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Supplementary private health insurance and health care utilization of people aged 50+

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Abstract

Does supplementary private health insurance coverage influence health care utilization in countries where the coverage ratio with public health insurance is high? I estimate this effect using the Survey of Health, Ageing and Retirement in Europe. Handling the potential endogeneity of supplementary insurance coverage and the large fraction of zero observations in the utilization models influences the empirical results. I show that the effect of private health insurance coverage on inpatient and outpatient care utilization is not trivial even in countries with generous public health funding. The main finding is that supplementary private health insurance coverage increases dental care utilization, but decreases the visits to general practitioners. Private insurance is estimated to have little and insignificant influence on the utilization of inpatient care and outpatient specialist care. The magnitude of the effect of supplementary private health insurance on health care utilization varies with the characteristics of the health

care systems.

1 Introduction

In most of the European countries there is almost universal coverage with public health insurance, and more than 50% of health expenditures are financed by the general government. Given this institutional background does supplementary private health insurance (PHI) coverage influence health care utilization? I focus on the utilization of hospital, general practitioner (GP), specialist, and dental care among people aged 50 and over. Due to the age restriction the sample used is not representative for the whole population of the analyzed countries. However, health care utilization increases on average with age, therefore the results can be indicative for the overall health care systems.

Despite the broad coverage with public insurance, the coverage rate with supplementary PHI is still not negligible in the countries analyzed. In this paper I estimate the effect of PHI on health care utilization, and also analyze how these effects vary with some institutional characteristics of the countries.

A seminal empirical paper analyzing the effect of health insurance on the demand for medical care is of Manning et al. (1987). Based on the RAND health insurance experiment conducted in the U.S., they show that more generous health insurance plans increase the demand for outpatient services. Gibbons and Wilcox-Gok (1998) also find positive effect of health insurance coverage on health care utilization probability, using the National Medical Expenditure Survey from the United States. In Europe mandatory health insurance is more widespread, therefore private health insurance might have smaller role in influencing health care utilization.

Two closely related papers which use European data are of Jones et al. (2006) and Paccagnella et al. (2012). Jones et al. (2006) find a positive effect of supplementary health insurance coverage on the probability of visiting a specialist. Their results are based on samples of four countries from the European Community Household Panel User Database (ECHP-UDB). My research differs from theirs not only in the wider country coverage of the sample used, but also in the different methodology and extended research question - I analyze the effect of PHI on hospital, GP and dental care utilization, as well. Paccagnella et al. (2012) give a detailed analysis of the determinants of voluntary PHI coverage in Europe, based on the first wave of the SHARE database.[1] They also analyze the effect of voluntary PHI on out-of-pocket expenditures, and find that this effect varies across countries. The demand for voluntary PHI, and its effect on medical expenditures based on the SHARE data are analyzed also by Holly et al. (2005). They find some evidence that voluntary PHI coverage may have a positive effect on out-of-pocket medical expenditures.

This paper contributes to the literature in providing an international comparison about the utilization enhancing effect of supplementary PHI. An additional novelty is to analyze the effect of supplementary PHI coverage if health care utilization is modelled as two-stage decision, and the endogeneity of PHI is taken into account. I identify the effect of PHI by using the assumption that only current employment characteristics influence the utilization, whereas past employment characteristics influence PHI coverage.

Section 2 provides an overview of the health care institutions and the role of private

[1] Details about the Survey of Health, Ageing and Retirement in Europe (SHARE) are provided in Section 5.

health insurance in the analyzed countries. The economic considerations underlying the empirical analysis are discussed in Section 3. Section 4 presents the empirical model, and the dataset used is described in Section 5. Section 6 discusses the empirical results, and Section 7 concludes.

2 Institutional background

I investigate the effect of supplementary PHI on health care utilization in eleven European countries. There are considerable differences across the health care institutions. Some of these differences are related to health care financing and health care resources. The institutional background influences the role PHI has. The demand for PHI, and its effect on health care utilization depend among others on the out-of-pocket cost of medical services. If the services are covered by the mandatory public insurance then the out-of-pocket costs cannot be further reduced by the supplementary PHI.

In this section I provide some details on the health care systems in the analyzed countries. I focus on those characteristics which might indicate the role PHI has in financing health care. In Table 1 I present a selection of indicators related to the health care institutions. Except for the data presented in the first column, all indicators are based on aggregate statistics provided by the World Health Organization (WHO).[2] In the third column the values are purchasing power parity (ppp) adjusted. I give a detailed explanation in Section 5 how the PHI indicator of the first column was generated.

[2] The WHO data are based on the WHO European health for all (HFA) database. In the WHO statistics the public health expenditure measure for Switzerland includes the expenditures covered by mandatory private health insurance.

The correlation coefficient of PHI coverage rate with the ratio of health expenditures covered by public sources is close to zero. On the other hand, PHI coverage is more prevalent among people aged 50 or over in those countries where the public health expenditure per inhabitant or relative to GDP is higher. An explanation for these positive relations can be that more developed and widespread health care resources imply higher costs of health care, which can increase not only the public health expenditures, but also the demand for PHI coverage.

Table 1: Heath insurance and health expenditure indicators, 2004

	PHI coverage ratio (%) in the sample	Public per total health expenditures (%)	Public health expenditures per inhabitant ($ ppp)	Public health expenditures per GDP (%)
AT	23.3	75.7	2,568	7.8
BE	76.1	72.9	2,172	7.0
DK	36.3	83.8	2,531	7.8
FR	84.2	79.3	2,550	8.7
DE	21.6	77.0	2,435	8.1
GR	5.2	59.1	1,189	4.3
IT	5.6	76.0	1,823	6.6
NL	81.9	64.4	1,936	5.8
ES	9.2	70.5	1,487	5.7
SE	9.1	81.8	2,425	7.6
CH	32.7	58.4	2,334	6.7
Source	SHARE	WHO	WHO	WHO

The following characteristics of the health care systems refer to year 2004, when the survey data I use were collected, and are based on OECD (2004), Paccagnella et al. (2012), and Thomson et al. (2009). Except for Switzerland, all the analyzed countries have mandatory public health insurance. In Switzerland there is mandatory insurance, but that is provided by private insurance companies. The coverage with the mandatory insurance is almost universal in all countries except for Germany and Netherlands. In Germany the civil servants, high earners, and self employed are exempt, whereas in the Netherlands the high earners are exempt (prior to 2006).

Although there is almost universal coverage with the mandatory (public) health insurance, some cost sharing arrangements still apply in all countries. These arrangements vary across the countries. It varies to which services and to whom does the cost sharing apply, and also its magnitude differs across the countries. For example, in Austria and Sweden it applies to most services, whereas in Spain there is no cost sharing for GP or specialist care. In some countries, as in Austria, Belgium, and Italy, those with low income or with chronic health problems are exempt from the cost sharing.

PHI can be the primary health insurance for those not covered by public insurance. Otherwise, PHI can have supplementary or complementary role. Supplementary PHI covers services not insured by the public insurance. This is the most prevalent role of PHI in Europe. Complementary PHI can be contracted to cover cost sharing for services not fully financed by the public insurance. This is widespread in France, where the complementary PHI is even provided free of charge for those with low income. In the following I call "supplementary private health insurance" all those PHI contracts which do not have primary function.

3 Economic considerations

In this section I provide some theoretical motivation to the empirical analysis. Health insurance coverage can decrease the observed costs of health services or can make higher quality of services available, both of which increase the demand for medical care.

An important assumption throughout this paper is that PHI coverage is predetermined. The main reason for this assumption is that individuals above a given age are generally excluded from contracting PHI (see Mossialos and Thomson (2004)). The decision about buying PHI is likely to be made before age 50, during the earlier working life. This decision can be influenced by the insurance costs and availability, and by the potential benefits of such a contract, which depend on risk-aversion, risk of future health problems and potential health care expenditures. Although PHI is considered as predetermined, some of the influencing factors of coverage are time-invariant, like gender, education, cohort-effects, or the main features of the health care system, at least in the short to middle run. Thus, it is possible to estimate the effect of such time-invariant factors on the likelihood of PHI coverage.

I assume that individuals maximize a deterministic utility function, which depends on consumption and health. Future health is influenced by the utilization of health care. Decision about making an initial contact with a physician or going to hospital is made by the individual. I also assume that the frequency of doctoral visits afterwards, and the length of hospital stay are at least partially decided by the patients.

Expenditure on consumption goods and on medical services are limited by income and wealth. The cost of medical services depends on several factors: on the type or quality of the service, whether the individual has PHI, and on the country-specific features of health care. In the empirical analysis I control for the country-specific effects by including country dummies in the utilization models, and allowing country-specific effect of some observables.

Assuming positive but diminishing marginal utility of consumption and health, and positive but diminishing marginal product of medical care on health, the demand for health care services decreases with the realized price and increases with the service quality. Thus, according to a simple health care demand model, PHI coverage is expected to increase the demand for health services. This effect can be due to moral hazard or to the access to services unavailable without PHI coverage.[3] However, if health care prices are generally low, and utilization is primarily determined by health problems then insurance coverage might have moderate effect on utilization. The empirical results of this paper affirm the positive effect of supplementary PHI on health care utilization only partially.

4 Empirical model

4.1 Empirical issues of health care demand estimation

Following the model of Grossman (1972), most empirical health care models include a rich set of regressors to capture health, and health production characteristics. Such empirical models of health care demand are applied among others by Hunt-McCool et al. (1994) and Gibbons and Wilcox-Gok (1998). This strand of the literature follows the consumer theory approach.

A detailed discussion about the econometric issues of estimating medical care usage models is given by Jones (2000). Basic issues are that the dependent variable is not continuous, there is a large number of zero observations, which can be modelled with one-step or two-step models, and there are usually measurement problems as well.

Time-invariant but unobserved taste shifters might be correlated both with supplementary PHI coverage and health care utilization. It can be due to adverse selection and to positive selection, as well. First, the problem of adverse selection arises if those people are more likely to be covered with PHI who are also more likely to utilize health care due to

[3] Jones et al. (2006) differentiate four influencing mechanisms of health insurance on utilization: 1. moral hazard effect due to reduced prices, 2. risk reduction effect due to reduced financial uncertainty, 3. income transfer effect (ex post transfer from the healthy to the ill), and 4. access effect due to the access to high quality services.

unobserved health problems or due to less subjective disutility attached to medical care. Second, there is positive selection if PHI is more likely to be purchased by wealthier individuals who are at the same time in better health condition, thus have lower demand for health care. Although I control for income and wealth in the empirical models, these controls cannot perfectly capture the economic situation of the respondents.

I estimate the insurance coverage and utilization models on a pooled sample of the analyzed countries. Bago d'Uva and Jones (2009) reject the equality of income and education effects on health care utilization across European countries. However, some assumption of equality is needed in order to avoid the problem of small country-specific samples. Apart from including country dummies in the empirical models, I allow the effect of income and wealth on utilization to be country-specific. The out-of-pocket costs of health care services vary across countries, these differences imply varying effect of income and wealth on utilization. The liquidity of certain wealth components, thus their effect on health care utilization might also vary across countries. The effect of supplementary PHI on health care utilization is also allowed to be country specific.

4.2 Two-part specification

In the preferred specification the underlying assumption is that separate processes drive the probability of making any doctoral visits, and the number of visits (similarly for hospital stays). The statistical reason for applying two-stage modelling is the relatively large number of observed zero outcomes.[4]

[4] Two-stage modelling is a standard approach in modelling health care demand, see e.g. Zimmerman Murphy (1987), Pohlmeier and Ulrich (1995), and Werblow et al. (2007).

An alternative modelling strategy could be the application of finite mixture (latent class) models, as e.g. Deb and Trivedi (1997). Such models allow for heterogeneity in the population, but do not apply strict

Following the argument of Dow and Norton (2003), if zero values are "true zeros", i.e. the results of corner solution and not of sample selection then applying sample selection estimation methods can be misleading, whereas two-part models can be appropriate. In addition, Norton et al. (2008) analyze the properties of sample selection and two-part models if there is a large fraction of zero observations and there are no exclusion restrictions. They show that two-part models can be superior even if the errors in the two parts of the models are correlated. In the health care utilization models of this paper there are no clear exclusion restrictions: the same observed characteristics drive the probability of health care utilization and the amount of utilization. This modelling feature calls for the application of two-part models, instead of selection models.

The two-part model is based on the assumption that the second stage error term has zero expected value, conditional on positive outcome and on the exogenous regressors. Based on this assumption the two parts of the model can be estimated separately. The first part is about the probability of health care utilization, and the second part is about the amount of utilization. The simple two-part model has to be modified due to the potential endogeneity of PHI in the utilization models.

The equations of the first part model the supplementary PHI coverage together with the probability of having any GP visits, specialist visits or hospital stays (Pos_Y_j). This part of the model can also be estimated for dental care, for which only a binary indicator of

separation between those who utilize and do not utilize health care services. Then the marginal effects are allowed to vary among "latent classes" of the population. I apply the simpler two-part modelling approach, but extend that with handling the endogeneity of PHI coverage.

utilization is available.

$$
\begin{aligned}
PHI_i^* &= Z_i\alpha + \nu_i \\
PHI_i &= 1(PHI_i^* > 0) \qquad (1) \\
Pos\_Y_{ji}^* &= X_i\beta_{1j} + \gamma_{1j}PHI_i + \varepsilon_{1ji} \\
Pos\_Y_{ji} &= 1(Pos\_Y_{ji}^* > 0). \qquad (2)
\end{aligned}
$$

Index i refers to the individual, and index j differentiates the parameters and variables according to the dependent variable. The dependent variable Y is either the number of doctoral visits (GP or specialist visits) or hospital nights. PHI indicates the coverage with supplementary private health insurance, and X is a vector of variables including a rich set of socioeconomic indicators. In particular, X includes age, gender, marital status, dummy variable for having children, logarithmic income, logarithmic value of the main residence (replaced with zero if the reported value of the main residence is zero), education (four categories: International Standard Classification of Education (ISCED) codes 0-1, 2, 3-4 and 5-6), employment status, indicators of the current employment as civil servant, public sector employee or self employed, firm size at current employment, living area and smoking dummies, country dummies, and three health measures. In the outpatient care utilization models the education level and the number of health problems of the partner are also included as regressors. These can serve as proxies for the partner's health care utilization, which might induce utilization by the respondent. The effects of income, wealth, and supplementary PHI coverage are allowed to be country-specific. Further details about the data are given in Section 5.

The variables in vector Z which can also influence health care utilization are the following: age, gender, marital status, having children, wealth and income measures, education level, living area, and country dummies. Since PHI is treated as predetermined, I exclude those indicators that are likely to have changed since contracting the insurance (smoking indicators, health measures). Model (1) is a reduced form model of insurance coverage in which potential interactions between health and PHI coverage are not modelled. In this specification I include such control variables that can capture the socioeconomic circumstances when the decision on PHI coverage was made, keeping in mind that this decision was made earlier.

The identifying instruments of supplementary PHI are indicators of the last employment: the number of people employed at the last job (firm size), and whether the respondent was public employee, civil servant or self-employed at the last job. The firm size indicator is based on the number of employees at the current or last job. I differentiate six categories ranging from 1 to 500 plus employees, and an additional category holds if the respondent is self-employed or the question is not applicable (25% of the respondent). Occupational status influences PHI coverage, as it is possible that the insurance is contracted through or supported by the employer, and in some countries different insurance regulations hold for the self-employed or civil servants. Paccagnella et al. (2012) document that in most countries covered by SHARE, supplementary PHI coverage is predominant among employees of firms with more than 24 employees. Mossialos and Thomson (2004) also report that group policies, i.e. supplementary PHI purchased by groups (typically by employers) have a major role in many European countries. Group policies generally offer lower prices and more favorable conditions, and are often provided as an employee benefit. The availability of group policies varies with firm size.

The identification is based on the assumption that only the current characteristics of the employment influence health care utilization decisions, whereas the firm size at the last employment and the type of the last job influence insurance coverage. Current job characteristics might influence health care utilization e.g. through the availability of health services at the workplace or through required regular health checks. I assume that after retirement the characteristics of the last job do not have direct effect on health care utilization, ceteris paribus. Similar identification strategy is applied by Jones et al. (2006) and Paccagnella et al. (2012). It is important that I control for such factors as income, wealth, and education level in the utilization model, since these influencing factors of utilization can also be related to having been employed at a large firm, and to the employment status at the last job.

Assuming that ν and ε_1 have bivariate normal distribution with zero means and unit variances, these two binary models form a bivariate probit model. If the exogeneity assumptions hold (Z and X are exogenous in models (1) and (2)), the bivariate probit model gives consistent estimates.

The nonzero numbers of doctoral visits and hospital nights are estimated by zero-truncated negative binomial regressions. This is the second part of the two-part model. Again, PHI coverage can be endogenous in the utilization models, therefore I apply the method of two-stage residual inclusion (2SRI): first I estimate a probit model for the probability of PHI coverage (model (1)), then include the estimated residual as regressor in the zero-truncated negative binomial regression. The 2SRI method is an implementation of the method of instrumental variables in nonlinear models. This approach is widely applied in empirical models in health economics, for a list of citations see Terza et al. (2008). Provided that there are appropriate instruments for the endogenous regressor, the 2SRI method is consistent.[5]

Without conditioning on positive utilization, the expected value of the outcome is:

$$E(Y_{ji}|X_i, PHI_i, \hat{u}_i, \varepsilon_{2ji}) = \exp(X_i\beta_{2j} + \gamma_{2j}PHI_i + \delta_j\hat{u}_i + \varepsilon_{2ji}), \tag{3}$$

where ε_2 includes unobservables (heterogeneity components), $exp(\varepsilon_2)$ has gamma distribution, and $E(\varepsilon_{2ji}|Y_{ji} > 0, X_i, PHI_i, \hat{u}_i) = 0$. $\hat{u}$ is the first stage residual: $\hat{u}_i = PHI_i - \Phi(Z_i\hat{\alpha})$, where $\Phi(.)$ is the cumulative standard normal distribution function, and $\hat{\alpha}$ indicates the estimated parameter vector of the probit model. If PHI is exogenous in the jth health care utilization model then δ_j should equal zero. It is assumed in this model that the coefficient of the first stage residual is not country specific. This follows from the implicit assumption that the correlation between the unobservables in the utilization and PHI coverage models is the same across the countries. Without this assumption separate PHI coverage models should be estimated for all the analyzed countries, and the problem of small country specific sample sizes would arise.

The outcome of final interest is $E(Y_{ji}|X_i, PHI_i) = \Pr(Y_{ji} > 0|X_i, PHI_i) \cdot E(Y_{ji}|Y_{ji} > 0, X_i, PHI_i)$. The marginal effect of PHI coverage on the expected utilization can be calculated using the estimation results of the two parts of the model.

[5] Alternative consistent estimation methods are the full-information maximum likelihood and two-stage method of moments estimation suggested by Terza (1998).

Based on Terza et al. (2008), three conditions have to be satisfied for the consistency of the 2SRI method: 1. The identifying instruments cannot be correlated with the unobservable determinants of health care utilization. 2. The identifying instruments must be correlated with the PHI variable. 3. The identifying instruments might not have direct influence on the utilization measure, and might not be correlated with the random error term in the utilization model.

These conditions are satisfied based on the assumptions that the characteristics of the last job have no direct effect on current helath care utilization, and these characteristics are independent of the unobservable determinants of utilization.

5 Data

The empirical analysis is based on the first wave of the Survey of Health, Ageing, and Retirement in Europe (SHARE), release 2.3.1.[6] The SHARE data covers individuals aged 50+, and their spouses. Since only the first wave questionnaire of SHARE contains a question about PHI coverage, I use only the first wave, which corresponds to year 2004.

I use samples on 11 European countries: Austria, Belgium, Denmark, France, Germany, Greece, Italy, the Netherlands, Spain, Sweden, and Switzerland. In order to avoid the problem of small samples, I use pooled data, the size of the estimating sample is 23.5 thousand. I weight the observations so as each country has the same share in the pooled sample. Each weight is country specific, and equals the number of all observations divided by the number of observations in the particular country.

Due to the relatively high rate of nonresponse, for income, wealth, and health insurance premia I use the imputed values provided in the dataset. The SHARE dataset contains multiple imputations, I use the average of these.[7] The household-level income and wealth measures are divided by the household size so as to get individual-level measures. I generate the income measure used in this analysis as the gross income minus the health insurance payments.[8]

[6]This paper uses data from SHARE release 2.3.1, as of July 29th 2010. SHARE data collection in 2004-2007 was primarily funded by the European Commission through its 5th and 6th framework programmes (project numbers QLK6-CT-2001- 00360; RII-CT- 2006-062193; CIT5-CT-2005-028857). Additional funding by the US National Institute on Aging (grant numbers U01 AG09740-13S2; P01 AG005842; P01 AG08291; P30 AG12815; Y1-AG-4553-01; OGHA 04-064; R21 AG025169) as well as by various national sources is gratefully acknowledged (see http://www.share-project.org for a full list of funding institutions).

[7]This approach is a simplification, since it neglects the uncertainty of the imputations, therefore can cause downward bias in the estimated standard errors. However, this simplification does not affect the main results of the paper.

[8]Since PHI is predetermined in this model, it is reasonable to subtract its costs from the disposable income measure. I replace the net income to one for whom its calculated value is zero or negative (there are 63 such observations in the sample used). The median value of annual payments for private health insurance

Some descriptive statistics of the variables are reported in Table A.1 in Appendix A. The financial values are purchasing power parity adjusted. The adjusted values are included in the SHARE dataset, the adjustment was based on OECD purchasing power parity data. As health indicators I use the number of chronic diseases the respondents ever had, activities of daily living (ADL) limitations, and reported symptoms.[9]

Coverage with supplementary PHI refers by definition only to those individuals who do not have private insurance as primary health insurance. Having primary private health insurance is relevant only in Germany and the Netherlands (the mandatory private insurance in Switzerland is defined here as public insurance). In the SHARE sample 36% of the individuals living in the Netherlands report not having basic public health insurance coverage. These people have private primary coverage. In case of Germany, high-earners, self-employed people and civil servants might not be covered with the basic public insurance (9% of the sample). I exclude those individuals from the estimation sample who are covered with primary private health insurance. The reason for this exclusion is that my aim is to analyze the difference in utilization between those who are covered with only the mandatory health insurance, and those who have supplementary PHI coverage as well.

I define supplementary PHI coverage as having any type of private health insurance which supplements or complements the basic health insurance. Although there are questions in

contracts is 356 EUR, the mean is 596 EUR among those who report supplementary or complementary PHI coverage.

[9]The chronic conditions are: heart attack, high blood pressure, high blood cholesterol, stroke, diabetes, chronic lung disease, asthma, arthritis, osteoporosis, cancer, stomach ulcer, Parkinson disease, cataracts, hip or fremoral fracture.

The ADL limitations include difficulties with dressing, walking across a room, eating, bathing, getting in or out of bed, and using the toilet.

The specified symptoms are: pain in a joint, heart trouble, breathlessness, persistent cough, swollen legs, sleeping problems, falling down, fear of falling down, dizziness, stomach problems, and incontinence.

the SHARE about the services the PHI provides, I do not use this information because of the following reasons. First, the definitions of these insurance categories vary across the country-specific questionnaires. Second, in some insurance categories there are very few observations. The coverage ratios with the basic ten insurance categories are reported in Table A.2 in Appendix A. The predominant type of PHI varies across countries, for example in Austria it is the insurance for hospital care, in the Netherlands the dental care insurance, whereas in Spain the insurance that provides direct access to specialists.

The dependent variables I analyze in this paper refer to the last 12 months before the interview. These are the number of times seeing or talking to general practitioners and to specialists, the number of nights spent in hospital, and reporting visits to dentists. There is no information in the SHARE data about the number of dental visits. However, I can use the information if the respondent had any dental visits or not.

When estimating the number of hospital nights or doctoral visits, I exclude those observations where it is larger than 50. The main reason for this exclusion is theoretical: the underlying utility maximization model might not be valid for those in the worst health condition. Reporting high utilization can indicate critical health condition. Cutting the sample at 50 reported hospital nights, GP or specialist visits excludes less than 1% of the observations.

In Table A.3 in Appendix A I present the country-level averages of PHI coverage and health care utilization. There are large differences in supplementary PHI coverage rates (ranging from $5-6\%$ in Greece and Italy to 84% in France).[10] The cross-country variation in the ratio of people reporting specialist visits, dental visits, or hospital stays is also not

[10] The differences between the PHI coverage ratios of Table 1 and of Table A.3 in case of Germany and the Netherlands are due to the exclusion of those who are not covered by public health insurance.

negligible, but that is relatively small for GP visits. The majority (85%) of the respondents report some visits to general practitioners.

The SHARE dataset also provides information on the out-of-pocket expenditures on health care. The weighted average of annual out-of-pocket expenditure on inpatient services is 280 EUR for those who report nonzero hospital nights. The average annual outpatient expenditure is 130 EUR among those who report outpatient visits to GPs, specialists or dentist. The survey also asks if the respondent had to forego health care due to high costs: only 4% of the respondents report such difficulty, about half of them report that the costs of dental care were not affordable. These statistics indicate that the out-of-pocket inpatient and outpatient health expenditures are moderate in the analyzed European countries. Moral hazard due to PHI coverage is most likely to play a role in dental care utilization. For the other types of health care the role of PHI is more likely to make higher quality services available.

6 Estimation results

6.1 Supplementary private health insurance coverage

The estimated coefficients of the probit model of PHI coverage are reported in Appendix B. Since spouses might make joint decisions on PHI coverage and on health care utilization, I allow the error terms to be correlated across the household members, and the standard errors are clustered by household. Income is estimated to have significantly positive effect on insurance coverage (the reference country is Austria). The Netherlands is an exception in this respect because there the richest individuals are typically covered with primary PHI, which is not included in the supplementary PHI category. Higher education is also associated with higher probability of coverage. Most of the country dummy coefficients are significantly different from zero, due to the differences in the health care and insurance institutions across the countries.

Working for a big firm at the last employment can indicate the availability of group policies, and accordingly its effect is significantly positive. Although the estimated likelihood of PHI does not increase monotonically, the highest firm size implies the highest probability of coverage, ceteris paribus. As for the type of the last job, self-employment significantly increases the probability of being covered with PHI.[11]

These results suggest that the firm size and employment status indicators might indeed be used for identifying the effect of PHI coverage on health care utilization. When testing the joint significance of these indicators, the p-value of the Wald-test is approximately zero.

6.2 Two-part model coefficient estimates

The preferred specification follows the model described in Section 4.2: the utilization is modelled as two-stage decision, and supplementary PHI is considered to be endogenous in both stages.

The first part of the model is about the probability of utilization and PHI coverage. This can be estimated for dental care utilization, as well. In Table 2 I present the estimated coefficients of interest based on the bivariate probit models (equations (1) and (2)), and I

[11] Based on the estimated marginal effects at the average, the probability of having PHI is 5 percentage points higher if the firm size is above 500 employees than if the firm size is between $200-499$. The increasing effect of self-employment (compared to private sector employment) at the average is 7 percentage points.

also report the estimated coefficient of PHI if insurance coverage is assumed to be exogenous (probit model of equation (2)).[12]

Table 2: PHI coefficients: probit models of nonzero utilization

	Hospital nights		GP visits		Specialist visits		Dental visits	
		Bivariate		Bivariate		Bivariate		Bivariate
	Probit	probit	Probit	probit	Probit	probit	Probit	probit
AT	0.191**	0.489	0.108	-0.589	0.087	0.101	0.331***	0.520*
BE	0.120*	0.409	0.193**	-0.454	0.076	0.095	0.185***	0.374
DK	-0.045	0.245	0.120	-0.529	0.026	0.044	0.466***	0.647**
FR	0.083	0.394	0.360***	-0.340	0.121*	0.142	0.064	0.269
DE	0.175*	0.502	-0.097	-0.849*	0.151*	0.172	0.006	0.209
GR	0.303*	0.693	-0.154	-0.989*	0.033	0.057	0.150	0.385
IT	0.122	0.496	-0.105	-0.944*	-0.125	-0.102	0.121	0.349
NL	0.077	0.365	0.114	-0.535	0.050	0.069	0.474***	0.659**
ES	0.074	0.423	-0.058	-0.838	0.199*	0.220	0.329***	0.541*
SE	-0.108	0.253	-0.090	-0.872*	0.018	0.040	0.170	0.390
CH	0.169	0.457	0.020	-0.629	0.306***	0.325	0.177	0.358
corr.		-0.176		0.393		-0.011		-0.112

*, **, *** significant at the 10, 5, 1% level, respectively

If the endogeneity of PHI is neglected then its effect is underestimated in absolute value for hospital, GP and dental care utilization. For specialist care utilization the estimated effects under the simple and bivariate probit models are close to each other. Despite the differences in the point estimates of the probit and bivariate probit specifications, the estimated correlation coefficients between the error terms of the PHI and nonzero utilization models (i.e. ν and ε_1) are insignificant. Thus there is no clear evidence for the endogeneity of PHI in the first stage of utilization.[13] The results also indicate that coverage with supplementary PHI increases the probability of utilizing hospital care, visiting specialists and dentists, but decreases the probability of visiting a GP. Most of the estimated coefficients

[12] The detailed estimation results can be requested from the author.

[13] I also test the difference between the probit and bivariate probit PHI coefficients using the bootstrap Hausman test, following Cameron and Trivedi (2009), p. 429-430. The test indicates for all four types of health care that the estimated PHI coefficients under the two specifications do not differ significantly. This implies that the exogeneity of PHI in the first stage of utilization cannot be rejected.

are not significantly different from zero.

The estimated coefficients of PHI in the second part of the model are presented in Table 3. In this part the amount of utilization is analyzed for those respondents who report nonzero hospital nights or doctoral visits, and the method of 2SRI is applied. The standard errors have to be adjusted for two-stage estimation. The results presented in Table 3 are based on bootstrapped standard errors with 1000 replications. The adjustment of the standard errors has only small effects.

There is some evidence that PHI is endogenous in the second stage decision on GP care utilization. The estimated coefficient of the residual from the probit model of PHI coverage (estimated δ from equation (3)) is significantly positive in this model. The positive coefficient indicates that the unobservables which increase the probability of PHI coverage also increase the demand for GP care. On the other hand, the residual is insignificant in the hospital and specialist care models, thus PHI coverage might be exogenous there.[14]

The presented results suggest that PHI coverage might increase the probability of hospital care utilization, but decrease the length of the stay. Being covered with PHI implies lower probability and significantly fewer number of visits to GPs. There is some evidence for increased utilization of specialist care due to supplementary PHI coverage, but this effect is small and insignificant.

[14]The estimation results are consistent if the regressors other than PHI, and the characteristics of the previous job are exogenous. In order to test the validity of the exogeneity assumptions, it is possible to calculate the nonlinear version of the Sargan test, suggested by Cameron and Trivedi (2005), p. 277. The test fails to reject the exogeneity assumptions.

Table 3: PHI coefficients: zero-truncated negative binomial models of nonzero utilization

	Hosp. nights	GP visits	Spec. visits
AT	-0.500	-1.071***	0.424
BE	-0.779	-1.256***	0.393
DK	-0.821	-1.024***	0.550
FR	-0.537	-1.028***	0.283
DE	-1.020	-1.312***	0.349
GR	-0.810	-1.457***	0.246
IT	-0.091	-1.257***	0.478
NL	-0.623	-1.198***	0.588
ES	-1.564*	-1.221***	0.471
SE	-0.939	-1.104***	0.408
CH	-0.547	-1.209***	0.276
First stage residual	0.608	1.155***	-0.360

*, **, *** significant at the 10, 5, 1% level, respectively, based on bootstrapped standard errors

6.3 Analysis of the results

Due to the nonlinear nature of the empirical model, the partial effect of PHI varies among the individuals. In Table 4 I present the estimated marginal effect of supplementary PHI on the number of hospital nights and doctoral visits. Using the estimating sample the mode of the discrete regressors are determined. For the rest of the regressors the mean values are used, and the marginal effect of the insurance indicator is calculated for this representative individual.[15] The estimates of the total effect are based on the combination of the first and second part of the model, as described in Section 4.2 (the total effects are presented under the columns "Total"). For each service type I also present the estimated marginal effect on the probability of utilization (columns "Prob.", based on equation (2)), and on the nonzero number of hospital nights or doctoral visits (columns "Nonzero", based on equation (3)).

Except for Denmark and Sweden, PHI coverage has positive marginal effect on the ex-

[15]The *mfx* command of Stata is used when calculating the marginal effects. The significance levels of the marginal effects in the two-part models are based on bootstrapped standard errors. The Stata codes of Deb et al. (2010) are used as basis for the bootstrapping procedures, with 1000 replications.

pected number of hospital nights. The estimated increase in the overall number of hospital nights due to PHI coverage is small. The estimated overall positive effects come from the increasing effect of PHI coverage on the probability of utilization. On the other hand, being covered with PHI implies shorter stays in hospitals, and this estimated effect is not negligible in magnitude, although significantly different from zero only for Spain. Two explanations are possible for these findings. First, PHI coverage might make more efficient or alternative (home care) services available. Second, it is also likely that individuals with PHI coverage utilize different kinds of inpatient services than the uncovered ones. For example, general health checks induced by PHI coverage might necessitate only short stays in hospitals.

Table 4: Marginal effect of PHI based on the two-part model

	Hosp. nights			GP visits			Spec. visits			Dent. visits
	Total	Prob.	Nonzero	Total	Prob.	Nonzero	Total	Prob.	Nonzero	Prob.
AT	0.548	0.115	-3.111	-2.938***	-0.154	-2.599***	0.382	0.026	0.848	0.181**
BE	0.225	0.090	-4.420	-3.184***	-0.113	-3.052***	0.362	0.022	0.818	0.130
DK	-0.072	0.050	-4.386	-2.849***	-0.140	-2.561***	0.494	0.000	1.277	0.220***
FR	0.303	0.086	-3.380	-2.771***	-0.084	-2.716***	0.262	0.039	0.466	0.095
DE	0.390	0.119	-4.954	-3.568***	-0.252	-2.873***	0.381	0.053	0.702	0.073
GR	0.925	0.181	-4.263	-3.894***	-0.309	-2.989***	0.159	0.003	0.395	0.134
IT	0.813	0.118	-0.775	-3.737***	-0.295	-2.873***	0.280	-0.059	1.041	0.125
NL	0.226	0.080	-3.653	-3.100***	-0.140	-2.841***	0.545	0.013	1.342	0.223***
ES	0.104	0.097	-6.065**	-3.459***	-0.251	-2.756***	0.554	0.069	1.066	0.189*
SE	-0.083	0.053	-4.667	-3.370***	-0.263	-2.607***	0.316	-0.001	0.825	0.136
CH	0.455	0.106	-3.313	-3.188***	-0.170	-2.807***	0.440	0.114	0.527	0.125

*, **, *** significant at the 10, 5, 1% level, respectively

(amount of utilization: bootstrapped standard errors)

The estimated marginal effect of supplementary PHI on the expected number of GP visits is negative and significantly different from zero. According to the estimates, PHI has negative effect both on the probability and number of visits to general practitioners, and the second-stage effects are significantly different from zero. The marginal effect on the probability of visiting a GP is of considerable magnitude in some of the countries. For instance, PHI coverage is estimated to decrease the estimated probability for the representative individual by around 30 percentage points in Greece and Italy. The negative effect can be the result of direct access to specialists. Those covered with PHI might also have access to more efficient treatments and preventive care, which again necessitates fewer GP visits, ceteris paribus.

For specialist care utilization the estimated marginal effect of PHI coverage is less than one, insignificant, but positive for all countries. The estimated marginal effect on the probability of visiting a specialist is generally positive, but the maximum is 11 percentage points and insignificant for all countries. The number of nonzero specialist visits is also estimated to increase due to PHI coverage, but these results are also insignificant. This finding is different from the results of Jones et al. (2006), who estimate significantly positive effect of PHI on specialist visits. Although they apply different methodology to a different set of European countries, the most likely explanation for the contrasting findings lies in the age structure of the estimating sample. The findings of Jones et al. (2006) are based on a sample of individuals aged 16 and above, which suggests that specialist care utilization can be more responsive to PHI coverage among the younger generations than among the older ones.

Finally, I also analyze the marginal effect of PHI coverage on the probability of dental care utilization. This effect is positive for all countries. The substantial positive effects in Denmark and the Netherlands are reasonable, since there the main role of supplementary PHI is financing dental care.

The estimated marginal effects can be compared to the findings of other authors. The first stage utilization results are directly comparable to the results reported by Gibbons and Wilcox-Gok (1998), due to the similar methodology. Based on a U.S. sample they estimate that supplementary PHI coverage in the U.S. increases the probability of outpatient care utilization by about

$2-7$ percentage points, depending on the type of the insurance. Based on my estimation results the marginal effect of supplementary PHI coverage on the probability of doctoral care utilization varies across countries and service types. Unanimously positive effect among the outpatient services is found only for dental care. My estimates indicate that PHI has smaller effect on outpatient specialist care utilization in Europe than in the U.S., but the marginal effect on the probability of visits to dentists is relatively large. Similarly to my results, negative effect of PHI coverage on visits to general practitioners is found by Rodríguez and Stoyanova (2004) based on Spanish data. They explain this result by direct access to specialists due to private insurance. Hullegie and Klein (2010) also estimate negative effect of private insurance on doctoral visits in Germany, which they explain by receiving better medical treatment.

How do the estimated effects relate to the country-specific characteristics of the public health care system? The estimated marginal effect of supplementary PHI on the probability of hospital stays and dental visits, and on the overall number of hospital nights are positive for most of the countries. These positive effects are larger in countries where the relative measures of public health expenditure are smaller, using the aggregate statistics presented in Table 1. Thus the role of PHI coverage in making inpatient and dental care available is more important in countries where general government spends relatively less on health care. The estimated effect of supplementary PHI is also generally positive on the probability and amount of specialist care utilization. There is some evidence for positive correlation of this effect with the indicators of public health expenditures, but these relationships are weak.

The estimated effect of supplementary PHI is negative on the probability and amount of GP care utilization. These negative effects are smaller in absolute value if the public health care is more generous. This result suggests that the role of PHI coverage in ensuring direct access to specialists or higher quality services is less important in countries with larger public health care systems. In countries where public health expenditures are lower there might be greater need for avoiding the gatekeeper function of general practitioners.

6.4 Specification checks

In the following, I modify the preferred two-part model, and check how sensitive are the results to changes in the distributional and exogeneity assumptions. In column (1) under each service type in Table 5 I repeat the estimated marginal effect of the PHI indicator based on the second part of the two-part estimation. The results in columns (2)-(4) also refer to nonzero utilization.

The estimates under column (2) correspond to the case when supplementary PHI is still assumed to be endogenous, but standard negative binomial model is used in the second part. Due to the exclusion of zero observations this model is misspecified. However, in case of GP care the estimated effects are close to the zero-truncated negative binomial (ZTNB) estimates. For all three types of utilization, neglecting the lack of zero observations shifts the estimated effects towards zero. The significance of the estimates is not affected.

Specification (3) is a selection model with endogenous PHI. It is analogous to the two-part model, but this specification also models the potential correlation between the error terms of the probit model of utilization and the count data model of nonzero utilization. The problem with this specification is that there is no sample selection inherent in the health care utilization model: there are observed zero and nonzero utilizations. The first part of

Table 5: Estimated marginal effect of PHI on nonzero utilization under various specifications

	Number of hospital nights				Number of GP visits				Number of specialist visits			
	(1) ZTNB	(2) Negative binomial	(3) Selection model, MSL	(4) ZTNB, exog. PHI	(1) ZTNB	(2) Negative binomial	(3) Selection model, MSL	(4) ZTNB, exog. PHI	(1) ZTNB	(2) Negative binomial	(3) Selection model, MSL	(4) ZTNB, exog. PHI
AT	-3.111	1.080	-0.515**	0.789	-2.599***	-2.507***	-0.425**	0.282	0.848	0.066	-0.216	0.147
BE	-4.420	-1.173	-1.080*	-1.280*	-3.052***	-3.009***	-1.502***	-0.448***	0.818	0.025	-0.413*	0.083
DK	-4.386	-1.292	-1.090*	-1.513	-2.561***	-2.390***	-0.560**	0.467	1.277	0.490	-0.238	0.448
FR	-3.380	0.687	-1.078*	0.513	-2.716***	-2.498***	-1.369***	0.501**	0.466	-0.247	-0.589*	-0.152
DE	-4.954	-2.544	-1.185*	-2.573***	-2.873***	-2.896***	-0.511*	-0.605**	0.702	-0.097	-0.137	-0.013
GR	-4.263	-1.190	-1.634	-1.293	-2.989***	-3.040***	-0.171	-0.965*	0.395	-0.450	-0.246	-0.234
IT	-0.775	5.571	-0.272	5.221	-2.873***	-2.790***	-0.671*	-0.339	1.041	0.205	-0.215	0.258
NL	-3.653	0.051	-1.078*	-0.185	-2.841***	-2.782***	-1.587***	-0.196	1.342	0.440	-0.405*	0.545
ES	-6.065**	-4.610**	-1.886*	-4.673***	-2.756***	-2.744***	-0.265	-0.247	1.066	0.235	-0.117	0.250
SE	-4.667	-1.830	-1.843*	-2.092	-2.607***	-2.398***	-0.235	0.239	0.825	0.014	-0.121	0.095
CH	-3.313	0.400	-0.872*	0.286	-2.807***	-2.730***	-0.742**	-0.279	0.527	-0.228	-0.391*	-0.158

*, **, *** significant at the 10, 5, 1% level, respectively, based on bootstrapped ((1) and (2)) and adjusted (3) standard errors, the adjustment procedure is based on Greene (2003), p. 510.

the model is the same as in the two-part model (equations (1) and (2)). I modify equation (3) the following way:

$$E\left(Y_{ji}|\tilde{X}_i, PHI_i, \tilde{\varepsilon}_{2ji}\right) = \exp(\tilde{X}_i\tilde{\beta}_{2j} + \tilde{\gamma}_{2j}PHI_i + \tilde{\varepsilon}_{2ji}) := \lambda_{ji}(\tilde{\varepsilon}_{2ji}) \text{ if } Pos\_Y_{ji} = 1. \quad (4)$$

I assume that ν, ε_1 and $\tilde{\varepsilon}_2$ have multivariate normal distribution with mean zero and variance $1, 1, \sigma^2$, respectively. The main difference from the specification of the two-part model is that the probability and amount of utilization are estimated jointly, with allowing nonzero correlation between the error terms ε_1 and $\tilde{\varepsilon}_2$. The normality assumption simplifies the manipulation of the likelihood function. I also assume that the correlation coefficients between these error terms are the same across the countries.

The $\tilde{X}$ vector of regressors is the same as X in models (2) and (3), except for the exclusion restrictions, which are needed to strengthen the identification. For inpatient care utilization the living area is considered as such variable which influences the probability of hospital stay, but not the length of the stay. For outpatient care utilization the indicators of the spouse's visit to GP or specialist are excluded from the second stage model. Based on the distributional assumptions this model can be estimated with maximum simulated likelihood (MSL). Simulation is needed since there is no closed form of the likelihood function.[16]

[16] The contribution of the ith observation with nonzero utilization to the likelihood is

$$\begin{aligned}
&\Pr(Y_{ji}, Pos_Y_{ji} = 1, PHI_i = l|X_i, Z_i) = \\
&\qquad = \int \Pr(Y_{ji}, Pos_Y_{ji} = 1, PHI_i = l|X_i, Z_i, \tilde{\varepsilon}_{2ji})\phi(\tilde{\varepsilon}_{2ji})d\tilde{\varepsilon}_{2ji} = \\
&\qquad = \int \frac{\exp(-\lambda_{ji}(\tilde{\varepsilon}_{2ji}))\lambda_{ji}(\tilde{\varepsilon}_{2ji})^{Y_{ji}}}{Y_{ji}!} \Pr(Pos_Y_{ji} = 1, PHI_i = l|X_i, Z_i, \tilde{\varepsilon}_{2ji})\phi(\tilde{\varepsilon}_{2ji})d\tilde{\varepsilon}_{2ji}.
\end{aligned}$$

$\phi(.)$ is the normal probability density function with mean zero and variance σ^2, and l equals 0 or 1. The second term in the last integral can be expressed as a function of $\tilde{\varepsilon}_{2ji}$, using the first stage bivariate probit estimation results, and the assumption of multivariate normality. In order to simplify the estimation procedure, I apply

The estimated marginal effects are qualitatively different from the results of the preferred two-part model. The differences can be due to the fact that the selectivity model takes into account that in the second part of the model the sample is not random. However, if the selection model is reestimated with the assumption that the selectivity is exogenous then the results still differ from the two-part estimation results. These differences can be due to the different distributional assumption, and to the exclusion restrictions. Since there are no strong and theoretically funded exclusion restrictions in the selectivity models, the simpler two-part model is preferred. Nevertheless, the results still confirm the negative partial effect of PHI on the number of visits to general practitioners.

As a final specification check, I compare the estimation results of the zero-truncated negative binomial models to the case when PHI coverage is assumed to be exogenous in the second part of the model. Under this specification the residual from the probit model of PHI coverage is not included in the model of nonzero health care utilization. The estimated effects of PHI on hospital nights and GP visits are considerably upward biased, compared to the specification where endogeneity is taken into account (specification (1)). According to these results it is important to take into account the endogeneity of PHI in the utilization models. The sensitivity of the results can be explained by the self-selection into PHI coverage. Due to the influencing effect of unobserved preferences, those who are covered with PHI are also more likely to visit general practitioners and to stay longer in hospitals. Therefore specification (4) underestimates the negative effect of PHI coverage on the number of GP

two-stage maximum likelihood estimation - I estimate the bivariate probit model of equations (1) and (2) in the first stage, and use these estimation results as known in the second stage.

In the simulations I use 100 draws from the Halton sequence with prime number 7. For producing the Halton draws I use the Stata code *mdraws* written by Cappellari and Jenkins (2006). Cappellari and Jenkins also discuss the advantages of Halton draws in MSL estimation.

visits and hospital nights. In case of outpatient specialist care such upward bias cannot be observed, the association between PHI coverage and the amount of specialist care utilization is still estimated to be weak.

It follows from this analysis that neglecting the correlation between the unobserved terms of the utilization and PHI coverage models affects the estimation results. The specification checks also show that the estimation results are sensitive to the modelling assumptions, in particular to the distributional assumptions, and to the choice between two-part models and selection models. Due to identification problems inherent in the selectivity model, the two-part model is preferred here.

7 Conclusions

Assuming that individuals behave in utility maximizing way, health insurance coverage should influence health care utilization decisions. It depends not only on the individual characteristics, but also on the country specific institutional backgrounds to what extent supplementary private health insurance coverage influences the utilization of health care.

In this paper I analyze the effect of supplementary PHI coverage on the utilization of hospital, general practitioner, specialist and dental care among people aged 50 and above in Europe. I model health care utilization as a two-stage decision. Due to the effects of unobservables, insurance coverage is likely to be endogenous in health care utilization models. I identify its effects using the characteristics of the last job. The estimated effects are compared across various modelling assumptions. The size, and in some cases also the sign of the estimated effects vary with the assumptions. The specification tests show that the exogeneity assumptions about supplementary PHI have substantial effect on the estimated coefficients.

I compare the effects of supplementary PHI among 11 European countries. According to the results of the preferred two-part specification, PHI coverage increases hospital, outpatient specialist and dental care utilization, but has a negative effect on visits to general practitioners. The effects on the expected number of hospital nights and visits to specialists are insignificant and close to zero. Both the positive effects on hospital and dental care utilization, and the negative effects on general practitioner care utilization are larger in absolute value in countries where public health care funding is less generous.

The empirical results indicate that although there is almost universal coverage with public health insurance in the analyzed European countries, the role of supplementary private health insurance is not negligible among individuals aged 50 and over. There is evidence that the main roles of private insurance are making dental services available, and avoiding the otherwise compulsory visits to general practitioners when making contacts with specialists. The results presented in the paper can be informative for health policy decisions. Supporting private health insurance coverage might increase the utilization of some types of health services, especially of dental care, and direct the demand towards more efficient service types.

Appendix

A Descriptive statistics

A.1 Sample mean and standard deviation of the variables

	mean	sd		mean	sd
age	64.96	10.19	smoking habits		
female	0.55	0.50	never	0.53	0.50
marital status			stopped	0.27	0.44
with spouse	0.68	0.47	smoking	0.20	0.40
with partner	0.04	0.20	last job		
single	0.28	0.45	civil servant	0.10	0.29
has children	0.88	0.32	public employee	0.17	0.38
income (1000 EUR)	20.98	74.19	self-employed	0.17	0.37
main residence (1000 EUR)	102.51	321.00	supplementary PHI	0.32	0.47
education level			# illness	1.35	1.38
primary	0.35	0.48	# ADL problems	0.20	0.76
lower secondary	0.18	0.39	# symptoms	1.45	1.62
upper secondary	0.31	0.46	firm size not relevant	0.26	0.44
tertiary	0.16	0.37	firm size 1-5	0.13	0.34
living area			firm size 6-15	0.14	0.34
big city	0.14	0.35	firm size 16-24	0.08	0.26
suburbs big city	0.16	0.37	firm size 25-199	0.23	0.42
large town	0.19	0.39	firm size 200-499	0.07	0.25
small town	0.26	0.44	firm size 500-	0.10	0.29
rural	0.25	0.43	# gp visits	4.89	7.64
employment status			# hosp.nights	1.55	7.13
retired	0.50	0.50	# specialist visits	1.57	4.56
employed, other	0.12	0.33	visit dentist	0.54	0.50
unemployed	0.03	0.17			
disabled	0.03	0.17			
homemaker	0.15	0.35			
civil servant	0.04	0.19			
self-employed	0.07	0.26			
public employee	0.07	0.25			

A.2 Percentage of individuals covered by specific types of supplementary PHI

	AU	BE	DK	FR	DE	GR	IT	NL	ES	SE	CH
medical care with											
direct access to specialists	2.7	6.4	9.2	70.0	3.8	1.8	1.8	0.0	6.0	1.4	17.8
medical care with an											
extended choice of doctors	2.6	0.2	4.9	52.0	3.5	1.3	0.7	0.0	4.3	0.5	18.5
dental care	1.5	5.7	18.6	75.9	5.6	0.4	0.4	47.0	3.2	0.2	6.4
larger choice of drugs											
and/or full drugs expenses	1.6	2.7	13.8	72.1	0.7	0.6	0.4	34.7	0.9	0.4	14.2
extended choice of hospitals	16.5	0.1	5.3	73.7	4.2	1.5	1.7	0.0	4.3	0.5	38.2
long term care	0.8	0.2	0.5	64.1	0.0	0.2	0.0	0.0	0.1	0.1	9.2
nursing care at home	0.9	0.1	0.8	54.0	0.0	0.3	0.1	0.0	2.3	0.0	8.8
home help for ADL	0.7	2.7	0.3	25.8	0.0	0.1	0.2	0.0	0.4	0.0	8.3
full coverage of costs for doctor visits	2.1	0.8	2.0	49.7	0.0	1.0	0.5	0.0	4.1	1.2	1.7
full coverage of costs for hospital care	6.7	59.5	1.8	12.8	5.3	2.1	1.1	0.0	3.8	0.9	5.0

A.3 Supplementary private health insurance coverage and health care utilization - sample means

	Supplementary PHI coverage	Hospital stay	Visit GP	Visit specialist	Visit dentist	# hospital nights* (if hosp.>0)	# GP visits* (if GP>0)	# specialist visits* (if spec.>0)
AT	0.23	0.19	0.85	0.37	0.51	11.57	5.51	3.58
BE	0.76	0.14	0.92	0.48	0.49	9.35	6.17	3.77
DK	0.36	0.12	0.81	0.18	0.76	8.58	4.01	3.78
FR	0.84	0.15	0.93	0.46	0.44	8.92	5.75	3.63
DE	0.14	0.16	0.92	0.54	0.75	12.35	5.54	4.29
GR	0.05	0.08	0.76	0.27	0.37	8.22	5.43	4.63
IT	0.06	0.12	0.83	0.41	0.33	9.76	7.70	4.02
NL	0.72	0.11	0.80	0.40	0.57	7.50	3.71	4.18
ES	0.09	0.11	0.88	0.42	0.26	9.13	7.72	4.40
SE	0.09	0.11	0.75	0.28	0.78	6.66	2.70	3.07
CH	0.33	0.12	0.83	0.30	0.68	8.93	4.13	3.86

* Hospital nights or doctoral visits above 50 are excluded.

B Estimated coefficients of the probit model of supplementary private health insurance coverage

	PHI		PHI
age	-0.009***	last job	
female	0.077***	civil servant	0.028
marital status		self-employed	0.204***
with partner	0.074	public employee	-0.03
single	-0.118***	living area	
log income	0.093**	suburbs big city	-0.054
log income: DE	0.153**	large town	-0.065
log income: SE	0.061	small town	-0.152***
log income: NL	-0.121*	rural	-0.230***
log income: ES	0.046	firm size 1-5	0.183***
log income: IT	0.106	firm size 6-15	0.164***
log income: FR	-0.087	firm size 16-24	0.077
log income: DK	0.098	firm size 25-199	0.170***
log income: GR	0.010	firm size 200-499	0.146***
log income: CH	-0.106	firm size 500-	0.268***
log income: BE	-0.010	country: DE	-2.045***
log home	0.010	country: SE	-1.201
log home: DE	0.020**	country: NL	2.626***
log home: SE	-0.003	country: ES	-0.819
log home: NL	-0.005	country: IT	-1.513*
log home: ES	0.001	country: FR	2.674***
log home: IT	-0.014	country: DK	-0.747
log home: FR	0.004	country: GR	-0.644
log home: DK	0.011	country: CH	1.431**
log home: GR	-0.028**	country: BE	1.667***
log home: CH	-0.001	Constant	-1.554***
log home: BE	-0.002	Observations	23,503
education level			
lower secondary	0.136***		
upper secondary	0.360***		
tertiary	0.485***		

*, **, *** significant at the 10, 5, 1% level, respectively

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