A study of Australian individuals' Private Health Insurance

ETC4420 Microeconometrics Assignment

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Introduction

Motivation of this study

Healthcare is one the most important topics in almost every country. An efficient combination of services from public and private health institutions in a country can certainly facilitate the development in that country and also enhance its residents' welfare. Given people's behavior in healthcare relies heavily on the health insurance coverage, government policy could play a significant role in this scenario. For example, policies encouraging people to buy private health insurance (PHI) can also increase the private hospital usage. Hence, the study of how policies impact individuals' decision on purchasing PHI becomes more and more important. Having accurate estimations of the marginal effect of certain policies on the PHI purhcasing decision would be extremely useful for government to make right decisions in the future. As for the statement that "people's behavior in healthcare relies heavily on the health insurance coverage", it is intuitively true. But we still need to confirm its validation.

What's more, we want to study to what extend does the health insurance coverage affect the individuals' beheviors. For ease of exposition, only the relationship between the utilization of dental service and the PHI status will be studied in this paper. But the results can be generalized to other cases including private health service usage etc.

Problem statement

Therefore, in this study, we are interested in two questions.

Firstly, what are the determinants of Australian individuals' decision on PHI purchase and how are these determinants affecting the people's choices? Secondly, is an individual's dental service usage affected by his/her PHI status? More specifically, we want to find out the treatment effect of "having private private heal insurance" on dental service usage. We will discuss these two questions separately in the following paper.

Literature review

Despite of the fact that a lot of studies have been conducted relating the demand for private health insurance, not much of them asked the question about how PHI is affecting the healthcare utilisation. (Srivastava, Zhao, and others 2008) In terms of dental health services, there are even fewer. Related to our second question in this study, Dawkins et al. (2004) found that making more people purchase PHI does not necessarily increase the utility of the private health services.

Although Srivastava, Zhao, and others (2008) studied the impact of private health insurance on the individuals' choice of public versus private hospital services, not directly relate to the dental care service, the methodology, RUM analysis and the recursive trivariate probit system model, used in their paper shed light on this study.

According to Chrisopoulos et al. (2016), "in 2013, half (50%) of people aged 5 and over had some level of private health insurance with dental cover. More people living in Major cities (53%) had insurance than in Inner regional (45%) and Outer regional areas (44%). People living in lower income households were less likely to have dental insurance than those in higher income households. Most (77%) adults with some level of health insurance that covered dental made co-contributions towards the cost of dental visits. One (1) in 10 insured adults (10%) paid all their own expenses. Of these, approximately 19% reported that this caused a large financial burden. Total expenditure on dental services (except those in hospitals) in Australia was AUD 8,706 million in 2012–13, an increase from AUD 5,945 million (adjusted for inflation) in 2002–03. The largest source of funds for this overall dental expenditure was individuals, paying directly out of pocket for 58% of total dental costs."

Econometric Framework

Multinomial logit

The different types of PHI have no apparent natural order. We use Multinomial Logit (MNL) to model it.

Suppose the utility for individual i choosing choice j is given by:

$$U_{ij} = x_i' \beta_j + \epsilon_{ij} \quad (i = 1, \ldots, N; \quad j = 0, 1, \ldots, J)$$

where x_i only vary by i and are the same across j, and β_j differs by choice j. We observe $y_i = j$ iff.$U_{ij} > U_{ik} \quad \forall k \neq j (j, k = 0, 1, \ldots, J)$, using a Type I extreme value distribution with $F(\epsilon_{ij} = \exp[-\exp(-\epsilon_{ij})]$. Probabilities:

$$P_{ij} = P(y_i = j) = \frac{e^{x_i' \beta_j}}{\sum_{k=0}^{J} e^{x_i' \beta_j}} \quad (j = 0, 1, \ldots, J)$$

where β_0 is standardized to be zero. So

$$P_{i0} = P(y_i = 0 | x_i) = \frac{1}{1 + \sum_{k=1}^{J} e^{x_i' \beta_k}}$$

$$P_{ij} = P(y_i = j | x_i) = \frac{e^{x_i' \beta_k}}{1 + \sum_{k=1}^{J} e^{x_i' \beta_k}}$$

J=3 in this study.

Endogenous binary treatment for a binary outcome variable - EBVP

For the second question in this study, the EBVP model is used. Because the main outcome variable "whether having visited a dentist in past 12 months" (y) is a binary variable. The treatment variable "whether having PHI" (T) is also a binary variable and it is endogenous. The model structure is given by:

$$y_i^* = x_{i1}' \beta_1 + \delta T_i + \epsilon_{i1}, \quad y_i = 1 \text{ if } y_i^* > 0, \ y_i = 0 \text{ otherwise}$$

$$T_i^* = x_{i2}' \beta_2 + \epsilon i2, \ T_i = 1 \text{ if } T_i^* > 0, \ T_i = 0 \text{ otherwise}$$

$$\text{where} (\epsilon_{i1}, \epsilon_{i2}) \sim BVN(0, 0, 1, 1, \rho), \ -1 < \rho < 1$$

$$\rho \text{ is the correlation coefficient between } \epsilon_{i1} \text{and} \epsilon_{i2}$$

We will use the Maximum likelihood estimation because it gives consistent and efficient estimates. The log-likelihood function is

$$LogL = \sum_{y=1,T=1} log\ \Phi_2[x'_{i1}\beta_1 + \delta T_i,\ x'_{i2}\beta_2,\ \rho] + \sum_{y=1,T=0} log\ \Phi_2[x'_{i1}\beta_1,\ -x'_{i2}\beta_2,\ -\rho] \quad (1)$$

$$+ \sum_{y=0,T=1} log\ \Phi_2[-x'_{i1}\beta_1 + \delta T_i,\ x'_{i2}\beta_2,\ -\rho] + \sum_{y=0,T=0} log\ \Phi_2[-x'_{i1}\beta_1,\ -x'_{i2}\beta_2,\ \rho] \quad (2)$$

Results of interest: treatment effect of T on y:

$$TE_i = \Phi(x'_{i1}\beta_1 + \delta) - \Phi(x'_{i1}\beta_1)$$

Data

Our data source is the 2004-05 Australian National Health Survey (NHS) which was conducted using a representative sample of the non-institutionalised residential population. The sample design ensured that individuals were randomly selected within each state and territory (*Information Paper, National Health Survey, Curf 2004-05* 2006).

The data we use in this study is a randomly selected subset of 22,000 individuals from this data source.

Table 1: Definition of variables

Area	Variables
Type of private health insurance cover	phi=0 for people without PHI, phi=1 for hospital cover only, phi=2 for ancillary cover only, phi=3 for both hospital and ancillary cover.
Whether having visited dentist in the past 12 months	dvisit=1 for people have visited dentist in last year, 0 otherwise.
Age	age4 for age group 0-4 years, 0 otherwise (ref category); age59 for age group 5-9 years, 0 otherwise; age1014 for age group 10-14 years, 0 otherwise; age1519 for age group 15-19 years, 0 otherwise; age2039 for age group 20-39 years, 0 otherwise; age4064 for age group 40-64 years, 0 otherwise; age6579 for age group 65-79 years, 0 otherwise; age80 for age group 80 years and over, 0 otherwise.
Culture	Australia=1 for people born in Australia, 0 otherwise; English=1 for people born in English-speaking coutry, 0 otherwise; nonEng=1 for others, 0 otherwise.

Area	Variables
Other demographic variables	male=1 for male, and 0 otherwise; married=1 if married or de facto, and 0 otherwise.
Long term medical conditions	condnoc=0 for people has no long term condition, 1 for having 1 long term condition, 2 for having 2 long term condition, 3 for having 3 long term condition, 4 for having 4 long term condition, 5 for having more than 5 long term condition.
General health assessment	excelh=1 for excellent health, 0 otherwise; verygood=1 for verygood health, 0 otherwise; good=1 for good health, 0 otherwise; fair=1 for fair health, 0 otherwise; poor=1 for poor health, 0 otherwise.
Education	degree=1 for a tertiary degree, 0 otherwise; dipcert=1 for having diploma or certificate, 0 otherwise; less12yr=1 for no qualification, 0 otherwise.
Income	income3=1 if weekly personal income falls in 1st to 3rd income decile, 0 otherwise; income4=1 if weekly personal income falls in the 4th income decile, 0 otherwise; income5=1 if weekly personal income falls in the 5th income decile, 0 otherwise; income6=1 if weekly personal income falls in the 6th income decile, 0 otherwise; income7=1 if weekly personal income falls in the 7th income decile, 0 otherwise; income8=1 if weekly personal income falls in the 8th income decile, 0 otherwise; income9=1 if weekly personal income falls in the 9th income decile, 0 otherwise; income10=1 if weekly personal income falls in the 10th income decile, 0 otherwise.
Main occupation	workft=1 if employed full-time, 0 otherwise; workpt=1 if employed part-time, 0 otherwise; unemp=1 if unemployed, 0 otherwise; nlf=1 if not in the labour force, 0 otherwise (ref category).

Results

Conclusion

Discussion

For the second question. Because we assume this sample was randomly selected from the Australian population, both insured and uninsured people are observed. Therefore, there is no observability issue in this case. However, there may still be endogeniety problem in the model because people may "self-select" themselves into purchasing PHI. To be more specific, the unobservable factors affecting PHI self-selection may ne correlated with the factors making a person seeing a dentist. For instance, for people who are highly risk averse, the chance for them to purchase PHI is higher than other people, and it is also likely that they visit dentists more frequently to prevent possible dental disease. Since the "risk averse" characristic is unobservable, it will be left in the error terms. Thus regressor T (whether having PHI) will be positively correlated with the error term in the outcome Y (dentist visits) equation. And if this is the case, the effect of having PHI will be overestimated.

References

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