



Does Health Insurance Ownership Determine Access and Frequency of Hospitalization? Evidence from the Two-part Poisson Model

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ABSTRACT

This paper examined the effect of health insurance ownership on hospitalization within the context of Malaysia. The study utilized the data from Malaysia National Health and Morbidity Survey III (2006) and 14,234 respondents were selected for this purpose. Malaysia provides new evidence from an emerging market where voluntary purchase of private health insurance co-exists with almost free public health care. We used the standard and two-part Poisson models (TPM) in determining the effect of insurance ownership on utilization. Based on two selection criteria, TPM was found to be superior to the standard specification. Insurance ownership was found to be significant in determining access while it has no significant effect on frequency of hospitalization. Other significant variables that determine access were age, marital status, household size, health status and income while health status is the sole factor that affects frequency.

Keywords: Health Insurance, Hospital Utilization, Poisson Model

JEL Classification: I13

1. INTRODUCTION

The link between health insurance ownership and overutilization of health care services is highly debated. Some scholars argue that health insurance can induce moral hazard problems, which results in an inefficient reallocation of resources (Pauly, 1986). The moral hazard problem arises when an individual is indifferent on spending additional health care since the price paid during consumption is zero due to the reimbursement by the insurance company. The study of health insurance demand is unique on its own because the individual demand for health care may be influenced by other parties and the availability of care (medical providers). In a health care market, the three major players are the health care providers or producers, consumers and third-party payers. The consumers or patients are uncertain of their health

status and the needs for health care in the coming period. The health care providers are uncertain of the volume of care as it depends in part on the quantity demanded and the diagnostic. The existence of uncertainty both on the demand and the supply side show the unique feature of the health care market. The uncertainty in the occurrence of illnesses and the cost of treatment from the individual or consumers' perspective make the role of the third party payers (the insurance companies and the government) very important in a health care system.

As the Malaysian government is planning to introduce the National Health Insurance (NHI) Program, it is imperative to explore the influence of health insurance ownership on health care utilization. Empirical studies on the effect of insurance ownership within Malaysia context is quite limited except Kefeli and Jones (2012),

Samsudin et al. (2012) and Wan-Abdullah and Ng (2009). This study differs from Kefeli and Jones as they focus on determinants of access only while we also consider the intensity of use measured by the frequency of being hospitalized. While Samsudin et al. (2012) focuses on the elderly and Wan-Abdullah and Ng (2009) use data collected through health claims based on claims register of an insurance company, this study considers all individuals who are eligible to purchase health insurance. Specific evidence on Malaysian case is vital as findings from other countries may be less applicable to Malaysia due to different health care financing systems and population characteristics. It is expected that the existence of health insurance may induce demand that those who own health insurance are more likely to utilize health care. Besides, in addition to the standard one-part model in modeling frequency of use, we utilize two-part count model as the data contain large frequency of zeros. Large occurrences of zero count may lead to inconsistent parameter estimates (Samsudin and Moffatt, 2014). The use of two-part model also enables us to model separately the access and frequency. The findings from this study are valuable to policy makers as ensuring access to health care is a policy issue and overspending on health care may jeopardize the sustainability of the proposed NHI program.

The remainder of this article is organized as follows. The next section presents the theoretical foundation and past studies in the field. Then the methods employed in this study are discussed followed by the research findings and discussion. The final section concludes with recommendations.

2. THEORETICAL FRAMEWORK AND PAST STUDIES

In understanding access to hospital care, we use the Grossman model (Grossman, 1972) as a foundation of analysis. In Grossman's, individual acts a decision maker in deciding whether or not to utilize health care and also determine the amount of care. In viewing this at different angle, in this study we propose that the amount of care may also be determined by medical provider. Hence, the presence of significant influence of insurance ownership on frequency of hospital care, may reflect the existence of provider moral hazard. Grossman's claims that individuals consume health care as one of the measures taken to improve the stock of health; as health stock depreciates overtime. The consumption of healthy times together with other goods will eventually determine an individual utility.

A large and growing body of literature has investigated the effect of health insurance on health care use. For an expected utility maximizing consumer, the demand for health insurance and health care is interdependence. Individual who expects to consume more health care will be more likely to buy health insurance or purchase more comprehensive health insurance coverage. The utilization of health services can be explained by factors suggested by Aday and Anderson (1974) framework. It divides the factors that influence utilization into three main categories. First, the predisposing factors which consists of factors that exist within individuals before the illness takes place. Examples are age, gender and education

level. Second, the enabling factors which facilitates utilization. Factors, among others, that fall under this categories are income and medical insurance. The most significant factors are categorized as need factors which represent the perceived or evaluated need (of medical care) by individuals or medical providers. Example is individual health status, be it self-perceived or evaluated.

Insurance variable is one of the enabling variables that determine the level of utilization. Insurance variable is often included in studies that are based on mixed system health care financing, as in the United States and Canada (Gurmu and Elder, 2000; Munkin and Trivedi, 2003; Zimmer and Trivedi, 2006; Sarma and Simpson, 2006). In other studies, in which the datasets are based on tax-financed system, such as Italy, UK, Sweden, Portugal and Spain, the role of insurance status in health care demand is not prominent. Previous works examining the effect of insurance ownership on health care utilization have provided mixed evidence. In the case of Taiwan, when the NHI Program was introduced in 1995, the use of medical care has increased among the newly insurance covered individuals. By using 1021 randomly selected Taiwanese adults, Cheng and Chiang (1997) found that the introduction of NHI has made the newly insured persons to consume more physician and inpatient services.

By using Canadian microdata, Sarma and Simpson (2006) found that insurance has significantly determined doctor utilization for healthy users and insignificantly for the less healthy. Some studies found that utilization of health care is indifference between the insured and uninsured or between types of insurance (Lopez-Nicolas, 1998; Munkin and Trivedi, 2003; Nandakumar et al., 2000). Within the middle-income country context, Ekman (2007) found that health insurance ownership does not affect the probability of outpatient visits but it significantly influence the intensity of use. By using Indonesian dataset, Hidayat and Pokhrel (2010) found no evidence that insurance ownership influences future outpatient visits. The effect of insurance on hospitalization has been investigated in Yamada et al. (2014) and Zhou et al. (2014). By using dataset from Japan and the United States, Yamada et al. (2014) found that little moral hazard may exist in Japanese market but not in the US. One possible reason for this was due to higher premiums in the US drive people to substitute more health capital investment which may later lead to lower hospitalization. Zhou et al. (2014) on the other hand found that being insured were associated with higher utilization.

One of the most comprehensive study on the effect of health insurance enrolment on health care expenditure was conducted by Manning et al. (1987) who used the Rand Health Insurance Experiment (HIE). The Rand HIE covered 3000 families from six cities in the US were randomly assigned to 14 different fee-for-service plans or prepaid group practices which varied over two dimensions: The upper limit on annual out-of-pocket (OOP) expenses and the coinsurance rate. Most outpatient and inpatient services were covered in all plans. The researchers found that the probability of any use of medical services increases with income, with larger increase in the plan with co-payments compare to the free plan. However, the effect of income on the probability of inpatient care switched to negative

for the plans with co-payments. This conflicting result may be due to the upper limit in OOP that is capped according to the family income. Further, in response to health insurance coverage, it was also found that there is no significant difference in utilization between the healthy and the sickly as well as between the six regions. The findings also reject the hypothesis that a more comprehensive outpatient care will reduce total expenditure suggesting that outpatient and inpatient services were complements not substitutes.

3. METHODS

3.1. Data

Data were extracted from the National Health and Morbidity Survey III (NHMS). The NHMS III was conducted by the Institute of Public Health, a division under the Ministry of Health Malaysia. The NHMS III data were collected in year 2006 via self-administered questionnaire and interview. The sample was selected based on enumeration blocks (EB). Each EB contains about 80-120 living quarters (LQ) and only 8 LQs were selected in each EB. A total of 15,519 households participated in the survey with a total of 58,538 respondents (Institute for Public Health, 2008). The questionnaire has 26 sections and there are separate questionnaires for those who are 18-year-old and above, between 13 and 18-year-old and 12 and below (individual questionnaire). The findings of the different sections are reported in 26 modules and the data needed for this study are mainly in Module A – Household information and socio-demography, Module B – Health expenditure, hospitalization, private health insurance and Module D – Load of illness, health utilization and Module 0 – Tobacco consumption.

3.2. Selection of Variables

The research findings were published in year 2008 and the data was made available to the public in year 2010. NHMS III reported that 18.8% of the respondents owned some type of MHI either as a stand-alone health insurance policy and/or a rider to life insurance policy or other types of insurance related to health. As the information on the health insurance ownership is only answered by those 18 years and above, the cases answered by those below 18-year-old were deleted thus resulting in 34,393 cases. From the 34,393 cases only 14,223 cases have no missing values in all variables of interest for this analysis. The definition and summary statistics of variables used are explained in Table 1.

3.3. Empirical Specification

The objective of the analysis is divided into two-fold where the first is to identify the role of insurance ownership on the probability of being hospitalized and second is to identify its role on the frequency of visits. The logit model is used to explain whether or not someone being hospitalized within the 12 months reference period. Suppose y_i^* is an unobserved variable that reflects utility of utilizing health care and. Given x_i is a vector of covariates of individual i and β is a vector of regression coefficients, the index function model is given by,

$$Y_i^* = x_i' \beta + u_i, \quad i = 1 \dots N \quad (1)$$

We can only observe dependent variable y_i that linking to y_i^* by,

$$y_i = \begin{cases} 1 & \text{if } y_i^* > 0 \\ 0 & \text{if } y_i^* \leq 0 \end{cases}$$

The probability density function is,

$$Pr(y_i | x_i) = \frac{e^{x_i' \beta}}{1 + e^{x_i' \beta}}$$

Thus,

$$\ln \left[\frac{Pr(y_i | x_i)}{1 - Pr(y_i | x_i)} \right] = x_i' \beta \quad (2)$$

Solving for the probability in the logit model in Equation 2 gives,

$$Pr(y_i | x_i) = \frac{\exp(x_i' \beta)}{1 + \exp(x_i' \beta)} = \frac{1}{1 + \exp(-x_i' \beta)}$$

The second analysis involves the use of count data in modeling the frequency of hospitalization. We use both standard Poisson (one-part) and two-part Poisson models (TPM) or sometimes known as hurdle model for this purpose. Two-part model is considered due to the large number of zero-count (non-users) in the sample. This condition may cause overdispersion in count data which later leads to inconsistent parameter estimates. The use of two-part or hurdle models were found in Deb and Trivedi (2002), Gerdtham (1997), and Pohlmeier and Ulrich (1995).

We start with the standard Poisson model where hospitalization, Y , is specified as below:

$$E(Y = y_i | x_i) = \exp(x_i' \beta), \quad i = 1 \dots N$$

Where, y_i is the realized hospitalization for individual i and x_i is a vector of characteristics of individual i , assumed to be exogenous, that determine y_i . At this stage, no assumption has been made to distinguish different decision processes between the contact decision and the frequency of hospitalization. Suppose the number of occurrences for y_i given x_i is Poisson distributed with density:

$$f(y_i | x_i) = \frac{e^{-\lambda_i} \lambda_i^{y_i}}{y_i!}, \quad y_i = 0, 1, 2 \quad (3)$$

Which later gives,

$$E(y_i | x_i) = \lambda_i = \exp(x_i' \beta) = V(y_i | x_i) \quad (4)$$

Equation 4 shows the equality of the conditional mean and conditional variance (equidispersion). Count data may turn out to be overdispersed as a consequence of either unobserved heterogeneity, event dependence over time, or excess zeroes.

The next approach involves two-part process, where the first part represents access and the second part signifies the frequency

Table 1: Definition and summary statistics of variables (N=14,223)

Variables	Definition	Mean±standard deviation	Min	Max
<i>Hosp</i>	Being hospitalized the last 12 months 1 - Yes, 0 - No	0.056±0.229	0	1
<i>Hosp_N</i>	Number of hospitalization in the last 12 months	0.074±0.384	0	14
<i>Age</i>	Age in years	39.275±13.614	18	97
<i>Agesq</i>	Age square	1727.862±1172.005	324	9409
<i>Male</i>	1 if gender is male, 0 female	0.542±0.498	0	1
<i>No_edu</i>	Has no formal education (reference variable)			
Primary	1 if primary, 0 otherwise	0.280±0.449	0	1
Secondary	1 if secondary, 0 otherwise	0.579±0.494	0	1
Tertiary	1 if tertiary, 0 otherwise	0.082±0.275	0	1
Married	1 if married, 0 otherwise	0.746±0.436	0	1
Size	Number of household member	4.739±2.410	1	19
Chronic	Suffering from chronic illness (es); 1 - Yes, 0 - No	0.223±0.416	0	1
Smoker	A smoker; 1 - Yes, 0 - No	0.288±0.453	0	1
Insurance	Own medical insurance; 1 - Yes, 0 - No	0.206±0.404	0	1
Income	Log (1+total income)	4.829±3.137	0	10.309
Malay	1 if Malay, 0 otherwise	0.642±0.479	0	1
Distance	Distance to private hospital (km)	46.807±77.383	0	750
Urban	1 if lives in urban, 0 rural	0.544±0.498	0	1

of use. Strong assumption, however, has to be made that the hospitalization episodes are related to the same spell of illness. The first part involves logit model as its modeling probability of use (access) and the second part utilizes zero truncated Poisson model, which considers observation >0 . The density function of these two distinct processes of health care demand, y for individual i can be described as:

$$Pr(y_i = 0) = f_1(0), y_i = 0$$

And

$$Pr(y_i | y_i > 0) = \frac{1 - f_1(0)}{1 - f_2(0)} f_2(y_i), y_i > 0$$

4. FINDINGS AND DISCUSSION

Table 2 presents the estimates for hospitalization from logit, Poisson and zero-truncated Poisson model. The TPM model consists of logit and zero-truncated Poisson. Prior to further discussion, we use two selection criteria, namely Akaike Information Criteria (AIC) and Bayesian Information Criteria (BIC) to select the best count model which could explain the frequency of hospitalization. Both AIC and BIC consistently prefer the TPM than standard one-part Poisson model. Since TPM estimates determinants of access and frequency at once, therefore the following discussion on access and frequency of hospitalization are based on this model. The results show that health insurance ownership is significant in determining the probability of use which represents access but has no influence on frequency.

As far as health equity belief is concerned, one may argue that enabling factors should not be the significant determinants for health care utilization. The general agreement is that health

services are allocated according to need (health status) rather than ability to pay. Although insurance ownership is found to be significant in determining the probability of use in our model, we regard this as a greater access opportunity rather than inequality of use. Besides, we believe that individuals are not fully informed of their health status and appropriate treatments needed until the first access. Therefore we suppose that there is no evidence of serious moral hazard as insurance ownership is only significant in determining access but not frequency of use. The effect of insurance also depends on the type of health services considered (Ekman, 2007; Hidayat and Pokhrel; 2010). Hospitalization, for example, is largely determined by the doctors based on one's health status, thus individuals' moral hazard may be limited. Yet, there are evidence that insurance ownership affects the intensity to being hospitalized. Yamada et al. (2014) and Zhou et al. (2014) found that being insured were associated with higher hospitalization, hence supported the moral hazard theory. The influence of insurance ownership may also be sensitive to the type of provider being investigated. In this study we combine utilization from both public and private hospitals, which results the insignificant insurance effect on frequency of use. The effect may be different if we concentrate on private hospitals as private services have been associated with higher fees and OOP payment (OPP) and owning of insurance may reduce OPP, hence promotes demand.

Other significant variables that determine access are age, marital status, household size, health status and income while only health status influences frequency of care. The findings indicate that individual who is married and from a household with a larger number of members are more likely to access health care. Perhaps the spouse and the family members become enabling factors pushing the individual to seek for care. The likelihood of hospitalization also increases with age. As health status is

Table 2: Estimation results for hospitalization

Variables	Logit		Poisson		Zero truncated Poisson	
	Coefficient	Robust SE	Coefficient	Robust SE	Coefficient	Robust SE
Age	-0.121	0.016***	-0.105	0.016***	-0.017	0.032
Agesq	0.001	0.000***	0.001	0.000***	0.000	0.000
Male	-0.053	0.106	-0.037	0.118	-0.223	0.253
Primary	0.348	0.187	0.204	0.225	-0.257	0.323
Secondary	0.315	0.203	0.054	0.236	-0.630	0.359
Tertiary	0.236	0.253	0.007	0.276	-0.539	0.483
Married	0.547	0.117***	0.409	0.155***	-0.240	0.317
Size	0.057	0.015***	0.061	0.014***	0.034	0.022
Chronic	1.064	0.079***	1.197	0.087***	0.867	0.201***
Smoker	-0.097	0.106	-0.108	0.117	0.080	0.250
Insurance	0.253	0.103**	0.151	0.118	-0.311	0.338
Income	-0.037	0.015**	-0.035	0.017**	0.001	0.031
Malay	0.118	0.085	0.118	0.112	-0.060	0.289
Distance	-0.001	0.001	-0.001	0.001	0.000	0.001
Urban	0.016	0.082	0.029	0.092	0.069	0.198
Constant	-1.468	0.363	-1.360	0.395	-0.057	0.835
Log-likelihood	-2918.86		-3811.26		-603.17	
AIC	5869.724		7654.521		1238.343	
BIC	5990.725		7775.523		1313.116	
N	14,223		14,223		791	

**** Significant at 1% and 5% level respectively. SE: Standard error, AIC: Akaike Information Criteria, BIC: Bayesian Information Criteria

controlled for, this may indicate that older individual are more risk averse or anxious about their health and thus seek more care. Moreover, doctors are more likely to admit older patients as they are riskier compared to their younger counterparts. Interestingly, those with higher income are less likely to be hospitalized. It may reflect that individuals with higher income have greater resources at their disposal to avoid inpatient treatment. As expected, health status influences both the health access and frequency of use. Those with bad health status are more likely to seek and have higher frequency of use (Atella et al., 2004; Mangalore, 2006; Sarma and Simpson 2006).

5. CONCLUSION

This study investigates the role of medical insurance ownership in determining the probability (access) and frequency of hospital utilization within the context of Malaysia. To our best knowledge, there are no studies that focused on the effect of insurance on the frequency of hospitalization in Malaysia. TPM proves to be superior for our dataset and it is able to identify the possible determinants for access and frequency. The empirical finding suggests that extending health insurance coverage may increase health care access, in particular to inpatient services. Instead, it is found in this study that health insurance ownership does not influence the frequency of hospitalization and this may indicate that moral hazard does not seriously exist in the Malaysian market. The introduction of co-payment by many insurance companies now days has proved to control unnecessary utilization. We believe that the proposed NHI may increase access to care for the public and with proper measures and monitoring, it is also sustainable.

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