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Cream-Skimming And Risk Adjustment in Colombian Health Insurance System: The Public Insurer Case.

*(Msc Economics and Finance of Ageing. Faculty of Economics And Business Tilburg University. August 2007***).**

Ronald Eduardo GOMEZ-SUAREZ
Supervisor: DR. Norma B. COE

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Ronald Eduardo GOMEZ-SUAREZ[♣]
Supervisor: DR. Norma B. COE

Contents

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Abstract

This paper analyses the particular case of the bankruptcy of the biggest public insurer in the Colombian Health insurance system (contributory regime) in order to identify some selection patterns within such an insurance market. Using both cross-section and built-in panel data from DANE Quality of Life Survey in two waves (1997 and 2003) and applying an empirical approach based on binary choice models, the paper tries to solve two main questions. The first one is whether exists empirical evidence about advantageous selection in the contributory scheme of Colombian health insurance system. Secondly, I tried to establish whether cream-skimming (if existed) had real influence in the bankruptcy of the Colombian public insurer, which also would imply failures in the risk-adjustment formula. In the final section the principles of a good risk-adjustment system suitable for the local scenario are drafted.

The results show a strong evidence of dynamic selection from 1997 to 2003, which could take place by favoring both favorable "age load" and good socio economic status (income, education, work type and location) for private insurers. No evidence of selection based on household analysis was found, which reinforces the idea of an individual appraisal before enrollment. This situation affected the financial performance of the public insurance, but by no means was the definitive factor of the bankruptcy. On the other hand, the risk adjustment formula used in the Colombian system presents some theoretical flaws and still is established upon information from fifteen years ago. However, without updated information on morbidity and health care usage (not available) is not possible to measure the quantitative extent of such failures in an accurate manner.

JEL classification code: I11, I18.
Keywords: Adverse selection, cream-skimming, Colombian health insurance system, risk adjustment, binary choice models.

1 Introduction

Competition in social insurance markets will be always a polemic issue, especially because of its impact on both the micro level (families, individuals) and the macro level (public finance). So, it is not surprising to find a large economic literature devoted to analyzing different challenges and problems from participation within insurance schemes such as national pensions and health systems. Particularly the academic production dedicated to health insurance is outstanding, possibly due to the existence of well-structured private markets (especially in US and UK) as well as reliable information and policy changes.

However, what is evident is the lack of sufficient technical analysis on such subjects in developing countries. Some of them are one-step ahead in privatization of social insurance pensions, unemployment protection and health care[1]. They also have a different socio-economic background and generally more challenging goals in terms of coverage and quality of service. (Savedoof 2000)

One interesting case to examine the effect of private competition in health insurance markets is that of Colombia Health Insurance System (HIS). The Columbian HIS was completely reformed 15 years ago, through the introduction of an insurance scheme where private market participation is encouraged (in both insurance and care provision) but without completely depleting the public function. After that reform, the country made progress in terms of coverage, funding equity and health care access. However, there remain several challenges, some of which have to do with deficient design of the legal framework as well as

[1] Countries like Chile, Peru, Turkey and Colombia have run private-oriented reforms in its Social Security regimes in a much higher degree than most of developed countries.

weak supervision. In contrast, other problems are related with structural failures of the labor market and socio-economic issues in general.

One of the many sources of discussion of private participation in health market has to do with the natural failures of such markets, especially derived from asymmetric information. The Colombia health system, the "ISS case[2]" gives insight about how those market failures affect the performance of the system. In October 2006 the Colombian public health insurer ISS went bankrupt, after a long financial crisis. Among the possible causes, one explanation was a pattern of systematic adverse selection, which caused the population with higher probability of costly usage to be covered by ISS.

This thesis tries to establish whether adverse selection existed in that market and whether there is evidence of failures in the current risk-adjustment scheme, which could have influenced the subsequent bankruptcy of the Colombian public insurer. Furthermore, if so, a pertinent question is what an efficient risk adjustment should look like, taking into account the particular features of Colombia's system.

For this purpose, the paper is developed in three chapters. The first chapter explores the theoretical framework, which itself is divided into four sections. The first section describes the functioning of HIS in Colombia, including aspects such as institutions, funding, and risk adjustment and how that market deviates from those typically analyzed in the literature. Then a short review of the main public insurer (ISS) is presented, which includes financial, institutional and historic information. Finally, a brief literature survey about cream skimming and advantageous selection in private insurance markets is discussed, emphasizing the most relevant features related with the functioning of Colombian market.

[2] ISS: Instituto de Seguros Sociales (Social Security Institute)

The second chapter develops the formal empirical analysis of the questions with three well-differentiated sections. First, an analytical model of insurers in Colombia's HIS is presented, which describes the rationality of a profit-maximizing agent given the specific characteristics and incentives of Colombia's system. Secondly, there is a descriptive analysis to look for some different patterns in the risk profile of enrollees in both public and private insurance programs, using information on the National Survey of Quality of Life from 1997 and 2003. The same data is used in the third section to run several empirical models to determine the statistic influence of variables related to health status, socio-economic status and personal information on the probability of being enrolled by the public insurer.

The third chapter is intended to be an abridgment of policy recommendations about risk adjustment in Colombia, based on both previous recommendations in the literature and institutional issues specific to Colombia. The first section briefly explains how the current literature describes the benchmark of the risk-adjustment within private health insurance markets, mainly following the comprehensive work of Van den Ven & Ellis (2000). Afterwards, I compare the current risk-adjustment in Colombia HIS with the benchmark case previously depicted, drawing the main limitations and policy orientations. The last part summarizes the conclusions, discussion issues and future research topics from the whole work.

2 Theoretical Framework

2.1 Health Insurance System in Colombia

2.1.1 Institutional Description

The Colombian health system underwent a comprehensive reform in 1993. The cornerstones of the legislative content were the principles of solidarity, equity and integration of services. Under the name of General System of Social Security, the reform included pension schemes, health insurance and work-related protection in a unified framework with similar principles, organization and administration (Mesa-Lago 2005, Cepal 2006). Additional reforms have been performed since then, in order to correct some parameters of the system and homogenize it within the new concept of social protection[3].

Before the reform, there was not a health system as such, but rather several uncoordinated bodies functioning in a centralized environment under the principles of supply availability. For formal workers there were the social security institutions that included the initial Social Security Institution and several sectorial institutions that provided employer-based health packages to workers and their families. Given the constant low level of formal work in Colombia, it is not surprising that the coverage of health insurance was also low[4]. For poorer populations and low-income self-employed workers, the Ministry of

[3] See Londono and Frank (1997) for an ideological framework of the health system reform in Colombia and Latin America, based in risk management and social protection.
[4] In 1990 only the 25% of population were covered by some scheme of health insurance (DNP 2005).

Health provided public health inputs and managed supply subsidies for hospital care, in a centralized manner, through a public network of providers.

The reform in 1993 created two regimes of health insurance: the subsidized and the contributory[5]. The subsidized regime covers the population marked as poor and/or vulnerable, i.e. informal workers, self-employed, especial ethnic groups, etc. This scheme functions on a means-tested basis through an information system with socio-economical characteristics of the beneficiaries. This database is periodically updated, in order to check whether the requirements to receive the subsidy remain valid. One new feature introduced by the reform is the concept of subsidy to demand, which prioritizes the subsidy allocation based on the needs of the population rather than direct them to the public supply. (Restrepo et al 2007).

In order to match with the principle of solidarity (claimed as the ideological base of the reform), the subsidized regime is funded with resources transferred from contributory system, as well as general revenues. The package provided under this regime is qualitatively lower than the one offered by the contributory regime[6], but provides a fairly complete coverage, according to international standards. An evaluation of the subsidized regime is outside the purview of this paper.

The contributory regime aims to provide a basic and homogeneous health insurance package, called POS-C (Obligatory Health Service Plan - Contributory) to formal workers, pensioners and, in a general definition, people able to pay contributions. The system allows for family coverage (first degree related) and

[5] Along with these regimes, it also was ruled a transitory scheme to cover individuals not yet insured (known as "vinculados").
[6] For instance, there is no disability or maternity compensation. Moreover, the co-payments regime is different.

offers not only the basic health care but also monetary compensation for disability caused by non-job related health events[7]. While the health insurance reform was tied to pension reform, it is important to note that these systems are completely separate in practice

This regime is funded with a standard payroll tax of 12.5%, which is levied on reported income. The contribution is paid by both the employer (2/3) and the employee (1/3) [8]. The distribution of this tax collection is roughly as follows: 9% goes to fund the premium of the system in the compensation scheme, whereas 2% covers disability compensation and 1.5% to fund the subsidized regime (solidarity).

The contributory regime is structured around insurers generically called Health Promotion Agencies (EPS's[9]), that function as sickness funds and are responsible for promoting and undertaking insurance, as well as organizing and guaranteeing the delivery of health services included in the compulsory plan. They are mostly for-profit companies with private owners, even though one big public insurer (ISS) existed until 2006. These companies are not supervised as insurers, but rather as health sector companies with insurance functions.

Jack (2000) offers an alternative interpretation of the Colombian HIS functioning. He describes it as an implicit two-tiered voucher scheme, even though no formal voucher exists, for both regimes the contributory and the subsidized. Workers belonging to formal sector get a voucher for insurance that includes a qualitatively higher service package, while poor or informal populations receive a voucher for a less generous insurance. This author considers that the health

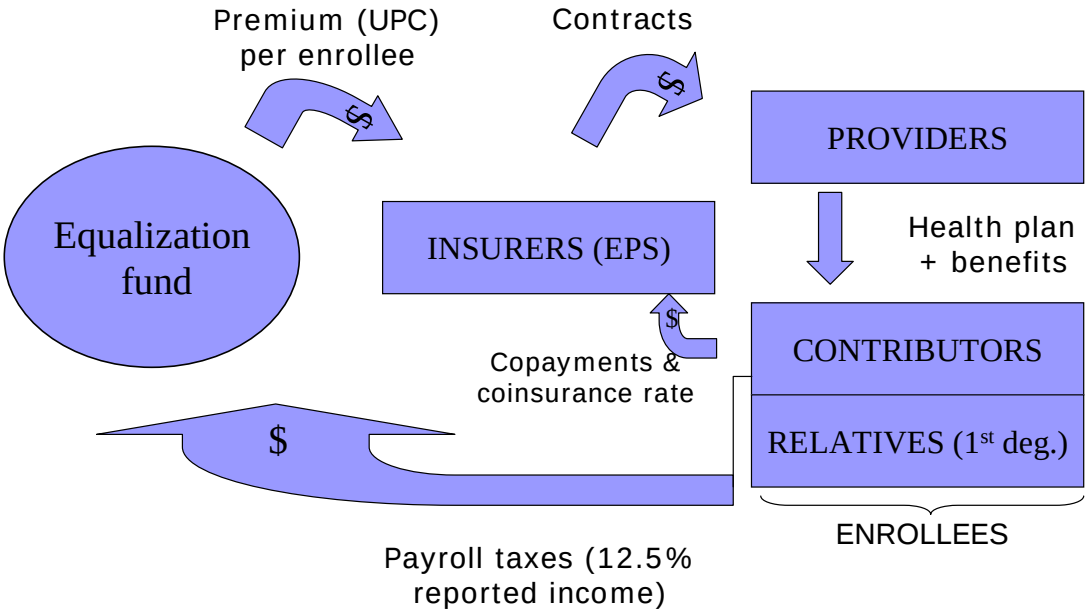
[7] For work-related disabilities, there exist an additional insurance funded by employers, which operates separately from the contributory regime
[8] Pensioners pay the full 12.5 percent out of their pension.
[9] EPS: Empresas Promotoras de Salud

contributions in Colombia cannot be classified as premiums but as general revenue, since individuals are not being offset in return for paying the tax.

2.1.2 Flow of Resources

The flow of resources within the contributory regime follows a cycle that is depicted in figure 1. The enrollees pay a contribution of 12.5% of income, which is channeled by the EPS and deposited in the equalization fund that is the real insurance pool of the system. Subsequently, the compensation fund pays to every EPS the value of the corresponding premium according with the characteristics of the enrolled population, which must be demonstrated by the insurer (more information about how the premium is determined is in the next section). In turn, the insurer must guarantee the mandatory health package to its affiliated members by contracting with health providers.

Figure 1. Contributory Regime Flow



Here we can see that three variables play a key role in the financial sustainability of the system: first, the salary density (meaning average reported income), since this is the source of the system income; second, the family density (number of beneficiaries per contributor), which determines the cost to the fund and the income of the insurers, and thirdly the costs of the medical services, or costs to the insurers.

2.1.3 The Premium

The premium of this sui-generis insurance market is called UPC[10] (per-capita unit of capitation). This is a differential premium adjusted by two risk attributes: age and gender, which is disbursed from the equalization fund as long as the insurer can demonstrate the rightful enrolment of every individual affiliated[11].

The Colombian HIS created seven age bands with an additional differentiation by gender in the age 15-44 years band. The lowest premium corresponds to theoretically the lowest cost population, in this case the male enrollee aged between 15 and 44 years old. The highest premium is given to the newborns (closely followed by the elderly), and is almost 4 times that of prime-age males (see Figure 8 in the third chapter).

Under this scenario, a profit-maximizing insurer will cover those insureds that make the maximum profit. If is assumed a perfect risk-adjustment, the insurers might be indifferent with respect to risk-status of people inasmuch as they would receive a higher premium for high-risk people, compensating the cost dispersion. But in case of imperfections in risk-adjustment, they may prefer to enroll people

[10] UPC: Unidad de pago por capitación
[11] Rightful enrolment includes the absence of a double claim from other insurer about the same person, as well as the due register in the system database with coherent information (source MPS).

whose reimbursement is expected to be higher than their average health care cost.

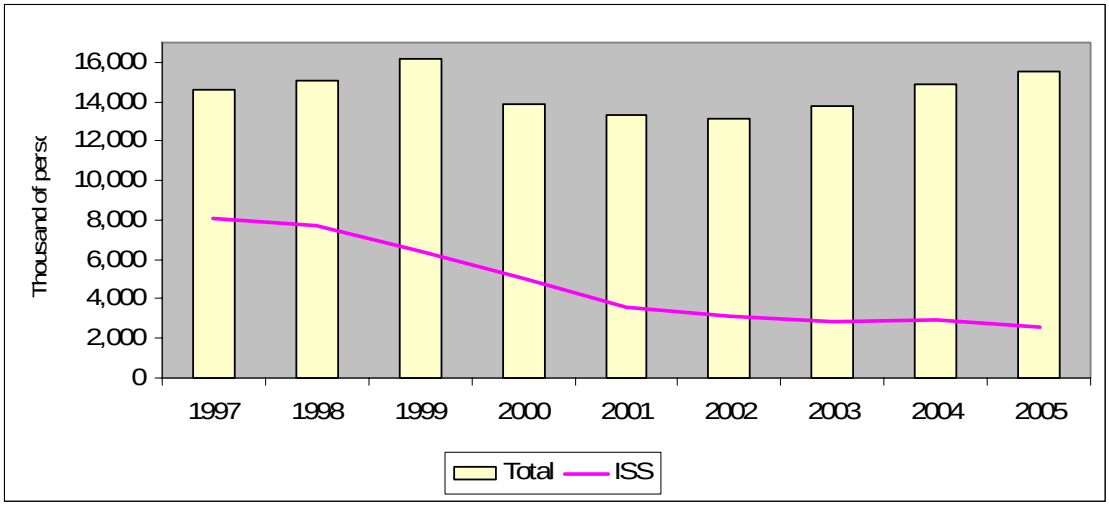
2.2 ISS Case

Insurers are central to the Colombian health insurance system, which are mostly for-profit private companies. However the public insurer ISS has been an important player in the system. Before the 1993 reform, the ISS acted as both insurer and care provider and directly collected the contributions, then 8% of income[12]. Additionally it was the only authorized sickness fund of formal workers in the private sector[13]. The institution had national presence and no need of competing to get enrollees, given its condition of public monopoly. Hence, it had no incentive to either reduce costs or increase efficiency.

The 1993 reform positioned ISS to compete within the market, giving it a transition period of 3 years, wherein it was allowed to manage directly the enrollee contributions while attuning its institutional ability to the new requirements of the system. In 1997, the entity was compelled to channel the contributions to the equalization fund, akin to the private insurers in the market. This implied that the institution had to carefully keep a record concerning every enrollee in order to receive the adjusted-premium. It seems that this was the breakpoint for the institution, since from then on it started to undergo financial deficits in its operation, which grew as years went by.

[12] The concurrence of the employer remained the same, that is 2/3 parts of the contribution was covered by the employer. See DNP (2003)
[13] Some sickness fund and prevision entities were in charge of coverage of civil servants, teachers and military forces.

Figure 2. Enrollees ISS and Total Contributory Regime 2000-2005



Source: National Department of Planning 2003, Ministry of Social Protection 2007.

The ciphers are subject to depuration, especially before 2000. See DNP (2003)

Figure 2 shows one of the main effects of the institutional crisis of ISS: the steady drop in enrollment throughout recent years. Indeed, the ISS had lost about 30 points of the market share between 1997 and 2005, without a similar adjustment in expenditures. It was a typical vicious circle: every year the institution faced drops in enrolment, which in turn lowered the income, further distressing the financial balance and indirectly lowering the quality of attention. This, of course, caused additional enrollment declines.

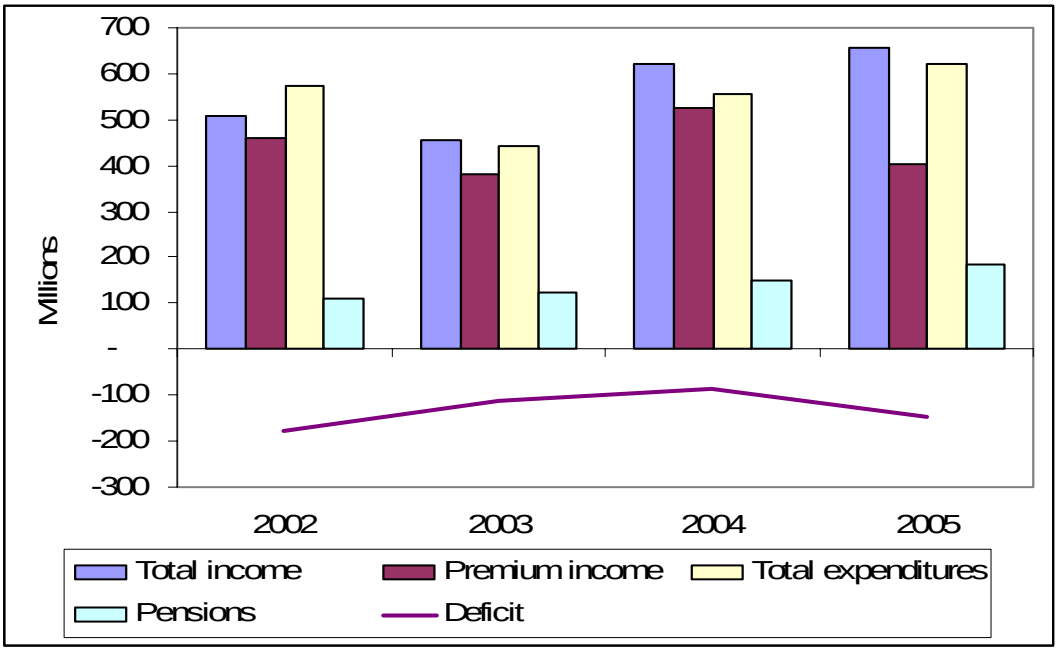
Multiple reasons have been used to explain the financial fall of the ISS. These can be classified in three groups:

- Databases. ISS always lacked a robust and complete information system of enrollment. Note that in the Colombian HIS, an insurer's income depends on the accurate registration of affiliates and beneficiaries that must fulfill minimal requirements in order to get paid the premium from the

equalization fund. Thus, ISS was not able to prove the enrollment that they claimed, due to the failures in the technological platform (DNP 2003).

- Institutional. The company inherited a heavy labor burden from the time when it was a monopoly. The generous and legally protected work-regime for unionized workers and the inflexibility of the work contract hindered the necessary adjustment of expenditures. Undoubtedly, the most onerous benefit was the special pension regime for workers, which represented a growing share of the expenditures year by year (see figure 3). Likewise, some external issues also affected the institution performance, such as instability in leadership, political vulnerability, corruption, etc. (DNP 2003)

Figure 3. Income and Expenditures ISS 2002-2005



Source: ISS, Budget Company 2002-2005.

- Structural: The high-risk population (old, chronically ill, poor, etc) was mostly affiliated to ISS. These groups experienced higher cost growth, breaking the financial balance of the insurance business and creating a structural deficit in its operation. It may also imply that private insurers were systematically "cream skimming" the population.

As it has been stated, there were multiple inefficiencies of ISS operation (mostly related with poor governance) that might have contributed to the subsequent bankruptcy of the entity. What is not as clear is the structural malfunction of the system that could have given incentives for adverse selection. Did adverse selection affect the ISS? Is there a pattern of cream-skimming from the private insurers? These are the questions I examine in this paper.

2.3 Related Literature

This section presents a short literature review of adverse and advantageous selection (cream-skimming) in private insurance markets. It is worth mentioning that the cream-skimming concept is strongly tied with adverse selection, and hence, it cannot be separately considered from the vast literature of adverse selection. Here I mainly focus in the undesirable effects of the selection using asymmetric information.

There is considerable literature about adverse selection in health insurance markets. The majority of the studies are based in US market (and private share of UK and European Union), where the amount of insurance, the premium as well as the plans are flexible and varied. That is because such failures are chiefly visible in markets with private participation and free choice. Most European countries still keep their health care systems functioning on a public basis in both

insurance and provision. Nevertheless, some developed countries[14] have run ambitious reforms of their health insurance systems, which allow for more private participation while still maintaining a large role for public monitoring and supervision.

Most of the literature describes both adverse selection and cream-skimming in health insurance systems that are substantially different than the Colombian system. First of all, in the Colombian system there is no choice regarding purchasing of insurance, since the plan is mandatory for all of formal workers. The individual decision is limited to which insurer can provide the health package rather than whether or not to be insured. On the other hand, the price the consumer faces is fixed, regardless of the health insurance company chosen. Thus, there is no room for "shopping around" behavior. Finally, the health plan is the same across all insurers and hence selection between insurance companies is limited to considerations such as customer service and company performance[15].

2.3.1 Adverse Selection in Health Insurance Markets

Adverse selection is a well-identified phenomenon in insurance markets, and has been accurately summarized by Krugman as the situation where "bad risks drive out good"[16]. This market process comes from information asymmetries between buyers and sellers. Specifically in health insurance markets, adverse selection is triggered by *a priori* individual knowledge of health status and probabilities of usage, which is unknown to the health insurance company.

[14] i.e. The Netherlands in 2006, Switzerland in 1995, Germany 1993, 1996
[15] There is the possibility of acquiring additional medical insurance, but it is mostly offered for different insurers and the business should be legally separated and not necessary integrated with the institutional framework of the mandatory plan.
[16] The New York Times, OP-ED columns, November 14, 2005.

A comprehensive review of the literature of adverse selection is not within the scope of this work. However, it is worth mentioning the very complete review of Cutler and Zeckhauser (1999), where a summary of the academic works on adverse selection is systematically presented (as of 1999). The articles are classified depending upon the choice of type of plans (managed or indemnity) as well as the choice of enrollment and the choice of generosity within plans, when possible. Most of the papers find empirical evidence of adverse selection, under a variety of approaches.

In the seminal work of Rotschild and Stiglitz (1976), the concept of adverse selection shows up as a question of a potential policy-holder choice, that is, whether or not to purchase insurance in accordance with some imperfections or asymmetries on information about risk. They point out that the high risk individuals exert a dissipative externality on low-risk ones, and at the very end they purchase different insurance policies. As a conclusion, they state that insurance markets are not competitive and this is because of information failures, so the existence of equilibrium is only possible under strict assumptions about insurance contracts [17].

Browne (1992), tests for adverse selection in health insurance markets applying a structural model of both demand expenditure and the amount of purchased insurance. Using micro-data from the US, he finds evidence of adverse selection as a difference of predicted vs actual insurance purchased. Thus, the two main conclusions of his work are, first that adverse selection leads to reduced

[17] This model was analytically revised by Wilson (1977) showing a state of pooling equilibrium (instead of the separating one proved by Rotschild and Stiglitz), wherein he applies different assumptions in regards to insurers ability of detecting future financial consequences of new policies, within a competitive scenario.

insurance consumption by the low risks and secondly, it causes a wealth transfer (subsidy) from low risks to high risks.

The findings of these two papers are of limited relevance in this case, due to the institutional set up of the Columbian system, namely the mandatory nature of health insurance and the government-defined health insurance package, Cutler and Zeckhauser (1997) provided one of the most comprehensive works about the nature of adverse selection in health insurance markets that are more comparable to the Colombian system. Their work focuses on individual choice of a health plan from a menu offered on an employeer-sponsored basis. They mention three different distorting effects of adverse selection: prices do not reflect marginal costs; insurance pooling is inefficient and finally health plans could be designed to attract healthier policyholders and to deter sick ones. By analyzing data from two different insurance providers, they conclude that adverse selection is a very real issue and can negatively influence the performance of market agents.

Cutler and Reber (1998) show in that not only the existence of adverse selection is real but also its noxious effect in terms of welfare, which is very relevant for the discussion of reforms. They use data from claims and enrollment of Harvard University to show that adverse selection in such a case brought about welfare losses and higher price responses (elasticity) in the long term. They also discuss efficient systems of risk-adjustment, as a way of palliating the effects of asymmetric information decisions[18].

The work of Altman, Cutler and Zeckhauser (1998) characterizes the phenomenon called "adverse retention", defined as the "tendency of people who stay put to magnify cost differential between plans. This event arises when

[18] In this study, there is evidence about the key role of adverse selection in the "death spiral pricing" of the premiums of Harvard University Health Insurance Plan. The "death spiral" is one of the literature's favorite examples about undesirable effects of adverse selection.

insured people have different mix (e.g. demographic that affects the efficient pooling) and they do not change their health plan, as rational behavior would suggest, whereas in a typical adverse selection behavior, the people would switch in light of their health state. These authors analyze a market where the enrollment in the plan is mandatory, which better suits the problem I deal with here.

2.3.2 Cream-skimming

The problems derived from asymmetric information have been concentrated in the choice of individuals, where insurers are financially harmed by the adverse selection. However, it is also common to examine it from the other way around: insurers with privileged information advantageously selecting their insureds. That is called cream-skimming (or cherry-picking). More formally, it occurs when low-risk segments of the population are in a health insurance plan, owing to the insurer's superior knowledge about insured's expected costs, using marketing strategies or the plan differentiation to attract a less costly population.

One of the first works that clearly states the possibility of cream-skimming in health private markets is that of Newhouse (1982), which describes the process in 2 steps: first, an identification of high-risk patients and second, the applications of both crude and subtle disincentives to high-risk enrollees (e.g. waiting lists, bad attention, etc). Newhouse opposes two previously proposed solutions to avoid such a selection. First, he finds that actuarially rating all individual patients in order to determine reimbursements to be very impractical. Second, he argues that pro-competence regulations can prevent discrimination only in

the enrollment stage, but not the disenrollment[19] decision, which does not solve the problem.

Three insurer-provider strategies of selection are remarked by Ellis (1998). The first is the over-provision of services to low-risk insureds (creaming) that is patent with tailored plans. Second, the under-provision to high-risk enrollees, expressed as either less generous plans or bad service. Finally, the pure avoidance of costly patients, called dumping. He finds that an optimal reimbursement scheme cannot be either a first-best or a second best and "…movements away from a fully prospective system appear to be welfare improving".

Van de Ven and Ellis (2000) establish an inverse relationship between predictable profits of advantageous selection and the ability of health plans to cover the needs of high-risk people, reinforcing the points made in Newhouse (1982). In consequence, the quality of service for chronically ill insureds may be low, contracts with provider's network might be biased towards less-costly attention and high-risk patients are charged with higher premium. Another distortion from cream-skimming is the incentive of investing in selection strategies rather than efficiency in the care-provision, since normally selection renders higher return in short-term.

On the other hand, Pauly (1982) comments that cream-skimming is not caused by the competition, but rather by the regulation, since sickness funds should be able to tailor plans and freely adjust premiums. He states that the possibility of risk segmentation and screening still remains, but mostly because of adverse selection. He also remarks that the identification of either good or bad-risks from

[19] See in Newhouse (1982) the example of the "Mother with an asthmatic child", also quoted by Van de Ven and Ellis (2000).

both insurers and individuals in general is not obvious, which might be an important role for the government. Pauly does not consider equity and fairness issues within his analysis.

Unfortunately, due to data limitations, I am unable to directly observe whether the private health insurance companies are exhibiting cream-skimming behavior. I do not have information on their marketing or targeting practices, services for chronically ill patients, or their dumping behavior. Instead, I use individual-level data and look for patterns of adverse selection, and whether or not that adverse selection is worsening over time. Thus I cannot distinguish between cream-skimming behavior on the part of private insurance companies and adverse retention on the part of ISS. I will use the term cream-skimming throughout the paper, but acknowledge that this could represent either phenomenon.

2.3.3 Colombian Experience

Relatively few papers about advantageous selection within Colombian HIS are available. This subject should be a rich research field in the health sector in Colombia, taking into account that the Quality of Life Surveys in 1997 and 2003 offer a special opportunity to empirically examine the progress and challenges of the reform in Colombia. I have highlighted two works in this section, which I consider being the most related with the subject of this thesis.

Trujillo and McCalla (2004) examine the Colombia's 1997 Quality of Life Survey to explore sickness fund selection behavior. They use bivariate Probit models with partial observability, where two decisions are modeled, the consumer's decision to participate in the formal sector and hence being insured in the

contributory regime, and the sickness fund's choice of whether to enroll an individual. Under this approach, they allege to collect evidence not only from the normal system participants but also from the uninsured families that could be rejected by sickness funds. There is not reference of the nature of insurer, but the system enrolment itself, which implies that the conclusions are applicable to both private and public insurers. They find signs of selection by health and social status rather than age, but warn about lacking of more complete information to conclude cream-skimming behavior in the sickness funds.

Castano and Zambrano (2006) test the hypothesis of biased selection between older participants (incumbents of public nature) and new insurers (entrants) to the social health insurance market. The decision of insurer's nature is analyzed by using bivariate analysis of proportions and multivariate logistic regressions. The adverse selection pattern is found to take place especially in 2003, affecting public insurers while favoring private insurers. This thesis differs of the analysis of these authors by focusing on one private insurer (ISS), including new empirical approaches and discussing the policy implications under the concept of risk-adjustment, which is obliquely discussed in the mentioned paper.

3 Formal and Empirical Analysis

3.1 Model for Insurers

The following section contains a very simple model where the rationality of insurers in the Colombian health system is depicted. Most of the information is asymmetrically known by insurers, setting up the principles of the advantageous selection in insurance markets. The analysis is based in the rationality behind the insurer's selection, taking into consideration the special features of the system. It is a profit-maximization approach, including the most representative revenues and costs of such an insurance business.

The first parameter we take into account is a_j, the differential premium by age groups *(j)*. As stated previously, this premium is fixed in advance by the health authority, which means there is no possibility of price-based decisions for either insurers or insureds. The premiums are the main source of the insurers' income, sometimes 90% or more of the total, according to the insurers' balance sheets reported to health supervisor in Colombia.

Regarding costs, q_j represents the average cost per age group, which is not observed empirically. q_j includes costs of providing the standardized health insurance package, as well as loading costs, such as administration, marketing and operation. These costs could vary by company, due to differences in efficiency, for example, but for ease of exposition a company-specific subscript is ignored It is assumed the companies know these costs and also that there are costs which are the average observed cost by age group in the market $\overline{q_j}$.

The legal framework of the system establishes 7 groups based on age and gender. The government sets differential premiums (a_1, a_2,…,a_7) for each group, which should be based on $\left(\bar{q}_1, \bar{q}_2, ..., \bar{q}_7\right)$ the average costs per insured for every age-group. The insurance company's total population group is defined by $X = \sum_{j=1}^{n} x_j$

where x_j stands for the number of persons in j age-groups.

Finally one additional source of income proceeds from the collection of co-payments and coinsurance rates. These rates also are defined by the health authority. These revenues are denoted as k_j where $0 < k_j < 1$ is the defined average percentage of co-payments and coinsurance with respect to costs (value of coverage) q_j. They represent out-of-pocket expenditure for the insureds.

First, let me assume that the premium for every age group completely offsets the average cost of that age group. Thus, the premium satisfies:

$$\hat{a}_j = (1 - k_j)\bar{q}_j \tag{1}$$

The total benefit $\boldsymbol{\Pi}$ for the insurer is given by

$$\Pi = \sum_{j=1}^{n} \Pi_j = \sum_{j=1}^{n} x_j \left(\hat{a}_j + k_j q_j - \bar{q}_j\right) \tag{2}$$

The insurance company maximizes profit Π within every age-group (Π_j).

$$\max \Pi_j = x_j \hat{a}_j - (1 - k_j) \sum_{i=1}^{N} q_{ij} \tag{3}$$

Replacing from (1) and (2), yields

$$\Pi_j = x_j \left[(1 - k_j) \bar{q}_j \right] - (1 - k_j) \sum_{i=1}^{N} q_{ij} \tag{4}$$

In the case of perfect risk-adjustment: $\sum_{i=1}^{N} q_{ij} = \bar{q}_j x_j$ and the remuneration for every risk profile is complete. Then, the premium should cover the average cost per user. In perfect competition, insurer's cost will be equal to the observed cost in the market. Therefore, a profit-maximizing firm would look for minimizing costs within the age-group. That is Π_j is maximized when $\sum_{i=1}^{N} q_{ij}$ is minimized

$(\sum_{i=1}^{N} q_{ij} < \bar{q}_j x_j)$

$$\max_{q_{ij}} \Pi_j = x_j \left[(1 - k_j) \bar{q}_j \right] - (1 - k_j) \sum_{i=1}^{N} q_{ij} \tag{5}$$

Now, I am going to analyze the case when the risk-adjustment is not perfect, here meaning by age-group. There are observed differences between premium and

average cost across the age groups: $\hat{a}_j \neq (1-k_j)\bar{q}_j$. The total benefit is defined as the aggregated value of the benefit across age-groups.

The expression for the premium-costs differential could be expanded to reflect the impact of every age group. To simplify, we define two possible situations. First, when the premium falls short of the average costs: $\hat{a}_j < (1-k_j)\bar{q}_j$. Here the groups are more costly and therefore the profit-maximizing firm minimizes x_j, the population in these age-groups.

The second case arises when the premium exceeds the costs: $\hat{a}_j > (1-k_j)\bar{q}_j$ In this case, the age groups will be more profitable, since they seemingly request less care, thus implying less cost. Obviously, the insurer will try to maximize x_j. Therefore, the profit function looks like

$$\max_{x_j} \Pi = \sum_{j=1}^{n} \Pi_j = \sum_{j=1}^{n} \left[x_j (1-k_j)\bar{q}_j - (1-k_j) \sum_{i=1}^{N} q_{ij} \right] \tag{6}$$

Ignoring the effect of other revenues and loading costs, it is clear that the real incentive of the insurer is to capture as many lucrative enrollees as it can, in order to maximize the profit.

3.2 Empirical Analysis

The main goal of this section is to show whether or not there is evidence of adverse selection for the public insurer. Due to the data available, I looked for a

systematic trend in the population who would use the health service in a more costly way, depending on the profit-status of the insurer.

3.2.1 Data

I use the Colombia's Quality of Life Survey, available in 2 periods: 1997 and 2003, conducted by the Colombian Statistics Institute[20]. This is cross-section survey with information about social and economic characteristics of the Colombian population. It also has national coverage at the rural-urban level and allows disaggregation into six large geographical regions. The sample size for 1997 is 38.518 individuals and 10.016 households, whereas in 2003 is 85.150 individuals and 24.090 households. It is representative at both the country and region level.

This data in two panels allows analyzing the trends in 1997, when ISS is starting to compete, and comparing them with the 2003, where the insurers could already have used selection strategies. Significant differences in both years favoring risk-related characteristics in the insurer's distribution of population can be interpreted as signs of dynamic adverse selection.

The variables for the analysis are classified in three groups. The first one contains general information such as age, which is the source of the risk-adjustment of this system. Also dummies of localization (as either urban or rural), marital status and gender are incorporated.

The second set comprises health-related dummies. They include self-perception of health in the last year, existence of chronic illness and reporting a health problem in the last month. For the empirical analysis, some health variables also

[20] Trujillo & McCalla (2004) add that this survey follows the format developed by the World Bank in the Living Standards Measurement Survey.

available in the survey, such as hospitalization and prevention check were not included because of the latent endogeneity with the nature of the insurer. That information is relevant to find out about the degree of utilization of medical care but not to explain patterns of biased selection on risk.

The third set of variables contains socio-economic information. Some authors suggest a direct relationship between health status and these variables[21]. Hence information about education level (dummy variables educational degrees in 5 categories), plus bands of income and type of employment (five categories)[22] are included. Finally, I also use a dummy variable for pension enrollment, since this fact can affect the choice of health insurer, since the enrollment in the contributory regime is not possible if there is not pension enrollment at the same time (and opposite), even though they are two different systems and the insurer's choice is free in each system. Table 1 in the Appendix shows the main descriptive statistics of the variables just described.

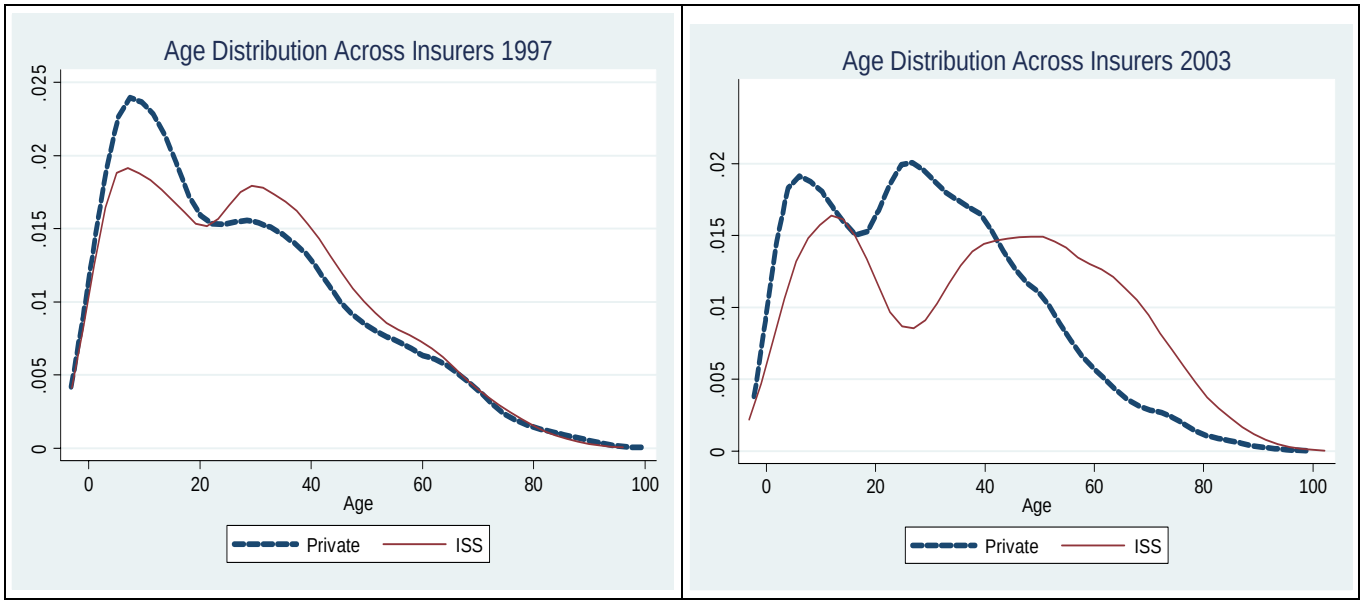
3.2.2 Descriptive Analysis

The analysis starts with the most perceptible trends found by observing the evolution in the descriptive statistics. Table 1 in the appendix shows the mean and standard deviations of the variables chosen for this work. In 1997 there is only a slightly difference in average age (2 years) between people insured by private companies and ISS; by 2003 there is a dramatic 10 year difference. This alone can shed some light on individual preferences.

[21] E.g. Smith & James (1999) consider economic status and Lleras-Muney (2005) considers education (see references).

[22] There are 5 groups of income based in minimal statutory wages of Colombia in the corresponding years. For type of employment, the DANE classification is applied for 5 groups, including the category N.A. for non participants.

Figure 4. Age Distribution Across Insurers 1997 & 2003



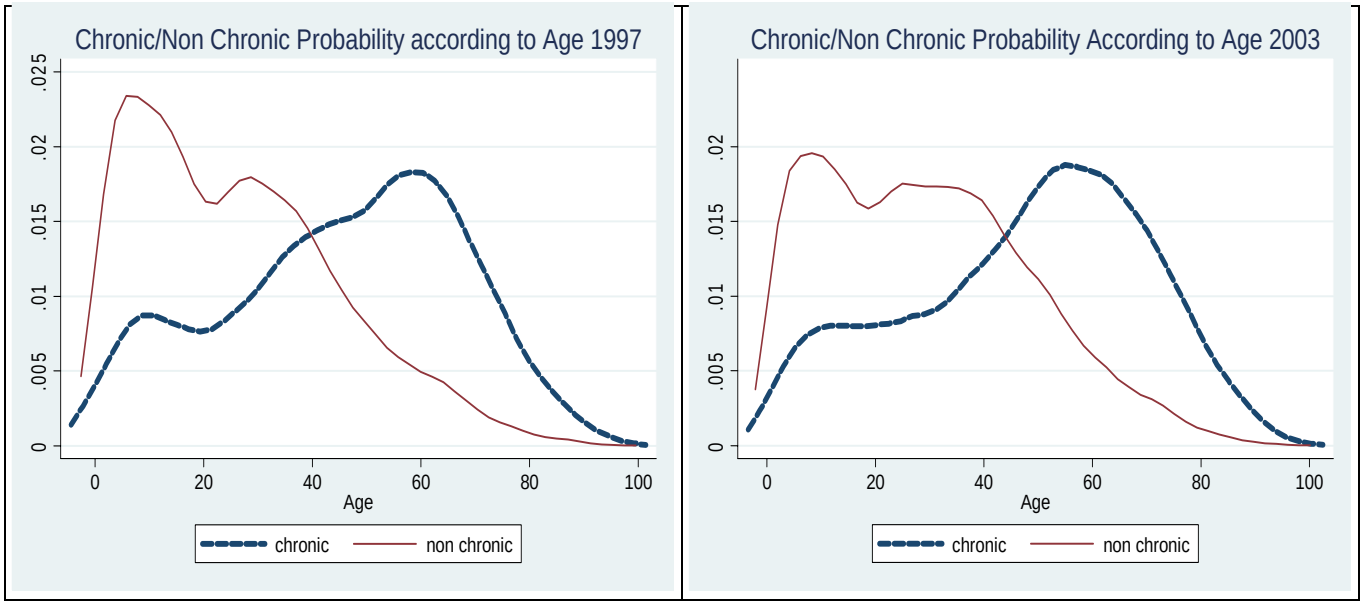
For more detailed trends, Figure 4 illustrates the age distributions among different kind of insurers in both years[23]. In both years the private sector has the highest segment of young enrollees. However, even in 1997 the younger population (10-20 year old generation) was overrepresented in the private sector while the generations with "higher risk" were underrepresented; we can state that the two curves remain close to each other for over the age of 50. For 2003 the diagrams change dramatically. The density curve of ISS crosses the one of private around the age of 40 and stays far above it for the older population. The age composition of the regimes changed substantially.

The situation is even more disadvantageous if we have a look at Figure 5 with the age-chronic disease distribution. It states that the "most expensive individuals" for the system are mostly in their fifties and sixties, which is the population that is overrepresented in the ISS sector. In 2003 13% of the privately

[23] . See annexes to check the same illustration for woman and man, which describe a similar pattern to that of the whole sample together.

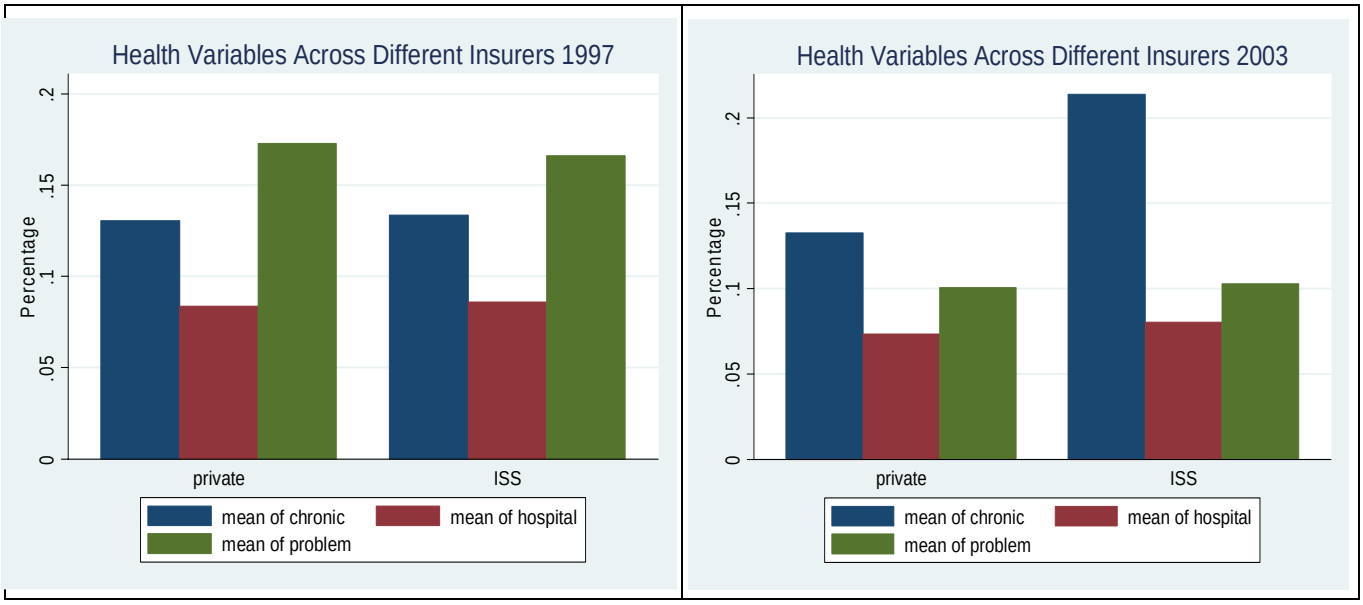
insured population had some chronic disease, 21% of those insured by ISS have a chronic disease.

Figure 5. Chronic State Distribution by Age 1997 & 2003



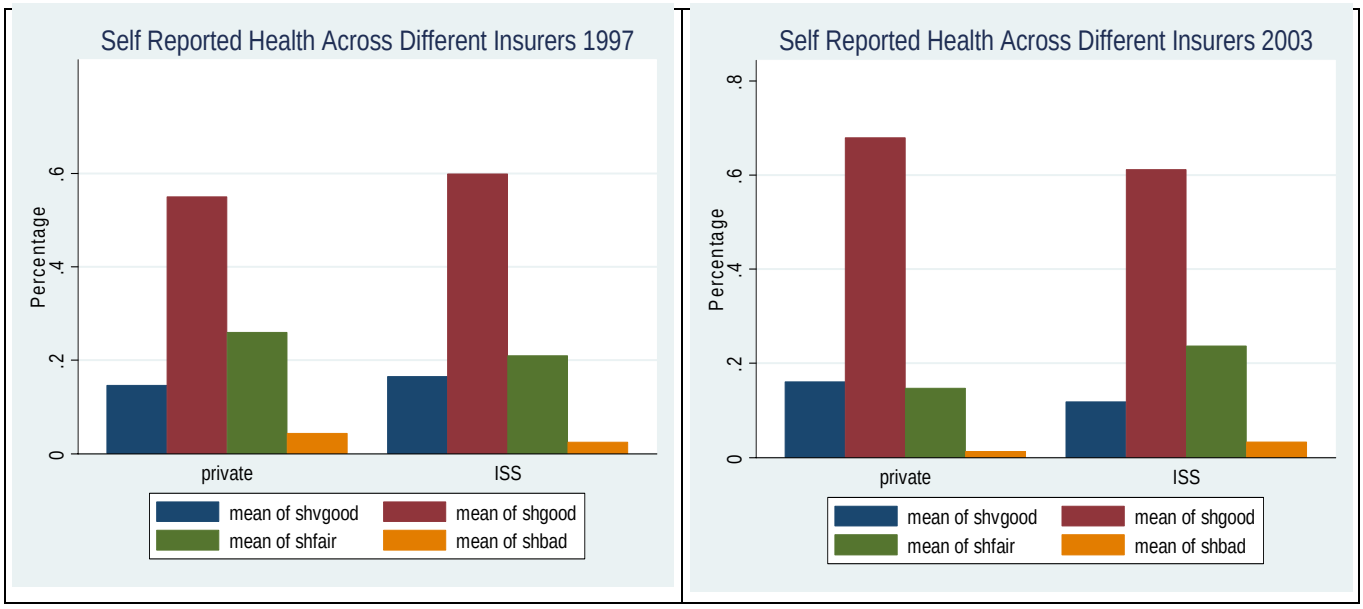
The utilization of the health care system, such as having some health problem in the last month, chronic illness or hospitalization was roughly the same in both ISS and private insurer in 1997. In 2003 there was an evident increase of chronic enrollees in the public insurer. The patterns remain the same for both health problem and hospitalizations, but the incidence was much less in 2003 for both insurer types. It seems there was a rationing of services in both sectors. This pattern was not observed for example in preventative visits (see Figure 2 in appendix), where the incidence was higher, especially for private insurers. Thus, patients with private insurance were more likely to be able to go for preventative visits, even though the health package is the same. This pattern can be indicative on the way as cream-skimming could be applied, for example, by increasing low-cost procedures and discouraging high-cost ones. Comparative graphical results are shown in Figure 6.

Figure 6. Health Care Variables Across Insurers 1997 & 2003



Although self reported health is riddled with confounding factors, here it is used as a proxy for true health, in absence of objective health measurement in the available data. In 1997, people in ISS rated themselves relatively better than the others in the private companies. Both the ratio of those reporting very good and good are higher while the proportion of fair self reported health is lower. However, this rating for ISS noticeably dropped by 2003. The percentage of those reporting good remained the same while very good declined by around 8% while fair and bad together increased by the same amount. This effect cannot be interpreted as a general trend because the self-reported health qualitatively improved in the private sector (see Figure 7). Again, the report could reflect either bad health or just the perception of it, but it is a sign of risk- profile worsening in ISS enrollees.

Figure 7. Self-Reported Health Status by Age Categories 2003



The descriptive statistics indicate that dynamic adverse selection could take place in the two observed periods. The static analysis in 1997 does not indicate significant inequality in the risk-profile between insurers. However, some trends do show up already, especially in age-distribution and usage. By 2003, the difference in the risk-profile among insurance groups was noticeable, and there were increasing patterns of average age, usage and bad health status for ISS population. This could be due to either cream-skimming behavior of private insurance companies, which were able to advantageously select insureds, or adverse retention on the part of ISS. One indication that it could be cream-skimming behavior is the shift in preventative care usage among the privately insured.

3.2.3 Specification

The goal of this section is tracking the evidence of adverse selection by examining the factors that influence being insured by either ISS or a private insurer. The hypothesis I want to test is whether dynamic adverse selection was

present from 1997 to 2003. Since the dependent variable is a discrete one of binary choice (public or private insurer), I opt for using standard Probit regressions. Discrete models are frequently used in the related literature to find empirical evidence of adverse selection. Cutler and Reber (1998) apply logistic regressions to model insurance choice on Harvard plans, controlling for age, working day, job status, distance from office and salary. Shmueli (2001) uses bivariate partial observability probit models to test for either acceptance or rejection in private supplementary insurance in Israel. Castano and Zambrano (2006) employ multivariate logistic regressions to analyze probabilities of enrollment between incumbents (public insurers) and new entrants (private) within Colombian health market. Similarly, Trujillo and McCalla (1998) also apply a bivariate Probit model with partial observability, assuming a joint decision between the insurer and the insured

The decision of ISS enrollment is modeled. The model in matrix form would look like as follows:

$$Y_i = \Phi(\beta' X_i) + \varepsilon_i$$

Where the subindex i represents the decision at an individual level, Y_i stands for the choice of insurer, which takes the value 0 if the individual chooses private insurance and 1 if ISS; Φ is the normal cumulative distribution function, β -s are the estimated coefficients, X_i is the vector with explanatory variables and ε_i is the error term, which is assumed to follow normal distribution with 0 mean and σ^2 variance.

Three sub-samples have been chosen for this exercise. The first one includes the all-age individuals enrolled in the contributory regime in either public or private

insurer. The second sample includes only enrollees older than 20 years, which I denote as the "economically active" sample. This sample allows controlling for more variables, such as education level, type of employment, etc, since this information is only available from certain age and obviously is mostly missing for the young population. The third sample presents information at household level, to identify family patterns of enrollment. Furthermore, a pooled dataset is included to measure the dynamic effect of selection. The same basic model is applied to the different samples.

3.2.4 Results

Table 2.a in the appendices shows the results of the regression for the complete sample, that is, all individuals reported as enrollees in the contributory regime. The estimated coefficients report the marginal effects given on an average individual in the sample. In order to look for a possible endogeneity of health variables used in the first model, an additional regression is included in table 2.b without those health variables. The coefficients do not substantively change, which reinforces the idea of non-significant correlation between the vector of explanatory variables and the error term in the model of Table 2.a.

The 1997 results do not show a clear tendency favoring any age-bracket of population, but conversely in 2003 there is a clear enrollment pattern in the public insurer for older than 60. We can see, in both the size and significance of coefficients of age, how the effect of ageing is stronger in ISS that in a private insurer. Over 60, the probability of affiliation to ISS is 30% higher (ceteris paribus) in 2003. The case is similar for ages 45-59 with 17% more likely to be enrolled in ISS.

I also draw some conclusions based on dynamic effects by using the pooled surveys including interactions with the 2003 "time effect" (Table 3 in Appendix). The increasing values of coefficients from age 15-44 female to age 60 show that the composition of the population affiliated to ISS become older, all with significant marginal effects. The decreasing values in negative terms from good health status to bad health status show that the self reported health also became disadvantageous for ISS. The same pattern can be observed for location and the marital status.

The 2003 data, when compared with 1997, shows some interesting changes in general patterns that could provide additional evidence about the worsening of the risk profile in ISS. Living in a city or town increased the probability of being ISS insured in 1997, but no longer in 2003, which could mean a geographical displacement of ISS enrollees towards rural zones, where the health care is more difficult and costly. Likewise, the self reported health status seems to be worse for the ISS population in 2003. For instance, in 2003, the fact of reporting bad health status increases the probability of having ISS insurance in 11%, whereas in 1997 it reduces that probability in 12%. A similar behavior is reported in "fair' report whereas in "good" status the changes are not meaningful. The chronic condition does not show any particular pattern of worsening for ISS[24], and although the effect in both years is positive, it is not significant.

When controlling for more socioeconomic information, the earlier trend of risk selection remains (Table 4 in Appendix). In 1997 most of education coefficients were positive and significant as the level increased (not significant in professional), but in 2003 the effect reversed, indicating that as education increases, the probability of being covered by ISS decreases. Within income

[24] The discussion about adverse selection in ISS has been mostly supported by the apparent big incidence of chronic patients for ISS (DNP 2003)

groups there was a re-grouping of ISS enrollees towards lower income in 2003, whereas in 1997 the pattern was the opposite. Finally in type of employment, working in the formal sector, being and employee or an independent professional no longer counted as a positive factor ISS enrolment in 2003, as it used to be in 1997.

Looking for more specific patterns of selection, it is possible to extract some conclusions by analyzing statistical evidence within age-groups. Tables 5 and 6 in Appendix show results of sub-samples of population corresponding to both the cheapest (males between 15-44 years) and the most expensive population (older than 60 years), according to the risk-adjusted premium formula of Colombian HIS[25].

For the 15-44 male group (Table 5), deemed the lowest cost by the Colombian Health Board, there is some evidence of selection based on education level, since the pattern changed drastically in 2003 against the ISS (negative and significant coefficients in that year, whereas in 1997 were all of them positive, though not all significant). When it comes to income, the trend for private insurers favors the highest income band, which also implies some degree of selection. No significant evidence of selection was found in the remaining variables.

The group of older than 60 years shows a different trend (Table 6). Here the selection criterion seems to be more focused on income rather than on education. However in this regression stronger evidence of health-status deterioration for ISS enrollees can be found, which might imply an advantageous selection based

[25] I prefer to run additional regressions instead of merely add interactions because like this is possible to find more accurate trends across variables, even though there can be room for sample selection problem. However, the sample size is big enough to extract some significant conclusions.

on morbidity. Nevertheless it is not clear how this selection could be exerted, given the information that insurers can extract from potential enrollees.

The final analysis was done at household level. The Colombian HIS has family coverage[26], meaning that family composition could bring about a set of additional incentives for the insurers. The selection process could occur at the moment of application by using information provided for the potential insured. Insurers could target specific family types, where the family members have desirable characteristics and socioeconomic background.

The empirical analysis at household level comprises 3 different samples. Table 7 shows a Probit regression with household samples for both years 1997 an 2003, where the insurance decision by the family head is a function of a characteristic vector of the family head, such as income, education and age, as well as family composition, which includes average age of children and number of children per household. The sample was restricted to married households with children (up to 25 years old). To control for family structure, that is, characteristics of households regarding marital status of the head (uni-personal, with and without children). Table 8 contains the household sample pooled for both years to identify dynamic effects and Table 9 expands the analysis made in Table 7 by controlling by family structure, meaning whether the family has only a single member, is a married couple without children or is a married couple with children

The results do not show consistent evidence of selection based on either household characteristics or family structure. Some dynamic patterns are favorable to ISS, particularly the trend of the lowest-income households, which

[26] The contributor can enroll spouse and children up to 18 years (also up to 25 years, as long as they are studying)

in 2003 reflects certain redistribution towards private insurers. But also this pattern is observable in the highest-income households. What is noticeable is the evidence of joint decision at the moment of insurance, even when the spouse is working[27]. In both years the insurer choice of the spouse matches the 90% that of the family head. Nevertheless, the spouse characteristics, the socio economic status of the family head, the age composition of children and the size of the household appear to not be important in the insurer decision, which suggests cream-skimming, if present, has been exerted using individual rather than household information.

[27] The Colombian HIS allows for different insurer's choice within households, so long as both the head and the spouse are working and contributing at the same time. But only one member can report the children as beneficiaries.

4 A Discussion of Risk Adjustment Within the Colombian His

One of the main conclusions of the previous empirical exercise of Colombian HIS is that some risk selection can be detected, which potentially affects the financial sustainability of affected insurers, in this case the public one. This section discusses the most relevant methods for preventing adverse selection through risk-adjustment methods and highlights both the strengths and weakness in the Colombian case.

4.1 Risk Adjustment: Target and Concepts

The concept of risk adjustment arises within the context of competitive insurance markets[28]. Insurers offer plans that may take actions such as designing, pricing and marketing, so that they actually select customers. The insurers must bear some financial risk related to the variation in expenditures across individuals and they primarily should provide health care plans by contracting with external providers, even though there are also insurers with some role at a provider-level.

In order to be actuarially fair, a premium should equal the average cost of health care within a group with the same risk profile. Thus, the insurers should homogenize risk of their enrollees (creating an "actuarial category") and subsequently set an actuarially fair premium by pooling individuals with the same risk or probability of shock, which can be either illness or health care usage in the case of health insurance markets (Holly et al 2004).

[28] Van den Ven and Ellis (2000) define as competitive markets wherein individual consumers face a choice of health plan, carried by insurers. Insurers are defined as risk-bearing entities that perform at least some insurance function.

However, the setting of risk-based premiums is usually labeled as either unfair or as a source of inequity between the high-risk and low-risk individuals. Normally the high-risk individuals are primarily not responsible for this condition, and hence the fact of having to pay more than others confronts the delicate issue of equity. Furthermore, as Holly et al (2004) indicate, the budget share devoted to health insurance is definitely higher for poor than rich individuals, which could affect directly the access to health care, in case of extremely high premiums for those without ability to pay.

Under the current system, raising premiums is difficult because of the equity issues mentioned above. Thus, ability of selection from insurers is then given by exploiting heterogeneity in the risk. This behavior is normally justified by the difference in cost across individuals. But in the end, is largely due to the losses for insurers with costly enrollees. To break even, they should charge an extra-premium to those with higher expenditures, whereas the ones with low incidence should be charged less. Cutler and Zeckhauser (1999) relate risk adjustment with that differential premium, which in theory can be hard to define. Thus, as these authors point out, risk adjustment aims to solve one of the fundamental questions about efficient design of health insurance: how to achieve the benefits of competition while containing the costs of selection.

Following this logic, Van de Ven and Ellis (2000) define risk adjustment as the use of information about expected outlays in health care of individuals by periods, in order to design either cross-subsidies or sponsor contributions among consumers, health plans or both to improve efficiency and equity. They also consider triggering issues such as the role of the sponsor, the difference between the supply price and the demand price of insurance, policy relevance due to increasing in expenditure and worsening of risk profiles, etc. The risk adjustment roughly implies reallocation of resources and subsidies in such a way that system

compensate insurers by paying a reasonable approximation of the difference in risk, and hence in expected costs, of its enrollees.

Risk-adjustment models act at three levels, following Van den Ven and Ellis (2000). First, setting appropriate incentives for insurers, who could perceive the practice of risk selection as less profitable. Thus, improvements in risk-adjustment would reduce selection practices such as cream-skimming, skimping and dumping (Ellis, 1998). Nonetheless, the discussion about the effectiveness of every proposed model is ongoing, and its scope of action varies substantially[29].

Second, the issue of fairness should also be taken into account, since most of health insurance markets deal with public and generalized coverage, and most of health markets are sponsored and regulated by governments. Normally the fairness issue calls for solidarity among insurers, meaning cross-subsidies. Nevertheless, there is no consensus about the scope of fairness when some scenarios of adjustment are considered. Specifically, the concept of individual responsibility with respect to their risk-profile is a point of contention[30]. In most cases, the fairness is reduced to the ability of purchasing insurance and accessing equally to health care.

Third, the concept of administrative feasibility for risk-adjustment measures is also considered. It has to do with the information required to adjust the costs in an efficient way, and therefore the premiums by risk-profile. Likewise, other aspects of feasibility are related with the social acceptance of adjusters, which may require certain private information[31]. Finally, it is also important to take

[29] Schokkaert and Van de Voorde (2000) provide an useful systematization of incentives for insurers in health markets

[30] For instance, patients with AIDS or lung cancer due to unhealthy life styles.

[31] The authors quote cases of individual information of seropositive patients, mental illness, ethnicity and religion.

into account the credibility of clinical information, since the providers play with different incentives and are affected by agency problems.

Many risk adjusters have been discussed in the literature (Van den Ven and Ellis 2000, Cutler and Zeckhauser 1999). Most of them include age and gender (demographic) as the most important adjusters, but not the only ones; there also are methods that consider diagnosis-based procedures, information from drug prescriptions, self-reported health information, mortality, disability, functional health status, and finally the pure reimbursement model (after-the-fact insurance).

There have been two functional forms considered to implement the risk adjustment. The first one considers using prospective information, that is to say the prediction of expenditures is made at the beginning of the period using information from previous years. Conversely, the retrospective form uses information at the end of the period, thus estimating the adjustment with observed information, generally 1 year or period.

Retrospective information is advantageous in the sense that it captures a greater percentage of the variance in health spending at the individual level. However, Van den Ven and Ellis (2000) insist that it may be not preferable in practice for a variety of reasons among which are the relative emphasis on acute conditions versus chronic conditions given by the retrospective framework. In addition, retrospective information is weak to combat both wrong incentives and unfairness in the long term. Some empirical work (Dunn et al 1996, Ellis et al 1996, Ash et al 1998) support the evidence in favor of prospective payments as a more efficient and feasible manner of predicting long term trends in expenditure.

It is good to mention that perfect risk adjustment, meaning an adjusted premium for any risk category equal to its actuarial value, is not a realistic target, but also it is not the only measure to avoid selection in health markets. Van de Vel and Ellis (2000) mention several alternative measures: risk sharing, carve out (separation of services), risk-rating of premiums, regulation, mandatory insurance, introduction of plan level entry (or barriers), increasing information to consumers, ethical codes, etc[32].

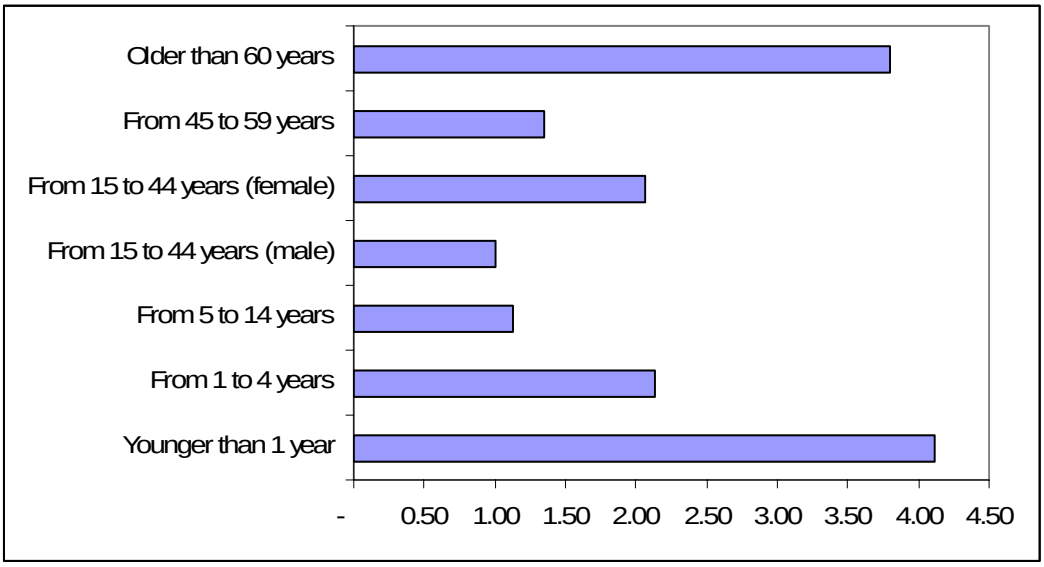
4.2 Features of Risk Adjustment in the Colombian System

The formula of risk adjustment in the contributory regime of Colombian HIS includes the definition of a reference premium, (UPC) that is periodically adjusted by the Health Board of the system[33]. This is a differential premium using age and gender as adjusters, which is disbursed through the equalization fund, as described earlier. The estimation of the premium differential was based on retrospective information on health profiles elaborated in the onset of the system (1993). That information is still being used.

[32] For example Bir and Eggleston (2003), using the net marginal benefit of risk selection, find that selection can be less when are considered more parameters apart from profit for insurers, such as adherence of professional ethics, payment method and others that could be considered as alternatives measures to risk adjustment..

[33] The Health Board is a semi-public institution (created by the same law that reformed the system), where government, society and health agents discuss and approve the changes of the health system. This body defines yearly the average UPC, which is the reference for all of adjusted premiums.

Figure 8. Premium Differential Across Age Intervals 2006



Source: Ministry of Social Protection. 2006. Own computations. Scale in terms of proportions.

It is worthwhile comment on this risk adjustment formula, following the conceptual framework described in the previous section. First of all, one of the main defects of its application is the lack of updating in morbidity profiles and expenditures every year. A perceptible change is expected in such indicators since 1993, but the only adjustment made is annual increases due to inflation. Thus, the discussion about either prospective or retrospective information is not pertinent since the estimation of health expenditures is absent, and the value of the premium is adjusted using only the general prices index.

On the other hand, the adjustment in Colombian formula is based on demographic adjusters, namely age and gender[34] (though age is the prevalent one, since gender only applies to 15-44 years range). Some authors have indicated the limitations of only using demographic information, due to its

[34] There is a special premium defined in base of location, but its incidence is relatively insignificant within the aggregate of the enrollees (2% of them, source MPS). That is why it is not taken into consideration.

limited predictive power. Altman et al (1998) suggest a nonlinear relationship between age and health expenditures, which invalidates the effectiveness of age as unique adjuster in the long term. Likewise, Becket et al (2001) remark that age and gender only explain 4% of the variance in health expenditures of Switzerland, whose current risk-adjustment formula is similar to the Colombian one[35]. Finally Knaus and Nuscheler (2002) also find a incomplete adjustment in Germany formula (with age and gender as adjustors), which can improve when a health status index is incorporated.

The risk-adjustment methodology of Colombian HIS focuses in fairness rather than efficiency. The solidarity principle is firmly settled into the ideological body of the 1993 reform (Jack 2000, Mesa-Lago 2005). However, this solidarity is basically "income-solidarity", meaning transfers between high- and low-income individuals[36]. As Van den Ven and Ellis (2000) point out, the redistribution concept varies across countries and is fairly autonomous of incentive issues and fairness across risk types.

Apart from the adjustment formula, some measures aimed at avoiding selection have been taken through regulation:

- Minimum basic health insurance is compulsory for all dependent workers, which has a twofold utility: to increase access to health care through universal insurance and also to ensure having low-risk individuals cross-subsidizing the high-risk ones.

[35] The risk-adjustment formula in Switzerland uses a risk equalization fund to cross-subsidize sickness funds with disadvantageous age-gender composition (e.g. many female and old), in a similar way as the Colombian System, but using different information for every Canton (Becket et al 2001).

[36] In 2000 the WHO report of health system performance ranked Colombian system as the most equitable system in the world, regarding financial equity.

- Open enrollment, which means that insurers must accept applicants without any reservations.
- The system charges community-rated premium, not related with fixed amount of money, but rather the same proportion of income to all its policyholders (payroll tax).
- All residents have freedom of choice in terms of insurers, but must fulfill some periods of coverage in order to get the full package of health care[37].

As a result, the main policy recommendation about risk-adjustment for the contributory regime of Colombian system is updating the information on mortality and morbidity profiles of insureds. It cannot be said how much the current formula for differential premiums deviates from the real pattern of expenditures in health care. This would be the first step to build an efficient risk-adjustment method.

The considered reforms should also improve the regulator role of the health authority, since is evident that the open enrollment is not being accomplished in practice. One of the main keys for success of selection containment is that insurers must perceive cream-skimming as costly. The strengthening of competition control from the health authority may temporarily supersede the absence of a reliable risk adjustment.

Trujillo and McCalla (2004) proposed a set of policy recommendations for the Colombian system. They divide the measures between regulatory improvements and changes in the risk-adjustment formula. Regulatory improvements should specifically include actions in the design, monitoring and evaluation of current

[37] Conclusions of Belli work (2001) may suggest a noxious effect of regulatory measures as those of Colombian system for containing selection. He says that imposition of a standard contract or restriction of premium rates can exacerbate the problem of adverse selection and lead to chronic market instability

insurance contracts. On the other hand, they suggest changing the risk-adjustment formula by adding new adjusters, establishing risk-related flat rate premium and adopting risk-sharing measures. Additionally, they suggest the adoption of both random and binding process to re-allocate more efficiently the pool of insureds.

Some of these reforms can be troublesome to apply, due to feasibility issues[38]. The adoption of new risk-adjusters is constrained because of the limitations for both the government and private companies to collect data at the inpatient and outpatient level, diagnosis, and the valuation of services (Castano and Zambrano 2006). The risk-related flat premium can go against the fairness of the system, since most of the high-risk enrollees are probably poorer populations without ability to pay a premium related with their inherent risk. Finally, the random reallocation of insureds does not take into account the efforts in marketing and enrollments made by most of the insurers which, even though may be selection-oriented, are legal and in tune with marketing strategies.

Summarizing, the adoption of an efficient method of risk-adjustment in Colombian Health Insurance System can be a very complex process. Although the system apparently performs well in terms of equity, the efficiency gap is still large and there is room for advantageous selection. The standard measures required for improving the current formula are hard to apply, since they involve the necessary, but difficult, collection of a vast amount of information on health expenditures, health care usage and morbidity diagnosis. Meanwhile it may be possible to get some improvement by fortifying the regulation framework and by increasing the health authority presence in the competition process of such a market.

[38] Recall that feasibility is one out of three points highlighted by Van de Ven and Ellis (2000) as key when improvements of risk-adjustment are considered

5 Conclusions

Throughout this work, evidence about an apparent and progressively worse selection against the public insurer (ISS) of Colombian Health Insurance System has been found, using data from Colombian socio-economic surveys. This fact could question the appropriateness of the risk-adjustment system in Colombia, based on private insurers' behavior. Thus, one possible hypothesis would be failures in risk-adjustment, since even the higher premia paid for the elderly cannot compensate for the higher health care costs of that group. As a result, the population of ISS became more costly (since it was riskier) as time went on, and it might have influenced its final bankruptcy in 2006.

As far as the empirical evidence can show, the risk-adjustment system in Colombia has not been able to cover the risk disparity between enrollees, which has contributed to the placement of dynamic selection incentives. This pattern could have been exerted by adjusting periodically their patterns of private insurer's enrollment, probably because of the presence of gaps in the design of the adjustment formula, as well as lack of reliable and updated information about health care usage and prospective expenditures. The results suggest certain degree of risk-selection based on the premium categories but not strong evidence on selection within age-group selection. This result goes in line with the second case described in the formal section in chapter 3, when the incentives of the insurers when premiums are not actuarially fair for the age group are exposed.

The policy recommendations should be oriented towards the construction of reliable and opportune information about mortality and morbidity in order to accurately predict individual health expenditures and hence, improve the role of

risk adjustment to avoid the adverse selection. Also is relevant to highlight the necessary improvement required in the

Nevertheless some caveats should be mentioned. First of all, the bankruptcy of ISS was caused by multiple factors, among which adverse selection would have a key role, but it was not the only one. Secondly, the data has some drawbacks that makes difficult to extract robust conclusions. Apart from some differences in design and sample between the surveys, it is lacking health expenditures information, which is not available in any source of the Colombian HIS. Moreover, is not possible to establish a causal relationship between health care usage and type of insurer, because of the potential endogeneity in most of health questions available in the surveys. Finally, since the data is cross-section and not panel, it is impossible to examine individual behavior and their decisions concerning health insurance choice.

Some additional questions remain unanswered. For instance, without information about the real cost of health package, it is not possible to extract definitive conclusions about the magnitude of the premium gap across risk-profiles. Statistical evidence of cream-skimming of private insurers has been found, but there is no indication of its underlying mechanism. It could be present due to wrong incentives of the system, poor risk management of ISS, "adverse retention", systematic position abuse, marketing strategies or a combination of them. These questions are left to future research.

6 References

1. Alary, David; Bien, Franck. Adverse selection in health insurance: are first best contracts impossible? CERPEM-SDF, University Paris Dauphine.
2. Altman Daniel; Cutler, David M.; Zeckhauser, Richard J. (1998). "Adverse Selection and Adverse Retention" The American Economic Review, Vol. 88, No. 2, 122-126.
3. Beck, Konstantin; Spycher, Stefan; Holly, Alberto & Gardiol, Lucien. (2001) "Risk Adjustment In Switzerland". Version without publishing.
4. Belli, Paolo. (2001). "How Adverse Selection Affects the Health Insurance Market". The World Bank Development Research Group. Policy Research Working Paper 2574.
5. Bir, Anupa & Karen Eggleston (2003): "Measuring selection incentives in managed care: Evidence from the Massachusetts State Employee Insurance Program," mimeo, Tufts University.
6. Browne, Mark J. (1992). "Evidence of Adverse Selection in the Individual Health Insurance Market". The Journal of Risk and Insurance, Vol. 59, No. 1. 13-33.
7. Castano, Ramon & Zambrano, Andres. (2006). "Biased selection within the social health insurance market in Colombia" Health Policy 79. 313–324
8. CEPAL. (2006). "Shaping the Future of Social Protection: Access, Financing and Solidarity". Economic Commission for Latin America ECLAC (CEPAL). Chapter III: Social Protection and Health Systems. 73-106.
9. Cutler David & Zeckhauser Richard (1999) "Anatomy of health insurance" National Bureau Of Economic Research Working Paper 7176.
10. Cutler, David M. & Sarah J. Reber. (1998). "Paying for Health Insurance: The Trade-off between Competition and Adverse Selection." The Quarterly Journal of Economics (May) 433-466.
11. Cutler, David M. (1994). "A Guide to Health Care Reform" The Journal of Economic Perspectives, Vol. 8, No. 3. 13-29.
12. DANE (National Department of Statistics, Colombia). Encuesta de Calidad de Vida. 1997 and 2003.
13. Departamento Nacional de Planeación (2003). Plan de Modernización Instituto de Seguros Sociales. Sector Salud. Documento Conpes 3219.
14. Eggleston Karen. (2000). "Risk Selection and Optimal Health Insurance-Provider Payment Systems". The Journal of Risk and Insurance, Vol. 67, No. 2, pp. 173-196.
15. Ellis, Randal (1998). "Creaming, Skimping and Dumping: Provider Competition on the Intensive and Extensive Margins" Journal of Health Economics 17, 537-555.
16. Folland Sherman, Goodman Allen C. & Stano Miron. (1997) "The Economics of Health and Health Care. Second Edition. Chapter 11. Insurance and organization of health providers. Prentice-Hall.

17. Glazer Jacob; McGuire Thomas G. (2000). "Optimal Risk Adjustment in Markets with Adverse Selection: An Application to Managed Care". The American Economic Review Vol. 90, No. 4, pp. 1055-1071
18. Holly, Albert; Gardiol, Lucien; Eggli, Yves; Yalcin, Tarik & Ribeiro, Tiago. (2004). "Health-based Risk Adjustment in Switzerland" Research financed by the Swiss National Fund, National Research Program 45 "Future Problems of the Welfare State" Institut d'économie et management de la santé (IEMS) University of Lausanne
19. Jack, William. (2000). "Health Insurance Reform in Four Latin American Countries: Theory and Practice". World Bank. Policy Research Working Paper 2492.
20. Jack, William. (2004). "Optimal risk adjustment in a model with adverse selection and spatial competition". Discussion Paper. Georgetown University.
21. Knaus, Thomas; Nuscheler, Robert. (2002) "Incomplete Risk Adjustment and Adverse Selection in the German Public Health Insurance System". Discussion papers Social Science Research Center Berlin Fs Iv 02 – 27.
22. Lleras-Muney, Adriana. (2005). "The Relationship between education and adult mortality in the United States." Review of Economic Studies, 72, 189-223
23. Londono, Juan L; Frenk Julio. (1997). Structured pluralism: towards an innovative model for health system reform in Latin America. Health Policy;41:1–36.
24. Mesa-Lago, Carmelo (2005). "Las reformas de salud en América Latina y el Caribe: su impacto en los principios de la seguridad social". Documentos de proyectos Comisión Económica para América Latina y el Caribe (CEPAL). 63.
25. Ministry of Social Protection. Colombia. Agreement CNSSS 322 2005. Law 100.1993
26. Morales, Luis. (1997). "El Financiamiento del Sistema de Seguridad Social Colombiano". Comisión Económica para América Latina CEPAL. Serie Financiamiento para el Desarrollo. 55.
27. Newhouse, Joseph. (1984). "Cream-skimming, asymmetric information, and a competitive insurance market". Journal of Health Economics 3, 97–100.
28. Newhouse, Joseph. (1984). "Is competition the answer?". Journal of Health Economics 1, 109-116
29. Newhouse, Joseph. (1996): "Reimbursing health plans and health providers: efficiency in production versus selection," Journal of Economic Literature, 34, 1236-1263.
30. Pauly, Mark. (1984). "Is cream-skimming a problem for the competitive medical market?" Journal of Health Economics 3 87-95. North-Holland
31. Pita Barros, Pedro. (2003). "Cream-skimming, incentives for efficiency and payment system". Journal of Health Economics 22 419–443
32. Restrepo, Jairo; Zambrano, Andrés; Velez, Mauricio; Ramírez, Manuel (2007) "Health insurance as a strategy for access: Streamlined facts of the Colombian

Health Care Reform" Universidad del Rosario, Bogota Colombia. Documentos de Trabajo No 14.
33. Rothschild, Michael & Joseph Stiglitz. 1976. "Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information." The Quarterly Journal of Economics, Vol. 90, No.4 (Nov) 629-649.
34. Savedoff, William D. (2000). "Is Anybody Listening? Ignoring Evidence in the Latin American Health Reform Debates: a health note". Discussion Paper Inter-American Development Bank. IADB
35. Savedoff, William D. (2000). "Reaching the Poor through Demand Subsidies: The Colombian Health Reform". SDS/SOC – Health Note No. 2 Inter-American Development Bank. IADB
36. Schokkaert, Erik & Van de Voorde, Carine. (2000) "Risk adjustment and the fear of markets: The case of Belgium" Health Care Management Science 3 121–130.
37. Shen, Yujing; Ellis, Randall P. (2002): "Cost Minimizing Risk Adjustment," Journal of Health Economics, 21(3), 515-530.
38. Shmueli, Amir. (2001). "The effect of health on acute care supplemental insurance ownership: An empirical analysis". Health Economics, 10, 341–350.
39. Smith, James P. (1999). "Healthy Bodies and Thick Wallets: The Dual Relation between Health and Economic Status". Journal of Economic Perspectives. Volume 13, Number 2. 145–166.
40. Swartz, Katherine. (2003). Reinsuring Risk to Increase Access to Health Insurance. American Economic Review. Vol. 93, No. 2, Papers and Proceedings of the One Hundred Fifteenth Annual Meeting of the American Economic Association, Washington, DC, January 3-5, pp. 283-287
41. Titelman, Daniel & Uthoff, Andras. (2003). "The role of insurance in social protection" Economic Commission for Latin America ECLAC. United Nations. CEPAL Review Nº 81. 99-117.
42. Trujillo, Antonio & McCalla Dawn (2004) "Are Colombian Sickness Funds Cream Skimming Enrolees? An Analysis with Suggestions for Policy Improvement". Journal of Policy Analysis and Management, Vol. 23, No. 4, 873–888
43. Van de Ven, Wynand & Ellis, Randall (2000): "Risk adjustment in competitive health plan markets" in A.J. Culyer and J.P. Newhouse (eds.) Handbook of health economics, North- Holland.
44. World Health Organization. (2000). "Health systems performance assessment". Geneva: WHO, 2000.
45. World Health Organization. (2004). "Private Health Insurance: Implications for Developing Countries". Discussion Paper Number 3
46. Wysong, Jere & Abel, Thomas. (1998) "Competition and cream skimming in Germany: Incentives and opportunities". Birkhauser Verlag, Basel. Soz.-Praventivmed. 43 5-6.
47. Zweifel, Peter (2005). "The Purpose and Limits of Social Health Insurance" Contribution prepared for the Annual Meeting of the Verein für Socialpolitik D-Bonn, 28-30.

7 Appendix

Figure 1. Variables across insurers 1997-2003 Colombia's Quality of Life Survey

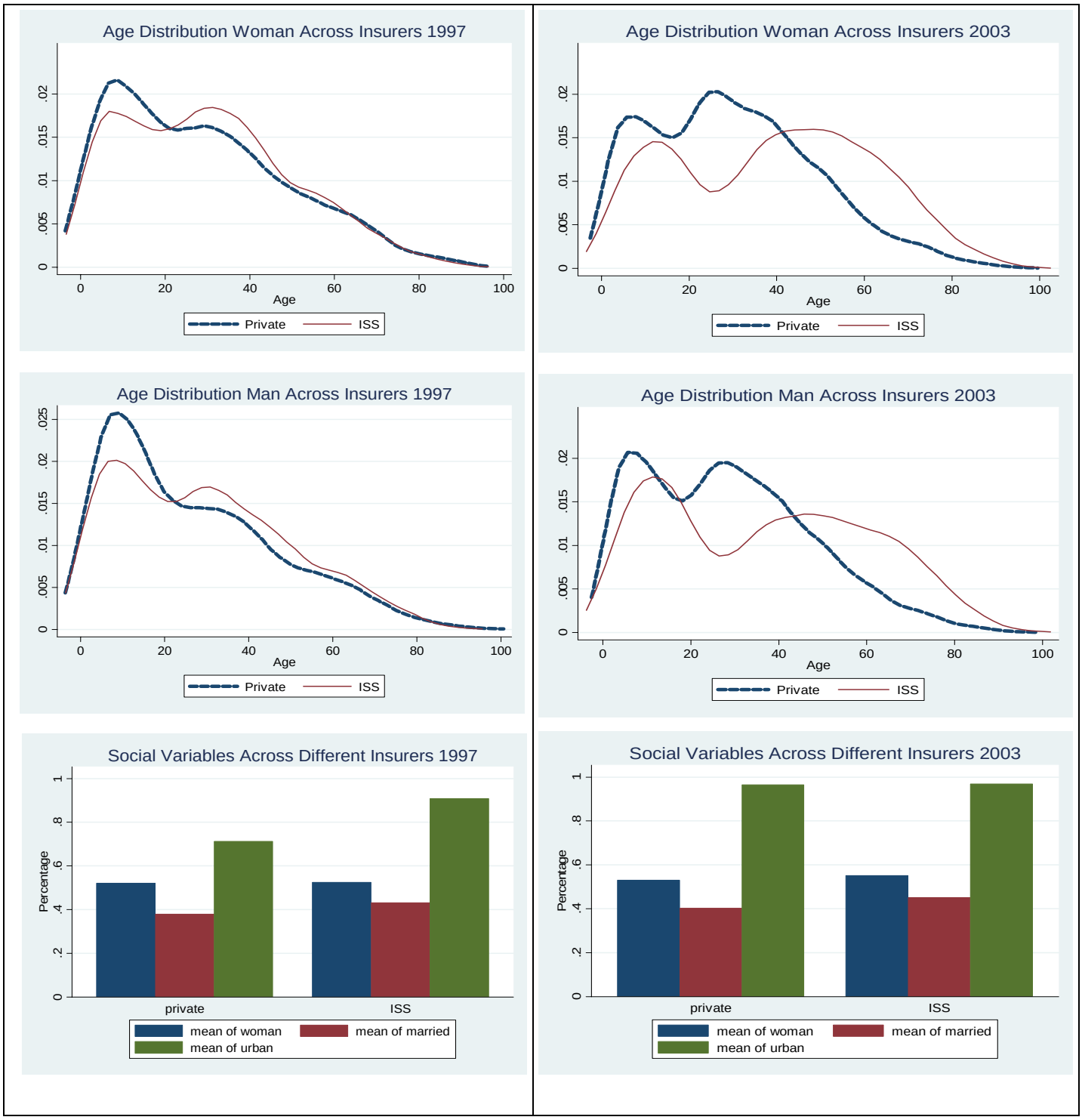


Figure 1. Variables across insurers 1997-2003 Colombia's Quality of Life Survey

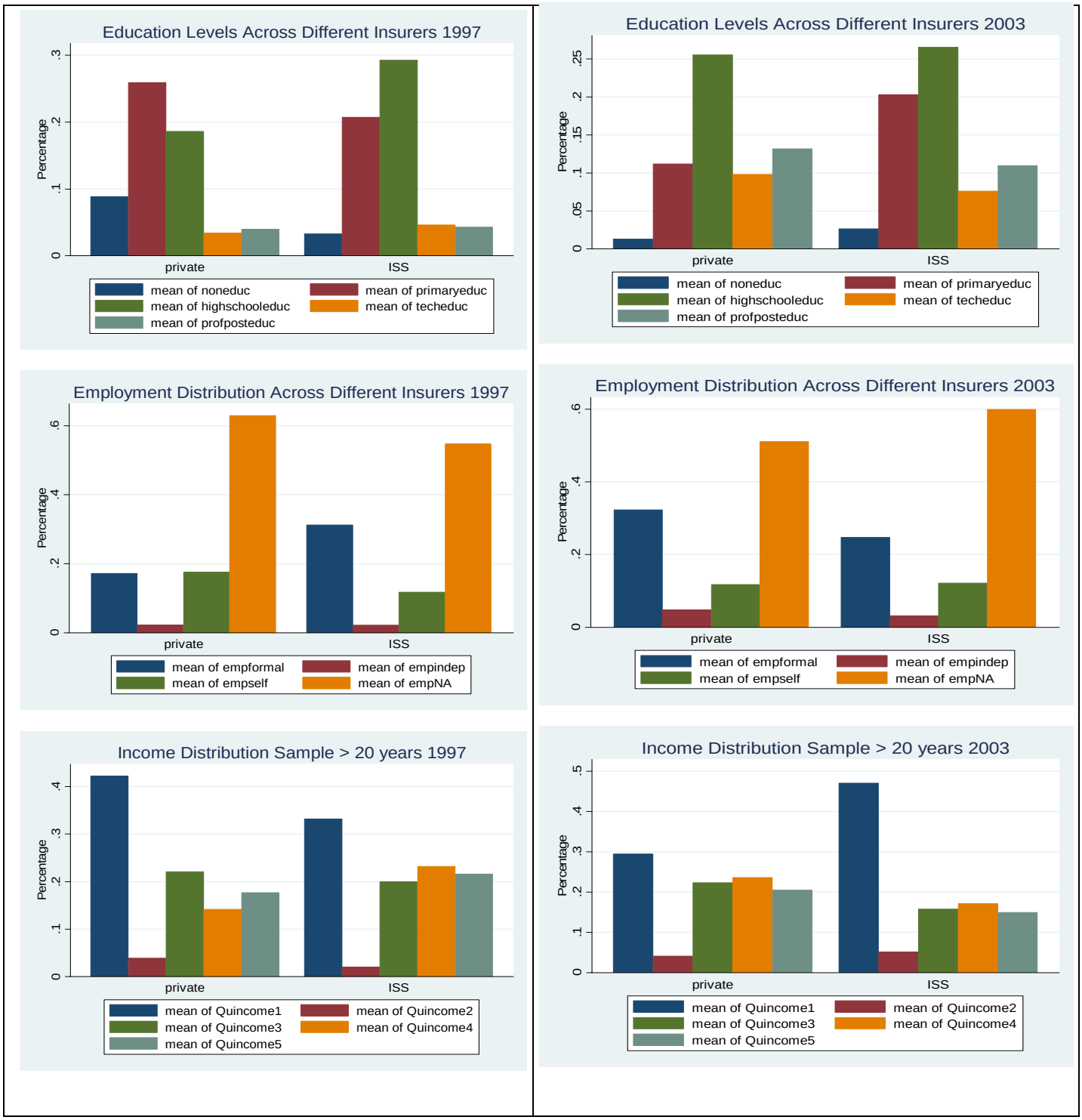
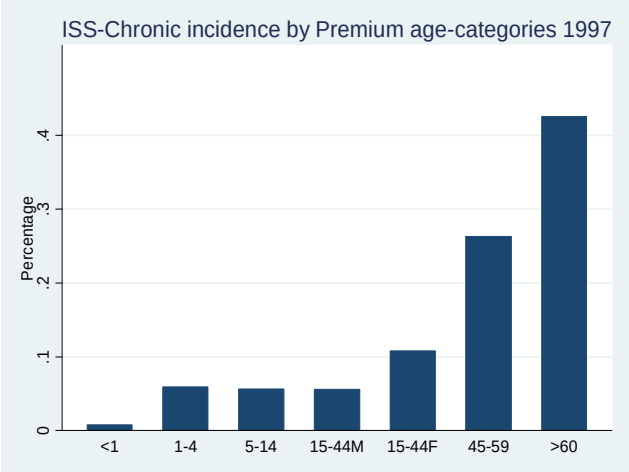
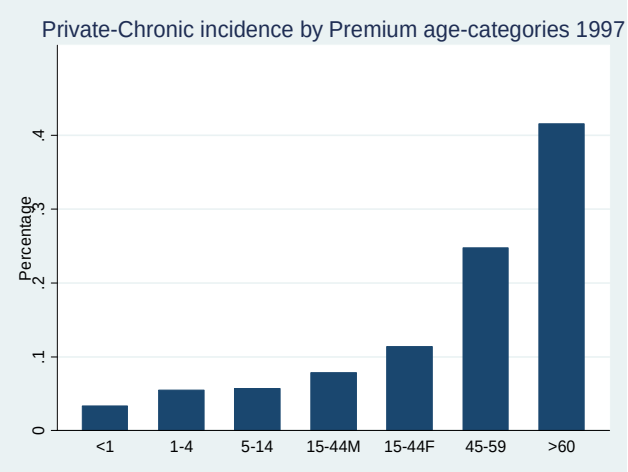
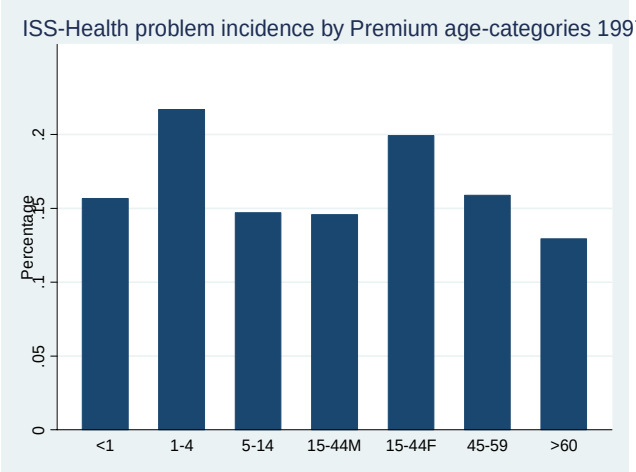
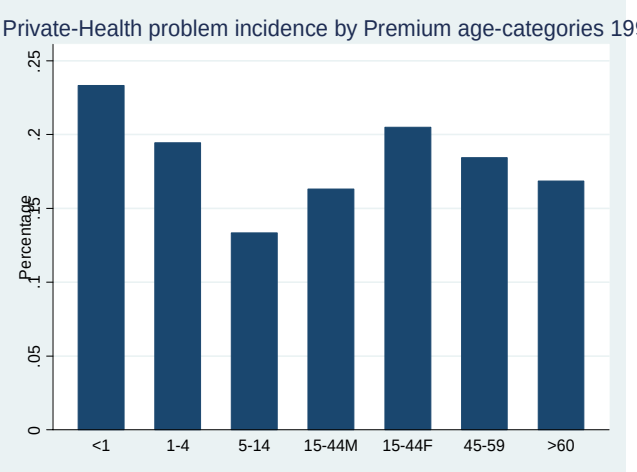


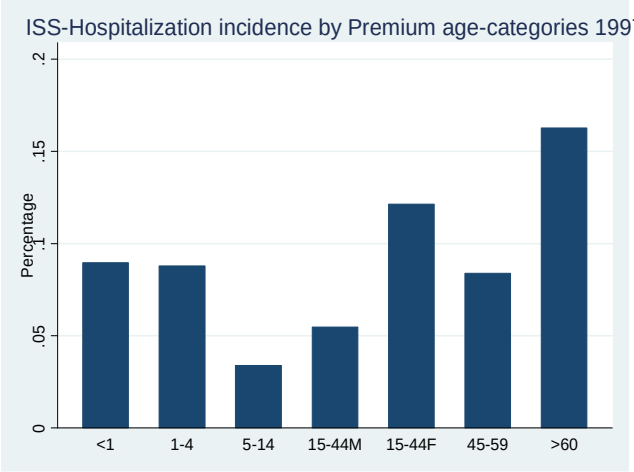
Figure 2. Variables across age bands 1997 Colombia's Quality of Life Survey (1)











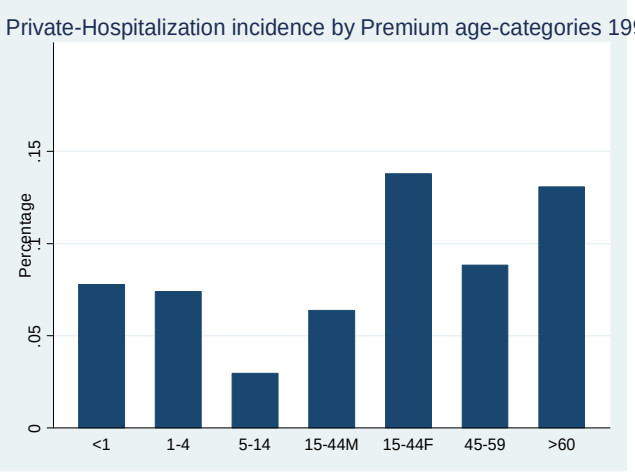
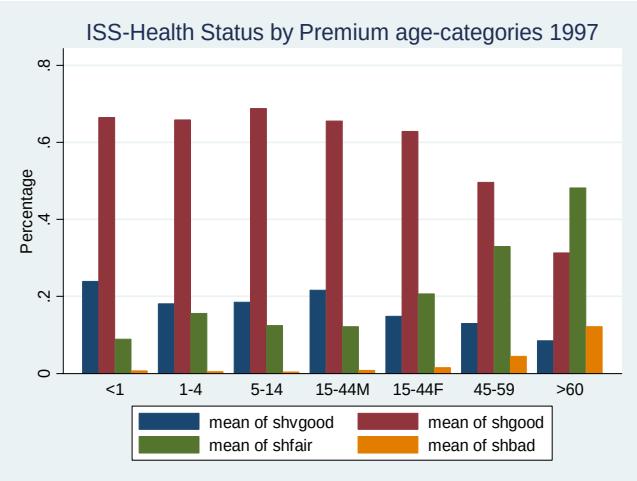
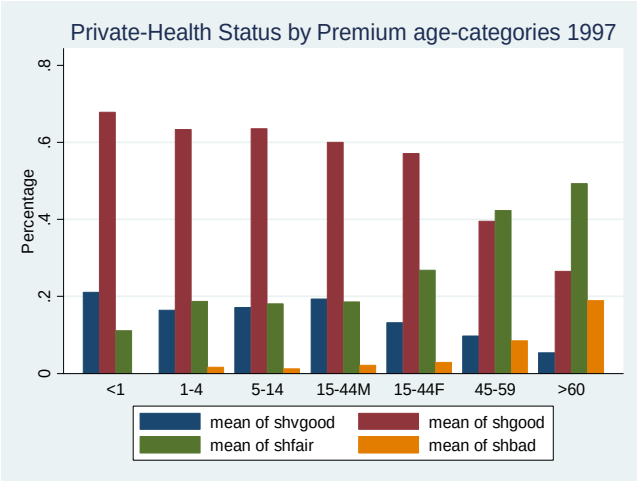
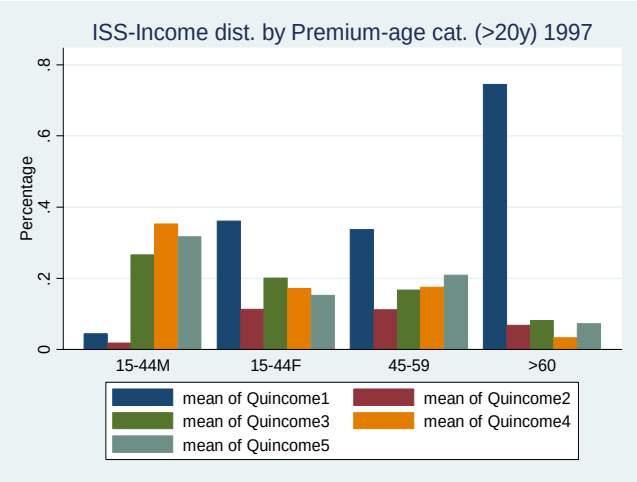
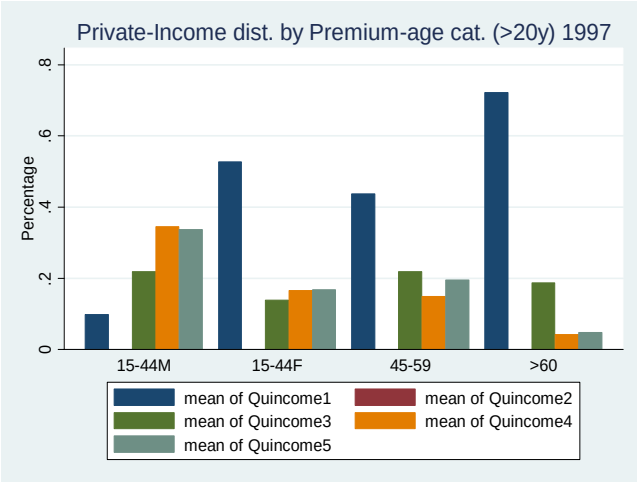


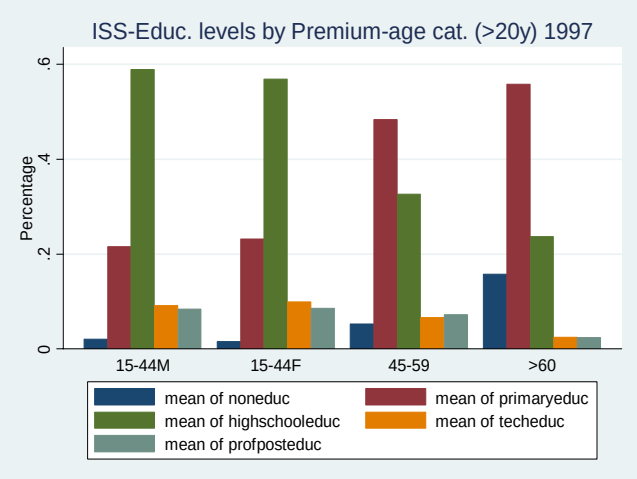
Figure 3. Variables across age bands 1997 Colombia's Quality of Life Survey











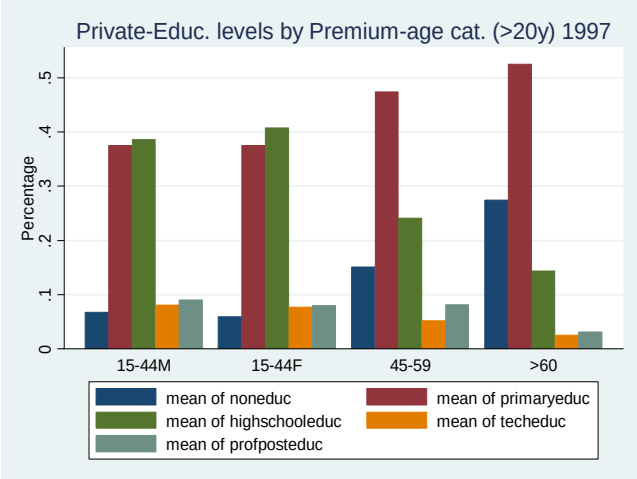
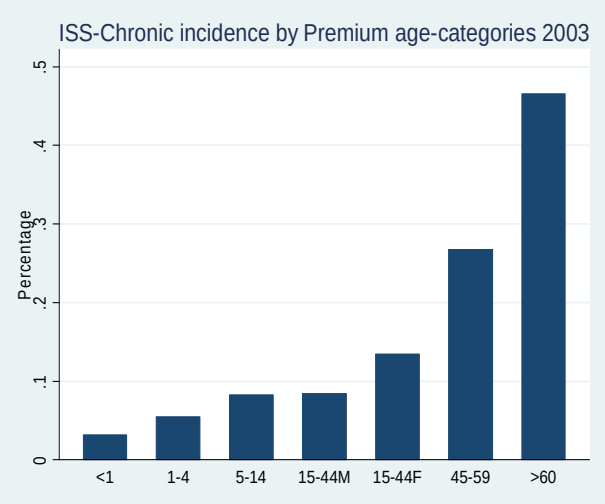
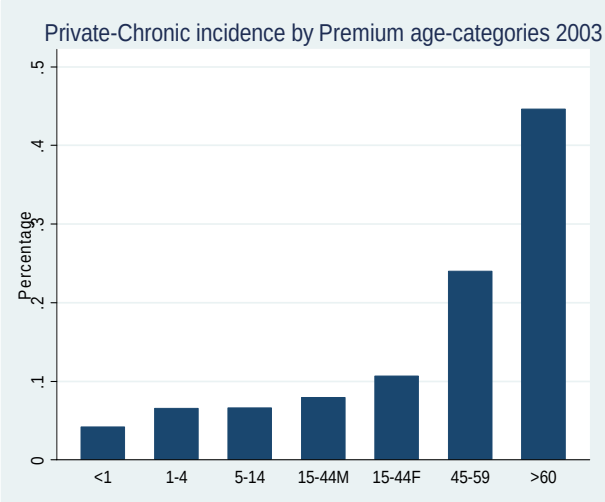
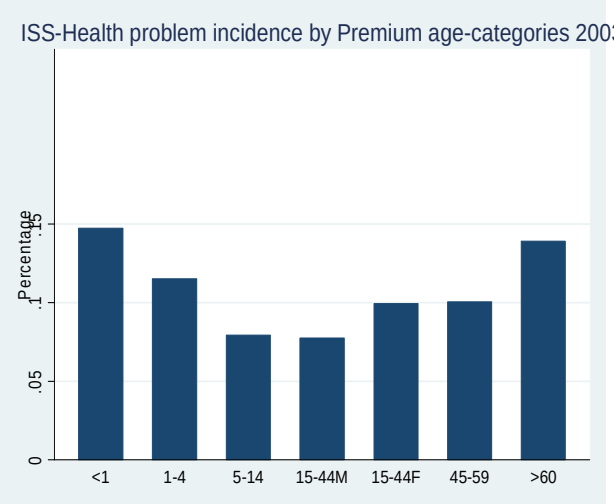
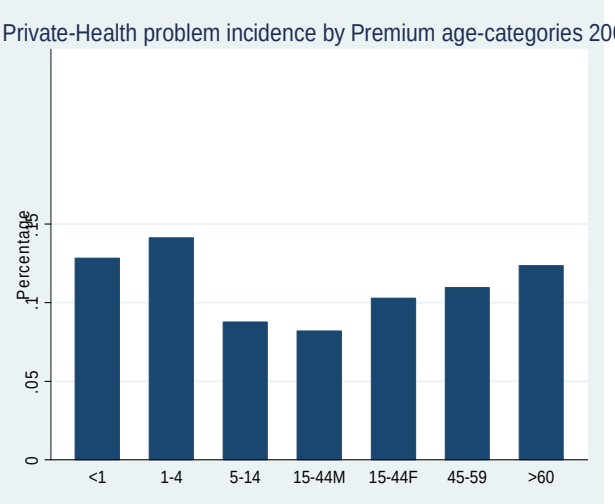


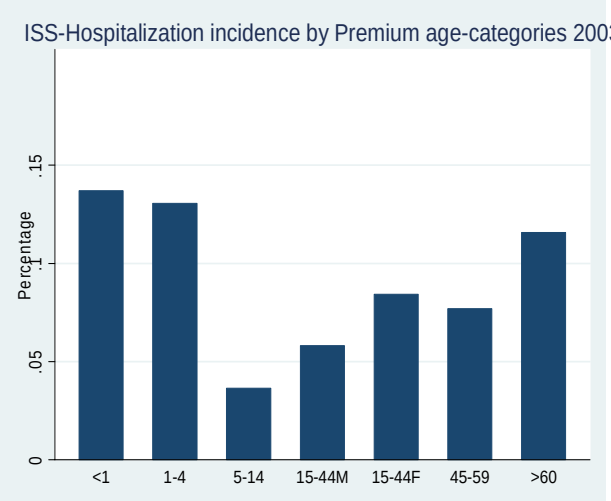
Figure 4. Variables across age bands and insurer 2003 Colombia's Quality of Life Survey (1)











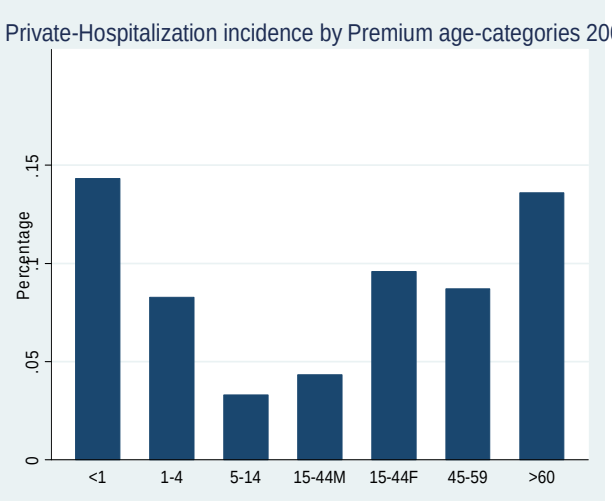
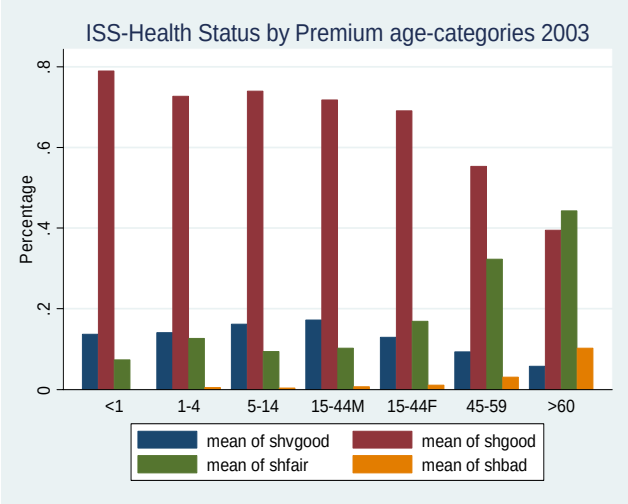
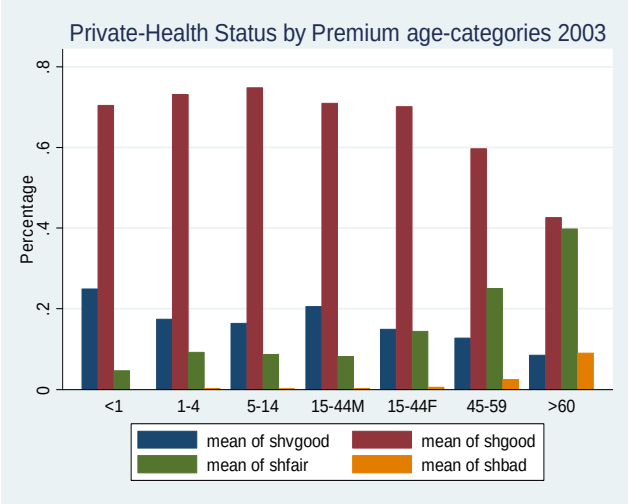
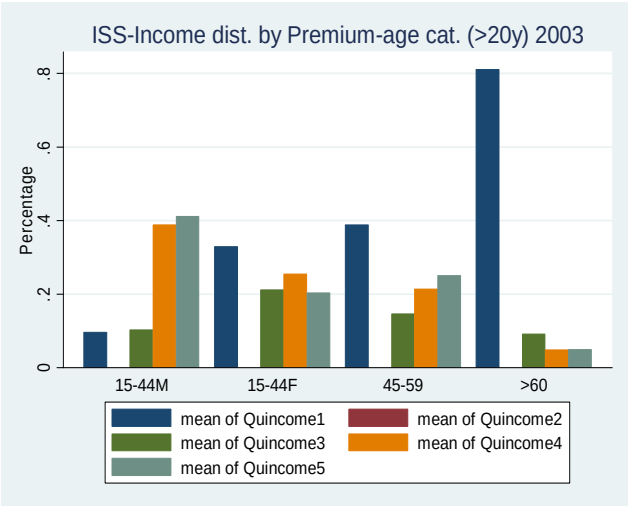
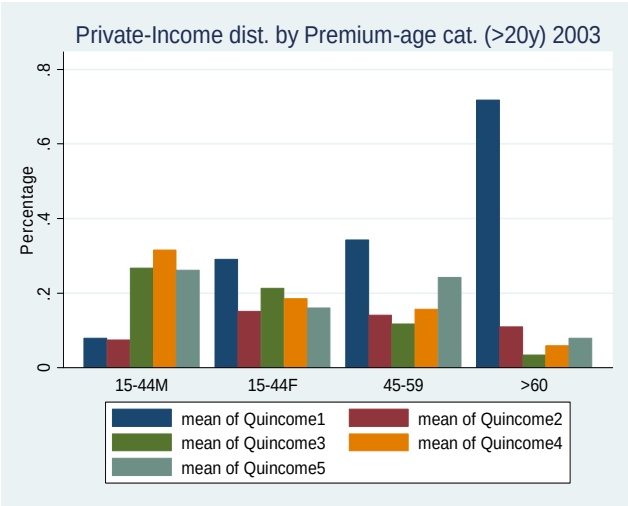


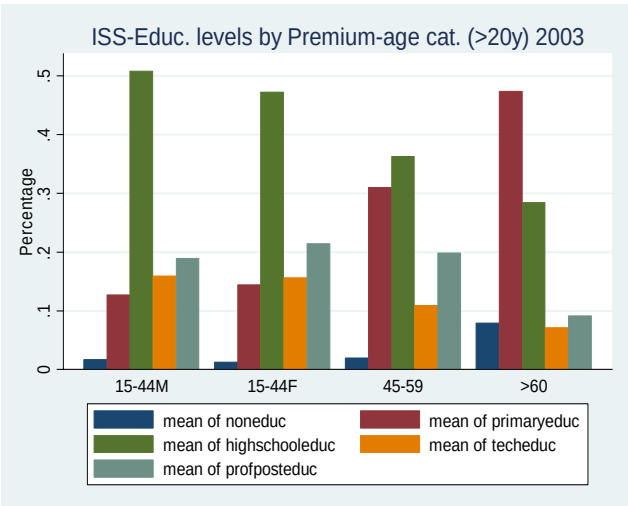
Figure 4. Variables across age bands and insurer 2003 Colombia's Quality of Life Survey (2)











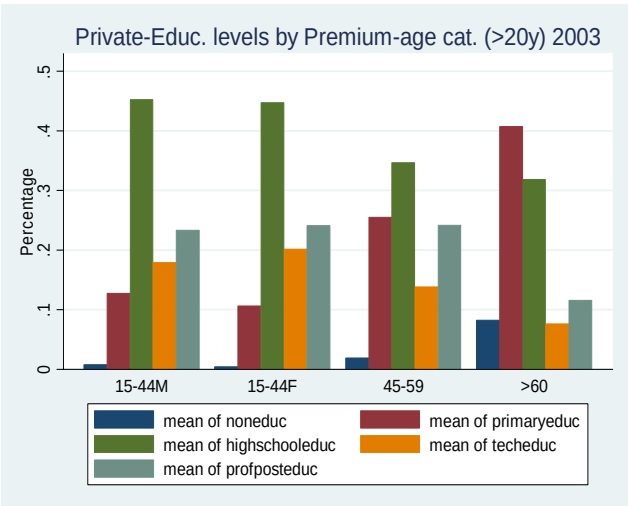


Table 1. Variables and descriptive statistics Colombia's Quality of Life Survey 1997-2003

Variables	Description	1997						2003					
		Total		Private		ISS		Total		Private		ISS	
		Mean	St Dev	Mean	St Dev	Mean	St Dev	Mean	St Dev	Mean	St Dev	Mean	St Dev
Age	# of years	28.87	20.23	27.79	20.39	29.86	20.04	32.37	20.82	29.38	19.02	38.61	22.91
Gender	1 if individual is female 0 otherwise	0.52	0.50	0.52	0.50	0.53	0.50	0.54	0.50	0.53	0.50	0.55	0.50
Marital status	1 if individual is married 0 otherwise	0.41	0.49	0.38	0.49	0.43	0.50	0.42	0.49	0.40	0.49	0.45	0.50
Location	1 if individual lives in town or city 0 otherwise	0.81	0.39	0.71	0.45	0.91	0.29	0.97	0.18	0.96	0.19	0.97	0.17
Chronic	1 if individual reports chronic condition 0 otherwise	0.13	0.34	0.13	0.34	0.13	0.34	0.16	0.37	0.13	0.34	0.21	0.41
Health problem	1 if individual reports health problem last month 0 otherw.	0.17	0.38	0.17	0.38	0.17	0.37	0.10	0.30	0.10	0.30	0.10	0.30
Health status	Self-reported health status												
Very good	*1 if individual reports very good HS 0 otherwise*	*0.16*	*0.36*	*0.15*	*0.35*	*0.17*	*0.37*	*0.15*	*0.35*	*0.16*	*0.37*	*0.12*	*0.32*
Good	*1 if individual reports good HS 0 otherwise*	*0.58*	*0.49*	*0.55*	*0.50*	*0.60*	*0.49*	*0.66*	*0.47*	*0.68*	*0.47*	*0.61*	*0.49*
Fair	*1 if individual reports fair HS 0 otherwise*	*0.23*	*0.42*	*0.26*	*0.44*	*0.21*	*0.41*	*0.18*	*0.38*	*0.15*	*0.35*	*0.24*	*0.43*
Bad	*1 if individual reports bad HS 0 otherwise*	*0.03*	*0.18*	*0.04*	*0.20*	*0.03*	*0.16*	*0.02*	*0.14*	*0.01*	*0.11*	*0.03*	*0.18*
Pension enrollment	1 if individual is enrolled in pension system 0 otherwise	0.48	0.50	0.33	0.47	0.59	0.49	0.59	0.49	0.56	0.50	0.67	0.47
Educational level	Dummies of education level organized in 5 groups												
None	*1 if individual has no education 0 otherwise*	*0.08*	*0.26*	*0.11*	*0.32*	*0.05*	*0.21*	*0.02*	*0.15*	*0.02*	*0.13*	*0.03*	*0.18*
Primary	*1 if individual has complete primary education 0 otherwise*	*0.35*	*0.48*	*0.39*	*0.49*	*0.32*	*0.46*	*0.20*	*0.40*	*0.17*	*0.37*	*0.28*	*0.45*
High school	*1 if individual has complete high school education 0 otherw.*	*0.37*	*0.48*	*0.30*	*0.46*	*0.43*	*0.50*	*0.36*	*0.48*	*0.36*	*0.48*	*0.35*	*0.48*
Technic & Spec. training	*1 if individual has training post high school 0 otherwise*	*0.07*	*0.25*	*0.06*	*0.24*	*0.07*	*0.26*	*0.13*	*0.34*	*0.15*	*0.35*	*0.11*	*0.31*
Profes. & Postgr.	*1 if individual has bachelor or postgraduate educ. 0 otherw.*	*0.07*	*0.25*	*0.07*	*0.26*	*0.07*	*0.25*	*0.18*	*0.39*	*0.20*	*0.40*	*0.15*	*0.36*
Type of employment	Type of working contract, if applies												
Formal	*1 if individual is dependent employee 0 otherwise*	*0.39*	*0.49*	*0.28*	*0.45*	*0.47*	*0.50*	*0.43*	*0.49*	*0.47*	*0.50*	*0.34*	*0.47*
Employer or independent professional,	*1 if individual is employer or ind. Professional 0 otherw.*	*0.04*	*0.19*	*0.04*	*0.19*	*0.03*	*0.18*	*0.06*	*0.24*	*0.07*	*0.26*	*0.04*	*0.21*
Self-employed	*1 if individual is self-employed 0 otherwise*	*0.22*	*0.41*	*0.28*	*0.45*	*0.18*	*0.38*	*0.17*	*0.37*	*0.17*	*0.38*	*0.16*	*0.37*
N.A.	*1 if individual is unemployed or non participant 0 otherwise*	*0.36*	*0.48*	*0.40*	*0.49*	*0.32*	*0.47*	*0.34*	*0.47*	*0.28*	*0.45*	*0.45*	*0.50*
Income groups	As numbers of statutory minimum monthly wage MW												
Up to 1 MW	*1 if individual earns up to 1 MW, 0 otherwise*	*0.56*	*0.50*	*0.63*	*0.48*	*0.50*	*0.50*	*0.56*	*0.50*	*0.52*	*0.50*	*0.65*	*0.48*
1-2 MW	*1 if individual earns between 1 and 2 MW, 0 otherwise*	*0.23*	*0.42*	*0.17*	*0.38*	*0.27*	*0.44*	*0.20*	*0.40*	*0.22*	*0.42*	*0.15*	*0.36*
2-3 MW	*1 if individual earns between 2 and 3 MW, 0 otherwise*	*0.09*	*0.29*	*0.08*	*0.27*	*0.11*	*0.31*	*0.10*	*0.30*	*0.11*	*0.31*	*0.09*	*0.28*
3-6 MW	*1 if individual earns between 3 and 6 MW, 0 otherwise*	*0.04*	*0.19*	*0.03*	*0.18*	*0.04*	*0.20*	*0.09*	*0.29*	*0.10*	*0.30*	*0.08*	*0.27*
More than 6 MW	*1 if individual earns more than 6 MW, 0 otherwise*	*0.08*	*0.28*	*0.08*	*0.28*	*0.09*	*0.28*	*0.04*	*0.20*	*0.05*	*0.22*	*0.02*	*0.15*

Source: DANE

Table 2.a. Standard Probit regression

Complete sample for individuals

VARIABLES	DEFINITIONS	1997		2003	
Observations		14,166		39,183	
Prob>chi2		0.00000		0.00000	
Log likelihood		-9,281.55		- 23,479	
Pseudo R2		0.0533		0.0485	
Dependent variable Insurer	1 f individual has ISS insurance 0 otherwise	**dF/dx(*)**	**P>z**	**dF/dx**	**P>z**
AGE BRACKETS	Based in the age defined in Colombia's health system premium, controlling by 15-44 male				
age1	1 if individual is younger than 1 year 0 otherwise	0.074	0.037	-0.064	0.005
age1-4	1 if individual is between 1 and 5 years 0 otherwise	-0.021	0.272	-0.016	0.180
age5-14	1 if individual is between 5 and 15 years 0 otherwise	-0.029	0.055	0.044	0.000
age 15-44 female	1 if individual is female between 15 and 44 years 0 otherwise	0.021	0.223	0.006	0.522
age 45-59	1 if individual is between 45 and 59 years 0 otherwise	0.047	0.005	0.171	0.000
age 60	1 if individual is older than 60 years 0 otherwise	0.044	0.021	0.316	0.000
SOCIOECONOMIC VARIABLES					
Gender	1 if individual is female 0 otherwise	-0.010	0.414	0.005	0.431
Marital status	1 if individual is married 0 otherwise	0.042	0.000	-0.013	0.023
Location	1 if individual lives in town or city 0 otherwise	0.312	0.000	0.020	0.123
HEALTH RELATED VARIABLES					
Chronic	1 if individual reports chronic condition 0 otherwise	0.015	0.289	0.011	0.124
Health problem	1 if individual reports health problem last month 0 otherwise	-0.008	0.503	-0.025	0.002
Health Status	Self-reported health status (controlling by very good health)				
Good	*1 if individual reports good HS 0 otherwise*	*0.011*	*0.348*	*0.034*	*0.000*
Fair	*1 if individual reports fair HS 0 otherwise*	*-0.055*	*0.000*	*0.089*	*0.000*
Bad	*1 if individual reports bad HS 0 otherwise*	*-0.121*	*0.000*	*0.116*	*0.000*

* Reporting marginal effects

Table 2.b. Standard Probit regression

Complete sample for individuals with and without health variables

VARIABLES	DEFINITIONS	1997		2003	
Dependent variable Insurer	1 f individual has ISS insurance 0 otherwise	**Health (*)**	**No H**	**Health**	**No H**
AGE BRACKETS	Based in the age defined in Colombia's health system premium, controlling by 15-44 male				
age1	1 if individual is younger than 1 year 0 otherwise	0.074	0.078	-0.064	-0.070
age1-4	1 if individual is between 1 and 5 years 0 otherwise	-0.021	-0.021	-0.016	-0.017
age5-14	1 if individual is between 5 and 15 years 0 otherwise	-0.029	-0.028	0.044	0.044
age 15-44 female	1 if individual is female between 15 and 44 years 0 otherwise	0.021	0.018	0.006	0.007
age 45-59	1 if individual is between 45 and 59 years 0 otherwise	0.047	0.032	0.171	0.185
age 60	1 if individual is older than 60 years 0 otherwise	0.044	0.012	0.316	0.346
SOCIOECONOMIC VARIABLES					
Gender	1 if individual is female 0 otherwise	-0.010	-0.013	0.005	0.010
Marital status	1 if individual is married 0 otherwise	0.042	0.040	-0.013	-0.011
Location	1 if individual lives in town or city 0 otherwise	0.312	0.323	0.020	0.012

* Reporting marginal effects. Highlighted represents significance at 1%

Table 3. Standard Probit regression

Pooled surveys with interactions. Sample for all individuals.

VARIABLES	DEFINITIONS	1997 & 2003	
Observations			53,349
Prob>chi2			0.00000
Log likelihood			-32,760.60
Pseudo R2			0.0731
Dependent variable Insurer	1 f individual has ISS insurance 0 otherwise	**dF/dx(*)**	**P>z**
AGE BRACKETS	Based in the age defined in Colombia's health system premium, controlling by 15-44 male		
age1*	1 if individual is younger than 1 year 0 otherwise	0.073	0.037
age1_4*	1 if individual is between 1 and 5 years 0 otherwise	-0.020	0.272
age5_14*	1 if individual is between 5 and 15 years 0 otherwise	-0.028	0.055
age 15-44 female*	1 if individual is female between 15 and 44 years 0 otherwise	0.020	0.223
age 45-59*	1 if individual is between 45 and 59 years 0 otherwise	0.045	0.005
age 60	1 if individual is older than 60 years 0 otherwise	0.042	0.021
SOCIOECONOMIC VARIABLES			
Gender	1 if individual is female 0 otherwise	-0.009	0.414
Marital status	1 if individual is married 0 otherwise	0.040	0.000
Location	1 if individual lives in town or city 0 otherwise	0.255	0.000
HEALTH RELATED VARIABLES			
Chronic condition	1 if individual reports chronic condition 0 otherwise	0.014	0.289
Health problem	1 if individual reports health problem last month 0 otherwise	-0.007	0.503
Health Status HS (self reported)	Self-reported health status (controlling by very good health)		
Good	*1 if individual reports good HS 0 otherwise*	0.011	0.348
Fair	*1 if individual reports fair HS 0 otherwise*	-0.051	0.000
Bad	*1 if individual reports bad HS 0 otherwise*	-0.109	0.000
INTERACTIONS			
Year dummy	1 if observation is from 2003 0 otherwise	-0.069	0.004
age1*	Age band up to 1 X year dummy	-0.131	0.001
age1_4*	Age band 1-4 1 X year dummy	0.003	0.891
age5_14*	Age band 5-14 X year dummy	0.075	0.000
age 15-44 female*	Age band 15-44 female X year dummy	-0.013	0.489
age 45-59*	Age band 45-59 X year dummy	0.130	0.000
age 60	Age band older than 60 X year dummy	0.279	0.000
Gender	1 if individual is female X year dummy	0.015	0.268
Marital status	1 if individual is married X year dummy	-0.053	0.000
Location	1 if individual lives in town or city X year dummy	-0.293	0.000
Chronic condition	1 if individual reports chronic condition X year dummy	-0.002	0.872
Health problem	1 if individual reports health problem last month X year dummy	-0.019	0.173
Health Status HS (self reported)	Self-reported health status (controlling by very good health)		
Good	*1 if individual reports good HS X year dummy*	0.026	0.062
Fair	*1 if individual reports fair HS X year dummy*	0.147	0.000
Bad	*1 if individual reports bad HS X year dummy*	0.241	0.000

* Reporting marginal effects

Table 4. Standard Probit regression

"Economically active" older than 20 years sample for individuals

VARIABLES	DEFINITIONS	1997		2003	
Observations		5,239		16,084	
Prob>chi2		0.00000		0.00000	
Log likelihood		- 3,220.23		- 8,999.15	
Pseudo R2		0.0961		0.0698	
Dependent variable Insurer	1 f individual has ISS insurance 0 otherwise	**dF/dx(*)**	**P>z**	**dF/dx**	**P>z**
AGE BRACKETS	Based in the age defined in Colombia's health system premium, controlling by 15-44 male				
age 15-44 female	1 if individual is female between 15 and 44 years 0 otherwise	0.083	0.010	-0.018	0.235
age 45-59	1 if individual is between 45 and 59 years 0 otherwise	0.111	0.000	0.151	0.000
age 60	1 if individual is older than 60 years 0 otherwise	0.127	0.000	0.248	0.000
SOCIOECONOMIC VARIABLES					
Gender	1 if individual is female 0 otherwise	-0.013	0.663	0.049	0.000
Marital status	1 if individual is married 0 otherwise	0.060	0.000	0.040	0.000
Location	1 if individual lives in town or city 0 otherwise	0.180	0.000	0.011	0.593
Education levels	Dummies of education level organized in 5 groups (controlling by none education)				
Primary	*1 if individual has complete primary education 0 otherwise*	*0.103*	*0.002*	*0.000*	*0.987*
High school	*1 if individual has complete high school education 0 otherwise*	*0.151*	*0.000*	*-0.029*	*0.363*
Technic & Spec. training	*1 if individual has training post high school 0 otherwise*	*0.048*	*0.256*	*-0.089*	*0.004*
Profes. & Postgr.	*1 if individual has bachelor or postgraduate educ. 0 otherwise*	*0.005*	*0.911*	*-0.071*	*0.025*
Pension enrollment	1 if individual is enrolled in pension system 0 otherwise	0.208	0.000	0.162	0.000
Type of employment	Type of working contract, if applies (controlling by non participant)				
Formal	*1 if individual is dependent employee 0 otherwise*	0.057	0.271	-0.066	0.000
Employer or independent professional,	*1 if individual is employer or ind. Professional 0 otherw.*	0.033	0.562	-0.068	0.000
Self-employed	*1 if individual is self-employed 0 otherwise*	-0.047	0.353		
Income groups	As numbers of statutory minimum monthly wage MW (controlling by up to 1 MW)				
1-2 MW	*1 if individual earns between 1 and 2 MW, 0 otherwise*	*0.055*	*0.005*	*-0.015*	*0.124*
2-3 MW	*1 if individual earns between 2 and 3 MW, 0 otherwise*	*-0.034*	*0.183*	*0.042*	*0.001*
3-6 MW	*1 if individual earns between 3 and 6 MW, 0 otherwise*	*-0.051*	*0.144*	*0.019*	*0.167*
More than 6 MW	*1 if individual earns more than 6 MW, 0 otherwise*	*-0.068*	*0.021*	*-0.080*	*0.000*
HEALTH RELATED VARIABLES					
Chronic	1 if individual reports chronic condition 0 otherwise	-0.012	0.612	0.015	0.168
Health problem	1 if individual reports health problem last month 0 otherwise	-0.046	0.016	-0.030	0.012
Health Status	Self-reported health status (controlling by very good health)				
Good	*1 if individual reports good HS 0 otherwise*	*0.024*	*0.230*	*0.039*	*0.000*
Fair	*1 if individual reports fair HS 0 otherwise*	*-0.020*	*0.437*	*0.100*	*0.000*
Bad	*1 if individual reports bad HS 0 otherwise*	*-0.059*	*0.233*	*0.106*	*0.004*

Table 5. Standard Probit regression

Lowest premium age band Range 15-44 years male. Sample for individuals.

VARIABLES	DEFINITIONS	1997		2003	
Observations			2,245		5,558
Prob>chi2			0.00000		0.00000
Log likelihood			- 1,326.46		- 2,784.02
Pseudo R2			0.1444		0.0307
Dependent variable Insurer	1 f individual has ISS insurance 0 otherwise	**dF/dx(*)**	**P>z**	**dF/dx**	**P>z**
SOCIOECONOMIC VARIABLES					
Marital status	1 if individual is married 0 otherwise	0.076	0.002	0.047	0.000
Location	1 if individual lives in town or city 0 otherwise	0.077	0.026	0.030	0.285
Education levels	Dummies of education level organized in 5 groups (controlling by none education)				
Primary	*1 if individual has primary education 0 otherwise*	*0.070*	*0.284*	*-0.116*	*0.023*
High school	*1 if individual has high school education 0 otherwise*	*0.216*	*0.001*	*-0.115*	*0.049*
Technic & Spec. training	*1 if individual has training post high school 0 otherwise*	*0.112*	*0.143*	*-0.146*	*0.004*
Profes. & Postgr.	*1 if individual has bachelor or postgraduate educ. 0 otherwise*	*0.040*	*0.624*	*-0.151*	*0.004*
Pension enrollment	1 if individual is enrolled in pension system 0 otherwise	0.232	0.000	0.090	0.000
Type of employment	Type of working contract, if applies (controlling by non participant)				
Formal	*1 if individual is dependent employee 0 otherwise*	*0.220*	*0.021*	*-0.025*	*0.130*
Employer or independent professional,	*1 if individual is employer or ind. Professional 0 otherw.*	*0.248*	*0.011*	*-0.050*	*0.034*
Self-employed (**)	*1 if individual is self-employed 0 otherwise*	*0.066*	*0.484*		
Income groups	As numbers of statutory minimum monthly wage MW (controlling by up to 1 MW)				
1-2 MW	*1 if individual earns between 1 and 2 MW, 0 otherwise*	*0.116*	*0.000*	*-0.013*	*0.357*
2-3 MW	*1 if individual earns between 2 and 3 MW, 0 otherwise*	*0.032*	*0.422*	*0.094*	*0.000*
3-6 MW	*1 if individual earns between 3 and 6 MW, 0 otherwise*	*-0.024*	*0.669*	*0.047*	*0.027*
More than 6 MW	*1 if individual earns more than 6 MW, 0 otherwise*	*0.013*	*0.766*	*-0.049*	*0.077*
HEALTH RELATED VARIABLES					
Chronic	1 if individual reports chronic condition 0 otherwise	-0.070	0.129	-0.007	0.745
Health problem	1 if individual reports health problem last month 0 otherwise	-0.066	0.033	-0.030	0.123
Health Status	Self-reported health status (controlling by very good health)				
Good	*1 if individual reports good HS 0 otherwise*	*0.022*	*0.452*	*0.029*	*0.043*
Fair	*1 if individual reports fair HS 0 otherwise*	*0.042*	*0.303*	*0.083*	*0.001*
Bad	*1 if individual reports bad HS 0 otherwise*	*-0.002*	*0.986*	*0.064*	*0.651*

* Reporting marginal effects

** Dropped due to collinearity

Table 6. Standard Probit regression

Highest premium age-band. Range older than 60 years male. Sample for individuals.

VARIABLES	DEFINITIONS	1997		2003	
Observations			1,353		4,653
Prob>chi2			0.00000		0.00000
Log likelihood			- 843.71		- 3,115.28
Pseudo R2			0.0978		0.0129
Dependent variable Insurer	1 f individual has ISS insurance 0 otherwise	**dF/dx(*)**	**P>z**	**dF/dx**	**P>z**
SOCIOECONOMIC VARIABLES					
Gender	1 if individual is female 0 otherwise	0.003	0.920	-0.031	0.062
Marital status	1 if individual is married 0 otherwise	0.125	0.000	-0.014	0.395
Location	1 if individual lives in town or city 0 otherwise	0.374	0.000	0.036	0.456
Education levels	Dummies of education level organized in 5 groups (controlling by none education)				
Primary	*1 if individual has primary education 0 otherwise*	*0.089*	*0.016*	*0.055*	*0.046*
High school	*1 if individual has high school education 0 otherwise*	*0.104*	*0.029*	*0.008*	*0.778*
Technic & Spec. training	*1 if individual has training post high school 0 otherwise*	*-0.039*	*0.682*	*0.037*	*0.321*
Profes. & Postgr.	*1 if individual has bachelor or postgraduate educ. 0 otherwise*	*-0.146*	*0.121*	*0.023*	*0.525*
Income groups	As numbers of statutory minimum monthly wage MW (controlling by up to 1 MW)				
1-2 MW	*1 if individual earns between 1 and 2 MW, 0 otherwise*	*0.153*	*0.016*	*-0.132*	*0.000*
2-3 MW	*1 if individual earns between 2 and 3 MW, 0 otherwise*	*0.158*	*0.117*	*-0.169*	*0.001*
3-6 MW	*1 if individual earns between 3 and 6 MW, 0 otherwise*	*-0.011*	*0.941*	*-0.196*	*0.000*
More than 6 MW	*1 if individual earns more than 6 MW, 0 otherwise*	*0.042*	*0.625*	*-0.161*	*0.004*
HEALTH RELATED VARIABLES					
Chronic	1 if individual reports chronic condition 0 otherwise	-0.009	0.776	-0.006	0.704
Health problem	1 if individual reports health problem last month 0 otherwise	-0.052	0.210	0.024	0.278
Health Status	Self-reported health status (controlling by very good health)				
Good	*1 if individual reports good HS 0 otherwise*	*-0.034*	*0.572*	*0.061*	*0.040*
Fair	*1 if individual reports fair HS 0 otherwise*	*-0.054*	*0.376*	*0.090*	*0.004*
Bad	*1 if individual reports bad HS 0 otherwise*	*-0.095*	*0.177*	*0.087*	*0.021*

* Reporting marginal effects

Table 3. Standard Probit regression

Sample for households with married couples and children able to be covered.

VARIABLES	DEFINITIONS	1997		2003	
Observations			2,458		7,507
Prob>chi2			0.00000		0.00000
Log likelihood			- 408.85		- 4,571.77
Pseudo R2			0.7405		0.0677
Dep. Var Head HH Insurer	1 f individual has ISS insurance 0 otherwise	**dF/dx(*)**	**P>z**	**dF/dx**	**P>z**
SOCIOECONOMIC VARIABLES					
Head HH					
Age band head HH	Dummies of age-band organized in 3 groups (controlling by 15-44 male)				
age 15-44 female	*1 if individual has primary education 0 otherwise*	*0.118*	*0.176*	*0.012*	*0.756*
age 45-59	*1 if individual has high school education 0 otherwise*	*0.138*	*0.002*	*0.138*	*0.000*
age 60	*1 if individual has training post high school 0 otherwise*	*0.071*	*0.230*	*0.197*	*0.000*
Education levels head HH	Dummies of education level organized in 5 groups (controlling by none education)				
Primary	*1 if individual has primary education 0 otherwise*	*0.069*	*0.317*	*0.052*	*0.413*
High school	*1 if individual has high school education 0 otherwise*	*0.099*	*0.168*	*0.082*	*0.192*
Technic & Spec. training	*1 if individual has training post high school 0 otherwise*	*0.086*	*0.346*	*0.044*	*0.510*
Profes. & Postgr.	*1 if individual has bachelor or postgraduate educ. 0 otherwise*	*-0.042*	*0.653*	*0.102*	*0.130*
Income group head HH	As numbers of statutory minimum monthly wage MW (controlling by up to 1 MW)				
1-2 MW	*1 if individual earns between 1 and 2 MW, 0 otherwise*	*0.179*	*0.000*	*-0.025*	*0.264*
2-3 MW	*1 if individual earns between 2 and 3 MW, 0 otherwise*	*0.165*	*0.004*	*0.012*	*0.671*
3-6 MW	*1 if individual earns between 3 and 6 MW, 0 otherwise*	*0.114*	*0.134*	*-0.058*	*0.043*
More than 6 MW	*1 if individual earns more than 6 MW, 0 otherwise*	*0.124*	*0.034*	*-0.096*	*0.008*
Spouse					
Insurer spouse	1 f individual has ISS insurance 0 otherwise	0.896	0.000	0.887	0.000
CHILDREN					
Number of children per HH	Children able to be insured(controlling by HH without children)	*-0.024*	*0.163*	*0.021*	*0.052*
Average age of children	As average age of children (controlling by HH without children)				
0-1 years	*1 if average age is up to 1, 0 otherwise*	*0.105*	*0.814*	*-0.079*	*0.822*
1-5 years	*1 if average age is between 1 and 5, 0 otherwise*	*0.083*	*0.189*	*-0.042*	*0.258*
5-14 years	*1 if average age is between 5 and 14, 0 otherwise*	*0.081*	*0.143*	*-0.032*	*0.267*
More than 15 years	*1 if average age is older than 15, 0 otherwise*	*0.047*	*0.424*	*-0.009*	*0.756*

* Reporting marginal effects

Table 8. Standard Probit regression

Sample for households with married couples pooled 1997 & 2003.

VARIABLES	DEFINITIONS	1997 & 2003	
Observations			9,965
Prob>chi2			0.00000
Log likelihood			- 1,975.42
Pseudo R2			0.7067
Dep. Var Head HH Insurer	1 f individual has ISS insurance 0 otherwise	**dF/dx(*)**	**P>z**
SOCIOECONOMIC VARIABLES			
Head HH			
Age band head HH	Dummies of age-band organized in 3 groups (controlling by 15-44 male)		
age 15-44 female	*1 if individual has primary education 0 otherwise*	*0.124*	*0.176*
age 45-59	*1 if individual has high school education 0 otherwise*	*0.139*	*0.002*
age 60	*1 if individual has training post high school 0 otherwise*	*0.071*	*0.230*
Education levels head HH	Dummies of education level organized in 5 groups (controlling by none education)		
Primary	*1 if individual has primary education 0 otherwise*	*0.068*	*0.317*
High school	*1 if individual has high school education 0 otherwise*	*0.098*	*0.168*
Technic & Spec. training	*1 if individual has training post high school 0 otherwise*	*0.088*	*0.346*
Profes. & Postgr.	*1 if individual has bachelor or postgraduate educ. 0 otherwise*	*-0.040*	*0.653*
Income group head HH	As numbers of statutory minimum monthly wage MW (controlling by up to 1 MW)		
1-2 MW	*1 if individual earns between 1 and 2 MW, 0 otherwise*	*0.185*	*0.000*
2-3 MW	*1 if individual earns between 2 and 3 MW, 0 otherwise*	*0.176*	*0.004*
3-6 MW	*1 if individual earns between 3 and 6 MW, 0 otherwise*	*0.119*	*0.134*
More than 6 MW	*1 if individual earns more than 6 MW, 0 otherwise*	*0.129*	*0.034*
Spouse			
Insurer spouse	1 f individual has ISS insurance 0 otherwise	0.897	0.000
CHILDREN			
Number of children per HH	Children able to be insured(controlling by HH without children)	*-0.024*	*0.163*
Average age of children	As average age of children (controlling by HH without children)		
0-1 years	*1 if average age is up to 1, 0 otherwise*	*0.110*	*0.814*
1-5 years	*1 if average age is between 1 and 5, 0 otherwise*	*0.084*	*0.189*
5-14 years	*1 if average age is between 5 and 14, 0 otherwise*	*0.080*	*0.143*
More than 15 years	*1 if average age is older than 15, 0 otherwise*	*0.047*	*0.424*
INTERACTIONS			
Year dummy	1 if observation is from 2003 X year dummy	0.022	0.842
Age band head HH	Dummies of age-band organized in 3 groups (controlling by 15-44 male)		
age 15-44 female	*1 if individual has primary education X year dummy*	-0.100	0.279
age 45-59	*1 if individual has high school education X year dummy*	0.010	0.849
age 60	*1 if individual has training post high school X year dummy*	0.136	0.051
Education levels head HH	Dummies of education level organized in 5 groups (controlling by none education)		
Primary	*1 if individual has primary education X year dummy*	-0.012	0.904
High school	*1 if individual has high school education X year dummy*	-0.008	0.933
Technic & Spec. training	*1 if individual has training post high school X year dummy*	-0.039	0.735
Profes. & Postgr.	*1 if individual has bachelor or postgraduate educ. X year dummy*	0.152	0.197
Income group head HH	As numbers of statutory minimum monthly wage MW (controlling by up to 1 MW)		
1-2 MW	*1 if individual earns between 1 and 2 MW, X year dummy*	-0.191	0.000
2-3 MW	*1 if individual earns between 2 and 3 MW, X year dummy*	-0.145	0.018

3-6 MW	*1 if individual earns between 3 and 6 MW, X year dummy*	-0.165	0.030
More than 6 MW	*1 if individual earns more than 6 MW, X year dummy*	-0.205	0.001
Insurer spouse	*1 f individual has ISS insurance X year dummy*	-0.031	0.416
Number of children per HH	*Children able to be insured X year dummy*	0.047	0.024
Average age of children	As average age of children (controlling by HH without children)		
0-1 years	*1 if average age is up to 1, X year dummy*	-0.174	0.745
1-5 years	*1 if average age is between 1 and 5, X year dummy*	-0.121	0.085
5-14 years	*1 if average age is between 5 and 14, X year dummy*	-0.110	0.068
More than 15 years	*1 if average age is older than 15, X year dummy*	-0.054	0.394

Table 9. Standard Probit regression

Family heads with type of family structure variables.

VARIABLES	DEFINITIONS	1997		2003	
Observations			2,890		8,617
Prob>chi2			0.00000		0.00000
Log likelihood			- 1,746.38		- 4,972.84
Pseudo R2			0.1169		0.0777
Dependent variable Insurer	1 f individual has ISS insurance 0 otherwise	**dF/dx(*)**	**P>z**	**dF/dx**	**P>z**
AGE BRACKETS	Based in the age defined in Colombia's health system premium, controlling by 15-44 male				
age 15-44 female	1 if individual is female between 15 and 44 years 0 otherwise	0.076	0.140	-0.033	0.159
age 45-59	1 if individual is between 45 and 59 years 0 otherwise	0.121	0.000	0.144	0.000
age 60	1 if individual is older than 60 years 0 otherwise	0.127	0.000	0.253	0.000
SOCIOECONOMIC VARIABLES					
Gender	1 if individual is female 0 otherwise	-0.066	0.181	0.034	0.091
Location	1 if individual lives in town or city 0 otherwise	0.179	0.000	0.012	0.651
Family structure	Family structure according with head status (controlling by married without children)				
Single	1 if individual is single 0 otherwise	*-0.072*	*0.078*	*-0.011*	*0.555*
Married children	1 if individual is married with children 0 otherwise	*-0.076*	*0.006*	*-0.027*	*0.090*
Education levels	Dummies of education level organized in 5 groups (controlling by none education)				
Primary	*1 if individual has complete primary education 0 otherwise*	*0.077*	*0.057*	*0.056*	*0.193*
High school	*1 if individual has complete high school education 0 otherwise*	*0.121*	*0.006*	*0.043*	*0.320*
Technic & Spec. training	*1 if individual has training post high school 0 otherwise*	*0.036*	*0.520*	*-0.030*	*0.498*
Profes. & Postgr.	*1 if individual has bachelor or postgraduate educ. 0 otherwise*	*-0.023*	*0.687*	*-0.012*	*0.792*
Pension enrollment	1 if individual is enrolled in pension system 0 otherwise	0.201	0.000	0.204	0.000
Type of employment	Type of working contract, if applies (controlling by non participant)				
Formal	*1 if individual is dependent employee 0 otherwise*	-0.044	0.284		
Employer or independent professional,	*1 if individual is employer or ind. Professional 0 otherw.*	-0.137	0.000	-0.025	0.176
Self-employed	*1 if individual is self-employed 0 otherwise*	0.196	0.249	0.034	0.018
Income groups	As numbers of statutory minimum monthly wage MW (controlling by up to 1 MW)				
1-2 MW	*1 if individual earns between 1 and 2 MW, 0 otherwise*	*0.098*	*0.000*	*-0.017*	*0.204*
2-3 MW	*1 if individual earns between 2 and 3 MW, 0 otherwise*	*0.036*	*0.308*	*0.057*	*0.001*
3-6 MW	*1 if individual earns between 3 and 6 MW, 0 otherwise*	*0.007*	*0.880*	*0.008*	*0.662*
More than 6 MW	*1 if individual earns more than 6 MW, 0 otherwise*	*-0.038*	*0.324*	*-0.102*	*0.000*
HEALTH RELATED VARIABLES					
Chronic	1 if individual reports chronic condition 0 otherwise	-0.020	0.500	0.024	0.117
Health problem	1 if individual reports health problem last month 0 otherwise	-0.047	0.075	-0.044	0.009
Health Status	Self-reported health status (controlling by very good health)				
Good	*1 if individual reports good HS 0 otherwise*	*0.057*	*0.040*	*0.025*	*0.097*
Fair	*1 if individual reports fair HS 0 otherwise*	*0.003*	*0.930*	*0.074*	*0.000*
Bad	*1 if individual reports bad HS 0 otherwise*	*-0.041*	*0.523*	*0.139*	*0.005*