CHOOSING HEALTH INSURANCE IN A DUAL HEALTH CARE SYSTEM: The Chilean Case[*]

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Abstract

The Chilean health care sector has a dual character. On the one hand, there is a public system where people contribute a fixed percentage of their income to buy a public insurance, and have access, mainly, to a network of public health care providers. On the other, there is a private insurance system where people pay a premium based on their personal characteristics, and have access to private health care providers, usually offering higher quality services. This work studies the determinants of the decision to buy a private health plan. Using a large survey for 1996, we find that the probability of buying a private health plan has a positive correlation with income, with having a permanent contract job, with living in a district with a large urban area, and with having completed secondary education. We also find that this probability decreases as families become older, and when there is a larger proportion of females of fertile age. Using a simultaneous equations framework, we also find evidence of a selection bias on the decision of buying a private health plan. People with poor health status are more likely to buy a private health plan. This bias is shown to be more important for low income and older families. Finally, we also find that the extent of the moral hazard in using health care services is mild. People enrolled in a private health plan, with a larger coverage than the public health insurance, increase their use of health care services but not to a large extent. This behaviour is more significant for high income and young families.

Key Words: health insurance, adverse selection, moral hazard.
JEL Classification: D81, I11

1. Introduction

The Chilean health insurance system has a dual character. On the one hand, there is a public insurance system where people contribute with a fixed percentage of their work income and receive health care services when needed[1]. On the other hand, there is a private health insurance system which works as a traditional private insurance scheme[2]. A set of health plans, with different coverage levels, deductibles, and caps on expenses, are offered. People pay a premium which is proportional to the expected cost of the health care services demanded. Workers have to allocate a fixed percentage of their work income to enroll themselves and their dependents into one of the health insurance systems. If they opt for a private health plan, they can supplement this minimum payment to have access to a more comprehensive health plan. People who are not working can voluntarily buy private insurance, if they are unable to do so, they are covered by the public health system.

These two health insurance schemes are parts of a health care sector that as a whole has a dual character. While people enrolled in the private health insurance scheme have access to a wider range of health care providers, and particularly to private providers offering services of higher quality, people enrolled in the public security system are in general constrained to the public providers, and have access to services of a lower quality allocated on a non –price basis.

Although most workers are enrolled in the public system, after more than 15 years of development, the private system has become more mature and consolidated. The private insurance system, which in its origin was only able to enroll a small segment of upper-middle and high income households, has experienced a significant expansion toward lower-middle income segments. This expansion has been the result of a growing commercial effort by private insurers, who have developed more competitive products based on managed care practices. These innovations have been introduced by the growing difficulty private insurers were experiencing in transferring people from the public system to the private system.

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[1] The public health security system is the Fondo Nacional de Salud, FONASA.

The major attraction of the private system is that it allows to a larger extent access to providers offering medical services of a higher quality. Although some of those enrolled in the public security scheme can opt for a fee for service modality, its high cost forces the great majority of the beneficiaries to use public providers. Cheaper private health plans entail significant co-payments, and private health plans are usually not a convenient alternative for low income people. On the other hand, the institutional design of the private insurance system has lead to practice risk selection. In order to be competitive, private insurers have an incentive to exclude people with severe medical conditions, or older people belonging to a higher risk class. Finally, the attractiveness of private health plans are seriously impaired when, given the geographical location of beneficiaries, there is no a network of private health care providers.

In this context, it is interesting to understand the determinants of people's enrollment decision into both health insurance alternatives. This would allow a better understanding of the determinants of access to private health plans, as well as the magnitude of the selection biases faced by the public system and private insurers. This paper has four objectives; to study the determinants of the decision to enroll into a private health plan; to characterise people enrolled in both health insurance schemes from a social and economic standpoint; to assess the selection bias faced by the public system and private insurers, and to evaluate if having a private health plan with better coverage increases the demand for health services.

Some of these issues have been studied by Sapelli and Torche (1998). Using data from the Casen 1990 and 1994 surveys, the authors study the determinants of the decision to contribute to the public system or to buy a private health plan. This work introduces some methodological and empirical innovations. In the empirical domain, we control for employment status of an individual choosing between the insurance schemes, as well as for educational level, which it is argued to be important on the decision to buy a private health plan. More importantly, Sapelli and Torche use too simple a

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[2] The private companies offering health plans are called Institutos de Salud Previsional, ISAPRE.

framework to study how health status affects people's decision between the alternatives, and their results are likely to be biased because they did not control for endogeneity. To overcome this shortcoming, we use a simultaneous equations model which enables us to identify the selection bias and the extent of moral hazard faced by private insurers. We also use a more recent survey from 1996 in our study.

The paper is organised as follows. Section 2 briefly surveys the recent literature on the choice and demand for health insurance. Section 3 presents a simple model of health insurance choice and discusses its estimation. Section 4 discusses the data used and the operationalization of the variables. Section 5 presents, and discusses, the results of the model. In section 6, we focus on the endogeneity of the demand for health services and the choice of a private health plan. We present a simultaneous equations model which allows the identification of the selection bias and the extent of moral hazard faced by private insurers. The last section is a conclusion.

2. The Choice and Demand of Health Insurance

The choice of a health insurance plan is driven by two set of determinants which are closely related, but are analytically separable – the characteristics of the health plan itself, and the personal characteristics of the individual making the choice.

A series of works have highlighted the importance of the characteristics of the health plans offered. For example, Feldman et al. (1987) studied the determinants of the individuals' choice among health plans for employees of a group of firms. They found that the choice among different health plans were strongly sensitive to the prospective payments the individual would have to make when demanding medical services. In a similar work, Short and Taylor (1989) found that the prices of the different health plans, as well as the existence of coverage for hospital expenses and catastrophic illnesses, constitute relevant dimensions in the choice among alternative health plans. Both determinants also appeared to be important in the work by Ellis (1989). Mechanic et al. (1990) studied

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the importance of the degree of freedom in choosing a health care provider on the choice among different health plans. They found that, in the United States, people with a higher level of education, caucasian, older, and with a smaller number of children preferred health plans that allowed a larger freedom to choose the provider.

With respect to the personal characteristics of the individual choosing health insurance, an important determinant is the level of income. People with very low income, or those who are unemployed, usually do not have access to health insurance when it is not mandatory and publicly provided. This has been shown in the works by Swatrz and McBridge (1990), Diehr et al. (1991), and Swartz, Marcotte and McBride (1993). Income level does not only influence the decision of having health insurance but also the type of health plan that is acquired. At low income levels people demand cheaper insurance, that is to say with a lower coverage. This relationship has been shown in several works, among them Cameron at al. (1988), Cameron and Trivedi (1991), Feldman et al. (1987) and Short and Taylor (1989).

The demand for health insurance is intimately related to the demand for medical services. People with private information on their health status, who think that their probability of generating medical expenses is high, will buy health insurance with larger coverage than those with a better health status, who do not expect to generate large medical expenses. This adverse selection effect has been discussed among others by Hsiao (1995) and Cutler and Zeckhauser (1997), and has been empirically studied by Mc Call et al. (1991), Marquis (1992), and Browne and Doerpinhaus (1993). Another way the demand for health insurance is linked to the demand for health insurance is that people who already have a health insurance face a lower cost of demanding health care services, and therefore they will demand services to a larger extent that they would have if uninsured. This moral hazard effect has been considered in the work of Cameron et al. (1988), who analysed the combined determination of the demand for medical services and health insurance.

The literature studying the demand for health insurance and its determinants refers for the most part to the reality of the United States, where there is a system of private health insurance closely connected to the workplace. However, the Chilean health care sector has a dual character where a public sector coexists with private insurers and providers. For that matter, the Chilean health sector resembles to a larger extent some European mixed systems, where a significant public sector exists in parallel with a private sector providing health insurance and medical services. The demand for health insurance in this context has been studied by Zweifel (1982), van de Ven and van de Praag (1981), and Propper (1989 and 1993). This last author explores the determinants of the decision of acquiring private health insurance in England, where a public health insurance financed by means of taxes is mandatory, and coexists with private insurers who offer supplementary health insurance allowing access to higher quality health care providers.

3. A Simple Model of Health Insurance Choice

Building on the framework offered by Besley (1989), and used by Selden (1993), we present a simple model of health insurance choice. Consider a consumer who faces ex -ante uncertainty with respect to an illness severity parameter θ with distribution $F(\theta)$ with $\theta \in [\theta_0, \theta_1]$. The consumer's utility function is strictly increasing and concave,

$$U = U[C(\theta), y(\theta)] \quad (3.1)$$

where, C denotes consumption of non-health goods, and y denotes health.

The individual is assumed to produce health through a well – behaved concave production function,

$$y(\theta) = g(X(\theta), \theta, P) \quad (3.2)$$

where X denotes health services, P is a vector of personal characteristics, and $\partial g / \partial X > 0$ and $\partial g / \partial \theta < 0$. Thus given θ, the individual can improve his or her health by purchasing health services.

The individual has two possibilities of getting health insurance. To contribute a fraction Ω of his income to the public security system, and to get a state specific lump-sum compensation $S(\theta)$. Otherwise, to buy a private health plan, where he pays a premium $m(R)$ and receives a fraction α of the total costs of the health services consumed, where R is a risk index based on age and sex.

If the individual opts to contribute to the public security system, given an exogenously determined level of income I, an insurance payment program $S(\theta)$, and a realised value of θ, he solves in each state the following problem,

$$Max_{X(\theta)}U\left[I + S(\theta) - \Omega I - X(\theta), g(X(\theta), \theta, P)\right] \quad (3.4)$$

From the first order condition for utility maximization, we can derive the state specific demand function for health services,

$$X = X(I + S(\theta) - \Omega I, \theta, P) \quad (3.5)$$

and the state dependent indirect utility function is written as,

$$V(I + S(\theta) - \Omega I, \theta, P) = U\left[I + S(\theta) - \Omega I - X(I + S(\theta) - \Omega I, \theta, P), g(X(I + S(\theta) - \Omega I, \theta, P), \theta, P)\right]$$
(3.6)

If the individual chooses to buy a private health plan, given his exogenously determined level of income I, a premium $m(R)$, and a realised value of θ, he solves in each state the following problem,

$$Max_{X(\theta)}U\left[I - m(R) - (1 - \alpha)X(\theta), g(X(\theta), \theta, P)\right] \quad (3.7)$$

Then, from the first order conditions, for a given α, we can derive a state specific demand function for health services,

$$X = X(I - m(R), \alpha, \theta, P) \quad (3.8)$$

and the state specific indirect utility function can be written as,

$$V[I - m(R), \alpha, \theta, P] = U[I - m(R) - (1 - \alpha) X (I - m(R), \alpha, \theta, P), g(I - m(R), \alpha, \theta, P)] \quad (3.9)$$

Assuming a competitive private insurance market and zero administrative costs, the equilibrium contract is actually fair, therefore,

$$m(R) = \int_{\theta_0}^{\theta_1} \alpha \, X (I - m(R), \alpha, \theta, P) \, dF(\theta) \quad (3.10)$$

Since insurance is purchased ex ante, the individual will choose to buy a private health plan if the expected utility of this option is greater than the expected utility of contributing to the public security system, which can be expressed by means of a function corresponding to the difference in expected utility, ΔV,

$$\Delta V(I, R, \alpha, \Omega, P) = \int_{\theta_0}^{\theta_1} V[I - m(R), \alpha, \theta, P] dF(\theta) - \int_{\theta_0}^{\theta_1} V[I - S(\theta) - \Omega I, \theta, P] dF(\theta) \quad (3.11)$$

In order to estimate the model, we assume that the difference in expected utility can be modelled as,

$$\Delta V(I, R, \alpha, \Omega, P) = Z^{'} \beta + \mu \quad (3.14)$$

where Z is the vector of variables determining the difference in expected utility, β is a vector of unknown parameters, and μ is an error term representing the collective contribution to ΔV of unmeasured characteristics. ΔV cannot be directly observed. We only observe if the individual buys the private health plan or not. Therefore, we define an index variable W, such that,

$$\begin{aligned} W &= 1 \qquad if \quad \Delta V > 0 \\ W &= 0 \qquad if \quad \Delta V \leq 0 \end{aligned} \quad (3.15)$$

and the probability that the individual gets a private insurance is given by,

$$\begin{aligned} \Pr(W = 1) &= \Pr(\mu > -Z'\beta) \\ &= 1 - \Phi(-Z'\beta) \end{aligned} \quad (3.16)$$

where $\Phi(.)$ is the cumulative distribution for μ. We assume that the error term is normally distributed with mean zero and variance 1^3, and estimation of the vector parameter β can be made by maximum likelihood techniques. The expected value of our index variable can be written as $E(W) = \Phi(Z'\beta)$, and the change in the probability that the individual buys a private insurance with respect to the jth independent variable is given by $\partial E(W)/\partial Z_j = \phi(Z'\beta)\beta_j$ where $\phi(.)$ is the normal density function.

4. The Data

In general, the studies focusing on the choice among alternative health insurance options consider both the characteristics of the health plans offered, and the personal characteristics of the individuals making the choice. Nevertheless, given the characteristics of the Chilean health insurance system, it is not possible to consider the characteristics of the health plans offered. The level of co-payments for different medical services, the degree of freedom to choose providers, the coverage for hospital expenses, and the maximum level of reimbursement, are largely heterogeneous among private health plans, and they are not easily comparable with the one offered by the public insurance system. Moreover, in the surveys available no information on the characteristics of private health plans held by people is reported. Therefore, following Propper (1989 and 1993), we circumscribe our analysis to study the effect of households' characteristics on the choice between a private or public health insurance.

The data comes from the Chilean National Characterization Survey (CASEN) for 1996. This survey describes the social and economic characteristics of Chilean families, including information on income, housing, education, health, and labor. Our unit of study corresponds to the individual deciding whether to contribute to the public insurance system or getting a private health plan. Within

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[3] The normalization of the variance is an innocuous standarization because the parameter vector β can be identified only up to a factor of proportionality.

each household, we consider as a decision maker the head of the household, and his/her spouse, if he or she works and has a contract. Any of the offspring, older than 25, or older than 18 if not studying, and not handicapped, we also considered as a decision maker. Other members of the household, who legally qualify as dependent, were considered as being dependent on the head of the household.

The index variable is a dummy taking the value of 1 if the individual and his dependents are enrolled in a private health plan and zero otherwise[4]. Our vector of independent variables Z includes the personal characteristics of the decision makers such as; age, income, education, employment, health status, and an observable risk index of the individual and his dependents. These independent variables are constructed as follows, and their descriptive statistics are shown in Table 1.

Income: We use as income the total disposable income of the individual deciding whether to contribute to the public insurance system or buy a private health plan. We expect that the wealthier the individual the more likely it is that he and his dependents will be enrolled in a private health plan.

Age: We directly used the age of the individual choosing a health insurance as an independent variable**.** We expect that the older the individual the lower the probability of enrolling in a private health plan.

Education: Another element determining the access to private health plans is the ability of people to understand and evaluate the different options offered by private insurers. Private health plan contracts are usually hard to understand. They are not clear with respect to co-payments, reimbursement limits, and conditions which determine the out-of-pocket cost of future health care services. Moreover, the large heterogeneity existing among the different health plans makes it even harder to evaluate the alternative of buying one. On the contrary, the benefits offered by the public security system are more easily understood, mainly with respect to the out-of-pocket cost of getting future health care services. In this sense, it is more likely that more literate and educated people,

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[4] We eliminated from the sample those household who were enrolled in special health insurance plans such as those of the Armed Forces, student health services, etc. Those households did not represent more than a 5% of the total number of observations.

capable of evaluating the alternatives of having a private health plan, will buy one. We use as an indicator of the level of education a dummy variable which indicates whether the individual choosing health insurance has completed secondary education. We expect that the probability of getting a private health plan is greater if people have completed their secondary education.

Employment status: We use two dummy variables to characterise the employment status of the individual. A first dummy takes the value of one if the person has permanent employment or zero otherwise. A second dummy indicates whether the person holds a contract for working. People who do not have permanent employment are less likely to be enrolled in a private health plan, because the premium is usually deducted from the pay check, and also because of the uncertainty about having the financial means to pay for the premium. Although the contribution to the public security system, or getting a private health plan, is mandatory, its enforceability is closely related to the type of work the individual has. It is very difficult to enforce contribution from people working independently, i.e. those who do not have a work contract. These persons are more likely not to buy private insurance and not to contribute to the public security system, given that they can get covered by the public security system becoming non-paying beneficiaries.

Perceived risk index: Although private insurance plans offer better access to higher quality health care services, the cost of a given health plan is proportional to the risk of generating medical expenses. While the contribution to the public security system is proportional to work income, private health plans discriminate among different age and sex groups. Older people and women of fertile age pay a higher premium than young people and men, because they are expected to generate higher medical expenses. On the other hand, in order to be competitive insurers have incentives to perform risk selection when pooling risk, by excluding from their health plans those people belonging to a high risk class. These factors are taken into account when enrolling in a plan, so that the larger the perceived risk by insurers, based on the age and sex composition of the individual and his dependent, the less likely it is that they can buy a private health plan. Based on the actual relative price structure of one of

the main private insurers, we construct an index of perceived riskiness using the age and sex of the individual choosing health insurance and his dependents. The value of the index corresponds to the sum of the corresponding score assigned to each member based on his/her sex and age as shown in Appendix 1.

Health status: Although the premium charged in a private health plan is proportional to the perceived risk based on age and sex, the likelihood of generating medical expenses depends to a greater extent on health status, which is known by the people buying health plans but not by the insurer[5]. This generates an adverse selection bias in the decision to buy a private health plan. Those people with poor health conditions, knowing that they face a larger probability of generating medical expenses, will be more likely to get a private health plan offering larger coverage and access to better health care providers. However, people applying for a private health plan are required to declare if they already have a pre existing severe medical condition, and the private insurer can deny the offer of a health plan. Therefore, the existence of severe medical conditions in the household may hinder the possibility of getting a private health plan. Following Sapelli and Torche (1998), we construct an index of health status for the individual and his dependents based on different indicators. The first indicator is the number of medical visits during the last 3 months. The second indicator is the number of surgeries or hospitalization of the members of the household during the last 3 months. We also include three dummy variables indicating; whether the members of the household had an accident during the last 3 months, whether one of the members had a child, and whether they buy medicine. To reduce the dimensionality of this multivariate data, we construct the index using the first principal components.

Access to private providers: The benefits of buying a private health plan are intimately related to the access to higher quality health care providers. Therefore, the availability of a network of private providers in the area an individual lives is an important determinant on the choice of a private health

plan. Hence, people living in rural areas, or in low density urban areas, where this network of higher quality health care providers does not exist, are less likely to buy a private health plan. We classified the different districts into high density urban areas, and the rest. Therefore, if the individual lives in a district which had more than 70,000 people living in its urban area by 1992 a dummy takes the value of 1, and zero otherwise.

Table 1: Descriptive Statistics

Continuous variables	Mean	Std. Dev.	Minimum	Maximum
Income	267 800	529 680	0	26 100 000
Age	42.05	16.47	14	98
Risk	2.79	1.49	1	10.09
Health Status	2.62	4.51	0	82.99
Categorical Variables	% observations = 1			
Private Health Plan	40.71			
Secondary Education	25.72			
Contract Job	63.11			
Permanent Employment	68.05			
Private Providers	73.19			
Number observations	32 908			

5. The Results

We estimated the model for different specifications of the vector of covariates. The first model includes only the dependent variables discussed in section 4. In order to test for non linearities, we also run alternative specifications for the covariates including income square, and age square. The results for the different specifications are presented in Table 2.

We reject the third specification because its log-likelihood turns out to be higher than the first specification. We choose the second specification because when we introduce the square of income, we find a non-linear effect of income on the probability of being enrolled in a private health plan which is statistically significant.

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[5] As shown by Wynard y Van de Ven (1994), when only age and sex are used to differenciate risk among different individuals a very small proportion of the total variation among individual risks is explained.

Table 2: Results for probit models

Dependent variable: Probability of having a private health plan

Variable	(1)	(2)	(3)
Income	1.0314	1.21155	1.02425
	(0.000)	(0.000)	(0.000)
Income square		-0.48631E-07	
		(0.000)	
Age	-0.0093	-0.0094	-0.00419
	(0.000)	(0.000)	(0.00)
Age-square			-0.000056
			(0.000)
Risk	-0.08739	-0.09267	-0.08715
	(0.000)	(0.000)	(0.000)
Health Status	0.005542	0.005664	0.005393
	(0.000)	(0.002)	(0.000)
Secondary education	0.75863	0.74129	0.7590
	(0.000)	(0.000)	(0.000)
Contract job	0.48081	0.49474	0.47509
	(0.000)	(0.000)	(0.000)
Permanent employment	0.1615	0.1359	0.15359
	(0.000)	(0.000)	(0.000)
Private providers	0.5629	0.5584	0.56428
	(0.000)	(0.000)	(0.000)
Constant	-0.9471	-0.94375	-1.0386
	(0.000)	(0.000)	(0.000)
Observations	32 908	32 908	32 908
Log-Likelihood	-2046732.1	-2039273.8	-2046664.9
Pseudo R^2	0.5432	0.5373	0.5444

Income is expressed in millions of Chilean pesos
p-values in parenthesis

Considering the statistical significance of the covariates, these results show that the probability of an individual and his dependent having a private health plan increases with income, although at a decreasing rate. This probability is also positively correlated with the head of household having completed secondary education, having a permanent contract employment, and living in an area with nearby private providers. One point which is interesting to note is the negative relation existing between the probability of having a private health plan and the age of the head of household. The older the individual the less likely it is that he has a private health plan. By the same token, the perceived risk index is also negatively related to the possibility of having a private health plan. The older the individual and his dependents, or the larger the percentage of females, the lower the probability of having private health insurance.

Our Health Status variable has a positive correlation with the probability of having a private health plan, suggesting that less healthier people are more likely to get a private health plan with better coverage than the publicly provided health insurance. This effect could be interpreted as evidence of an adverse selection bias in the enrollment into private health plans. Nevertheless, it is important to note that we use as a proxy for the individuals' health status an index based on past demand for health services. Therefore, this positive correlation can also be interpreted as evidence of moral hazard - individuals having a private health plan with larger coverage demand more health services. We focus on this issue in the next section.

To see the economic significance of the covariates, let's consider their impact on the average probability of having a private health plan. The average probability of having a private health plan in our sample is 0.397, which is very close to the observed unconditional sample frequency 0.4071. When income doubles, this probability increases to 0.5211, i.e. by 37.5%. When the individual does not have a permanent contract job this probability drop to 0.2527, i.e. by 36.3%. By the same token, the probability of having a private health plan when the individual has not completed his secondary education is only 0.3257, a drop of 18%. When he does not live in an area with nearby private providers this probability is only 0.2515, which is 36.6% lower than the case of living in a district with a large urban area. Although our estimations show a positive correlation of the probability of being enrolled in a private health plan and the use of medical services, its economic effect is not large. The probability of having a private health plan for our sample drops to 0.3912 if the household did not use any health service during the last three months, i.e only 1.5%. In the next section we take up this point again.

One of the characteristics of probit models is that the marginal effects of changes in the covariates are non linear. To see whether the changes in covariates are economically significant for different family types, we have defined nine baseline families based on income and stage in the life cycle. With respect to income, we define three type of families; low income families with a monthly income of

$125,650 (Chilean pesos), middle income families with monthly income of $267,800, and high income families with monthly income of $1,272,672[6]. With respect to their stage in the life cycle, we also define three categories; young, middle aged, and older. Our young baseline family is composed of a male head of household aged 35, a spouse aged 30, a female child aged 6 and a male child aged 4. The head of household has a permanent contract job, has completed secondary education, he and his dependents have not used medical services in the last 3 months, and live in an area with private providers. The middle aged baseline family is composed of a male head of household aged 50, a spouse aged 45, a daughter aged 21 and a son aged 19. The older baseline family is formed of a male head of household aged 66 and his spouse aged 61. The middle aged and older baseline families have a head of household who has completed secondary education, has a permanent contract job, and the family has not used medical services in the last 3 months, and lives in an area with private providers. The marginal effects of covariates are reported in Table 3.

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[6] Low income corresponds to the average value of the 5th decile. Medium income corresponds to the sample average value of income, and high income correspond to the average income of the 10th decile.

Table 3: Marginal Effects for Family Types

Type of family	Marginal effects	Young family	Medium age family	Old family
Low income	Baseline	0.3382	0.2361	0.1722
	No permanent contract	0.2055	0.1306	0.0885
	Without sec. educ.	0.2716	0.1815	0.1279
	No private providers	0.2044	0.1297	0.0878
	No health services	0.3328	0.2315	0.1684
Medium income	Baseline	0.4021	0.2914	0.2188
	No permanent contract	0.2570	0.1700	0.1189
	Without sec. educ.	0.3305	0.2297	0.1669
	No private providers	0.2557	0.1690	0.1181
	No health services	0.3964	0.2863	0.2145
High income	Baseline	0.8144	0.7233	0.6429
	No permanent contract	0.6878	0.5746	0.4846
	Without sec. educ.	0.7592	0.6562	0.5696
	No private providers	0.6864	0.5730	0.4830
	No health services	0.8104	0.7184	0.6373

As can be seen in Table 3, the probability of having a private health plan decreases as households get older, and this effect is greater for low income families. While for low income families, the probability of having a private health plan when older is 49% lower than when young, for high income families, this probability drops by only 21%. The economic effect of not having a permanent contract job turns out to be significant for families of all income levels, but its effect on the probability of having a private health plan decreases as income rises. While the probability of having a private health plan decreases by 40% to 50% for low income families, it only decreases by 16% to 25% when income is high. The effect of not having a permanent contract job on the probability of having a private plan also increases as families become older for all income levels. A similar result is found for the economic significance of not having a completed secondary education. While the probability for low and middle income drops by 18% to 26%, for high income families this drop is only by 7% to 11%. The economic effect of not living in an area with nearby private providers also turns to be very significant for low and medium income families, but it fades as income rises. The probability of having a private health drops by 40% to 50% for low and medium income families, but only 15% to 25% for high income ones. The economic effect on the probability of buying a private

health plan when there was no demand for health care services is only marginal for all families, independent of their age and income.

6. Adverse Selection and Moral Hazard

6.1 The Model

The model estimate uses as a proxy for individuals' health status an index based on the actual demand for health services. The results shown in the previous section suggest that there is an adverse selection bias to private insurers. Nevertheless, using the actual demand for health care services as a proxy for unobservable health status may be misleading because of moral hazard. Individuals who are already enrolled in a private health plan, with larger coverage and lower co-payments than the public security system, face a lower out-of-pocket price for demanding health care services, and hence consume more. Therefore, the actual demand for health services is simultaneously determined with the propensity of getting a private health plan.

Our attention now turns to the construction of a model that accounts for this joint endogeneity of health services demanded and the propensity of getting a private health plan. Because the index variable indicating the enrollment to a private health plan is discrete, we cannot imbed this analysis in a standard simultaneous equations framework. Instead, we use a latent variable model first discussed by Heckman (1978) and used by Bollen et al. (1995), and Norton et al. (1998a and 1998b) among others. Unlike the probit model presented in section 3, this model accounts for the simultaneity of continuous and discrete variables; in our case, the demand for health services (the health status index) and the enrollment in a private health plan. The model can be written as,

$$\Delta V_i = \delta_1 HS_i + Z_{1i}\beta_1 + \mu_{1i}$$
$$HS_i = \delta_2 \Delta V_i + Z_{2i}\beta_2 + \mu_{2i} \quad (6.1)$$

In this specification, the level of health services demanded is directly affected by the propensity of being enrolled in a private health plan, as well as by a set of exogenous variables Z_2. At the same

17

time, the level of health services demanded has a direct impact on the propensity of buying a private health plan, while it is also affected by a set of exogenously determined variables Z_1. To estimate this model we follow Madala (1983, Ch.8), who presents a two stage procedure based on the work of Nelson-Olsen (1978) and Amemiya (1979). This procedure requires writing reduced forms for ΔV_i and HS_i,

$$\Delta V_i = \Pi_1 Z + v_{1i}$$
$$HS_i = \Pi_2 Z + v_{2i} \quad (6.2\ )$$

where Z includes all the exogenous variables in Z_1 and Z_2. Because ΔV_i is not observed, and we only observed the index variable W which takes the value of 1 if $\Delta V_i > 0$, we can only estimate Π_1 / σ_1, where $\sigma_1^2 = Var(v_1)$. Hence, the first equation of the reduced form system (6.2) can be written as,

$$\Delta V_i^* = \frac{\Delta V_i}{\sigma_1} = \frac{\Pi_1}{\sigma_1} Z + \frac{v_1}{\sigma_1} = \Pi_1^* Z + v_1^* \quad (6.3)$$

Considering (6.2) and (6.3), we can rewrite (6.1) as,

$$\Delta V^* = \frac{\delta_1}{\sigma_1} HS + Z_1 \frac{\beta_1}{\sigma_1} + \frac{\mu_1}{\sigma_1} \quad (6.4)$$
$$HS = \delta_2 \sigma_1 \Delta V^* + Z_2 \beta_2 + \mu_2$$

The two stage procedure would be to estimate Π_2 by OLS, estimate Π_1^* by probit ML, estimate the second equation of (6.4) by OLS after substituting $\hat{\Pi}_1^* Z$ for ΔV^*, and estimate the first equation of (6.4) by probit ML after substituting $\hat{\Pi}_2 Z$ for HS. The estimable parameters in this model are

$\frac{\delta_1}{\sigma_1}, \delta_2 \sigma_1, \frac{\beta_1}{\sigma_1}, \beta_2, \sigma_2,$ and $\frac{\sigma_{21}}{\sigma_1}$. To estimate the asymtotic covariance matrix we define two

matrices, $H = (\Pi_1 \ J_2)$ and $G = (\Pi_2 \ J_1)$, where J_1 and J_2 are matrices consisting of 1´s and 0´s so

that $ZJ_1 = Z_1$ and $ZJ_2 = Z_2$. Given the estimable parameters in this model we define

$$\alpha_1' = (\frac{\delta_1}{\sigma_1}, \frac{\beta_1'}{\sigma_1}) \text{ and } \alpha_2' = (\delta_2\sigma_1, \beta_2'), \text{ and the covariance matrix of two stage estimates are,}$$

$$Var(\hat{\alpha}_1) = (H'V_0^{-1}H)^{-1} + d(H'V_0^{-1}H)^{-1}H'V_0^{-1}(Z'Z)^{-1}V_0^{-1}H(H'V_0^{-1}H)^{-1} \quad (6.5)$$

$$Var(\hat{\alpha}_2) = c(G'Z'ZG)^{-1} + (\delta_2\sigma_1)^2(G'Z'ZG)^{-1}G'Z'ZV_0Z'ZG(G'Z'ZG)^{-1} \quad (6.6)$$

where $c = \sigma_2^2 - 2\delta_2\sigma_{21}$, $d = \left(\frac{\delta_1}{\sigma_1}\right)^2 \sigma_2^2 - 2\left(\frac{\delta_1}{\sigma_1}\right)\left(\frac{\sigma_{21}}{\sigma_1}\right)$, and V_0 is the covariance matrix of the

probit ML estimate of Π_1.

6.2 The Covariates and Results

To estimate the model we need to define the covariates contained in Z_1 and Z_2. We keep as Z_1 the same covariates as Z in the previous section, except HS which is now endogenous. In Z_2 we include the set of exogenous variables determining the demand for health services. Health care services demanded, being a normal good, is expected to increase as income rises. We also expect that the older the individual the larger is his demand for health services. We also include the square of age to capture an eventual non linearity. The demand for health care services is also expected to be positive correlated with the age and sex composition of the individual and his dependents, so we include the perceived risk index. Finally, the demand for some health care services are expected not to be of first necessity, and may be postponed if the head of household does not have employment. Therefore, we also include a dummy if the head of household has permanent employment. The results for the estimation are presented in Table 4.

Table 4: Simultaneous Equation Estimation

Variable	Probit	OLS
Private health plan		0.17059
		(0.000)
Health status	0.053760	
	(0.000)	
Income	1.121379	-0.130585
	(0.000)	(0.006)
Income square	-4.9091E-08	
	(0.000)	
Age	-0.006732	0.0282
	(0.000)	(0.000)
Age-square		-0.000934
		(0.000)
Risk	-0.150922	1.2261
	(0.000)	(0.015)
Secondary education	0.743595	
	(0.000)	
Contract job	0.48631	
	(0.000)	
Permanent employment	0.1366	-0.07495
	(0.000)	(0.043)
Private providers	0.54298	
	(0.000)	
Constant	-1.010438	-1.9882E-07
	(0.000)	(0.121)
Observations	32 908	32 908
Log-Likelihood	-166491.9	-
Adj. R^2	-	0.11

Income is expressed in millions of pesos
p-values in parenthesis

What is interesting to note is that, even when we control for endogeneity, our health status variable is positively and statistically significant correlated with the probability of having a private health plan. The average sample probability of having a private health plan is 0.4014, but when there was no demand for health services this probability drops to 0.3427, i.e. by 14.6%. This evidence shows that the adverse selection bias on the purchase of a private health plan is much more important than the one estimated in the previous section, when we did not control for endogeneity.

The average sample probability of having a private health plan drops significantly when the individual does not have a permanent contract job, from 0.4014 to 0.2582, i.e. by 35.7%. When the individual has not completed secondary education, the probability is only 0.3297. When there are no

private providers nearby, the probability of being enrolled in a private health plan is only 0.2548, i.e. 36.5% lower.

In Table 5, we show the probability that baseline families have a private health plan and the marginal effects of the covariates. Although the economic significance of changes in covariates on the probability of having a private health plan are not very different from the ones estimated in a single equation model, the economic significance of the demand for health care services on the probability of having a private health plan turns out to be more important when we control for endogeneity.

Table 5: Marginal Effects for Family Types in Two Stage Estimation

Type of family	Marginal effects	Young family	Medium age family	Old family
Low income	Baseline	0.3440	0.2447	0.1745
	No permanent contract	0.2117	0.1378	0.0909
	Without sec. educ.	0.2768	0.1888	0.1298
	No private providers	0.2086	0.1354	0.0891
	No health services	0.2694	0.1648	0.1141
Medium income	Baseline	0.4078	0.3005	0.2212
	No permanent contract	0.2635	0.1782	0.1216
	Without sec. edu.	0.3358	0.2376	0.1687
	No private providers	0.2601	0.1754	0.1194
	No health services	0.3283	0.2104	0.1503
High income	Baseline	0.8161	0.7294	0.6428
	No permanent contract	0.6920	0.5839	0.4867
	Without sec. edu.	0.7611	0.6628	0.5695
	No private providers	0.6883	0.5797	0.4825
	No health services	0.7577	0.6325	0.5432

The probability of having a private health plan when there was no demand for health care services drops between 20% to 35% for low and middle income families. This drop in the probability of choosing a private health plan is greater for middle aged and older families when compared with young families. The drop in the probability for high income families is milder and it ranges from 7% for young families to 15% for older families. These results show that there is an adverse selection bias in the decision of buying a private health plan, which increases as families become older but decreases as income rises.

The second interesting finding is that the demand for health services is also positively and significantly correlated with the probability of having a private health plan. The estimated average

sample value of our index, constructed based on the actual demand for health care services is 2.9389. When households were not enrolled in a private health plan, the estimated index drops to 2.8721, i.e. by 2.3%. This drop in the estimated value of our index of health services demanded can be viewed as evidence that there is only a mild degree of moral hazard in the demand for health care services when households are enrolled in a private health plan. The economic importance of this behaviour differs by different family types. In Table 6, we show the percentage change in the demand for health care services when households do not have a private health plan.

Table 6: Average Health Services Demanded for Different Family Types Without a Private Plan

Family Type	Marginal Effect	Young family	Medium age family	Old family
Low income	Baseline	3.9658	5.2896	4.9881
	No private plan	3.9071	5.2479	4.9583
	Change (%)	1.5	0.8	0.6
Medium income	Baseline	3.9582	5.2806	4.9775
	No private plan	3.8886	5.2293	4.9397
	Change (%)	1.8	0.6	0.8
High income	Baseline	3.8966	5.2226	4.9182
	No private plan	3.7574	5.0981	4.8085
	Change (%)	3.5	2.3	2.2

Although the degree of moral hazard is mild, its extent increases with income. Richer families show a larger increment in their use of health care services. While young low-income families increase their use of health care services by only 1.5% when they are enrolled in a private health plan, they demand a 3.5% more services if they have a high income. An analogous situation is observed for middle aged and older families. While low-income older families increase their demand for health care services by only 0.6% when they are enrolled in a private health plan, the rich ones demand 2.2% more services. This non-linear relationship between the extent of moral hazard and income can be explained by the fact that, even though private health plans lower the out-of-pocket cost of using health services, lower income families have less disposable income for demanding health services.

The extent of moral hazard in using health care services is larger for young families compared with middle aged and older families. The percentage increase in the use of health care services for

young families doubles when compared with middle aged and older families, when they have low income. This increase in the use of health services by young families is even larger for medium income families, but is less significant for high income families.

7. Conclusion

This paper studied the determinants of the decision to buy a private health plan or to contribute to the public health insurance system, in a health care sector that has a dual character. It also studied whether private insurers face a bias in terms of enrolling people with poor health status, and whether having a private health plan, offering better access to private health care providers with lower co-payments, induces a greater use of medical services.

Using data from the CASEN 1996 survey, we find that the probability of buying a private health plan is positively correlated with the level of income, of having a permanent contract job, living in a district with a large urban area, and having completed secondary education. We also find that this probability decreases as families become older, and when there is a larger proportion of females of fertile age. When the sample mean income doubles, the sample average probability of having a private health plan increases by more than 37%. People with permanent contract jobs also are more likely to have a private health plan, but this effect is larger for high-income and young families than for low-income and older ones. Having finished secondary education also increases the probability of having a private health insurance. This educational effect turns out to be more significant for low and middle income levels. Living in a district with a large urban area greatly increases the probability of buying a private health plan. This effect is quite large for low and middle income families, but fades as income rises.

Using a simultaneous equations framework, we also find evidence of a selection bias on the decision of buying a private health plan. People with poor health status are more likely to buy a private health plan. This bias is shown to be more important for low income and older families. Old

and low income families which have demanded health care services show an increase in their probability of having a private health plan by almost 53% with respect to one who has not demanded medical services. This adverse selection effect is less important as income increases. Richer families show a greater probability of having a private health plan and this probability is less sensitive to the fact of having used health care services.

Finally, we also find that the extent of moral hazard in using health care services is mild. People enrolled in a private health plan, with a greater coverage than the public health insurance, increase their use of health care services but not to a large extent. The average use of health care services for the sample increases by only 2.3% when people are enrolled in a private health plan. This behaviour is more important for high-income and young families. While young low-income families increase their use of health care services by only 1.5% when they are enrolled in a private health plan, they demand 3.5% more services if they are high-income. An analogous situation is observed for middle aged and older families. While low income old families increase their demand for health care services only by 0.6% when they are enrolled in a private health plan, the rich ones demand 2.2% more services.

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Appendix 1

Relative Prices in Private Health Insurance Plans for 1996

Age	Male Affiliate	Female Affiliate	Male Dependent	Female Dependent
Age≤18 years	-	-	0.54	0.54
18≤Age≤39	-	-	0.79	1.5
Age≤40 years	1	1.6	-	-
40 ≤Age≤ 54	1.3	1.5	1	1.32
55 ≤Age≤60	2.3	2.3	1.79	1.79
Age ≥ 61	3.6	3.6	2.7	2.7

Source: Authors elaboration based on actual prices from a major insurer