ASIMETRIČNE INFORMACIJE U ZDRAVSTVENOM OSIGURANJU: PRELIMINARNI REZULTATI ANALIZE SUSTAVA JAVNOG DOPUNSKOG OSIGURANJA U HRVATSKOJ

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1 Asymmetric Information in Health Insurance: Some Preliminary Evidence from the Croatian State-Administered Supplemental Plan

RESEARCH PAPER

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Abstract

In this paper, we conduct simple micro-level econometric tests for the presence of the moral hazard and adverse selection manifestations in the Croatian supplemental health insurance program. Despite the fact that the obtained results are rather preliminary, they seem to be indicating the statistically significant presence of both adverse selection and moral hazard types of problems with various degrees of difficulty that they actually cause to the functioning of the Croatian health insurance system. The obtained results are then used to outline several policy recommendations in the realm of health insurance reform.

Keywords: health insurance, adverse selection, moral hazard
JEL classification: D82, J18

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1 Introduction[1]

The last decade in Croatia (and elsewhere) has been characterized by pronounced inflation in health care costs. One commonly suggested explanation for this phenomenon is the distortion in the health insurance market due to asymmetric information about the latent health status of individuals that leads to the adverse selection problem (see e.g. Akerlof, 1970; Spence, 1973; Rothchild and Stiglitz, 1976; and Wilson, 1977; 1980) and run-away medical expenditures due to moral hazard (see e.g. Arrow, 1963; Pauly, 1968). There has been a large empirical literature about the effects of health insurance on medical utilization (see Zweifel and Manning, 2000 for a recent review). In spite of being the textbook example of a market plagued with asymmetric information problems, empirical evidence on the importance of either moral hazard or adverse selection in health insurance markets is inconclusive, which makes the research on these topics theoretically interesting and policy relevant.

The main objective of this paper is to conduct simple econometric tests for the presence of the moral hazard and adverse selection manifestations in the Croatian supplemental insurance program. The pronounced presence of either one or both of these effects, if not appropriately accounted for, will have serious detrimental effects on the actuarial soundness of the insurance program and could effectively cause its bankruptcy. Having an approximate idea of the magnitude and the welfare costs of these asymmetric information, problems could become highly valuable inputs in redesigning the health insurance coverage plans and other pertinent policy formulations. Despite the fact that the obtained results are rather preliminary, they seem to be indicating the statistically significant presence of both adverse selection and moral hazard types of problems with various degrees of difficulty that they actually cause to the functioning of the Croatian health insurance system.

[1] *While conducting this research Tomislav Vukina was supported by the 2008-2009 Short-Term Travel Grants (STG) Program from IREX (International Research and Exchanges Board), funded by the US Department of State.*

2 Stylized Facts

Health care in Croatia is mainly funded by the state-administered Croatian Health Insurance Institute (HZZO). Only about 10 percent of funding comes from other sources, such as co-payments or payments by other insurance companies. Payroll contributions are set at 15 percent of the gross wage, with an additional 0.5 percent for work-related injury insurance. In terms of health outcomes, Croatia has performed better than most countries with similar income levels, as argued in Jafarov and Gunnarsson (2008). For example, in terms of healthy average life expectancy, Croatia has done better than all EU-10 countries except for Slovenia and the Czech Republic.[2] Croatia's performance is also better than the EU-10 average for standardized death rates, incidence of tuberculosis, and maternal, infant and child mortality rates. However, Croatia still lags very much behind the EU-15 averages in terms of all available outcome indicators, especially standardized mortality rates for non-communicable diseases (cardio-vascular, cancer, injuries, chronic respiratory diseases, diabetes, etc.). Unlike many other former socialist countries, Croatia does not exhibit overcapacity in terms of intermediate output indicators. The number of hospital beds (5.6), the number of physicians (2.4) and the health workers density (7.7) per 1,000 people are all lower than the average for EU-15 countries (5.5, 3.2 and 13.0, respectively) and lower than the averages for EU-10 (7.0, 3.0, 9.8). Moreover, Croatia's ratio of in-patient admissions per 100 inhabitants (16.6) is also below the averages for EU-10 (21.2) and EU-15 (17.9).

However, the system is plagued with many other problems.[3] First, the health care system is not financially sustainable and runs chronic deficits. At the end of 2006, the health sector debt amounted to 1.1 percent of GDP. Whereas part of this debt has been repaid in 2007, reform measures have been insufficient to harden the budget constraint (Jafarov and Gunnarsson, 2008). Second, Croatia's total expenditure on health care amounts to 7.9 percent of GDP and

[2] *The EU-10 countries here include Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic, and Slovenia.*

[3] *Mihaljek (2007) gives an excellent review of many issues characterizing the contemporary health care system in Croatia and formulates a number of reform proposals.*

is one of the highest in the region (the EU-10 average is 6.8 percent), so Croatia's good relative performance comes at a high cost. Public expenditure on health amounts to 6.6 percent of GDP (or 84 percent of the total) and is also very high compared to the EU-10 average of 4.9 percent. Third, population aging is likely to worsen the financial situation of the health sector as older people require more health care than younger generations. The old-age dependency ratio in Croatia, being already one of the highest in the region, is projected to increase from 26 percent in 2005 to 42 percent in 2050.[4]

High and increasing public health spending reflects strong demand and supply inefficiencies. Croatia's public health insurance system administered by HZZO is a two tiered system consisting of compulsory and supplemental health insurance (see Zrinščak, 2007). For all practical purposes all citizens of Croatia are covered under the compulsory health insurance plan which affords a full coverage of all preventative, primary and emergency care services to all its members.[5] Other services are subject to 15-50 percent co-payment rates. Under the supplemental health insurance plan, the covered individuals are excused for paying these contributions (co-payments). There are two mechanisms for obtaining the supplemental insurance coverage. Under the current provisions of the law, there are widespread exemptions from co-payments for various groups of citizens (children, students, people with disabilities, etc.), so these people effectively obtain the supplemental insurance automatically and free of charge. Others have to buy the policy at the monthly rate of HRK 80 (around € 11), with retirees enjoying a 37.5 percent discount which amounts to paying a monthly fee of HRK 50. The number of people covered by the supplemental insurance policy for whom all medical services, with the exception of some prescription drugs,[6] are essentially free is approximately 600,000. Therefore it is not surprising that the share of co-payments in total health spending is less

[4] The projections are quoted from Švaljek (2005). Old-age dependency ratio is defined as the ratio of population aged 65 and older to population aged 15-64.

[5] According to HZZO's Information Technology Service, the number of people with compulsory health insurance on May 6, 2008 was 4,343,088, which is close to the entire resident population of Croatia.

[6] When it comes to prescription drugs benefits, there is no difference between the compulsory and the supplemental health insurance coverage. Around 1,900 types of drugs on the so called A-list are fully covered by the HZZO, while 300 types of drugs on the B-list are partially covered by the HZZO. For drugs on the B-list, HZZO pays a reference price and the patients pay the difference between the sales price and the reference price.

than 1 percent, compared with 7-33 percent in Western European countries (Jafarov and Gunnarsson, 2008).

The current system of the HZZO payments to hospitals is capacity and inputs based. This system has encouraged hospital managers to keep beds full and extend the length of patients' stay. As a result, the average length of stay in hospitals in Croatia in 2005 was about 10.3 days, compared to 8.6 days in EU-10 and 8.4 days in EU-15 countries. Over a third of total health care spending in Croatia is attributed to hospitals in-patient care (Jafarov and Gunnarsson, 2008). A related problem comes from the fact that a substantial part of the primary care is provided by the costly specialists. This outcome is mainly due to the fact that privately owned family practices in Croatia contract the provision of the primary care services with the HZZO on a fixed per head annual compensation basis. This system provides a clear incentive for primary-care doctors to sign-up as many patients as possible and refer them to specialists instead of treating them themselves. According to Jafarov and Gunnarsson (2008), 70 percent of all patients at the primary health care level are referred to hospitals but experts believe that this number could be reduced to 30 percent.

In addition to incorrectly aligned incentives for physicians to perform efficiently, obviously there are incentives alignment problems on the patients' side as well. They are deeply rooted in the well known asymmetric information problems that inherently plague all insurance plans. First, there is a problem of moral hazard. The term refers to a problem of altered incentives for an insured person to change his/her behavior once the insurance coverage is purchased or otherwise acquired. A quintessential example of a bicycle owner is illustrative. Prior to purchasing the bicycle insurance, the owner was constantly on alert to protect his bicycle from being stolen. After purchasing the insurance, his/her behavior has dramatically changed and he/she does not care any more, knowing that if the bicycle gets stolen he/she will file the claim with the insurance company, collect the indemnity payments and buy a new bicycle. Same is true of people covered by health insurance, or at least so the argument goes. Knowing that they are covered by the insurance, they will go to see a doctor the moment they first sneeze. Those who do not have the

insurance, but rather have to pay from their pocket for every doctor's visit, may avoid seeing a doctor unless they are really ill.

Due to the fact that the compulsory health insurance in Croatia is nearly universal, it is reasonable to anticipate that an average Croatian would visit the doctor's office much more frequently than an average American (there are approximately 60 million people in the U.S. with absolutely no health insurance whatsoever) because it is free.[7] Similarly, people who purchased or otherwise acquired the supplemental insurance are more likely to use more secondary health care services than people with only compulsory insurance. This is because, as mentioned before, visits to the primary care physicians are completely free for both categories of insured citizens (with compulsory and supplemental insurance), but all referral visits are subject to co-payments for people with only compulsory insurance whereas they are completely free for people with the supplemental insurance.

Second, there is a problem of adverse selection. The term describes a situation where, as a result of private information, the insured person is more likely to suffer a loss then the uninsured person. In this particular situation that we study, it is highly likely that people who decided to buy the supplemental health insurance are those with impaired health who therefore anticipate to use the insurance coverage frequently enough to make the premium worth paying. Of course, their actual health status is their private information in the sense that it is unknown to the HZZO, or simply too costly to acquire. As a result of this asymmetric information, healthy people and ill people face the same premiums, which could be too high for healthy types to pay and they will go without the supplemental insurance. Therefore, the pool of insured people is going to be "polluted" with high percentage of ill types, which will necessitate a further increase in premiums and cause more reasonably healthy types to drop the insurance. Therein lies the market failure.

[7] *In order to curb demand for unnecessary health services, in 2005 the Government introduced a flat administrative fee of HRK 10 per person per visit (with a monthly cap of HRK 30). The impact of this measure on demand had been weakened by widespread exemptions from these fees and in 2008 the Government decided to abolish them as ineffective and administratively too cumbersome.*

3 Data

The data for this study come from two different sources. The first data set was assembled from the Croatian Household Budget Survey (HBS) for 2005. In addition to surveyed individuals' socio-economic characteristics (age, education, employment, income), the survey instrument contains two questions on health. The first question deals with the type of insurance an individual has (compulsory, supplemental, private, or no insurance) and the second question elicits a self-assessed health status (very good, good, fair, bad, and very bad). The summary statistics for the survey data are presented in Table 1.

The HBS data on health insurance reveal a very minor inconsistency with the HZZO data. As seen from Table 1, 98.8 percent of the population is covered by the HZZO compulsory insurance, whereas in reality this number should be virtually 100 percent. It is also interesting to note that a significant majority of people (64 percent) claim to be in a very good or good health, whereas only 16 percent of people claim to be in a bad or very bad health. The remaining 21 percent claim to have fair health.

The second data set was obtained from a medium size (1,940 patients) private primary care practice in the Zagreb metropolitan area. The practice employs one family care physician and one nurse. The data consists of three segments: data on individual visits to the primary care physician's office, data on patients' insurance coverage and socio-economic characteristics, and data on individual referrals to diagnostic labs, specialists, and hospital care (both out-patient and in-patient). The data on individual visits contain patient identification number, date when the visit occurred (from January 3, 2007 until May 27, 2008), and the basic description of the services provided. There were 14,327 visits recorded during this 17-months period. This means that the doctor saw on average close to 40 patients every day.

Table 1 **Summary Statistics for the 2005 Household Budget Survey Dataset**

	Mean/ Proportion		Mean/ Proportion
Demographic Characteristics		**Household Income**	
Age (years)	41.2 (22.7)	Monthly income per person (HRK)	2,094 (1,279)
Male	0.484		
Female	0.516	**Activity**	
		Employees	0.435
Marital Status		Self-employed	0.037
Single	0.213	Farmers	0.068
Married/Cohabitated	0.499	Unemployed	0.059
Widowed/Divorced/Separated	0.288	Retired	0.223
		Other inactive	0.177
Location			
Urban	0.505	**Health Insurance**	
Rural	0.495	Non-insured	0.008
		Compulsory only	0.810
Education		Compulsory + Supplemetal	0.178
Unfinished primary (< 8 years)	0.273	Private	0.005
Primary (8-year school)	0.213		
Vocational secondary education	0.212	**Self-declared Health Status**	
General secondary education	0.212	Very good	0.331
Tertiary (College, Post-graduate)	0.091	Good	0.306
		Fair	0.207
		Bad	0.115
		Very bad	0.041
No. of Observations 7,720			

Note: Standard deviations are in parentheses.
Source: Authors' calculations based on the 2005 HBS.

The patients' file contains the patient's identification number, sex, date of birth, the primary policy owner's eligibility criterion/category (employed, self-employed, farmers, retired, unemployed on welfare, foreigners, below the poverty line, and self-funded), an identifier of whether a person is the primary owner of the insurance policy or derives the coverage through a dependency status (like a child or a spouse), an identifier of whether a person is

automatically excused from the co-payments (people with disabilities, people in certain low income brackets, unemployed registered with the Employment service, children up to 18 years of age, full-time students, and some categories of war veterans),[8] an identifier of whether a person has the supplemental insurance or not, and finally an indication of whether a person quit this family practice during the period covered by the data for reasons of changing the family doctor, moving, or death. Here, one needs to recall the fact that the persons who bought supplemental health insurance and the persons automatically excused from paying the participation co-payments via belonging to some of the mentioned social categories essentially enjoy the same insurance coverage.

The third segment is the data on referrals which contains the referral identification number, visit identification number, patient identification number and the description of what type of referral is requested (verbal description and numeric code). The fact that most of the referrals (to specialist, labs, hospitals, etc.) are subject to co-payments allows us to analyze the difference in the utilization of medical services between people that only carry the compulsory insurance, and hence are subject to co-payments, and those that have supplemental insurance or are otherwise exempt from paying the participation rates (co-payments).

The critical drawback of this dataset is the fact that prices (co-payments) for prescribed services are not available. The reason for this is a rather complicated and generally non-transparent system of calculating fees that HZZO pays to the providers of services. The system is based on a very detailed and elaborate scheme of points for various types of activities or services (for example, the grid could be as fine as itemizing the counting of leukocytes as one activity when performing blood tests) that get summed up across all performed activities/services and then multiplied by the point's unit value. The arrived at number is the amount of money that the HZZO pays to the provider of the service (a hospital, a lab, etc.). The co-payments are determined as a percentage

[8] *The complete list of exmptions can be obtained from the HZZO documents, see http://www.hzzo-net.hr/dopunsko/DZO-koje_provodi_Zavod.htm.*

of the value of the service/activity. Most of the activities are in the 15 percent participation rate bracket. This bracket includes secondary health care such as visits to specialists, hospital out-patient services including out-patient surgeries, all diagnostics not at the primary level, orthopedic and prosthetic devices, health treatments abroad, and physical rehabilitation services carried out in the home of the patient. The 25 percent bracket includes board and lodging fees for in-patient (hospital) treatments of chronic diseases. The 30 percent bracket is reserved for physical therapy and rehabilitation and board and lodging expenses for in-patient treatments of acute diseases.[9]

Table 2 **Summary Statistics for the 2007-2008 Private Primary Care Practice Dataset**

	Mean/ Proportion		Mean/ Proportion
Demographic Characteristics		**Source of Insurance**	
Age (years)	44.7 (21.0)	Employed	0.572
		Self-Employed	0.042
Male	0.489	Farmer	0.027
Female	0.511	Retired	0.249
		Unemployed	0.064
Health Insurance		Poverty	0.009
Compulsory only	0.658	Self-funded	0.037
Compulsory + Supplemental	0.102		
Exempt	0.241	**No. of Visits/Patient**	7.4 (8.7)
Primary Policy Owner	0.888		
Drop-outs	0.041	**No. of Referrals/Patient**	3.9 (6.1)
No. of Observations 1,940			

Note: Standard deviations are in parentheses. Exempt is a dummy variable indicating people that are exempt from paying co-payments. Drop-outs is a dummy variable indicating people that left the practice within the sample time period.

The data set is organized by patients. In addition to his/her socio-economic characteristics and the data on the type of insurance or eligibility that the person carries, we also use the data on the number of visits to the primary care

[9] *There is also a 50 percent co-payment bracket for some dental prosthetic procedures of adults. The same thing for people over the age of 65 belongs to the 25 percent bracket. In this paper we are not dealing with dental care services at all.*

physician during the period covered by the data and the number of referrals that the primary care physician issued to a particular patient. Since we do not have co-payments associated with each particular referral, unfortunately we cannot estimate demand elasticities or anything that would involve prices. We are simply going to search for any systematic differences in the number of visits and number of referrals in relationship to the type of insurance coverage people carry. Another assumption implicitly contained in the analyses is that all referrals are executed, i.e. that people acted upon each of the issued referral.[10] The summary statistics of this dataset are presented in Table 2.

As seen from Table 2, the 1,940 patients in this dataset seem to represent the total Croatian population as represented by the 2005 Household Survey fairly well. The average age of a patient is 45 years which is somewhat higher than in the survey (41) due to the fact this practice treats only adults as children are always seen by primary care pediatricians. The sex breakdown is almost the same. The percentage of the patients with supplemental insurance (10 percent) is smaller than in the survey, but some of the people that are exempt from paying the co-payments could have been included by default in the supplemental insurance category in the survey, which could explain the difference. The source of insurance breakdown for patients in our primary care practice jives reasonably well with the activity breakdown in the general household survey. The percent share of employed patients (57 percent) is larger in the practice than in the survey (44 percent) and so is the percent share of retired people (25 percent vs. 22 percent). The difference is offset by fewer farmers and other fringe categories, typically underrepresented in metropolitan areas.

[10] *Of course, this is somewhat restrictive as well, since there is a certain percentage of referrals that will expire as the patient could get better or change his/her mind and decide to abandon the pursuit of a cure.*

4 Hypotheses and Empirical Tests

This section of the paper contains two sets of simple empirical tests for the presence and significance of the asymmetric information problem in the health insurance market in Croatia. The test of adverse selection is carried out using the 2005 Household Budget Survey data and for testing of the moral hazard we use the 2007-2008 Private Primary Care Practice data.

4.1 Adverse Selection

First, we hypothesize that the institutional setting under which the provision of supplemental health insurance through the HZZO is organized is prone to substantial adverse selection problems. The problem has two facets. On the one hand, there could be a true asymmetry of information about the latent health status of people that purchased the supplemental insurance, and hence the true adverse selection problem as is narrowly defined in the literature. This means that the true individual's health status is unknown to the HZZO and cannot be correctly ascertained at meaningfully low cost.[11] This problem can only be solved by offering a menu of contracts where people would self-select themselves into purchasing a contract that is closely reflective of their type (health status). This menu would typically involve various combinations of benefits and premiums (prices) that people can choose from.[12] On the other hand, there could be no fundamentally important asymmetry of information in the sense that using the readily observable individual socio-economic and other characteristics, the HZZO can correctly predict the probability of a person having a loss (in this context, going to the doctor and consuming a health service) and can sell insurance policies to different categories of people at different prices (premiums).

[11] Of course, if cost is not an issue, then the HZZO can figure out each individual's health status almost precisely by subjecting all applicants to a thorough medical exam prior to purchasing the policy.

[12] This is a general type of solution to adverse selection problems and is found, for example, in comprehensive and collision car insurance markets where people are offered various combinations of premiums and deductibles and are free to chose the combination that fits their driving experience, driving style, the type of vehicle they drive, etc. Comprehensive and collision insurance policies in Croatia come under the common name "casco", and a deductible is called a "franchise".

Since we currently observe the HZZO selling all policies at one price,[13] a priori, it is not clear which of the two cases described above apply. We could observe the HZZO selling all policies at one price because the asymmetric information problems are severe and offering a menu of contracts may be administratively too costly to apply. Alternatively, the asymmetric information problems could be rather modest and the reason why the HZZO does not use some degree of price discrimination can be explained by some social welfare considerations.

The empirical analysis of adverse selection is done with the household survey data from Table 1. Since we are only interested in the degree of asymmetric information about the latent health status of individuals who may consider purchasing the supplemental health insurance, we excluded the segments of the population who are excused from paying the co-payments and hence never even contemplated purchasing the insurance since they already enjoy the same benefits as those with the supplemental insurance. Given the fact the entire list of exemptions is quite extensive we do not have enough information to exclude all exempt categories. Therefore, we excluded only children up to 18 years of age and students up to 27 years of age. The error from not excluding others may not be too large as many of the other categories may not involve very many people.[14]

The testing of hypotheses is accomplished by estimating limited dependent variable models (probit and logit) where the left-hand-side variable assumes the value of 1 if the person purchased the supplemental insurance, and 0 otherwise. We estimated two models. The explanatory variables in the first model are all observables, i.e. the variables that the HZZO can easily observe (collect), such as age, sex, education, income, etc. (left panel in Table 3).[15] In the second model, we added the self-declared health status variable, our best

[13] *In fact, the situation is even worse in the sense that the supplemental insurance to retirees, who are most likely to have a loss (to use it) is sold at a 37.5 percent discount, which is obviously done not for actuarial but for social welfare reasons.*

[14] *We also excluded the individuals without any insurance as this category is highly suspect given the Croatian compulsory health insurance coverage, and the people that only have private insurance (mostly foreign citizens).*

[15] *Logit results are qualitatively identical to probit and are available from authors upon request.*

available measurement of the true health status which obviously cannot be readily observed by the HZZO (right panel in Table 3). If adding the unobservable health status to the covariates significantly improves the goodness of fit and the significance of the parameters, then one can think about the asymmetric information problem being important, otherwise not.

Table 3 **Testing for Adverse Selection in Supplemental Health Insurance**

Dep. Var.: Supplemental Insurance	**Probit on observables**			**Probit on observables and health status**		
Yes=1; No=0	**Coeff.**	**Prob>|z|**	**Marg. Effects**	**Coeff.**	**Prob>|z|**	**Marg. effects**
Female	0.177	0.000	0.048	0.178	0.000	0.048
Age	0.026	0.000	0.007	0.023	0.000	0.006
Marital status (vs. Widow/Div/Sep)						
Single	0.196	0.042	0.057	0.199	0.040	0.057
Married/Cohab	0.229	0.001	0.061	0.220	0.001	0.058
Urban	0.241	0.000	0.066	0.236	0.000	0.064
Education (vs. Unfinished Primary)						
Primary	0.325	0.000	0.096	0.319	0.000	0.094
Vocational Secondary	0.508	0.000	0.152	0.525	0.000	0.156
General Secondary	0.592	0.000	0.183	0.617	0.000	0.190
Tertiary	0.556	0.000	0.178	0.607	0.000	0.195
Activity (vs. Employees)						
Self-employed	-0.190	0.082	-0.048	-0.211	0.052	-0.053
Farmers	-0.332	0.002	-0.081	-0.380	0.000	-0.089
Unemployed	-0.462	0.000	-0.105	-0.509	0.000	-0.113
Retired	0.184	0.008	0.052	0.118	0.093	0.033
Other Inactive	-0.395	0.000	-0.095	-0.453	0.000	-0.105
Income/1000	0.113	0.000	0.031	0.122	0.000	0.033
Health Status (vs. Very Good)						
Good	-	-	-	0.165	0.036	0.046
Fair	-	-	-	0.453	0.000	0.135
Bad	-	-	-	0.432	0.000	0.132
Very bad	-	-	-	0.348	0.005	0.107
Constant	-4.043	0.000	-	-3.907	0.000	-
Wald χ^2	450.30			461.16		
Pseudo R^2	0.143			0.152		
No. of Observations	5,721			5,721		

The estimated coefficients on all observables in both models have expected signs and most are statistically significant at the 1 percent significance level. The interpretation of the results is as follows. For example, being a woman relative to being a man increases the probability of purchasing the supplemental insurance by 4.8 percent. The marginal effect remains the same after the inclusion of the unobservable health status. Every year of a person's age increases the probability of purchasing the insurance by almost 1 percent. Being single relative to being widowed, divorced or separated increases probability of purchasing the insurance by 6 percent, and similarly, married people are 6 percent more likely to purchase the supplemental insurance than widowed, divorced or separated. Urban people and more educated people are also more likely to buy the supplemental insurance relative to rural and people with unfinished primary education. Relative to employees, all other categories are less likely to buy the supplemental insurance except the retirees, who are more likely to purchase the supplemental insurance than employees by roughly 5 percent. The least likely to purchase the insurance are farmers and unemployed people. The result is absolutely not surprising for the latter category in light of the fact that some of them may be exempt from paying the co-payments so effectively they do not need the supplemental insurance at all. Finally, for each additional HRK 1,000 of income per month the likelihood of purchasing the supplemental insurance goes up by about 3 percent.

Comparing now the left panel model (with observables only) with the right panel model that includes the latent health status variable, one can see that the goodness of the model fit has not improved by much (pseudo coefficient of determination increased by about 1 percentage point) and the significance and the magnitudes of parameters changed very minimally. All health coefficients have correct signs and all are significant at least at the 5 percent level. Relative to the left-out health variable "very good", all other inferior health conditions would increase the likelihood of a person purchasing the supplemental health insurance, but the increases are not monotonous as intuitively expected. For example, dropping from "very good" to "good" health increases the probability of purchasing the insurance by 4.6 percent and dropping to "fair" increases the probability to 13.5 percent. However, dropping even further to "bad" causes the probability to increase less (13.3 percent), and finally

deteriorating health even further to "very bad" increases the probability of purchasing the insurance even less (10.7 percent).

Another possibility to test for the existence of adverse selection would be to check whether residuals from the above model with only observables are correlated with the self-declared health status. The correlation coefficient between the standard errors of the prediction (from probit for supplemental insurance on observables) and self-declared health-status (1-very good, 2-good, 3-fair, 4-bad, 5-very bad) is fairly low (-0.1588), indicating no serious asymmetry of information between the HZZO and its clients. Based on all results, one can conclude that the adverse selection problem is not significant and that the HZZO should be able to sell the supplemental insurance policies at fair rates if they choose to do so.[16] Obviously, the reason they are not doing it has to do with various social welfare considerations which are beyond the scope of this paper.

4.2 Moral Hazard

Turning now to the problem of moral hazard. All insurance programs suffer from it, the question is only how severe is the problem. The idea is very simple: the fact that the principal (insurer) cannot perfectly monitor the agent's (insured) actions, the insured person will tend to behave differently than before when he/she was not insured. Concretely, people with health insurance will tend to see a doctor more often than those with no insurance. In order to price the insurance policy correctly, the insurance company needs to anticipate this change in behavior or otherwise the aggregate indemnity payouts are going to be larger than the amount of money collected through premiums. Our objective here is to see how much is the behavior of the insured people different from the uninsured people. Our working hypothesis is that people who purchased or otherwise acquired the supplemental

[16] *By "fair" rate we mean the price (premium) which is calculated under the zero-profit condition for the insurer such that it equals the total loss (indemnity) times the probability of its occurrence.*

insurance are more likely to use more health care services than people with only compulsory insurance.

The institutional design of the health insurance in Croatia necessitates some clarification and fine tuning of the hypotheses. First, the fact that everybody has compulsory insurance makes the comparison between insured and uninsured people meaningless, so we can only compare the behavior of people with supplemental insurance relative to people with compulsory insurance. Second, since supplemental insurance is buying the relief from paying co-payments for secondary level medical services, one would anticipate that we should only detect differences in the consumption of secondary level medical services between the two categories of insured. However, in order to get access to the secondary level care, by and large, one has to go through a primary care physician's office to get a referral for the secondary level treatment. This produces an effect that should be reflected in different number of visits to the primary care physician between the two groups of insured as well, even if there are no differences in out-of-pocket expenses between them for the primary care services.

Finally, the presence of the large number of exempt people complicates the analysis but also enables the identification of the two types of asymmetric information effects. Recall that people who are exempt from paying co-payments essentially enjoy the same coverage as people with supplemental insurance but completely free of charge. So for this people, there is no self-selection bias, i.e. no adverse selection effect, because they obtained this level of coverage automatically and not by choice. So for this people, the excessive consumption of medical care should be the result of the pure moral hazard effect. Contrary to this, for people who actually bought the supplemental insurance, their behavior, when it comes to health care consumption, has been impacted by both adverse selection effect (they bought the insurance because of their inferior health) and moral hazard (having the insurance changed their behavior relative to when they were uninsured).

To summarize, we hypothesize that under the current system of health insurance in Croatia we should see both the increased number of visits to the

primary care physicians and the increased number of referrals to the secondary care level for both exempt people and people with the supplemental insurance relative to people with compulsory insurance only. However, the effect (the number of visits and referrals) should be larger for people who actually bought the supplemental insurance relative to those that are exempt. The difference between the two categories effect should be attributed to a pure adverse selection effect.

Table 4 **Testing for Moral Hazard in Supplemental Health Insurance - OLS Results**

	Dep. Var.: No. of Visits		**Dep. Var.: No. of Referrals**	
	Coeff.	**Prob>|t|**	**Coeff.**	**Prob>|t|**
Health Insurance (vs. Compulsory)				
Supplemental	9.546	0.000	7.319	0.000
Exempt	4.570	0.000	3.286	0.000
Male	-0.568	0.101	-0.204	0.419
Age	0.101	0.000	0.036	0.000
Primary Policy Owner	-1.370	0.017	-0.531	0.205
Source of Insurance (vs. Employed)				
Self-Employed	-1.040	0.229	0.283	0.653
Farmer	-2.638	0.025	-3.057	0.000
Retired	1.064	0.064	0.231	0.579
Unemployed	-1.008	0.176	-0.072	0.895
Poverty	0.250	0.891	0.538	0.686
Self funded	0.796	0.423	-0.396	0.584
Drop-outs	-3.722	0.000	-1.916	0.002
Constant	2.346	0.000	1.411	0.003
Adjusted R^2	0.271		0.201	
No. of Observations	1,940		1,940	

Econometrically, the testing has been done by regressing the number of visits and the number of referrals per person per period (within the 17 months time period covered by the data) on health insurance indicators and other available socio-economic characteristics. The OLS results are presented in Table 4. The definitions of the variables are the same as in Table 2. A casual inspection of results reveals that all coefficients have the expected signs and most of them

are significant at the standard levels. The most important results are of course the estimates of the "supplemental" and "exempt" coefficients. Both of them are positive, indicating a greater number of visits and referrals for both categories of patients relative to those patients with compulsory insurance only. Also, as intuitively anticipated, the coefficient on "supplemental" is larger than the coefficient on "exempt" for both indicators.

However, looking more carefully at the above models, it can be easily argued that decisions on how many times one goes to seek medical attention are not made independently of the type of insurance that one carries. In other words, the decision to buy supplemental insurance is endogenous to the decision on how much health services to afford. The endogeneity of the right-hand-side variables causes inconsistent (biased) estimators. The problem has been corrected using instrumental variables (2-stage-least squares) where "supplemental" has been instrumented using the male dummy and the source of insurance indicators.[17] The results are presented in Table 5.

Table 5 **Testing for Moral Hazard in Supplemental Health Insurance – Instrumental Variables Approach (2SLS)**

	Dep. Var.: No. of Visits		Dep. Var.: No. of Referrals	
	Coeff.	**Prob>|t|**	**Coeff.**	**Prob>|t|**
Health Insurance (vs. Compulsory)				
Supplemental	24.353	0.000	14.623	0.000
Exempt	6.728	0.000	4.306	0.000
Age	0.063	0.000	0.009	0.470
Primary Policy Owner	-1.553	0.017	-0.541	0.220
Drop-outs	-3.584	0.000	-1.794	0.007
Constant	1.989	0.005	1.531	0.001
Adjusted R^2	0.039		0.082	
No. of Observations	1,940		1,940	

[17] *Other obvious choices of instruments give virtually identical results.*

The results show that compared to the OLS estimation, both coefficients on "supplemental" and "exempt" increased in magnitude, indicating that indeed the OLS coefficients were biased downwards. These estimates indicate that an average owner of the supplemental insurance will pay 24 visits to the primary care facility more than an average person with only compulsory insurance. Given the fact that the time period under consideration is 17 months, this amounts to 1.4 more visist per month. For the same time period, an average exempt person would only pay 7 more visits to the primary care facility (0.4 visits per month) than a person with only complusory insurance.

Turning now to the number of referrals, we see an identical pattern. A person with the supplemental insurance will request almost 15 more referrals (0.9 referrals per month) than a person with only compulsory insurance, and an exempt person would request 4 more referrals (0.2 per month) than a person with basic insurance only. Based on the previous discussion, these results indicate that out of 0.9 extra referrals per month that a person with supplemental insurance requests 0.2 are due purely to moral hazard and 0.7 are due to adverse selection.

5 Conclusions and Policy Recommendations

To the best of our knowledge this is the first and only micro-level quantitative economic analysis that looks into the functioning of the Croatian state-administered health insurance system. The results presented in this paper are preliminary and need to be interpreted cautiously until more research is done. The access to more and better quality data could substantially strengthen the research findings. In summary, we presented several important findings. First, we found that the asymmetric information problem regarding the latent health status of the insured is not very large and that the HZZO should be able to sell supplemental insurance policies at diversified rates. Secondly, we found that people with inferior health are substantially more likely to purchase supplemental insurance and consequently consume more medical services, and since all policies are sold at the same price, they are not in any way penalized

for doing so. Finally, we also found that the effect of moral hazard is statistically significant but substantially smaller compared to the excessive medical consumption of people with inferior health who were able to acquire the supplemental insurance policy at a flat rate that appears to be substantially below the actuary fair rate.

Due to the fact that the Croatian health insurance system is basically unsustainable in its current form, some serious modifications and reforms are likely forthcoming in the foreseeable future. The actual reform of the entire Croatian health sector that may eventually take place is likely to be multifaceted and will involve the reform of the prescription drugs benefits, the reform of how physicians, labs, and hospitals are reimbursed for their services, as well as the reform of the health insurance system per se. The first two possible reforms are completely outside the scope of this paper, so all that we can say invariably refers to the reform of the health insurance component of the health sector alone. In this domain, two policy recommendations clearly follow from the obtained results.

First, in order to curb the moral hazard side of the problem, a universal system of co-payments needs to be introduced. This proposal has two prongs: (a) the current system of wide exceptions from paying co-payments needs to be abolished, and (b) the co-payment rates have to be widely applied to a majority of health services and need to be increased to the point where they begin to effectively "bite". Possible problems with affordability of health services by low-income and other vulnerable groups should be solved through the social security system. Second, in order to address the problem of adverse selection, a system of differentiated pricing of supplemental insurance needs to be introduced. This can be done through: (a) price discrimination based on some observable socio-economic attributes of insurance applicants, or (b) offering a menu of insurance policies with different combinations of premiums and benefits where people can self-select themselves into buying a policy most suitable to their needs. The actual design of both of the suggested reforms is way outside the scope of this paper. It would require very serious and rigorous economic analyses that can only be accomplished by a team of competent health economists with full access to all HZZO data.

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