, Mossialos E. The determinants of private medical insurance prevalence in England. *Health Serv Res* 2005; 40 (1): 195-212.
- [9] Nolan BT. The Interaction of public and private health insurance: Ireland as a case study. *The Geneva Papers on Risk and Insurance. Issues Pract* 2006; 31(4): 633-49.
- [10] Picone G, Uribe M, Wilson RM. The effect of uncertainty on the demand for medical care, health capital and wealth. *J Health Econ* 1998; 17(2): 171-85.
- [11] Nordquist G, Wu SY. The joint demand for health insurance and preventive medicine. In: Rosett RN, Ed. *The role of health insurance in the health services sector*. New York, National Bureau of Economic Research 1976; pp. 35-65.
- [12] Rice T, Lavarreda SA, Ponce NA, Brown ER. The impact of private and public health insurance on medication use for adults with chronic diseases. *Med Care Res Rev* 2005; 62(2): 231-49.
- [13] Costa-Font J, Font-Vilalta M. Preference for national health service use and the demand for private health insurance in Spain. *The Geneva Papers on Risk and Insurance. Issues Pract* 2004; 29 (4): 705-18.
- [14] Saver BG, Doescher MP. To buy, or not to buy: factors associated with the purchase of nongroup, private health insurance. *Med Care* 2000; 38 (2): 141-51.
- [15] Sapelli C, Torche A. The mandatory health insurance system in Chile: explaining the choice between public and private insurance. *Int J Health Care Finance Econ* 2001; 1: 97-110.
- [16] Liu TC, Chen CS. An analysis of private health insurance purchasing decisions with national health insurance in Taiwan. *Soc Sci Med* 2002; 55 (5): 755-74.
- [17] Hakim RB, Benedict MB, Merrick NJ. Quality of care for women undergoing a hysterectomy: effects of insurance and race/ethnicity. *Am J Public Health* 2004; 94 (8): 1399-405.
- [18] Costa-Font J, Jofre-Bonet M. Are private health insurance subscribers unsatisfied with the spanish national health system? *The Geneva Papers on Risk and Insurance. Issues Pract* 2006; 31: 650-68.
- [19] van den Berg B, Van Dommelen P, Stam P, Laske-Aldershof T, Buchmueller T, Schut FT. Preferences and choices for care and health insurance. *Soc Sci Med* 2008; 66(12): 2448-59.
- [20] Doiron D, Jones G, Savage E. Healthy, wealthy and insured? the role of self-assessed health in the demand for private health insurance. *Health Econ* 2008; 17: 317-34.
- [21] Sapelli C, Vial B. Self-selection and moral hazard in Chilean health insurance. *J Health Econ* 2003; 22: 459-76.
- [22] Savage E, Wright DJ. Moral hazard and adverse selection in Australian private hospitals: 1989-1990. *J Health Econ* 2003; 22(3): 331-59.
- [23] Kessler D. The long-term care insurance market. *The Geneva Papers on Risk and Insurance. Issues Pract* 2008; 33: 33-40.
- [24] Shino U. Demand for private health insurance and public health insurance. *Kikan Shakai Hoshu Kenkyu* 2000; 36(3): 378-90.
- [25] Sawano K, Ohtake F. The demand for health insurance: private or public? Iryo to Shakai. *J Health Care Soc* 2002; 12(3): 117-36.
- [26] Ezawa M. On the account-type life insurance policies. *Waseda Commer Rev* 2003; 398: 67-86.
- [27] Life Insurance Association of Japan. *Trend of life insurance*. Tokyo, Japan 2007; pp. 1-30.
- [28] Kadonaga S, Kanzler L, Yokoyama Y. Addressing Japan's health care cost challenge. *McKinsey Quarterly* 2008 May. Available from: http://www.mckinsey.com/Addressing_Japans_health-care_cost_challenge_2144 [Accessed: 15 Jan 2009].
- [29] Shimono K. Shiteki Kaigo Hoken no Kanousei ni tsuite. *Oikonomika* 2004; 40: 95-103.
- [30] Yamada T, Yamada T. The demand for health checkups under uncertainty. In: Ogura S, Tachibanaki T, Wise DA, Eds. *Labor markets a firm benefit policies in Japan and the United States*. Chicago: University of Chicago 2003; pp. 267-314.
- [31] Greene WH. *Econometric analysis*. 4th ed. London: Prentice-Hall International 2003.
- [32] Yamada T, Chen CC, Yamada T, Fahs M, Fukawa T. Behavioural analysis of the choice of community-based formal home care, informal home care, and nursing home care in Japan. *The Geneva Papers on Risk and Insurance. Issues Pract* 2006; 31(4): 600-32.
- [33] Jones A. *Applied econometrics for health economists*. Oxon, United Kingdom: Radcliffe Publishing 2008.
- [34] Jones A, Rice N, Bago d'Uva T, Balia S. *Applied Health Economics*. London, United Kingdom: Routledge 2007.
- [35] Szpiro G. Measuring risk aversion: an alternative approach. *Rev Econ Stat* 1986; 68(1): 156-9.
- [36] Holt CA, Laury SK. Risk aversion and incentive effects. *Andrew Young School of Policy Studies Working Paper 06-12*; Georgia State University 2002.

Received: March 9, 2009

Revised: June 22, 2009

Accepted: June 30, 2009

© Yamada et al.; Licensee Bentham Open.

This is an open access article licensed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0/>) which permits unrestricted, non-commercial use, distribution and reproduction in any medium, provided the work is properly cited.