EVIDENCE ABOUT THE MORAL HAZARD IN THE ECUADORIAN HEALTH SYSTEM

Mercy Raquel Orellana Bravo, Juan Andrés Piedra Peña, Luis Santiago Sarmiento Moscoso

University of Cuenca; Research Group in Regional Economics, University of Cuenca;

Research Group in Regional Economics, University of Cuenca;

Research Group in Regional Economics.

mercy.orellana@ucuenca.edu.ec, juan.piedra@ucuenca.edu.ec,

santiago.sarmiento@ucuenca.edu.ec

Abstract: *The aim of this study is to estimate the presence of moral hazard in the Ecuadorian health system, understood as an over-utilization of it. For this, a binomial logit model, which measures the probability of use of health services between insured and uninsured people is used. The results show evidence of moral hazard for individuals who are insured, mainly for adults over 60 years. In addition, it is noted that when having extra expenses that are not covered by insurance, insured people tend to reduce the use of medical services.*

JEL classification: I11, I18, D82, H55.

Keywords: Moral Hazard, asymmetric information, health insurance, health system, health services.

1. INTRODUCTION

Among the main problems that could arise in the market for health insurance and services, which would not allow efficient operation, are the phenomena known as moral hazard and adverse selection. The first is due to the fact that risk coverage exempts individuals from payment in the event of an accident and, therefore, incentives are generated for an "overuse" of medical services, which results in an increase in medical expenses, whether public or private, resulting in higher costs to those socially necessary to treat a disease, which could trigger an increase in premiums in response to higher expected expenses.

On the other hand, there would be asymmetries of information conditioned to the health state of individuals, since they know more about their situation than the health company, and, therefore, generate an adverse selection process of the type of insurance chosen by forming a biased sample of the universe of people insurable. This will lead to problems such as inadequate selection of insurance plans, a suboptimal distribution of risk among the insured population, and finally under-coverage (or lack of coverage) for potentially risky individuals marginalized from the market.

Among the main studies that report a moral hazard in the demand for health services, we have Cameron et al. (1988), Newhouse (1993); and Sapelli and Vial (2003). Regarding literature on adverse selection in various health plans analyzed, we have Cameron et al. (1988), Bertranou (1998); and Sapelli and Vial (2003). For Ecuador, there is no academic-empirical literature concerning this subject as far as we can tell.

In Ecuador, the health insurance system has a dual character. On the one hand, there is the public insurance system of the Ecuadorian Institute of Social Security (IESS), which is mandatory for dependent employees, where individuals contribute a proportionate amount to the remuneration earned and receive health services when they need it.[1] On the other hand, there are private insurance systems which offer different schemes of insurance, however, the purchase of these is not mandatory, the system charges a premium, which is proportional to the consideration for risk coverage by the health service used. It is important to note that the public health service covers the expenses not only of the insured but also of all children under 18 years old. The complete coverage feature presented by public health insurance makes it possible to presume the existence of moral hazard in the system.

In this paper, we aim to estimate the presence of moral hazard in the Ecuadorian health system, understood as an overuse of services when comparing the use among those who have compulsory public insurance against individuals who do not have it. Additionally, the effect of the variables associated with the characteristics of individuals and the system on the probability of using health services is analyzed and measured. The results can bring important implications of public and health policy, since they would demonstrate that given the significant existence of asymmetric information in the system, it would be exposed to strong

---

[1] The contribution is divided in 9.45% paid by the employee and 11.15% paid by the employer. Health coverage is complete regardless of illness, and has no co-payments.

problems of inefficiency in the market, resulting in a loss for society (Pauly, 1968; Rothschild and Stiglitz, 1976).

The outlay of this paper is as follows. First, we describe the Ecuadorian health insurance system, both public and private, as well as the main empirical data. We give a brief compilation of the main empirical studies on the subject. Through the health service demand model developed by Cameron et al. (1988) and Cameron and Trivedi (1991), we carry out an analysis of the factors that determine the choice of the health system's use (or self-medication) of the individual when she presents a disease, using a logit model, which allows us to analyze the probability of using the health system using the ENSANUT database.[2] Next, we present the main results of the model and estimate the presence of a moral hazard or "overuse" in the Ecuadorian health system. Finally, we present the most relevant conclusions.

2. THE ECUADORIAN HEALTH INSURANCE SYSTEM.

In Ecuador, a two-way analysis can be developed for the health insurance system, the first covering private health insurance, and the second for the public health system (IESS).[3]

The people who are affiliated to compulsory public insurance are those who work in a dependency relationship, however, it may be the case that despite having a work relationship, the individual does not have compulsory public insurance due to problems of informality, an important feature of the labor market in Ecuador.[4] On the other hand, the IESS has experienced in the last decade a significant increase in the number of beneficiaries. In fact, in 1978 the system had 571 thousand policyholders, growing at an average annual rate of 7% between 1978 and 2014, currently owning 4302 thousand insured people. It is also interesting to note that the accelerated rate of growth in the last five years has reached an average of 10%, mainly due to the new constitutional reforms in social security.[5] From an economic

---

[2] National Health and Nutrition Survey - ENSANUT - ECU", which was elaborated by the Ministry of Health in coordination with the National Institute of Statistics and Censuses, during the years 2011-2013.

[3] It also includes the Peasant Health Insurance, the Social Security Institute of the Armed Forces (ISSFA) and the Social Security Institute of the National Police (ISPOL).

[4] According to the National Institute of Statistics and Censuses (INEC), by December 2013 there were 40% of people working under informality in Ecuador.

[5] Article 34 of the Constitution of Ecuador of 2008 establishes that the State shall guarantee the full exercise of the right to social security. As a result, a number of reforms have been carried out, such as coverage of children under the age of 18 (Article 102, Social Security Law) or deprivation of liberty for employers who do not affiliate workers within a maximum period of 30 Days (Art. 244, Organic Comprehensive Criminal Code).

perspective in 2014, this institution collected contributions of approximately $ 429 million, or 0.04% of GDP for that year.

As for the private insurance market, two types of companies that are engaged in this activity can be distinguished, due to the legal nature of private insurance. First, we have prepaid medical companies,[6] which are regulated by the Superintendency of Companies;[7] these offer very diversified contracts, which can cover plans for young people, adults, seniors, as well as corporate or family plans. In the same way, these plans offer different rates, ranging from a minimum of approximately $8 per month to a maximum of approximately $ 400 (depending on the plan and the insurance company). On the other hand, there are insurance companies through policies that include health coverage. These companies are regulated by the Superintendency of Banks and Insurance.[8] With regard to the number of insured people, there are no statistics on these entities, however, by the year 2014, they report revenues close to 96 million dollars.

Tables A1 and A2 of the appendix provide summary information on the general benefits each type of insurance offers.

2.1. Data

In this paper, we use the ENSANUT 2013 survey. According to which, 33% of the total population benefits from public health insurance, 1.17% have private insurance, 2.4% have both types of insurance and 63.43% of the population do not have insurance. Thus, according to these figures, there would be approximately 9 million Ecuadorians without health protection.[9] According to the socioeconomic categorization, it is also reported that coverage of

---

[6] All those services whose object is the acquisition of access to medical or health benefits in advance and that do not constitute either formally or materially services or modalities of medical insurance or life insurance (Law of Medical Insurance and Prepaid Medicine).

[7] Prepaid medicine is systems or plans, but not policies. Unlike a health insurance policy, the company that provides the service of prepaid medicine is obliged to provide the consultation service that is carried out at the express will of the user, without requiring that she is ill, as long as she wishes through potestative action with purely preventive purposes. It is regulated by the Superintendence of Companies, which is the "Technical body responsible for monitoring and controlling the organization, activities, operation, dissolution and liquidation of companies and other entities".

[8] A health insurance is a policy, which covers economic damages as a result of illness or accident, allowing access to treatments intended to recover health, diagnose or alleviate effects of illness, the insured can benefit only if the event that is detailed in the policy happens. It is regulated by the Superintendency of Banks and Insurance, which is the "Technical body responsible for monitoring and controlling the transparency and effectiveness of financial system institutions, private insurance and social security".

[9] According to INEC, by the year 2013 there were about 15 million inhabitants in Ecuador.

all types of insurance increases as income increases. Public insurance reports a 41.7% affiliation in individuals with higher resources, located in the last quintile, compared to 9.4% of the individuals located in the first quintile. On the other hand, among the total of workers, 64.71% are dependent and 35.29% are independent.

Table 1 shows the characteristics of individuals who presented health problems in the 30 days prior to the survey and who attended a medical center or were self-medicated, divided in relation to the type of health insurance they have. According to the data reported, the visit to a health center (public or private) increases with income in individuals who have some type of insurance, that relationship is not conclusive for people who do not have insurance, On the other hand, the visit to a medical center increases according to the age, regardless of whether it is insured or not, in addition, the visit is greater for women and for individuals of indigenous race. This could happen because the majority of indigenous people are insured under peasant insurance, the same ones that pay low quotes and have high coverage, also, no significant difference is found according to the area of origin of the individual, be it urban or rural.

Table 1: Distribution of individuals who self-medicated or attended a medical center, by individual characteristics and by type of insurance

	Have a health insurance		Do not have a health insurance	
	Self-medicated	**Attended a hospital, center, medical subcenter**	**Self-medicated**	**Attended a hospital, center, medical subcenter**
Health condition				
Excellent	40.64%	59.36%	49.78%	50.22%
Very good	34.27%	65.73%	40.65%	59.35%
Good	35.69%	64.31%	43.24%	56.76%
Regular	34.42%	65.58%	43.92%	56.08%
Bad	22.90%	77.10%	40.30%	59.70%
Age				
< 40	35.94%	64.06%	43.55%	56.45%

40-60	34.49%	65.51%	46.10%	53.90%
>60	23.20%	76.80%	33.41%	66.59%
Income Group				
quintile 1	35.15%	64.85%	44.03%	55.97%
quintile 2	34.83%	65.17%	42.07%	57.93%
quintile 3	37.90%	62.10%	43.64%	56.36%
quintile 4	36.88%	63.12%	44.20%	55.80%
quintile 5	30.69%	69.31%	42.34%	57.66%
Gender				
Female	31.95%	68.05%	40.39%	59.61%
Male	37.44%	62.56%	47.41%	52.59%
Ethnicity				
Indigenous	28.29%	71.71%	41.64%	58.36%
Afro-Ecuadorian	43.52%	56.48%	43.09%	56.91%
Black	39.48%	60.52%	42.84%	57.16%
Mulatto	35.66%	64.34%	41.78%	58.22%
Montubio	37.18%	62.82%	47.41%	52.59%
Mestizo	34.45%	65.55%	43.31%	56.69%
White	36.00%	64.00%	39.32%	60.68%
Other	31.99%	68.01%	30.65%	69.35%
Area				
Rural	33.45%	66.55%	40.68%	59.32%
Urban	35.21%	64.79%	44.36%	55.64%

Source: Own elaboration based on data from ENSANUT.

3. EMPIRICAL LITERATURE

Since authors like Arrow (1963) and Pauly (1968) Introduced the first studies that indicated the presence of moral hazard in the use of health services and how it influenced the behaviour of agents, numerous studies have been developed that aim to analyze this phenomenon in the behaviour of agents in the markets. In this sense, many of these studies have been done with cross-sectional data of agents, who, having different types of insurance, perceive a lower cost

of medical services, leading to an overuse of them (moral hazard). Studies like Manning et al. (1987) and Chiappori et al. (1998) are based on experimental data and find the presence of moral hazard in the population samples of France. In addition, the second paper uses a probit panel model to measure the decision to use medical visits in two sub-samples for two different years, observing that with a 10% increase in the co-payment rate there is no evidence of moral hazard in visits to medical offices, but for medical visits to the home, because non-monetary costs (time of arrival, waiting time, etc.) are lower.

Cameron et al. (1988), Demonstrate with dichotomous variables and count data models that moral hazard influences when measuring the demand for medical services in Australia, where, the insurance with the highest coverage shows the highest positive effect (in comparison with others insurance analyzed) ranging between 12 and 21 percentage points,[10] But these effects vary for services where net prices fluctuate based on the type of insurance; Results consistent with Zweifel and Manning (2000), Who based on various empirical studies concerning moral hazard, find that the use of medical care will increase with insurance coverage, provided that co-payments and "out-of-pocket" expenses are not too large.

Recent work like Bajari et al. (2014) and, Keane and Stavrunova (2016) introduce new econometric methodology and semi-parametric approaches to measure the impact of moral hazard on the use and spending of medical services. The former finds that an insured person would be spending 40% more on medical services than if they did not have any type of insurance. While the latter study the Medigap insurance increases medical spending by 24%, with relatively greater effects for people in good health.[11]

At the Latin American level, there are few academic papers that study this effect. Some of them like Sapelli and Vial (2003) and Höfter (2006) for Chile. In the first paper, the authors used a negative binomial counting data model to measure the use of medical services in dependent and independent workers. They found a percentage of overuse between 4% (private insurance) and 18% (public insurance) for dependent workers, and 43% (private insurance) and 61% (public insurance) for self-employed workers, showing clear evidence of moral hazard, especially in the use of public insurance. The second paper uses a censored Tobit

---

[10] By dealing only with the rich population and correcting self-selection using instrumental variables, this effect is even greater.

[11] This is a type of insurance offered in the United States by private insurers to cover certain services that other insurance does not cover.

model to measure the use of medical services in private insurance. They note that private insurance is more attractive for outpatient medical services, but not for inpatient services because they entail greater expense, which can be covered by public insurance, this effect, they say, would be showing evidence of moral hazard.

4. THEORETICAL MODEL

The theoretical basis we use was developed by Cameron et al., (1988) and Cameron and Trivedi (1991). Consider representative consumer, which has an intertemporal utility function (two-periods) under uncertainty and takes the form of $U[C_0, C_1, H(e, s \backslash A, B)]$, where C denotes the consumption in the different periods and H denotes the health state measured as equivalent income. Both U and H are growing in their arguments. In addition s is the uncertain health state, the same that will affect the demand for health services denoted by a vector e of K dimensions. A refers to the consumer attributes vector (could include household demographic variables) y B To the attribute of insurance vector. $H(e, s \backslash A, B)$ Can be interpreted as a function of health production with inputs e in the health state s.

The source of uncertainty of the model is the unknown health status (s). The distribution of subjective probability of s conditional to A, and independent from the health insurance chosen, is denoted by $\pi(s/A)$. The consumer transfers purchasing power between the two periods using a risk-free asset whose price is p_a, which is equal to $1/(1+r)$, r is the market interest rate. To maximize the expected utility the consumer chooses between a discrete quantity J of health insurances. The problem facing the consumer is:

$$máx \ EU_j[C_0, C_1, H(e, s \backslash A, B)] \hspace{3cm} (1)$$

$$[j, C_0, C_1, a, e]$$

Subject to a three-part budget constraint

$$Y_{0j} + P_j = Y_0,$$

$$C_0(s) + a(s) = Y_{0j}, \hspace{4cm} (2)$$

$$C_1(s) + p_j e(s) = Y_1 + (1+r)a(s).$$

We assume that income in each period is independent of s. The first part of the restriction assigns the current period income to the payment of the insurance premium, P_j, And the "discretionary" income, Y_{0j}; The second restriction assigns the discretionary income to the current contingent consumption, whose price p_0 Has been standardized to the unit, and to the

assets, $a(s)$; The last equation allocates future income, Y, plus the value of the assets, to the future contingent consumption and net expenditure on health services $p_j e(s)$, where p_j denotes the price vector under the insurance j.

The solution to the optimization problem follows a dynamic programming approach. Optimizing demand values, the variables $C_0, C_1, a\ y\ e$ Are obtained conditioned to the choice of j And to each possible realization of the state s.

Given that the purpose of the present study is to estimate the presence of moral hazard in the Ecuadorian health system, by determining the use of medical services, we make a description of the demand for these services exposed in Cameron et al. (1988), more than the indirect utility offered by the choice of some type of insurance. In this work, we adopt a functional form for the utility function,[12] and the following function of demand for services is obtained under certain assumptions:

$$e_k(s\backslash j) = \alpha_k(s)(1 + \theta(s)^{-1}) \exp\left[log(1+\sigma) - logp_{jk} + log[Y_1 + (1+r)Y_{0j}]\right] \qquad (3)$$

Where σ Is the risk aversion coefficient, θ Is a relative risk aversion coefficient (with respect to income) And the subscript k, Denotes the health service used. The expected value, $E[e_k(s\backslash j)]$, is taken with respect to the distribution, $\pi(s\backslash A)$, of the health status; it is also assumed that $\int \alpha_k(s)(1 + \theta(s)^{-1})\pi(s\backslash A) = \exp(Z'\beta_k + e_k)$. On the other hand, since income also enters a priori into the distribution $\pi(s\backslash A)$, simply enters as another regressor.

$$E[e_k(s\backslash j)] = \exp(Z'\beta_k - logp_{jk} + e_k) \qquad (4)$$

5. EMPIRICAL METHODOLOGY.

The dependent variable of the model is the attendance to a medical center or self-medication since the individual was sick in the last 30 days before the survey. The use or non-use of the health system will depend on the type of insurance that the head of the family has. We use the model to detect the overuse of the system associated with the type of insurance that is owned.

---

[12] $U = \left[C_0 C_1^{1-\alpha} H(e, s\backslash A, B)^{\sigma+1}\right]$. Where σ is a constant coefficient of risk aversion, where for a risk adverse consumer $-1 < \sigma < 0$, and the health production function is $H(e, s\backslash A, B) = \prod_k e_k^{\alpha_k(s,A,B)}$. Where $\alpha_k(s, A, B) \geq 0$ depends on the health state **s**, of the attributes A and the characteristics of the choice j, denoted by B, In addition the subscript k, denotes the health service used.

To estimate the utilization equation (probability of attending a medical center or self-medicating), we use a binary choice model, since the dependent variable takes the value of 1 if the individual attended a medical center or 0 she self-medicated. The model allows us to find different marginal effects according to the population segment analyzed.

The model that explains the probability of use of the health system takes the following functional form:

$$E[e_k(s\backslash j)] = \exp(Z'\beta_k - logp_{jk} + \varepsilon_k)$$

where:

e_k is the demand for medical service or self-medication, the subscript j, refers to the type of insurance that the individual owns , Z is the vector of individual and household characteristics that the individual possesses, $logp_{jk}$ s the cost of the decision made by the individual and ε_k Is a heteroscedastic error term. To correct this error it is assumed that ε_k follows a logistic probability distribution. Following Grenee (2012) This assumption leads to a probability model where e_k follows a binomial logit distribution of the form:

$$Prob(e_k(s\backslash j) = 1|\text{x}) = \frac{\exp(x'\beta)}{1+\exp(x'\beta)} \tag{5}$$

Where $e_k(s\backslash j)$ can take the values of:

$$e_k(s\backslash j) \begin{cases} 1, \text{In case of attending a medical center} \\ 0, \text{In case of self} - \text{medication} \end{cases}$$

x': Represents the set of individual characteristics Z and the cost of the decision taken $logp_{jk}$.

5.1. Measuring moral hazard. Overuse of health services

The expected value of the system overuse given that the individual has a type of health insurance is the difference between i) the expected probability of using the system given that the individual has public insurance and ii) the expected probability of using the system given that the individual does not have insurance.

Moral hazard (compulsory health insurance) = $Prob(e_k(s\backslash j = 1)) - Prob(e_k(s\backslash j = 0))$

Where j=1 represents individuals who have compulsory public insurance and j=0 to individuals who do not have such insurance.

5.2. Independent Variables

This study considers those people who responded to have had a disease or accident in the last 30 days and did not require hospitalization, this way we try to evaluate individual behavior for medical events that allow them to decide to use health services or self-medicate, for hospitalization cases this decision may not be in the hands of each individual. Thus, to study the use of the health system, we took into account variables of income and expenditure, some social, demographic and health variables of individuals, as well as a dummy variable that shows if the person has a compulsory health insurance.

The income variable refers to the total income of the household, which was obtained based on the gross income that each individual receives. We expect that the effect of this variable has a positive relation with respect to the use of the health system, since individuals with more income will make greater use of them, however, a quadratic term is included because the income intervenes both in the demand function, as in the probability of choice, given the risk aversion assumption, we expect from the quadratic term a negative sign that is related to a decreasing Engel curve (Gertler, Locay, and Sanderson, 1987; Cameron and Trivedi, 1991).

On the other hand, the expense takes into account the payment made by individuals either in the health system or at the time of self-medication, i.e. payments for services received, for medicines, tests, etc. We expect that this variable has a negative relation with the use of the health system and is used as a proxy to measure the price effect. We include a variable that measures the interaction of people who have compulsory public insurance and could incur in extra expenses, thus demonstrating that the demand for medical services would increase with coverage as long as the extra costs incurred by individuals do not increase (Zweifel and Manning, 2000).

We include socio-demographic variables: gender, the area of residence, the level of schooling, age, employment status, marital status and ethnicity. The inclusion of gender is based on the assumption that women make more use of medical services, particularly during their reproductive years (Höfter, 2006). As for the area, urban areas are expected to have a positive effect on the use of the system, since they are more densely populated areas and have better access to health centers, medicines, etc. For schooling, we expect a positive sign, basically because more educated individuals have a greater capacity to evaluate their current state and the options that insurance offers them. Likewise, age inclusion is born from the hypothesis

that medical needs increase with age, younger individuals or families tend to be less wealthy, but healthier (Van de Ven and Van Praag, 1981; Höfter, 2006).

With respect to the influence of work status, we initially expect that people who have a formal job, and therefore have insurance, make greater use of the services offered, however, this decision may also be influenced by the opportunity cost of time: seeking and obtaining medical care costs time, which can be used for consumption or work (Zweifel and Manning, 2000). In relation to the marital status, a positive effect is expected between married people (or free union) and the use of medical care, a fact that would also be related to the care and coverage of the children. Finally, the ethnicity is included to know whether indigenous and montubios (who would be mostly insured by the peasant insurance) would be overutilizing the system since the insurance covers almost in their totality, at a minimum cost.

The variable that allows to estimate the presence of moral hazard in the Ecuadorian health system is a dummy that takes the value of 1 if the person has compulsory public insurance and 0 otherwise.[13] We expect a positive and significant sign because with this we can demonstrate that when being insured and perceive lower costs in health care, individuals would be overutilizing the system.

Finally, we include variables that reflect the health status of individuals, to control their impact on the use of the health system, since a severe illness or a progressive deterioration of health could mean a greater probability of its use. We include illnesses or accidents that were attended or self-medicated in the last 30 days and a variable that controls if this disease has been affecting the person for more than a week. The sign of these variables will vary as to the severity of the disease, in principle, it is expected that chronic diseases or those that require constant or urgent medical attention present a positive relation with the formal use of the health system.

6. RESULTS

According to the model, we analyzed the existence of overuse of the Ecuadorian health system among individuals who presented a health problem, according to whether they have

---

[13] Voluntary insurance is not included in compulsory public insurance, since the decision to get the insure would be in the hands of each individual. In addition, those who have private insurance and more then one insurance are excluded from the sample, whit this, we attempt to control the possible self-selection bias that could be generated in this variable.

compulsory health insurance or not. First, we estimate a logit model with the purpose of verifying the effect of individual, household and system's variables, on the probability of using the health services (demand) and then we calculate the marginal effects of the variables. The signs of the estimated coefficients are consistent with the theory, except for certain variables related to the type of disease that were not significant (regression results are shown in Table A4 of the appendix)[14].

Table 2 shows the marginal effects related to the probability of using the system. In the first column, the average values of the variables are replaced using the whole sample, column 2 and 3 contains the average values of the first and fifth quintiles respectively. The use of the health system is positively affected by income in the whole sample; however, the negative sign of the squared income is interesting, since this shows that although the probability of attending a medical center increases as income increases, it begins to decrease for incomes in the fifth quintile, so that from income greater than 13 thousand dollars per household the probability of using the system decreases, this could be explained by the high opportunity cost of the time it takes for these people to wait to be taken care of. Thus, income, in spite of its positive effect, has a low impact on the system demand, results that are consistent with Cameron et al. (1988) and Höfter (2006) who find that the income seems to have a stronger effect when choosing a type of insurance than at the time of using the services it provides.

Table 2: Average marginal effects and by income quintiles.

	Average	**Quintile (1)**	**Quintile (5)**
Income	0.00280***	0.00279***	0.00274***
Income^2	-0.0000216***	-0.0000215***	-0.0000211***
Expenditure	-0.00773***	-0.00770***	-0.00755***
Expenditure_insurance	-0.00680***	-0.00677***	-0.00664***
Male	-0.0459**	-0.0458**	-0.0449**
Age_male	-0.00102**	-0.00101**	-0.000995**
Area	-0.0583***	-0.0586***	-0.0562***
Area_insurance	0.0422**	0.0418**	0.0415**

---

[14] The model was run in the Stata 13 program with robust variances to correct possible violations in the assumptions, model specification and fit testing, multicollinearity tests and adjustment of Pearson errors and deviation.

Schooling	0.00507***	0.00505***	0.00495***
Age 40-60	0.0414***	0.0412***	0.0405***
Age>60	0.125***	0.124***	0.121***
Age(>60)_insurance	0.0492	0.0489	0.0478
Employment	-0.0473***	-0.0472***	-0.0459***
Marital	0.0251***	0.0250***	0.0246***
Indigenous	0.0267*	0.0266*	0.0260*
Montubio	-0.0447**	-0.0445**	-0.0439**
Public_insurance	0.0508***	0.0504***	0.0500***
Illnes_respiratory	-0.212***	-0.212***	-0.208***
Illnes_cardiovascular	0.0513*	0.0510*	0.0498*
Illnes_digestive	-0.0176	-0.0176	-0.0173
Illnes_skin	0.121***	0.120***	0.117***
Illnes_eyes	0.0665*	0.0662*	0.0645*
Illnes_neuromuscular	-0.0826***	-0.0824***	-0.0815***
Illnes_dental	0.111***	0.110***	0.107***
Illnes_ pregnancy	0.394***	0.390***	0.367***
Illnes_ psychological	-0.103**	-0.103**	-0.102**
Illnes_bones	-0.00356	-0.00355	-0.00348
Illnes_fracture	0.148***	0.147***	0.142***
Illnes_ chronic	0.134***	0.133***	0.129***
Illnes_female	0.00182	0.00181	0.00178
Illnes_male	0.0692*	0.0688*	0.0670*
Illnes_traditional	-0.249***	-0.249***	-0.250***
Duration	0.0969***	0.0966***	0.0944***
N	17746		

Source: Own elaboration based on data from ENSANUT

Age shows an increasing probability in the use of medical services, that is, people who use the system the most is the group older than 60 years, this is consistent with predictions of moral hazard in terms of observable risk variables, clearly a young person tends to be more self-medicated by the perception of being in good health. The differential impact of gender on the

probability of using the system is clear. The negative and statistically significant coefficient for the male gender indicates that females are more likely to use the system. This may be due to the effect of the non-inclusion of gender and age-differentiated premiums in compulsory insurance, thus, women of childbearing age will use the system more intensely, an effect reinforced by the negative coefficient of interaction between age and Gender, demonstrating that women use the system more than men in any age range. This effect is also studied by Sindelar (1982) and Höfter (2006), the first author shows that when system use is measured in monetary expenditure or in a physical quantity, women on average tend to use more health care services even after they are checked for gynaecological or obstetric illness severity.

Another variable of great interest is the price of the use of the system, it has the expected sign and shows that a 10% increase in spending decreases the probability of using medical care by 0.07 percentage points, showing an inelastic relationship. Obviously, this conclusion is in accordance with the theory since the introduction of a co-payment causes a decrease in the use of the system. In addition, when analyzing by income quintile, we can see that the response to spending is more elastic in the poorest sector.

The coefficient on the marital status is significant and positive, in this sense it is reasonable to expect individuals to become more risk-averse once they are married or in a free union. Likewise, individuals with higher educational attainment are less likely to self-medicate, which confirms the hypothesis that higher education can better assess health status.

Health status and disease type are clearly the most significant factors in explaining the use of the health system, rather than socioeconomic characteristics, the results emphasize, as expected, that people will make a bigger use of the system when the disease that afflicts them is more serious, or the longer they carry with them, results that are in line with what is reported by Cameron et al. (1988).

The important variable for the analysis is whether or not to have public insurance, which allows analyzing whether there is moral hazard in the use of the health system, the sign is positive and significant, this shows that people with public insurance increase the probability of using the system in 0.05 percentage points, if we analyze other iterations it is evident that if the person has insurance but must also pay for their use, it decreases the probability of going to a medical center, this shows that if the coverage is complete and has no co-payment, individuals tend to overuse the system. In addition, it is interesting the greater use of people

over 60 who have insurance, they have a probability of use greater by 0.05 percentage points than those who do not.

6.1. System Overuse (Moral Hazard)

Clearly, the parameters obtained were significant and according to the theoretical predictions, however, it is interesting to analyze whether there is evidence of moral hazard in the different groups of analysis.

Table 3: Estimated values of the probability of using the health system, by analysis groups.

Condition	Insured	Non-insured	Difference (moral hazard)	Significance (p-value)
Indigenous older than 60 years	0.7658	0.6442	0.1216	0.000
Indigenous under 60 years	0.6477	0.5557	0.0920	0.000
Montubio older than 60 years	0.7094	0.5747	0.1347	0.000
Montubio under 60 years	0.5785	0.4829	0.0957	0.000
Mestizo older than 60 years*	0.7453	0.6184	0.1270	0.000
Mestizo under 60 years	0.6220	0.5282	0.0886	0.000

Source: Own elaboration based on data from ENSANUT

* In the condition of mestizo we include different ethnicities (mestizo, mulatto, white, etc.), however, mestizo ethnicity represents 92% of the total of this condition.

Table 3 shows the probability of use for an insured and uninsured individual, and it is evident that the expected value of moral hazard in the use of the medical system is positive for all cases analyzed. The expected value indicates that, on average, insured individuals are 12% more likely to use the medical system, that probability increases with age and varies according to the self-defined ethnic group. Results that are in agreement with those of Sapelli

y Vial (2003), who find a greater presence of moral hazard in public insurance, nevertheless use a counting data model and show that insured workers use the system more than twice as much as uninsured employees. This result goes according with the fact that insured workers have access to almost complete coverage and should not make any co-payments.

Therefore, according to the results reported, the public health insurance system would show an overutilization of the system that would cause higher costs to those socially necessary to treat a disease, which could trigger an increase in the percentage of contribution in response to the higher expected expenses.

7. CONCLUSIONS

In this paper, we seek to estimate the presence of moral hazard in the Ecuadorian health system, where there is no academic-empirical literature regarding this subject. The results show evidence of the existence of such, from which the following can be derived.

The use of the health system increases with increasing income, however, it begins to decrease from higher incomes, included in the fifth quintile, in addition, the effect it has on the dependent variable is on average quite low, which coincides with the empirical literature.

Another important variable is the price that has the use of the system, which is evidenced, has a negative impact on it and much stronger than the income, because, according to the literature, the use of the system will increase with the level of insurance coverage, as long as the extra expense to be realized is not too high.

In general, the socio-demographic variables included are highly significant at the time of making the decision to use medical services. They mainly highlight the effects that people have on the age and gender of the person.

Finally, the presence of moral hazard or "overuse" of the system by individuals with compulsory public insurance is evidenced, since it is estimated that an insured person would have a probability of 67% using the system as opposed to 56% probability of use if health insurance is not available, and the presence of moral hazard is especially evident for adults over 60 (regardless of ethnicity).

REFERENCES

1. Arrow, K. J. (1963). *Uncertainty and the Welfare Economics of Medical Care*. The

American Economic Review, 53, 941–973.

2. Bajari, P., Dalton, C., Hong, H., Khwaja, A. (2014). *Moral hazard, adverse selection, and health expenditures: A semiparametric analysis*. The RAND Journal of Economics, 45, 747–763.

3. Bertranou, F. (1998). *Health Care Services Utilization and Health Insurance Coverage: Evidence from Argentina*. Revista de Análisis Económico – Economic Analysis Review, 13, 25–52.

4. Cameron, A., Trivedi, P. K. (1991). *The role of income and health risk in the choice of health insurance*. Journal of Public Economics, 45, 1–28.

5. Cameron, A., Trivedi, P., Milne, F., Piggott, J. (1988). *A Microeconometric Model of for Health Care the Demand and Health Insurance in Australia*. Review of Economic Studies, 55, 85–106.

6. Chiappori, P., Durand, F., Geoffard, P. Y. (1998). *Moral hazard and the demand for physician services: First lessons from a French natural experiment*. European Economic Review, 42, 499–511.

7. Gertler, P., Locay, L., Sanderson, W. (1987). *Are user fees regressive? The welfare implications of health care financing proposals in Peru*. Journal of Econometrics, 36, 67–88.

8. Grenee, W. (2012). Econometric Analysis (7th ed.). New York, NY: Pearson Education.

9. Höfter, R. H. (2006). *Private health insurance and utilization of health services in Chile*. Applied Economics, 38, 423-439.

10. Keane, M., Stavrunova, O. (2016). *Adverse selection, moral hazard and the demand for Medigap insurance*. Journal of Econometrics, 190, 62–78.

11. Manning, W., Newhouse, J., Duan, N., Keeler, E. B., Leibowitz, A. (1987). *Health Insurance and the Demand for Medical Care: Evidence from a Randomized Experiment*. The American Economic Review, 77, 251–277.

12. Newhouse, J. (1993). *Free for all?: lessons from the RAND health insurance experiment*. Harvard University Press.

13. Pauly, M. (1968). *The Economics of Moral Hazard: Comment*. The American Economic Review, 58, 531–537.

14. Rothschild, M., Stiglitz, J. (1976). *Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information*. The Quarterly Journal of Economics, 90, 629–649.

15. Sapelli, C., Vial, B. (2003). *Self-selection and moral hazard in Chilean health insurance. Journal of Health Economics*, 22, 459-476.

16. Sindelar, J. L. (1982). *Differential Use of Medical Care by Sex*. Journal of Political Economy, 90, 1003–1019.

17. Van de Ven, W., Van Praag, B. (1981). *The demand for deductibles in private health insurance*. Journal of Econometrics, 17, 229–252.

18. Zweifel, P., Manning, W. (2000). *Moral hazard and consumer incentives in health care*. In J. Culyer, J., Newhouse, J. (Editors), Handbook of Health Economics. North Holland; 409–459.

APPENDIX

Table A1: Services provided by public and private Ecuadorian health insurance

	Tipo de Seguro	Prestaciones (Generales)	Cobertura
Public	IESS (Includes Voluntary Insurance) Peasant Insurance (IESS) ISSFA ISSPOL	✓ Medical, surgical, pharmaceutical and rehabilitation care. ✓ Maternity insurance. ✓ Disability insurance. ✓ Work risk insurance. ✓ Death insurance. ✓ Dental care. ✓ Medicine. ✓ Hospitalization. ✓ Health insurance, ✓ Funeral Services Expenses. ✓ Retirement due to old age.	100% There is no limit to the economic amount.

		✓ Severability. ✓ Retirement Funds. ✓ Mortgage and Unsecured Loans. *(The last three are not covered by Peasant Insurance)*	
Private	All authorized by the Superintendency of Companies and the Superintendency of Banks and Insurance of Ecuador	✓ Disease. ✓ Hospitalization. ✓ Medicines. ✓ Ambulatory procedures. ✓ Unemployment. ✓ Intensive therapy. ✓ Dental care. ✓ Travel Insurance. ✓ Maternity. ✓ Accidental Death and Disability.	According to the multiple plans and premium you choose.

Source: Own elaboration based on the Social Security Law of Ecuador, and official websites of Private Insurance and Prepaid Health in Ecuador.

Table A2: Comparative table of plans and coverage between public and private insurance.

Private insurance (SALUD S.A)	Public insurance
<u>Family Plan</u> *Minimum Plan* ($29,60 - Holder) ➢ Coverage:	The contribution rates (2013), are based on the monthly remuneration of the member; The respective percentages are as follows:

<table>
<tr>
<td>

- Up to $ 22,000 per person

- 100% in room and food

- 100% intensive therapy

- 80% in outpatient coverage

- 60% in drug coverage

- 100% in hospital and maternity coverage

- Up to $ 800 in denture, orthosis and non-dental implants.

- Up to 10 rehabilitation therapies per year.

Maximum Plan ($63,10 - Holder)

➢ Coverage:

✓ Up to 160 000 per person

✓ 100% in room and intensive care

✓ Up to $ 200 in annual deductible per person

✓ 80% in ambulatory coverage

✓ 80% in drug coverage

✓ 100% in hospital coverage

✓ 100% in maternity coverage

✓ Up to $ 1500 in dentures, orthoses and non-dental implants

✓ Up to $ 5000 in newborn care

✓ Up to $ 25,000 in organ transplants

✓ Up to $ 2500 in compensation for living donner

✓ 10 rehabilitation therapies per year

✓ 12 consultations of homoeopathy, acupuncture and chiropractic

</td>
<td>

General Insurance Required:

Private Sector:

   Personal contribution: 9,35%

   Employer contribution: 11,15%

Public Sector:

   Personal contribution: 11,35%

   Employer contribution: 11,15%

Voluntary: 20,5%

Peasant Health Insurance: 2-3%

ISSFA:

   Personal contribution: 23%

   Employer contribution: 26%

ISSPOL:

   Personal contribution: 16,1%

   Employer contribution: 17,25%

There is no maximum economic amount for the coverage of the services offered by these types of public insurance, covering 100% of the medical eventuality.

</td>
</tr>
</table>

Source: Own elaboration based on the Social Security Law of Ecuador and Web page of "Salud" S.A

Table A3: Definition of explanatory variables

Income	Total gross income the household receives (in hundreds of dollars)
Income^2	Total gross income that the household perceives squared
Expenditure	Logarithm of the extra expense which was not covered by the insurance
Expenditure_insurance	An interaction variable for people who have public insurance and had to make an extra expense
Male	1 male, 0 female
Age_male	A variable of interaction between age and gender of each individual
Area	1 for people living in urban areas, 0 for people living in rural areas
Area_insurance	An interaction variable between people who have public insurance and live in urban areas
Schooling	Years of schooling
Age 40-60	1, for people between 40 and 60 years, 0 otherwise
Age>60	1, for adults older than 60 years, 0 otherwise
Age(>60)_insurance	An interaction variable between adults over 60 years old who have public insurance
Employment	1 for people who work (worked at least 1 hour, did not work but have work), or for people who do not work (unemployed workers and agents who do not work)
Marital	1 for people who are married or in a free union, 0 for separated, divorced, widowed or single people
Indigenous	1 if the person is considered of indigenous ethnicity, 0 otherwise
Montubio	1 if the person is considered montubio, 0 otherwise
Public_insurance	1 if the person has compulsory public insurance, 0 does not have insurance
Illnes	15 dummy variables that reflect the illness or accident that people were taken care of or self-medicated, be they respiratory, cardiovascular, digestive or vomiting problems, skin, eye, neuromuscular, dental, pregnancy, psychological, bone diseases,

	fractures, wounds or beatings, chronic diseases, diseases of women, diseases of man, traditional diseases
Duration	1 if the disease takes more than a week, 0 otherwise

Source: Own elaboration

Table A4: Regression model: dependent variable use of the health system

	Coefficient	Standard error	z	P-value	Confidence Interval	
Income	0.0115083	0.0032354	3.56	0	0.005167	0.0178495
Income^2	-0.0000888	0.0000267	-3.33	0.001	-0.00014	-0.0000365
Expenditure	-0.0317719	0.0032148	-9.88	0	-0.03807	-0.0254711
Expenditure_insurance	-0.0279437	0.0052864	-5.29	0	-0.0383	-0.0175824
Male	-0.1883421	0.0736406	-2.56	0.011	-0.33268	-0.0440091
Age_male	-0.0041846	0.0018929	-2.21	0.027	-0.00789	-0.0004747
Area	-0.2409992	0.0423287	-5.69	0	-0.32396	-0.1580365
Area_insurance	0.1753213	0.0713914	2.46	0.014	0.035397	0.315246
Schooling	0.0208399	0.0045441	4.59	0	0.011934	0.029746
Age 40-60	0.1711238	0.0425348	4.02	0	0.087757	0.2544905
Age>60	0.5409276	0.0856897	6.31	0	0.372979	0.7088764
Age(>60)_insurance	0.2059135	0.1309508	1.57	0.116	-0.05075	0.4625723
Employment	-0.1948976	0.0371463	-5.25	0	-0.2677	-0.1220922
Marital	0.1030493	0.0360776	2.86	0.004	0.032338	0.1737602
Indigenous	0.1107131	0.0593615	1.87	0.062	-0.00563	0.2270595
Montubio	-0.1815178	0.0759929	-2.39	0.017	-0.33046	-0.0325744
Public_insurance	0.2099773	0.0584243	3.59	0	0.095468	0.3244868
Illnes_respiratory	-0.8758965	0.0631498	-13.87	0	-0.99967	-0.7521251
Illnes_cardiovascular	0.2148828	0.1161085	1.85	0.064	-0.01269	0.4424513
Illnes_digestive	-0.0721969	0.0728498	-0.99	0.322	-0.21498	0.0705861
Illnes_skin	0.528828	0.1437806	3.68	0	0.247023	0.8106328
Illnes_eyes	0.2812694	0.1743592	1.61	0.107	-0.06047	0.6230072
Illnes_neuromuscular	-0.3340116	0.0879609	-3.8	0	-0.50641	-0.1616114

Illnes_dental	0.4808624	0.1519092	3.17	0.002	0.183126	0.7785989
Illnes_ pregnancy	3.289511	1.016654	3.24	0.001	1.296905	5.282117
Illnes_ psychological	-0.4164693	0.1924219	-2.16	0.03	-0.79361	-0.0393293
Illnes_bones	-0.014619	0.0896631	-0.16	0.87	-0.19036	0.1611175
Illnes_fracture	0.6594449	0.1482229	4.45	0	0.368933	0.9499564
Illnes_ chronic	0.5876143	0.1028403	5.71	0	0.386051	0.7891775
Illnes_female	0.0074793	0.0847545	0.09	0.93	-0.15864	0.1735951
Illnes_male	0.2929303	0.1786477	1.64	0.101	-0.05721	0.6430734
Illnes_traditional	-1.0235	0.1325032	-7.72	0	-1.2832	-0.7637986
Duration	0.4017546	0.0329661	12.19	0	0.337142	0.4663668
Income	0.2843296	0.0804548	3.53	0	0.126641	0.4420181
N	17748					

Source: Own elaboration