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Moral Hazard and the Impact of Private Health Insurance on the Utilisation of Health Care in Malaysia

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ABSTRACT

In Malaysia, private health insurance coverage is usually limited to inpatient treatment or hospitalisation. With private health insurance there is a possibility that individuals will use or spend more on health care because they know that they are protected which can cause the moral hazard effects. This study estimates the importance of factors affecting the demand for private health insurance and how private health insurance affects health care utilisation. This paper also provides an empirical test for the existence of moral hazard effects in health care utilisation. The analysis uses the second and third National Health and Morbidity Surveys (NHMS) which were conducted in 1996 and 2006. The analysis applies a bivariate probit model to estimate the demand for private insurance and its effect on the utilisation of health care which is defined as admission to public and private hospitals. The results show that the taking up of private health insurance is lower among the disadvantaged such as individuals with lower income, lower level of education, those living in less developed regions and the unemployed. The findings also show that health conditions have a very strong effect on hospitalisation decision. Furthermore, the results demonstrate that there is evidence of moral hazard in 1996 but not in the 2006 data. From the results, the policy makers can target the right group of population in providing health subsidies if the National Health Insurance Scheme is implemented.

Keywords: private health insurance, health care financing, moral hazard, health care utilisation.

INTRODUCTION

Malaysia's health care service is shifting from a largely public-sector-provided system financed by general revenue sources towards more reliance on private sector services which are financed through fee-for-service (NHHES[1] Final Report, 1996). While public health care is still heavily subsidised by the government at a nominal cost or free, the health care system is shifting away from the universal welfare model of public health care through a number of policy decisions. First, to generate more income from co-payments; second, to promote private health insurance and savings for health care through social security funds such as the Employees Provident Fund (EPF)[2] or Social Security Organisation (SOCSO)[3]; third, to encourage health service provision as a charitable act by non-government organisations, charitable bodies and firms; fourth; to corporatise some hospitals; and finally to privatise some health services and to foster the commercial private health care sector (Barraclough, 1999).

The private health insurance sector in Malaysia is relatively new but growing. In 1999, total expenditure by health insurance was 4.5% (Chee and Barraclough, 2007). The percentage has increased to 15% in 2006 (Central Bank of Malaysia, 2005). Private health insurance coverage is usually limited to hospital inpatient treatment (either in public or private hospitals) and the patient is typically required to pay the hospital bill first and subsequently claim from the insurance company. To counter the effects

[1] National Household Health Expenditure Survey
[2] EPF is a social security institution for private and non-pensionable public sector employees which provide retirement benefits for members through management of their savings in an efficient manner. There are two EPF accounts namely Account I and Account II. Withdrawals for medical expenses for EPF members and their families are allowed from Account II.
[3] SOCSO provides two social security schemes for private employees which are the Employment Injury Insurance Scheme and the Invalidity Pension Scheme. The two social insurance schemes provide medical coverage and financial guarantees and protection to employees and their families in the event of accidents resulting in outcomes such as disablement or death, or affliction with occupational diseases.

of adverse selection i.e. when those with higher risks are more likely to take out insurance, all private health insurance is risk-rated. Higher risk individuals or patients with pre-existing conditions may either be precluded from insurance or face higher premiums for their policy. There are four common types of private health insurance: hospitalisation and surgical insurance, critical illness insurance, hospital income insurance and accidental and hospitalisation insurance (Pee, 2008). Hospitalisation and surgical insurance is the most popular private health insurance in Malaysia.

Nevertheless, with private health insurance there is a possibility that individuals have better information about their illness probability than insurance companies which can lead to an adverse selection problem. Individuals may also spend more on health care because they know the cost of marginal expenditure is lowered by insurance which can give rise to a moral hazard effect (Neudeck and Podczeck, 1996; Feldstein, 1973). For individuals, taking up private health insurance can significantly reduce the out-of-pocket expenditure for health care treatment especially in the private health sector which charges higher fees. Normally, the co-payment is either 20% or 10% depending on the type of the private health insurance cover purchased (Pee, 2008).

Studies on market failure (either moral hazard or adverse selection) have been discussed in much of the previous literature (Rothschild and Stiglitz, 1976; Buchanan et al., 1991; Manning and Marquis, 1996; Rosset and Huang, 1973; Manning et al., 1987; Propper, 1989, 1993; and Newhouse, 1993). Since all private health insurance is risk-rated and the insurance company can opt to either terminate or not renew the health insurance policy, adverse selection may not be a strong feature of the private health insurance industry in Malaysia. However, this study might expect a moral hazard effect on the utilisation associated with private health insurance and might observe selection behaviour by insurers.

This study estimates the importance of factors affecting the demand for private health insurance and how private insurance affects health care utilisation. The analysis uses the Second and Third National Health and Morbidity Surveys (NHMS) which were conducted in 1996 and 2006. A seemingly unrelated bivariate probit analysis is used to estimate the demand for private insurance and its effect on the utilisation of health care which is defined as admission to hospital. In Malaysia, private health insurance coverage is usually limited to inpatient treatment or hospitalisation. The results show that the taking up of private health insurance is lower among the disadvantaged such as individuals with lower income, lower level of education, living in less developed regions and being unemployed. The findings also show that health conditions have a very strong effect on hospitalisation decision. Furthermore the results demonstrate that there is evidence of moral hazard in 1996 but that the effect is considerably reduced in the 2006 data. This may be explained by the newly introduced private health insurance in the market in the mid 1990s that might have triggered higher demand for medical care.

In the existing literature, there are limited empirical studies on the effect of health insurance on utilisation in Malaysia. For example, Wan Abdullah and Ng (2009a) examine the practices of two private hospitals, comparing their different charging for the insured and non-insured patients. Using data from insurance companies, they found that there is no difference in private hospital expenditure for people who are insured and non-insured. Wan Abdullah and Ng (2009b) explore the effect of employer-based health insurance on the health services utilisation in Malaysia. They use private insurance company data and compare the frequencies of health claims made by employees and their dependants from ten companies that provide health insurance benefit to their employees. They find that the behaviour of the insured does not result in an increased rate of service utilisation. This research does not support a finding of moral hazard in Malaysia. This study provides further understanding of the impact of private health insurance, in particular its effect on the utilisation of health care using a nationwide survey data i.e. the NHMS.

The organisation of this paper is as follows. Section 2 reviews related literature on the demand for private health insurance and its effect on the utilisation of health care. Section 3 describes the data and empirical models used in the estimation and section 4 discusses the results. Finally, section 5 concludes with some policy implications.

LITERATURE REVIEW

Most studies on the demand for health insurance and its effect on the utilisation of health care have been conducted in developed countries which already have an established health care system such as the United States, the United Kingdom and Australia. In the United States, private health sector is dominant and thus the public sector acts only as a safety net for the disadvantaged. In contrast, the United Kingdom health sector is highly subsidised by the government and dominated by the public sector even though the system has shifted to more of a public-private mixed health care (Bartlett and

Phillips, 1996). Meanwhile, Australia has a mixed public-private health care system that provides a publicly financed health scheme, known as Medicare and a significant private sector constituting around 47% of total health expenditure (Doorslaer et al., 2008).

Since the 1970s, researchers have been investigating the determinants of health demand and expenditure in order to suggest policies that may help lessen the burdens on low income groups. Earlier empirical work in the United States, on the demand for health care showed that a greater local availability of hospital beds increases the quantity of health services demanded directly as well as through lower prices (Feldstein, 1971). Later, Feldstein (1977) showed how higher or more expensive quality of hospital care does increase the demand for health care. From 1958 to 1973, across all states in the United States, dramatic changes in the quality of care were said to be caused by increased demand because of the growth of private and public insurance. Population density and other demographic factors have also been found to have influenced the demand for health care (Feldstein, 1977).

Furthermore, a number of studies have shown that price does affect demand for medical care. Price elasticity of demand in various types of settings can be substantial e.g. hospital stays ranging from -0.63 (Feldstein, 1971) to -0.47 (Davis and Russell, 1972), physician care from -0.14 (Phelps and Newhouse, 1972) and overall elasticity of demand for medical care as large as -1.5 (Rosett and Huang, 1973). In China, Ying et al. (2007) estimated the demand for health insurance for three types of insurance and found that the price elasticity of demand for major catastrophic disease insurance is -0.27, for inpatient expenses insurance -0.34 and for outpatient expenses insurance -0.42. Since private health insurance is an important source of health financing in developed countries, many studies have discussed the demand for health insurance and the factors that affect it. In Australia, Cameron et al. (1988) found that income is an important factor in determining health insurance choice while in England and Wales, Propper (1989) found that income as well as employment status increases the probability of health insurance purchase.

In economic theory, people are predicted to spend more on health because they are insured and buy more insurance because of the high cost of health care (Feldstein, 1973). This behaviour may cause a moral hazard problem, which is one of two main sorts of market failure often associated with asymmetric information in the provision of insurance. Ex-ante moral hazard predicts people with insurance may take greater risks than they would do without it because they know they are protected[4]. Ex-post moral hazard concerns increased spending by an insured individual. Adverse selection is another market failure which occurs when persons with poor health tend to choose insurance with high benefits and persons with good health tend to avoid such insurance because of its high cost (Rothschild and Stiglitz, 1976; Marquis and Phelps, 1987). Selection based on privately known risk aversion can be advantageous if those who are more risk averse both buy more insurance coverage and have lower risks. In other words, the direction of insurance selection that results when individuals have private information about multiple dimensions of relevant information, say both their risk type and their risk aversion, is unclear (de Meza and Webb, 2001).

In developed countries there is much evidence to suggest that health insurance may cause moral hazard and adverse selection. Early theoretical studies on moral hazard were done by Arrow (1963), Pauly (1968, 1974) and Zeckhauser (1970). Arrow for instance, considers moral hazard as an imperfection and so does Zeckhauser. Pauly (1968) discussed the response of seeking more medical care as consequence rational economic behaviour. Since then, many researchers have estimated the optimal health care insurance contracts and the types of market failure i.e. moral hazard and adverse selection such as in Buchanan et al. (1991) and Manning and Marquis (1996). Besides that, many of the early studies investigate the existence of market failure associated with private health insurance and factors affecting it such as in Rosset and Huang (1973), Manning et al. (1987), Propper (1989; 1993) and Newhouse (1993).

The effect of private health insurance on utilisation of medical care has also been studied in many developed countries. Significant effects of health insurance on the demand for health services i.e. moral hazard have been found in the literature in the United States (Newhouse, 1993) and Manning and Marquis (1996). A study conducted by Wolfe and Goddeeris (1991) specifically observed pensioners who owned a Medicare supplementary called Medigap and they provide some evidence of adverse selection, and that the moral hazard effect is overstated if adverse selection is not taken into account. A study by Dave and Kaestner (2006) also found evidence of a direct[5] moral hazard effect in the Medicare insurance market where private health insurance reduces prevention and increases unhealthy

[4] Retrieved from http://www.economist.com

[5] Dave and Kaestner (2006) define direct moral hazard as the loss of health insurance resulted from the change in individuals health behaviour that reduced the risk or severity of illness.

behaviours among elderly men. By looking at customers of similar health condition, Koc (2005) found that moral hazard effect for physician visits is higher for those in relatively better health states. Other studies by de Meza (1983), Nyman (1999, 2003), and Nyman and Maude-Griffin (2001) have found that consumer's willingness to pay for treatment is altered by health insurance coverage. While findings in many empirical studies have shown a strong relationship between risk and insurance coverage, Fang et al. (2008) found that risk preferences do not appear to be a main source of advantageous selection instead the results suggest that cognitive ability plays an important role.

In Australia, Cameron et al. (1988) suggest that for a broad range of health care services both moral hazard and self-selection are important determinants of utilisation of health care services. Savage and Wright (2003) found that moral hazard could substantially increase the expected length of hospital stay when the endogeneity of the insurance decision is accounted for. Using the same set of data, Barret and Conlon (2003) compared singles' and families' health care utilisation. They found that from 1989 to 1995, the persons insured are individuals with both bad health risks (indicating adverse selection behaviour) and good health risks. However, there is an increase in the degree of adverse selection within the privately insured population during this period.

In other countries, Sapelli and Vial (2003) show the existence of adverse selection and moral hazard in the Chilean health insurance industry among independent and dependent workers[6]. In Germany where 90% of the population is publicly insured, Riphahn et al. (2003) confirmed the existence of adverse selection where high risk individuals are more likely to have supplemental add-on insurance. Another study in Germany by Hullegie and Klein (2010) analysed the effect of private health insurance on medical care utilisation. Using the German Socio Economic Panel they found negative effects of private health insurance coverage on the number of doctor visits, no effects on the number of nights spent in a hospital, and positive effects on health, while Geil et al. (1997) found no relationship between insurance coverage and hospitalisation decision. Meanwhile in Belgium, Schokkaert et al. (2009) used the bivariate probit model and found weak evidence of adverse selection in the coverage of supplemental health insurance.

While the standard economic treatment of moral hazard emphasises the negative aspect and finds large effects, Nyman (2004) suggests that much moral hazard is actually efficient and makes consumer better off. He argues that moral hazard can generate welfare gains e.g. in the case of people with serious illnesses, involved in serious procedures or needing life-saving medical care where extra income from the insurance can be used to purchase other important procedures. While conventional theories often suggest cost sharing policies to reduce moral hazard and increase welfare, Nyman suggests that the generated medical spending produces an overall welfare gain, and that subsidising insurance premiums could be beneficial. High prices of health care are harmful and above all the new theory suggests that health insurance provides economy wide redistribution of income from the healthy to those who become ill. As a result, 'efficiency' is the new argument for national health insurance.

There has therefore been extensive discussion on the demand for private health insurance and its effect on the utilisation of health care in developed countries with established health insurance markets. Nevertheless, many developing countries are still relying heavily on the government to finance health care. Even though several ASEAN economies have recently extended coverage of their social health insurance schemes among the poor (Thailand and the Philippines), while others are considering the introduction of some form of social or national health insurance (Malaysia, Indonesia and Vietnam) (Sidorenko and Butler, 2007), due to new development in the health insurance markets, there are limited empirical studies conducted in the developing countries. Therefore, many of the studies in health care financing in developing countries have focused on the health systems and health sector reforms (Wagstaff, 2007; Hearst and Blas, 2001) including Malaysia.

In a developing country such as Malaysia, where private health insurance is a relatively new phenomenon and where there is a lack of data, there are limited empirical studies on the relationship between health insurance and the utilisation of health care. Most of the previous literature in Malaysia has emphasised issues such as the development of health care systems, and affordability and equity issues (Yu et al., 2008; Chee, 2008; Saleh and Ibrahim, 2005; Yon, 2004). Generally, the studies are descriptive in nature. In Malaysia, an empirical study on the determinants of the demand for medical care was conducted by Heller (1982). The results showed that total medical demand (the absolute volume of outpatient and inpatient consumption) was highly inelastic to the cash price and to the cost in time of utilisation. Total medical demand was also inelastic with respect to income.

[6] According to Sapelli and Vial (2003), a dependent worker is any person that works in a relation of subordination, with a contract. Independent workers are all active persons not included in the previous definition.

Until now, there is limited empirical evidence on the effect of health insurance on utilisation due to lack of data since private health insurance in Malaysia is still new and growing. Since studies by Wan Abdullah and Ng (2009a; 2009b) do not look for the existence of moral hazard in Malaysia, this study attempts to find empirical evidence of moral hazard effect from the use of private health insurance and how private health insurance influence health care utilisation in Malaysia.

DATA AND DESCRIPTIVE STATISTICS

This study uses data from the second and third National Health and Morbidity Survey (NHMSII and NHMSIII). The NHMSII was conducted in 1996. This study uses information from Modules A, C, F, G, H, I, J and N. The Third NHMS (NHMSIII) was conducted in 2006. The NHMSIII questionnaire covers Module A (socio-demography) to Module V (women's health). For the purpose of this research, information from Module A2, B, C, D, E, G, O, R and S is used since they are comparable with the NHMSII data. The NHMSII and NHMSIII are population-based surveys administered by trained interviewers.

Even though the NHMS lacks of detail health expenditure data, there is no available survey data that have both health and expenditure data. In doing the research, other survey data in Malaysia are referred to get the most representative variables for the analysis such as the Household Expenditure Survey (HES) data. However the data from HES cannot be used due to lack of data on health and diseases. The analysis was conducted based on available out-of-pocket expenditure data which were extracted from Module D: Health care cost in the NHMSII questionnaire and Module B: Health expenditure, hospitalisation and private health insurance from the NHMSIII.

Sample selection

The analysis is confined to adults over the age of 21 years old as it is plausible that parents make the decision for individuals below that age. The final samples were 29,690 observations from the NHMSII and 29,654 observations from the NHMSIII. A seemingly unrelated bivariate probit estimation is applied. To adjust for differences in probability of selection this study uses a post-stratification weight which takes into consideration population by state, region, ethnic and age group.

The variables used in this study are similar to those used in Schokkaert et al. (2009). The paper estimates the effect of private health insurance on health care utilisation with demographic, socioeconomic and a range of health status variables. In this study, the dependent variables are admission to hospitals and health insurance. Admission to hospitals is defined as admissions to either government or private hospitals reported by the respondent in the past twelve months. Meanwhile, information on health insurance is generated from question S12 Module A in NHMSII which asked "who pays for health care?". The health insurance variable is generated from the respondents who choose insurance at least once in the multiple answers of free, self, employer, insurance, donation or other type of payments. Variable health insurance in NHMSIII is derived from question 8 in Module B3 of the NHMSIII survey. The question asked "Do you have a private health insurance purchased by yourself?" with a 'yes' or 'no' answers.

Table 1 shows the distribution of health care payment methods in NHMSII and NHMSIII. In 1996, the NHMSII data show that the main source of financing comes from out-of-pocket payment where 62.4% of the respondents pay from their own pocket. This is followed by employer-based health benefits (19.6%), the combination of self-employer-insurance (3.7% percent), free payment (3.5%), the combination of self-employer (2.9% percent), the combination of free-self (1.7%), and the combination of free-employer-self (0.4%). Payment by insurance alone is only 0.1% percent. In 2006, the NHMSIII data show that 20% of respondents have private health insurance. Out of this, 8.5% have health insurance as part of a life insurance scheme, 4.6% purely own private health insurance, 6.7% have both types of insurance and 0.3% has other types of health insurance. Besides data on out-of-pocket and private health insurance, the NHMSIII data have no information on other types of health care payment i.e. employer, donation, free, and other types of payment.

The independent variables such as socioeconomic indicators (such as household monthly income, education levels, job status and job sector), demographic characteristics (such as gender, age, marital status and ethnicity), geographical indicators (such as state grouping and region), and health conditions and lifestyles (such as hypertension, diabetes, asthma, and smoking status) are used in the analysis. All variables are dummy variables. One limitation of using the NHMS data is that the NHMSII and NHMSIII ask a slightly different set of questions. For the purpose of estimation, this study chooses health and lifestyles variables that are available in both datasets such as hypertension,

diabetes, asthma and smoking to make sure that the results are comparable. There may be some concerns about the endogeneity of some of the independent variables treated as exogenous in each of the two cross section data sets. It would be ideal to have possible instruments for marital status, labour force status income and smoking. However as we have remarked previously, the data is quite restrictive and since it is focussed on health rather than being a general survey credible instruments do not exist. We also note that the majority of the literature facing the same data problems has treated these variables as exogenous. Table 2 shows the definition of all variables used in the analysis.

In this study, income variable is categorised into eight groups with the lowest income group between RM0 – RM400 to the highest group with income higher than RM5,000. The categories are developed following the income category in the NHMSIII dataset given by the MOH. The most prevalent household income group is the middle income group between RM1,000 – RM2,000 which has been chosen as the reference group. Data from the Third Outline Perspective Plan (2001 – 2010) show that the mean monthly household income in Malaysia has increased significantly from RM2,472 in 1999 to RM3,249 in 2004. Income in urban areas is much higher than income in rural areas. The average annual growth rate of income between 2000 to 2004 is 5% in urban and 1.8% in rural areas. Meanwhile, the incidence of poverty has decreased from 8.5% in 1999 to 5.7% in 2004. According to Malaysia's income poverty line, people are considered as poor if they have household monthly income less than RM720 in Peninsular Malaysia, RM960 in Sabah and Labuan and RM830 in Sarawak[7]. Table 3 shows the distribution of income and incidence of poverty in Malaysia.

Education in Malaysia is highly centralised and is administered by the Ministry of Education and the Ministry of Higher Education. The primary school begins at the age of seven for 6 years (standard 1 – 6) while the secondary education is for 5 years (form 1 – 5). In the analysis, the levels of education available are no formal education, primary, secondary and tertiary education. Meanwhile, the variable job status refers to respondents who are working as government employees, private employees, self-employed, housewife or are unemployed. For those who are employed, they are categorised into different job sectors such as professional and technical, clerical, service and sales, agriculture, production and other job sectors.

To see whether age and gender influence the utilisation of health care, interaction variables were created for each age group and gender. It is expected that women in the reproductive age of 21 to 35 years old will have a significant effect on the utilisation of health care. Variable marital status is included to see the same effect. Ethnicity is also predicted to influence the utilisation of health care. This variable is divided into five categories i.e. Malay, Chinese, Indian, other Bumiputeras (e.g. tribal groups in Sarawak and Sabah such as Bajau, Kadazan, Melanau and Iban) and other ethnicities such as the European and other Asians. In 2000, the Population and Housing Census[8] reported that of the total population of 22 million, Bumiputera[9] comprised 65.1%, Chinese 26.0% and Indians 7.7%, with the remaining consisting of a variety of ethnicities, among them the indigenous *Orang Asli* people (Department of Statistics, 2000).

Health care is administered at the federal level, however significant state differences in utilisation may indicate supply differences regionally. Thus, states are grouped into three regions i.e. West Coast of Peninsular Malaysia, East Coast of Peninsular Malaysia and East Malaysia. The West Coast region is more developed than the East Coast and East Malaysia. Variables urban and rural were also included to see if there are any differences associated with living in or outside a city.

To compare the results from NHMSII and NHMSIII, the reference group for each indicator is kept the same. The reference groups are individuals with household income group between RM1,000 – RM2,000, secondary education, government employees, service and sales sector, male aged between 21 to 35 years old, married, Malay, live in the West Coast of Peninsular Malaysia and urban areas.

The model

In order to determine the extent of moral hazard effect of health insurance on health utilisation, variable health insurance (***PHI***) is included in the hospital admission equations. A significantly positive coefficient means that people utilise more health care when they are insured. From the data, it is expected that health insurance will have a positive relationship with admission to hospitals.

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[7] Retrieved from http://www.kpkt.gov.my/kpkt/main.php

[8] The Population and Housing Census 2000 is the fourth Census implemented since the formation of Malaysia, the previous Censuses being conducted in the years 1970, 1980 and 1991.

[9] Bumiputera are Malays and other indigenous ethnic groups such as the *Orang Asli* (aborigines) in Peninsular Malaysia and the tribal peoples in Sabah and Sarawak.

Recognising the possible endogeneity of private health insurance status in the explanation of health care use, this study uses a recursive seemingly unrelated bivariate probit model. The bivariate probit model with endogenous dummy model belongs to the general class of simultaneous equation models introduced by Heckman (1978). It builds on a first reduced form equation for the potentially endogenous dummy and a second structural form equation determining the outcome of interest (Fabbri et al., 2004). As described by Fabbri et al. (2004), the equation can be written as below:

$$y_{1i}^{\bullet} = \beta_1' x_{1i} + \mu_{1i} \quad [1]$$

$$y_{2i}^{\bullet} = \beta_{21}' x_{2i} + \mu_{2i} = \delta_1 y_{1i} + \delta_2' z_{2i} + \mu_{2i} \quad [2]$$

where $y_{1i}^{\bullet}$ and $y_{2i}^{\bullet}$ are latent variables, y_{1i} and y_{2i} are dichotomous variables observed following the rule:

$$\begin{cases} y_{1i} = 1 \; if \; y_{1i}^{\bullet} > 0 \\ y_{2i} = 0 \; if \; y_{1i}^{\bullet} \leq 0 \end{cases}; l = 1,2; \quad [3]$$

where x_{1i} and z_{2i} are vectors of exogenous variables, β_1 and δ_2 are parameter vectors, δ_1 is a scalar parameter, and $\beta_2' = (\delta_1 \; \delta_2')'$. The error terms are assumed to be independently and identically distributed as bivariate normal:

$$\begin{pmatrix} \mu_{1i} \\ \mu_{2i} \end{pmatrix} \sim IIDN \left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix} \right) \quad [4]$$

In the estimation, the exogenous vectors include private socioeconomic variables, demographic variables, geographical indicators, health and lifestyle variables, and private inpatient care utilisation. The model consists of two structural form equations for health insurance ($y_{iPHI}^{\bullet}$) and health care utilisation ($y_{iHOSP}^{\bullet}$) as below:

$$y_{iPHI}^{\bullet} = \alpha_{PHI}' SOCIO_i + \beta_{PHI}' DEMO_i + \gamma_{PHI}' GEO_i + \delta_{PHI}' HEALTH_i + \varepsilon_{iPHI} \quad [5]$$

$$y_{iHOSP}^{\bullet} = \alpha_{HOSP}' SOCIO_i + \beta_{HOSP}' DEMO_i + \gamma_{HOSP}' GEO_i + \delta_{HOSP}' HEALTH_i + \vartheta_{HOSP}' PVTCARE + y_{iPHI} + \varepsilon_{iHOSP} \quad [6]$$

where

$y_{iPH}^{\bullet}$	=	private health insurance status;
$y_{iHOSP}^{\bullet}$	=	health care utilisation (admission to either government or private hospital);
$\boldsymbol{SOCIO_i}$	=	socioeconomics variables such as household monthly; income, education level, job status and job sector;
$\boldsymbol{DEMO_i}$	=	demographic variables such as age, gender, marital status and ethnicity;
$\boldsymbol{GEO_i}$	=	geographical indicator of state grouping and region variables;
$\boldsymbol{HEALTH_i}$	=	health and lifestyle variables;
PVTCARE	=	private inpatient care variable.

In the absence of mandatory private health insurance, it is possible that the demand for private health insurance is driven by the rising cost of health care so that individuals who expect to use health services are more likely to demand private health insurance. The bivariate probit model allows for correlation between the unobserved determinants of private health insurance and health care utilisation. As discussed above, this endogeneity is accounted for in the econometric specification. Dealing with other possible sources of endogeneity in addition to this issue is difficult because of the nature of the data and the added econometric complications involved.

Descriptive statistics

Table 4 presents the descriptive statistics of all variables used in the econometric analysis. The summary statistics are available for all respondents and for individuals with private health insurance. This section focuses on the discussion on the means for individuals with private health insurance. In 1996, the weighted means for all respondents show that 5% of the respondents have private health insurance and it increased to 21% in 2006. The figures show that within 10 years, private health insurance became more popular among Malaysians to pay for health care. For individuals with private health insurance, 10% were hospitalised in 1996 decreasing to 4% in 2006. Among these 3% and 2% went to private hospitals in 1996 and 2006 respectively.

In 1996, the data show a strange picture where 22% of individuals with the lowest income (below RM400) own private health insurance, in second place are individuals with income between RM1,000 – RM1,999 while the highest income group (household income more than RM5,000) has the lowest percentage having private health insurance (1%). Since the more affluent group are usually taking private health insurance, there is a possibility that some households underreported their income or over-reported their insurance. Nevertheless, in 2006 there is a significant decrease of individuals with private health insurance below the income of RM400 from 22% in 1996 to 1% in 2006. The data show that people with middle income buy more private health insurance than the higher income group.

The summary statistics show that the taking up of private health insurance is the highest among individuals with secondary education, private sector employees, in service and sales (in 1996), married, Malay and Chinese, and living in West Malaysia or urban areas. Among different age groups, males or females in the younger age from 21 to 46 are the most prevalent group with private health insurance. The means for health conditions variables show that people with hypertension bought more private health insurance as compared to people with diabetes and asthma. The small differences between the means for the whole population and those with private health insurance in 1996 suggests, as expected in a strongly risk rated system, limited adverse selection and the lower rates for those with insurance in 2006 may even suggest favourable selection on these conditions. While more than 30% of smokers have private health insurance in 1996 and 2006 there is little difference between the whole population and those with insurance. This runs counter to the common finding of lower rates of smoking among the insured.

RESULTS

This section presents the results of a seemingly unrelated bivariate probit model that jointly models the uptake of private health insurance and the probability of at least one night stay in a hospital. The findings for 1996 and 2006 are reported in Table 5. Table 5 gives the z-statistics and the marginal effects (ME) i.e. the change in the absolute probability of having private health insurance or being admitted to hospital. The first four columns of the estimates are the results for 1996 while the last four columns are for the 2006 data. The barely significant and insignificant coefficients on the insurance dummy in the hospitalisation equations show that when observables are adequately taken into account, there is limited evidence of moral hazard in 1996 and none in 2006. Further, as observed in the raw differences in prevalence of conditions across the insured and uninsured, there is no evidence of adverse selection. There is however evidence in 2006 that diabetics are significantly less likely to hold insurance, perhaps because insurers offer unfavourable contracts or even refuse insurance.

The Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) are used to select the best model. We tested three specifications of the model: without exclusions of the health condition variables in equation 1 and 2; with exclusion in equation 1 only and with exclusions in equation 1 and 2. Based on the lowest AIC and BIC, this study chooses the bivariate probit model without the exclusion. Table 6 shows the AIC and BIC results with (minus health and lifestyle variables) and without exclusion restrictions. Even though Maddala (1983) argued that the parameters of the second equation are not identified if there were no exclusion restrictions on the exogenous regressors, Wilde (2000) proved that the classic identification problem actually does not exist. Problem will occur if only there is too small variation in the data. Given this evidence, the analysis uses the bivariate probit model without any exclusion restrictions.

Factors affecting the demand for private health insurance and its impact on the utilisation of health care in 1996

In 1996, the bivariate probit results show that socioeconomic factors that are associated with higher private health insurances are income, education, job status, job sector, ethnicity, states and lifestyles. Compared to the omitted group, individuals with income between RM1,000 – RM1,999, individuals with lower level of income between RM400 – RM699, RM700 – RM999 and the middle income from RM2,000 – RM3,000 are less likely to purchase private health insurance. Furthermore, as compared to individuals with secondary education, individuals with tertiary education are also less likely to buy private health insurance. This is most probably because the more highly educated individuals have access to generous health subsidies from their employer. For instance, in the government sector, government employees enjoy free treatment at government clinics and hospitals (Government of Malaysia, 1974). While in the private sector, top management or executives are also subsidised by their employer especially when they visit panel clinics or panel hospitals. Individuals who have no formal education, the professionals, production sector, the Chinese and smokers are more likely to have private health insurance. Individuals who have no formal education are more likely to have private health insurance since they are most likely to be self-employed and not covered either by the government or private employers. Thus, they need private health insurance more than individuals who have higher educational levels. As expected, the unemployed are also less likely to buy private health insurance whereas professional, technical and production sector workers have a higher probability of purchasing private health insurance.

In 1996, the results also show that demographic indicators such as ethnicity influence the taking up of private health insurance. The Chinese are more likely to have private health insurance while individuals who live in the less developed regions i.e. East Coast and East Malaysia are less likely to buy private health insurance as compared to individuals in the West Coast. As expected, because of risk rating this study found that health condition variables have no effects on people decision on buying private health insurance. Nevertheless, smoking is found to be positively significant for people to take up health insurance.

The marginal effects in the private health insurance equation are very small and do not show much impact of the variables on the probability of having private health insurance. Overall, the highest effect is seen for the geographical indicator that show a 10% decrease of living in the East Coast and East Malaysia decreases the taking up of private health insurance for 5.9% and 5.3% respectively.

The second equation examines the factors affecting hospitalisation at government and private hospitals conditional on private health insurance ownership. We found that individuals with income between RM700 – RM999 which are less likely to have private health insurance are more likely to be admitted to hospitals. While those in the higher income category (RM3,000 – RM4,000 and above RM5,000) are less likely to be admitted. As compared to government employees, private employees and the self-employed are less likely to be admitted to hospitals. Meanwhile, levels of education and job sector have no significant effect on hospitalisation.

The demographic indicators show that age has strong effects on hospitalisation. Older males (aged above 45 years old) and females in the reproductive age (aged 21 to 45 years old) are more likely to be hospitalised. As compared to the Malays, the Chinese are less likely to be hospitalised while the Indians are more likely to be hospitalised. Individuals living in the East Coast and rural areas bring positive effect on hospitalisation. Most importantly, all health condition and lifestyles variables show a positive relationship with hospitalisation. Choosing private care also shows a highly significant effect on hospitalisation. Finally, the 1996 results show that individuals with private health insurance are 11.3% more likely to visit a hospital. This indicates that individuals with health insurance seek more care when they get sick consistent with moral hazard behaviour. However the effect is only significant at the 10% level. The effect is insignificant in the 2006 data.

The highest marginal effects in the hospitalisation equation show that a 10% increase in being female aged 21 to 35 years old increases hospitalisation by 14.6%. Private care increases hospitalisation by 11.3%, asthma 7.3%, and diabetes 6.2%.

The *rho* estimate reported at the end of Table 5 measures the correlation of the residuals from the two models. After accounting for impacts of observable individual heterogeneity and other factors, there is a negative correlation (-1.83) between the taking up of private health insurance and hospitalisation in 1996, indicating that the unobserved characteristics of the sample (or random factors) that make them have a higher a probability of having private health insurance also make them have a lower probability of being admitted to hospitals. There are potentially important unobserved characteristics of households such as family size or number of children that might positively affect the probability of private health insurance buying but at the same time negatively affects hospitalisation.

Factors affecting the demand for private health insurance and its impact on the utilisation of health care in 2006

In 2006, the NHMSIII data show almost all variables have significant effects on the decision to purchase private health insurance. Firstly, the results show that there are strong socioeconomic differences. The purchase of private health insurance is associated with higher income where individuals with household monthly income more than RM1,000 – RM1,999 (the reference group) are more likely to have private health insurance while on the other hand, individuals with monthly income lower than the reference group are less likely to buy private health insurance. Education also plays an important role in determining the probability of having insurance. The results suggest that as compared to individuals with secondary education, individuals who have primary education or received no formal education are less likely to have private health insurance while individuals with tertiary education are more likely to purchase private health insurance.

Even though the sample means in Table 4 show that 42% of the private employees have private health insurance, the bivariate probit results show that individuals who work as private employees are less likely to have private health insurance than government employees. The self-employed, housewives and the unemployed are also less likely to purchase private health insurance as compared to government employees. The introduction of CuepacsCARE for government employees and civil servants in 1999 has increased the taking up of private health insurance among the public sector employees. Furthermore, since government employees have to pay out-of-pocket when they seek treatment at private hospitals, they are likely to purchase private health insurance to avoid waiting lists and longer waiting time at government hospitals. On the other hand, most private employees do not need private health insurance since they have access to treatment at private hospitals from their employment health benefits. Meanwhile, individuals who are working as professionals, technical or clerical workers are more likely to have private health insurance while persons who are working in agriculture and other job sectors are less likely to have private health insurance.

Older men above the age of 45 years and all women aged 21 years and above as well as individuals who are not married are less likely to have private health insurance. As compared to Malays, the Chinese, Indian and other Bumiputeras have higher probability of having private health insurance while other ethnicities variable show otherwise.

Despite being in the least developed states, individuals in the Eastern Region (Pahang, Terengganu and Kelantan) are more likely to purchase private health insurance as compared to individuals who live in the West Coast. This might be because the distribution of government employees is higher in the East Coast (11.9%) than in the West Coast (9.3%) and East Malaysia (11.8%). Earlier this study found that government employees are more likely to have private health insurance. Since most insurance companies excluded individuals with pre-existing conditions from purchasing private health insurance, this study found that similar to 1996 results, all health conditions variables are not significant in determining the purchasing of private health insurance except for diabetes. Since private health insurance plans do not cover pre-existing illness or conditions, individuals with diabetes are less likely to purchase private health insurance.

In 2006, the marginal effects for the private health insurance equation show that the taking up of private health insurance correspond to the changes in the income such that a 10% increase of having income higher than RM3,000 increase the probability of having private health insurance by more than 10%. Being a housewife, male or female aged above 66 years and Chinese also increases the probability of purchasing private health insurance by more than 10%. Among all the dependent variables, being Chinese has shown a very significant effect with a marginal effect of 25.8%.

Results from the hospitalisation equation show that income does not significantly affect the probability of admission to hospitals except for individuals with income higher than RM5,000. This income group is less likely to be admitted to hospitals. Education levels have no effect on hospitalisation. Nevertheless, the probability of being admitted to hospital is influenced by job status whereby private employees and the self employed are less likely to be admitted. In 2006, only males and females aged above 66 and females in the reproductive years of 21 to 35 are more likely to be admitted. Ethnicity variables show that the Chinese and other ethnicities are less likely to be admitted while the Indians and other Bumiputeras are more likely to be admitted to hospitals than Malays. States variables show that individuals who live in the East Coast are more likely to be admitted to hospitals while people in East Malaysia are less likely to be hospitalised in comparison to the West Coast. Similar to the results in 1996, heath conditions and lifestyles variables as well as the private care variable show a strongly positive relationship with being admitted.

Comparison of the marginal effects between 1996 and 2006 for the private health insurance and hospitalisation equations shows that the effects of having private health insurance are higher in

2006 while the marginal effects for hospitalisation are higher in the 1996 data. Lastly, this study found that the private health insurance variable is not significant in influencing hospitalisation behaviour which means that there is no moral hazard effect from the purchase of private health insurance. Overall the two equations show that these two equations are not correlated, *rho*=0.10, which is not statistically significant.

CONCLUSION

This research investigates factors that influence private health insurance ownership and admission to hospitals in Malaysia using the National Health and Morbidity Survey data in 1996 and 2006. Within 10 years, health insurance became more popular due to rising health care expenses in the private health sector. Given the possibility that individuals with health insurance will utilise more health care as predicted by the moral hazard theory, this study examines the size of the potential association between health insurance and admission to hospitals. This study estimates a bivariate probit model where the two behavioural equations are jointly estimated as a system with correlated error terms to model individual's choice of health insurance and admission to hospitals.

In the analysis, the effects of income, level of education, job status, job sector, age-gender, marital status, ethnicity, states, region and health conditions and lifestyles on the two behavioural models are tested. From the 1996 data, the results suggest that income, education, job status, job sector, ethnicity, states and smoking influence private health insurance decision. However, in 2006 almost all variables (except region and health conditions such as hypertension, asthma and smoke) influence health insurance decision.

From the analysis, several points are of important to be highlighted. First, in 1996, the lower income groups are less likely to have private health insurance however, the higher income groups are not significant in affecting private health insurance decision. In 2006, the lower income group still are less likely to have private health insurance however, the higher income groups are more likely to have private health insurance. This might be explained by the steady economic growth and higher individuals' income in 2006. In addition, rising income also increase the expectations and demands for better health care which leads to an increase in the costs of treatment (Economic Planning Unit, 1996). This in turn would increases the demand for private health insurance. Moreover, the increasing popularity of private health insurance to cover for the increasing health care costs is an important factor that influences private health insurance decision. Second, individuals with higher educational levels are more likely to have private health insurance in 2006 as compared to 1996. The increasing awareness among the population about the importance of having health insurance to cover for health care costs might be one of the factors. Third, among different ethnic groups, only the Chinese are found to be more likely to have private health insurance in 1996, however in 2006 the Chinese, Indians and other Bumiputeras are significant in influencing private health insurance decision. This findings show that private health insurance has become more popular and affordable among other ethnicities other than the Chinese.

This study also found that health insurance variable is not significant in the admission model that suggests there is no evidence of moral hazard behaviour in the 2006 data. In Malaysia, private health insurance is commonly used for hospitalisation and surgical treatment at the government and private hospitals. Since the government and private hospitals usually located in urban areas, the usage of private health insurance is limited to individuals who live in this areas. As a result, the findings demonstrated that individuals with lower income, lower level of education, living in rural areas or in the less developed regions, being a housewife, a student or unemployed are less likely to have private health insurance or have someone else pay for their health care. Being in these disadvantaged groups might affect an individual decision to go to hospital or to get treatment. Moreover, the 1996 and 2006 data show that people with health insurance tend to visit private hospitals. Since the government is planning to introduce a national health insurance scheme, Alvin (1996) recommended that in addition to the existing methods of financing, Malaysia should introduce social insurance that subsidise the poor and provide little or no subsidy to the upper and middle income group. If the government plans to introduce a new health financing scheme in the future, any policy reforms should take into consideration its consequence on the less advantaged group.

In future, with the availability of comprehensive health insurance data, research on asymmetric information such as adverse selection effects should be conducted. It is hoped that the findings of this study will assist policy makers to fill in the knowledge gap since there is limited empirical studies on the importance of health care financing alternatives in Malaysia.

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TABLE 1: Distribution of health care payment in NHMSII and NHMSIII

Types of payment	Freq	%
NHMSII		
Self payment	18,534	62.43
Employer	5,826	19.62
Self-Employer-Insurance	1,109	3.74
Free	1,030	3.47
Self-Employer	870	2.93
Free-Self	498	1.68
Free-Employer-Insurance	107	0.36
Insurance	32	0.11
Other combinations	1,457	4.91
Missing, refused to answer or don't know	227	0.77
No. of observations	29,690	100.00
NHMSIII		
Health insurance	5,946	20.05
Type of private health insurance:		
A. Part of life insurance scheme	2,487	8.44
B. Medical health insurance scheme	1,350	4.60
C. Others	90	0.31
A and B	1,947	6.57
A, B and C	14	0.05
A and C	6	0.02
B and C	2	0.01
Missing	50	0.17
Not applicable	23,280	79.66
No. of observations	29,226	100.00

Source: Author's estimation

TABLE 2: Definition of variables from NHMSII and NHMSIII

Variables	Definition
Dependent variables:	
PHI	= 1 if respondent's payment for health care is made by insurance
HOSP	= 1 if respondent has been admitted to any hospitals during the past 12 months
Independent variables:	
Household income	
HHINC0_399	= 1 if average monthly income is between RM0 – RM400
HHINC400_699	= 1 if average monthly income is between RM400 – RM699
HHINC700_999	= 1 if average monthly income is between RM700 – RM999
HHINC1000_1999*	= 1 if average monthly income is between RM1000 – RM1999
HHINC2000_2999	= 1 if average monthly income is between RM2000 – RM2999
HHINC3000_3999	= 1 if average monthly income is between RM3000 – RM3999
HHINC4000_4999	= 1 if average monthly income is between RM4000 – RM4999
HHINC5000	= 1 if average monthly income is above RM5000
Education	

PRIMARY	= 1 if completed primary education
SECONDARY*	= 1 if completed secondary education
TERTIARY	= 1 if completed tertiary education
NO_EDUC	= 1 if has no formal education
Job status	
GOVEMP*	= 1 if works in government sector
PVTEMP	= 1 if works in private sector
SELFEMP	= 1 if self-employed
HOUSEWIFE	= 1 if a housewife
UNEMPLOYED	= 1 if unemployed
Job sector	
PROF_TECH	= 1 if works as a professional or technical and related works
CLERICAL	= 1 if works in the clerical sector
SERVICE_SALES*	= 1 if works in the service or sales sector
PRODUCTION	= 1 if works in the production sector
AGRICULTURE	= 1 if works in the agriculture sector
OTHER_JOBSECTOR	= 1 if works in other sectors
Age*sex	
AGEM21_35*	= 1 if male and aged between 21 – 35
AGEM36_45	= 1 if male and aged between 36 – 45
AGEM46_55	= 1 if male and aged between 46 – 55
AGEM56_65	= 1 if male and aged between 56 – 65
AGEM66	= 1 if male and aged above 65
AGEF21_35	= 1 if female and aged between 21 – 35
AGEF36_45	= 1 if female and aged between 36 – 45
AGEF46_55	= 1 if female and aged between 46 – 55
AGEF56_65	= 1 if female and aged between 56 – 65
AGEF66	= 1 if female and aged above 65
Marital status	
MARRIED*	= 1 if married
SINGLE	= 1 if single
Ethnic	
MALAY*	= 1 if Malay
CHINESE	= 1 if Chinese
INDIAN	= 1 if Indian
OTHER_BUMIS	= 1 if Bumiputera other than the Malays such as the Indigenous people or tribal ethnic in Sabah and Sarawak
OTHER_ETHNIC	= 1 if belongs to other ethnic groups
State grouping	
WEST_COAST*	= 1 if live in Johor, Malacca, Negeri Sembilan, Selangor, Perak, Penang, Kedah or Perlis in the West Coast of Peninsular Malaysia
EAST_COAST	= 1 if live in Kelantan, Terengganu or Pahang in the East Coast of Peninsular Malaysia
EAST_MSIA	= 1 if live in Sabah or Sarawak in the East Malaysia region
Region	
URBAN*	= 1 if living in urban area
RURAL	= 1 if living in rural area
Health and lifestyles	
HPT	= 1 if having hypertension
DIABETES	= 1 if having diabetes
ASTHMA	= 1 if having asthma
SMOKE	= 1 if currently smokes
Admission to private hospital	
PVTCARE	= 1 if respondent has been admitted to any private hospitals during the past 12 months

Note: Variable name with * is the reference group.

TABLE 3: Mean monthly gross household income and incidence of poverty by region in Malaysia, 1999 and 2004

Strata	In current prices (RM)		Average annual growth rate (%)	Incidence of poverty (%)	
	1999	2004	2000 - 2004	1999	2004
Malaysia	**2,472**	**3,249**	**5.6**	**8.5**	**5.7**
Urban	3,103	3,956	5.0	3.3	2.5
Rural	1,718	1,875	1.8	14.8	11.9

Source: The Third Outline Perspective Plan 2001 – 2010, Malaysia (2001)

TABLE 4: Sample means, 1996 and 2006

Variable	1996		2006	
	All	With PHI	All	With PHI
	n=29,690		n=29,654	
PHI	0.05	-	0.21	-
HOSP	0.09	0.10	0.05	0.04
PVTCARE	0.02	0.03	0.01	0.02
Household income				
HHINC0_399	0.23	0.22	0.09	0.01
HHINC400_699	0.18	0.18	0.14	0.03
HHINC700_999	0.10	0.10	0.11	0.05
HHINC1000_1999	0.13	0.15	0.27	0.22
HHINC2000_2999	0.03	0.03	0.16	0.21
HHINC3000_3999	0.01	0.01	0.08	0.15
HHINC4000_4999	0.00	0.01	0.04	0.09
HHINC5000	0.01	0.01	0.10	0.23
Education				
PRIMARY	0.30	0.32	0.30	0.15
SECONDARY	0.39	0.41	0.47	0.57
TERTIARY	0.11	0.08	0.11	0.26
NO_EDUC	0.18	0.17	0.11	0.01
Job status				
GOVEMP	0.12	0.10	0.10	0.22
PVTEMP	0.29	0.28	0.31	0.42
SELFEMP	0.21	0.25	0.20	0.20
HOUSEWIFE	0.25	0.23	0.25	0.11
UNEMPLOYED	0.10	0.08	0.08	0.02
Job sector				
PROF_TECH	0.08	0.08	0.18	0.41
CLERICAL	0.05	0.04	0.06	0.10
SERVICE_SALES	0.16	0.16	0.17	0.19
PRODUCTION	0.15	0.19	0.06	0.07
AGRICULTURE	0.11	0.10	0.08	0.03
OTHER_JOBSECTOR	0.07	0.08	0.10	0.07
*Age*sex*				
AGEM21_35	0.18	0.18	0.14	0.20
AGEM36_45	0.11	0.11	0.11	0.17
AGEM46_55	0.08	0.09	0.09	0.13
AGEM56_65	0.05	0.06	0.06	0.04
AGEM66	0.03	0.04	0.04	0.01
AGEF21_35	0.23	0.20	0.19	0.19
AGEF36_45	0.13	0.14	0.14	0.14
AGEF46_55	0.08	0.08	0.12	0.09
AGEF56_65	0.06	0.06	0.06	0.03
AGEF66	0.04	0.04	0.05	0.00
Marital status				
MARRIED	0.64	0.66	0.78	0.80
SINGLE	0.36	0.34	0.13	0.17

Ethnic				
MALAY	0.45	0.48	0.54	0.40
CHINESE	0.26	0.34	0.22	0.41
INDIAN	0.07	0.09	0.09	0.12
OTHER_BUMIS	0.16	0.04	0.10	0.05
OTHER_ETHNIC	0.07	0.04	0.05	0.02
State				
WEST_COAST	0.56	0.92	0.66	0.75
EAST_COAST	0.14	0.02	0.14	0.11
EAST_MSIA	0.30	0.07	0.20	0.14
Strata				
URBAN	0.55	0.57	0.64	0.80
RURAL	0.45	0.43	0.36	0.20
Health and lifestyle				
HPT	0.10	0.10	0.15	0.11
DIABETES	0.04	0.05	0.08	0.05
ASTHMA	0.04	0.04	0.05	0.03
SMOKE	0.31	0.34	0.34	0.34

Note: Descriptive statistics are calculated using cross-section sample weights.
Source: Author's estimation

TABLE 5: Bivariate probit and marginal effects for private health insurance and admission to hospitals in Malaysia, 1996 and 2006

	1996				2006			
	PHI		HOSP		PHI		HOSP	
	ME	z-stat	ME	z-stat	ME	z-stat	ME	z-stat
HHINC0_399	0.0006	0.13	0.0059	0.82	-0.067	**-6.35****	0.002	0.41
HHINC400_699	-0.0139	**-2.94****	-0.0082	-0.91	-0.073	**-9.94****	0.006	1.38
HHINC700_999	-0.0196	**-3.66****	0.0232	**1.87***	-0.030	**-4.05****	-0.002	-0.36
HHINC2000_2999	-0.0168	**-2.28****	-0.0008	-0.05	0.047	**7.29****	0.002	0.57
HHINC3000_3999	-0.0149	-1.42	-0.0464	**-1.69***	0.102	**11.89****	-0.003	-0.61
HHINC4000_4999	-0.0078	-0.48	-0.0293	-0.88	0.112	**9.66****	-0.002	-0.31
HHINC5000	0.0140	0.74	-0.0439	**-2.17***	0.137	**15.47****	-0.010	**-1.83***
PRIMARY	-0.0011	-0.25	-0.0108	-1.45	-0.065	**-12.52****	0.000	0.05
TERTIARY	-0.0208	**-3.83****	-0.0091	-0.61	0.055	**7.45****	-0.008	-1.61
NO_EDUC	0.0106	**1.74***	0.0026	0.25	-0.096	**-10.18****	-0.008	-1.59
PVTEMP	-0.0091	-1.55	-0.0361	**-3.95****	-0.049	**-8.03****	-0.013	**-3.15****
SELFEMP	0.0084	1.33	-0.0446	**-5.12****	-0.040	**-5.55****	-0.012	**-2.61****
HOUSEWIFE	-0.0043	-0.62	-0.0060	-0.51	-0.108	**-14.10****	0.001	0.24
UNEMPLOYED	-0.0145	**-1.98***	0.0150	1.16	-0.098	**-10.32****	0.008	1.23
PROF_TECH	0.0248	**2.79****	-0.0056	-0.46	0.087	**11.25****	0.003	0.51
CLERICAL	0.0050	0.32	0.0029	0.15	0.074	**7.07****	0.006	0.87
PRODUCTION	0.0122	**2.04****	0.0088	0.85	0.007	0.79	-0.005	-0.77
AGRICULTURE	-0.0013	-0.21	0.0187	1.55	-0.033	**-3.32****	0.005	0.88
OTHER_JOBSECTOR	0.0071	0.92	-0.0043	-0.27	-0.018	**-2.26****	0.001	0.21
AGEM36_45	-0.0041	-0.67	0.0080	0.65	0.012	1.57	-0.006	-1.01
AGEM46_55	-0.0037	-0.55	0.0286	**1.93***	-0.017	**-2.04****	0.001	0.24
AGEM56_65	0.0029	0.34	0.0356	**2.28****	-0.085	**-10.03****	0.010	1.38
AGEM66	0.0155	1.42	0.0522	**2.62****	-0.129	**-12.23****	0.018	**2.03****
AGEF21_35	-0.0007	-0.09	0.1463	**7.76****	-0.044	**-5.93****	0.034	**5.37****
AGEF36_45	0.0036	0.45	0.0545	**3.80****	-0.028	**-3.36****	0.009	1.41
AGEF46_55	-0.0053	-0.67	0.0069	0.50	-0.045	**-5.03****	0.004	0.56
AGEF56_65	0.0008	0.09	0.0020	0.14	-0.080	**-7.58****	-0.007	-0.95
AGEF66	0.0019	0.17	0.0322	1.69	-0.125	**-9.44****	0.019	**2.11****
SINGLE	-0.0024	-0.49	-0.0114	-1.60	-0.022	**-3.69****	-0.005	-1.09
CHINESE	0.0068	**1.65***	-0.0348	**-4.16****	0.258	**36.21****	-0.019	**-4.07****
INDIAN	-0.0080	-1.37	0.0418	**3.94****	0.156	**16.97****	0.011	**2.27****
OTHER_BUMIS	0.0152	1.10	0.0331	1.06	0.036	**3.58****	0.017	**3.00****
OTHER_ETHNIC	0.0010	0.09	0.0127	0.69	-0.036	**-3.13****	-0.011	**-1.88***
EAST_COAST	-0.0592	**-6.68****	0.0283	**2.60****	0.020	**3.08****	0.013	**3.45****

EAST_MSIA	-0.0531	**-9.71****	-0.0053	-0.37	-0.043	**-6.74****	-0.012	**-2.99**
RURAL	-0.0052	-1.50	0.0209	**3.17****	0.003	0.61	-0.000	-0.00
HPT	-0.0008	-0.17	0.0430	**5.27****	-0.002	-0.28	0.030	**7.70****
DIABETES	-0.0055	-0.82	0.0616	**5.39****	-0.020	**-2.20****	0.041	**8.03****
ASTHMA	-0.0045	-0.62	0.0727	**6.07****	-0.013	-1.21	0.046	**7.72****
SMOKE	0.0106	**2.25****	0.0148	**1.94***	-0.007	-1.19	0.015	**4.04****
PHI	-	-	0.1129	**1.83***		-	-0.014	-1.05
PVTCARE	-	-	0.9496	**32.43****		-	0.965	**128.40****
CONSTANT	-	**-14.35****		**-14.16****		**-13.77****		**-20.57****
Sample size	21,292				29,654			
χ^2 (df)	14,379.64 (82)				61826.29 (82)			
Rho (t)	0.1439				0.1023			
	(-1.83)				(1.07)			
Log likelihood	-3099584.1				-5956409.0			

Note: * Significant at 10% level. ** Significant at 5% level.
Source: Author's estimation

TABLE 6: AIC and BIC results

	AIC	BIC
1996 (n=21,292)		
Full bivariate probit model	6202435	6203113
Bivariate probit model without health and lifestyles variables in equation 1	6205884	6206529
Bivariate probit model without health and lifestyles variables in equation 1 and 2	6257409	6258023
2006 (n=29,654)		
Full bivariate probit model[10]	1.19e+07	1.19e+07
Bivariate probit model without health and lifestyles variables in equation 1	1.19e+07	1.19e+07
Bivariate probit model without health and lifestyles variables in equation 1 and 2	1.20e+07	1.20e+07

Source: Author's estimation

[10] Based on the 1996 data, we selected the full bivariate probit model even though the AIC and BIC in 2006 for full bivariate probit model and bivariate probit model without health and lifestyles variables in equation 1 are the same.