Are tax subsidies for private medical insurance self-financing? Evidence from a microsimulation model

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Abstract

This paper develops an empirical strategy to estimate whether subsidies to private medical insurance are self-financing in countries where public and private insurance coexist and the latter covers the same treatments as the former. We construct a simulation routine based on a micro econometric discrete choice model that allows us to evaluate the impact of premium changes on the utilization of outpatient and inpatient health care services. As an application, we estimate the budgetary effects of scrapping a subsidy from the purchase of individual private policies, using micro data from Catalonia. Our results suggest that the subsidy is not self-financing. This result is driven by the fact that private medical insurance holders make concurrent use of public and private services, and by the price inelasticity of the demand for private policies.

JEL Codes: H24, I18, C25

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Introduction

Private medical insurance (PMI) is an important ingredient of health systems in most OECD countries. Its characteristics and prevalence vary across countries, being largely determined by the way in which the public sector regulates health care. While in some countries PMI acts mainly as the only source of coverage for a large share of the population (e.g. USA, Netherlands, Germany), in other countries PMI covers treatments that are also covered by public insurance, but PMI improves on the public system along some quality dimension, for instance, shorter waiting times and a wider choice of health care providers. Examples of countries where there is such "double coverage" include the UK, Ireland, Spain, Italy, Portugal, Greece, and New Zealand. Between these extremes are countries where PMI has a "supplementary" role, mainly covering the difference between the full cost of services and what public insurance covers (e.g. France, Medigap population in USA).

A substantial number of governments (Australia, Austria, Belgium, Canada, France, Germany, Greece, Ireland, Italy, Luxembourg, Mexico, Netherlands, Portugal, Spain and USA) provide tax incentives to PMI (OECD 2004). Cutler and Zeckhauser (2000) point out that the main motive behind subsidising PMI is the view that governments have a special responsibility towards ensuring access to medical care. Thus, PMI subsidies in countries without tax funded universal public insurance would emerge as a policy tool to improve access to medical care for those who might otherwise not enjoy insurance. However, this motive is much less compelling for countries with universal public insurance, especially those where PMI "doubles" the coverage that some individuals enjoy. In these countries, PMI provides individuals with a wider choice of health care providers than public insurance, so there is a sense in which the subsidies to PMI are addressing preference heterogeneity in the population. Furthermore, favouring the existence of alternatives to the services included in the public schemes could improve productive efficiency due to competition. Nevertheless, according to the OECD, subsidies in countries where PMI mainly doubles the coverage provided by public insurance are "often seen as instrumental in reducing cost pressures on public systems by shifting demand and costs from public to private hospitals and providers" (OECD 2004 p.34).

This paper proposes an empirical strategy to evaluate whether subsidies to PMI are self-financing in health systems where PMI "doubles" the coverage provided by the public system. We apply this strategy using the Spanish health care market. The Spanish National Health System (SNHS) provides free treatment financed through general taxation to all individuals. Apart from the public coverage, 10.3% of the population is covered by both public insurance and a PMI policy.[1] The Spanish fiscal system treats generously the take up of PMI. Up until 1999, 15% of every euro spent on health care (including PMI policies) was deducted off total liabilities from the personal income tax bill. Since 1999, individuals cannot obtain subsidies for PMI directly, but firms can offer company plans to their employees as a tax-free in-kind benefit. This implies a subsidy of up to 35% (the maximum company tax rate) for each euro spent on PMI by the firm. Our illustration does not pursue a simulation of the financial effects of switching the *modus operandi* of the subsidy (from personal income tax to company tax).[2] Instead it focuses on the removal of the personal income tax rebate, and therefore provides an insight into the budgetary effects of a scenario with a personal income tax rebate versus a scenario without any type of fiscal subsidies. While the Spanish case is an archetype for the issue that we wish to investigate, our methodology could potentially be applied to a variety of countries and contexts, as we do not exploit any exclusive feature of the Spanish health care system, apart from a dataset with both supply and demand variables.

The desire to evaluate the fiscal treatment of PMI has generated studies such as Gruber and Poterba (1994), who analyze the effect of tax subsidies for the self-employed in the United States. Emmerson *et al*. (2001) analyze the elimination of tax deductions for over 60's in the UK, and Finkelstein (2002) studies the effect of fiscal changes on employer-provided supplementary health insurance in Quebec. More recently, Gruber and Washington (2005) analyze the role of subsidies to employee health insurance as a means of improving insurance coverage in the United States. These studies exploit the fact that part of the population was not affected by the reforms in order to obtain a control group against which to measure the change in behaviour in the treatment group. However, it is often the case that fiscal reforms affect the whole population (the 1999

[1] In Catalonia, the region where our data comes from, the percentage of the population with both PMI and public coverage is around 16%.
[2] We use pre-reform data so our results are not affected by the way the *modus operandi* of the subsidy changed.

Spanish reform is a clear example), so an exogenous control group is not always available, and a structural modelling approach is required. We follow this strategy, and we rely on data including supply side determinants that provide us with an exogenous variable that affects prices as a source of identification in a model where PMI is endogenously determined. In general, supply determinants constitute useful instruments when estimating demand equations with endogenous variables.

In particular, we specify and estimate a micro econometric model of health care utilization distinguishing between outpatient and inpatient treatment using data from a representative sample of the Catalan population in 1994 (the *Enquesta de Salut de Catalunya*), which contains information on insurance status, paid premia, and health care utilization. This model has two basic elements. First, it allows us to examine how changes in the premium faced by the consumer influence the purchase of PMI. This is important since some individuals will purchase PMI even in the absence of tax relief. The elasticity of demand for PMI with respect to the premium is a crucial parameter in this respect. Second, it predicts the patterns of health care use according to whether or not the individual has purchased PMI. In our specification we use both supply and demand determinants to identify the effect of tax changes in a model where both PMI and the insurance premium are potentially endogenous.

Patterns of health care use will affect the public budget in a relatively complex way in health systems where PMI provides double coverage. First, individuals with PMI also use the public network for both outpatient and inpatient services, so there is no guarantee that individuals who buy PMI will not use the public network. Second, because of the gatekeeping role of the General Practitioner (GP) in the public network, individuals without PMI use specialist services less frequently than individuals with PMI. Since health care costs are higher for a specialist service than for a GP service, the expected cost of an individual in the public sector will be lower than in the private sector. Our empirical strategy acknowledges these features. In particular, when obtaining estimates of the changes in health care expenditures arising from changes in the patterns of utilization, we use data on the costs of a GP, a specialist and a hospitalization.

Our approach combines two branches of the literature. One branch focuses on the purchase of PMI when a free public insurance scheme is available (Rodriguez and Stoyanova 2008, King and Mossialos 2005, Propper *et al*. 2001, Costa and García (2003), Jofre-Bonet 2000, Besley *et al*. 1999, Besley *et al*. 1998, González 1995, Propper 1993, Propper 1989). These papers highlight the role of political ideology, quality, resources available to the private sector, insurance premia, income, and substitutability between individual and group insurance purchases. Here we focus on the effects of the net insurance premium on the probability of having PMI. In particular, we take into account the endogeneity of PMI by relying on instruments that come from the supply side of the market. Whilst our data are suitable for this purpose, they are not rich enough to deal with political ideology, resources available to the private sector or quality determinants. Moreover, these factors might have some inertia and their capacity to adjust in the short term might be limited. Hence our estimates should provide a good approximation to the effects of the tax reform at least in the short term.

Our paper is also related to a second branch of the literature, that on health care utilization in the context of a National Health System (NHS) where both public and private alternatives are available (Windmeijer and Santos Silva 1997, Vera-Hernández 1999, Propper 2000, López Nicolás et al. 2000, Badenes and López Nicolás 2007, Jones et al. 2006, Van Doorslaer *et al*. 2002 and Rodríguez and Stoyanova 2004). This literature recognizes the complex mix of public and private care demand that takes place under a NHS. Taking this mix into consideration is necessary to analyze the redistributive consequences of the system (Besley and Coate 1991), as well as to understand the public support for NHS funding (Buchardt and Propper 1999, Hall and Preston 1998). This mix of public and private health care can be explained by theoretical models of majority voting (Epple and Romano 1996, Gouveia 1997).

The behavioural model that we present in this paper combines several features from the studies cited above and bridges the gap between studies of utilization and studies of insurance choice by allowing changes in net insurance premia feed through to changes in utilization via changes in insurance tenure. This is a novel feature that allows for estimation of the expected budgetary impact of changes in the fiscal treatment of PMI.

The structure of the paper is as follows. In section 2 we present the main institutional features of the Spanish health insurance system together with the pattern of utilization of outpatient and inpatient services according to insurance status. This motivates the discrete choice model for utilization that we present in section 3. Section 4 discusses the model estimates. Section 5 discusses the tax simulation methodology and the results for the policy change that we consider in this paper. Section 6 concludes.

2. PMI in the Spanish health care system and patterns of health care services utilization

Universal, tax-funded public insurance is a relatively recent feature of the Spanish health system, as the legal reforms leading to the current setting took place in the mid 1980's. Essentially, these reforms shifted the source of public insurance funding from social security contributions (payroll taxes) to general taxation, extending coverage to all residents regardless of their participation in the labour market. Up to 1999, there was a fiscal rebate on the purchase of PMI. This can be partially explained by the recent history of the system, since prior to these reforms some groups, notably the self-employed, were excluded from public insurance. In such a context the subsidies fulfilled a similar role as the tax deductions for the purchase of (principal) private insurance in the US, since they facilitated access to the only form of health insurance available to a group of the population. This would also explain why, unlike systems such as Canada, PMI companies are allowed to offer all -or any subset- of the comprehensive range of services covered by public insurance. Nowadays, 10.3% of the population in Spain (16% in Catalonia) has PMI despite the fact that public insurance coverage is universal. PMI affords them a greater choice of health care provider and less waiting time.[3] A similar situation is found in, for example, the UK, Portugal, Greece and Italy.

The services covered by PMI are mostly provided by Preferred Provided Organization (PPO) type networks. The professionals within these networks receive a discounted fee for service and are allowed to run consultancies in the public network. To a lesser

[3] It is noteworthy that insurance for services not covered by the public scheme, i.e. services for which PMI has a supplementary role such as dental care, are marketed separately from the rest of private policies.

extent, there is also some vertical integration between insurers and providers in the form of Health Maintenance Organizations whose staff are paid on a full time salaried basis.

There are some aspects of the Spanish system for which the services of the typical PMI policy differ from equivalent services in the public scheme. First, whereas the public scheme requires patients to visit a GP before being referred to a specialist, PMI policies allow patients to see a specialist in the private network without a GP referral. Second, the choice of provider, particularly for outpatient services, is wider under private coverage. As for inpatient services, hospital amenities tend to be superior under private coverage (e.g. individual rather than shared hospital rooms). Third, outpatient drugs prescribed by a doctor in the public network are heavily subsidised (co-payments vary from 40% to 0%) whereas prescriptions by doctors visited under private coverage are not. Fourth, private insurance policies cover some but not all hospital expenses. According to OCU (1997) many companies limit the number of hospital days that will be paid for within a given year to 30, with stricter limits on the number of days in intensive care.[4] The OCU report also reveals that the public sector covers a much more comprehensive list of treatments than any of the policies offered by the private sector. In these circumstances tenure of PMI might not completely crowd-out the utilization of the public network. Patients with severe conditions might resort to public hospitals even if they have PMI. Moreover, patients with PMI have an incentive to visit doctors in the public network in order to receive subsidised prescriptions.

We shall consider that an individual has "double" coverage if (s)he is entitled to receive free health care from the public network and, additionally, is covered by a PMI policy. By analogy, we shall denote as "single" coverage the situation where individuals are only entitled to free health care from the public network.

Our empirical application is based on the 1994 edition of the *Enquesta de Salut de Catalunya* (ESCAT), a representative survey of the non-institutionalised population of individuals in Catalunya.[5] In our working sample 16.4% of individuals have "double"

[4] OCU stands for Consumers and Users Organization. Approximately every two years OCU publishes a report on private medical insurance in Spain. The report analyzes the insurance contracts offered by the most important private insurance companies in Spain.

[5] The population of Catalunya in 1994 was 6,100,707. The grossing up factors in the ESCAT add up to 6,059,484 individuals. For our empirical analysis we have discarded 1,153 observations due to item non-

coverage and report an annual average premium payment per household of € 1225 (all monetary figures in the paper have been adjusted for inflation up to February 2007). Sample weights allow us to construct an estimate of aggregate expenditure on net premia, which amounts to € 524.53 million. Foregone taxes from the deductions associated with these expenditures are € 92.52 million (which is equivalent to 15% of the implicit gross expenditure).

The ESCAT contains detailed information on the use of health care services. As far as outpatient visits are concerned, it records any visits to physicians in the fifteen days prior to the interview, and we observe whether an individual has visited either a GP or a specialist and whether the visit has been to a public or private provider.[6]

The first row in the upper panel of Table 1 shows that the proportion of individuals without any visit is practically identical for single and double coverage groups. This is similar to what is observed using data for the whole of the Spanish population (López Nicolás 2001 and Alvarez 2001). Table 1 also shows that individuals with single coverage visit mostly public outlets while those with double coverage visit mostly private outlets. This suggests that public health care costs can increase if the amount of individuals with single coverage increases. Notice also that individuals with double coverage concentrate their outpatient care use in visits to a private specialist, whereas individuals with single coverage visit mostly the public GP, which costs less than a specialist.

As for hospitalizations, information is not as rich as in the case of outpatient episodes. Individuals in the survey are asked whether they have stayed in a hospital in the previous 12 months. However they are not asked whether this stay was at a public or private outlet. We impute the nature of the outlet using information provided by the response to the question "What coverage did you use most frequently during the year?". We adopt the following criterion for individuals who declare to have undergone a hospitalization: we assume that the inpatient episode is at a public outlet if the

response in relevant variables. Our working sample of 13,847 observations represents 5,570,240 individuals in the population.

[6] This information is only available for the last visit of the 15 days prior to the interview. Consequently we only consider the expenditure associated with this last visit. We believe that this is of minor

individual declares to have used the public coverage more frequently during the year. Otherwise it is considered to be hospitalization at a private outlet. This assignment procedure is based on what we believe to be the reasonable assumption that an individual will report to have used public (private) outlets more intensively if he has undergone hospitalization at a public (private) outlet within the previous 12 months. Later on in the paper we will see that our qualitative conclusions are robust to this assumption.

The lower panel of Table 1 shows that individuals with single coverage use mostly public inpatient services, as they would have to pay out of pocket to use private ones. Individuals with double coverage use mostly private outlets but, as expected from our previous discussion, a non-negligible fraction also uses public outlets.

3. Econometric model

We specify an econometric model to answer the question of whether subsidies to PMI are self-financing or not. In particular, the model allows us to estimate how the insurance premium affects the probability of having PMI, and, subsequently, how having PMI affects health care use and the costs borne by the public sector. The econometric model recognizes that there are variables unobserved to the econometrician that influence simultaneously the determination of the premium, the decision to purchase PMI, and health care use. We will use a factor representation to consider these unobserved variables as in Kenkel and Terza (2001), Terza (2002), Deb and Trivedi (2006), and Atella and Deb (2008). As these recent papers show, a factor representation for unobserved variables provides a computationally tractable way of introducing unobserved heterogeneity in nonlinear models with more than one equation.

3.1 Specification

We assume that individual *i* living in region *r* will have PMI if the latent index d_{ir}^* is larger than 0. The model for the latent index is given by:

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importance for our purposes as the vast majority had just one visit (83% of those that had at least one visit).

$$d_{ir}^{*} = x_{ir}\alpha_x + p_{ir}\alpha_p + \theta_r\alpha_\theta + \vartheta_i + \varepsilon_{ir} \quad (1)$$

where p_{ir} is the log of the PMI premium paid by individual i living in region r, x_{ir} is a $1xK_d$ vector of observable variables, ϑ_i is a normal unobserved variable that varies at the individual level, θ_r is a normal unobserved variable that is common for all individuals living in the same region, and ε_i is an *iid* normal error term. The parameter vector α_x has dimension K_dx1, and both α_p and α_θ are scalars. The binary variable d_{ir} takes the value 1 if the individual has PMI, and 0 otherwise. Formally, we have that

$$d_{ir} = 1\left[d_{ir}^{*} > 0\right]$$

We also specify a model for the log of the insurance premium, p_{ir}, because it is only observed for individuals who have bought PMI. Consequently, we assume that the log of the insurance premium is determined by the following model:

$$p_{ir} = z_{ir}\gamma_z + \theta_r\gamma_\theta + \vartheta_i\gamma_\vartheta + v_{ir} \quad (2)$$

where z_{ir} is a $1xK_p$ vector of observable variables, v_{ir} is an *iid* normal error term, and γ_z is a vector of K_px1 parameters. The unobserved variables ϑ_i and θ_r in equation (2) are the same ones as in equation (1), but the scale of how they affect the insurance premium is allowed to be different because γ_θ might be different from α_θ, and α_ϑ is not necessarily equal to one. The presence of ϑ_i in both equations (1) and (2) allows us to incorporate into the model the fact that the set of individuals that buys PMI is not random but is, *ceteris paribus*, the set of individuals that tend to have lower insurance premiums due to factors unobserved to the econometrician. The variable θ_r allows us to take into account that observations of different individuals living in the same region might not be independent. This is important because some of our observed variables will only vary at the regional level (Moulton 1990).

We assume that the individual can use J-1 different types of health care services, defined more precisely below. The variable y_{ir} takes integer values 1, 2, ..., $J-1$ indicating what type of health care service individual i living in region r has used. If the individual does not use any health care service, the variable y_{ir} takes the value J. For the sake of computational simplicity, we assume that the probability that y_{ir} takes the value j is given by the multinomial logit formula. Hence we have that:

$$\Pr(y_{ir} = j \mid w_{ir}, d_{ir}, \vartheta_i, \theta_r) = \frac{\exp(w_{ir}\beta_{jw} + d_{ir}\beta_{jd} + \vartheta_i\beta_{j\vartheta} + \theta_r\beta_{j\theta})}{\sum_{m=1}^{m=J}\exp(w_{ir}\beta_{mw} + d_{ir}\beta_{md} + \vartheta_i\beta_{m\vartheta} + \theta_r\beta_{m\theta})}, \text{ for } j=1 \ldots J \quad (3)$$

where w_{ir} is a $1xK_y$ vector of observable variables, d_{ir} is a binary variable that takes the value 1 if the individual i living in region r has PMI and 0 otherwise, β_{jw} is a vector of K_yx1 parameters, and β_{jd} is the coefficient on the PMI binary variable. The unobserved variable ϑ_i in equation (3) takes into account that the PMI variable, d_{ir}, might be endogenous because common unobserved variables, e.g. unobserved components of health that affect both the insurance decision and the use of health care. We assume that ϑ_i, θ_r, ε_{ir}, ν_{ir} are independently normally distributed random variables with zero mean. The variances of ϑ_i, θ_r, ε_{ir} are normalized to one. The variance of ν_{ir} is σ^2.

Equation (1) will allow us to simulate how exogenous changes in the insurance premium, due for instance to the elimination of a subsidy, affects the individual's decision to have PMI. This will feed into equation (3) to simulate the effect on the use of health care services. Next we describe the restrictions required to identify the model, as well as the estimation strategy.

3.2 Identification

To discuss the identification of the model, it is useful to partition the vectors x_{ir} and z_{ir} as $[x_{ir1}, x_{ri2}]$ and $[z_{ir1}, z_{ir2}]$ respectively. Without loss of generality, we assume that $x_{ir1}=z_{ir1}$, but $x_{ir2}\neq z_{ir2}$, that is that the variables in x_{ir1} are the same as the variables in z_{ir1} but the intersection between x_{ir2} and z_{ir2} is empty.

Substituting equation (2) in (1), and taking into account that $x_{ir1}=z_{ir1}$, we obtain:

$$d_{ir}^* = x_{ir1}(\alpha_{x1} + \gamma_{z1}\alpha_p) + x_{ir2}\alpha_{x2} + z_{ir2}\gamma_{z2}\alpha_p + \vartheta_i(1+\gamma_\vartheta\alpha_p) + \theta_r(\alpha_\theta + \gamma_\theta\alpha_p) + \nu_{ir}\alpha_p + \varepsilon_{ir} \quad (4)$$

Equation (2) can be re-written as:

$$p_{ir} = x_{ir1}\gamma_{z1} + z_{ir2}\gamma_{z2} + \theta_r\gamma_\theta + \vartheta_i\gamma_\vartheta + \nu_{ir} \quad (5)$$

Equations (4) and (5) constitute a standard selection model because the log of the premium, p_{ir}, is only observed when d_{ir}^* is larger than 0, and the error terms are normally distributed. As is standard in this type of model, identification requires that there is at least one covariate in equation (4) that is excluded from equation (5). In our case, this implies that α_{x2} is different from zero and that x_2 is excluded from z. An estimate of γ_{z2} could be obtained from equation (5), and an estimate of $\gamma_{z2}\alpha_p$ could be obtained from equation (4). Consequently, the parameters α_p and γ_{z2} are separately identified. The same can be said about α_{x2}, α_{x1}, and γ_{z1}. The last four terms of equation (4) constitute a composite error term, as do the last three terms of equation (5). The correlations between the two composite error terms depend on γ_θ, α_θ ,γ_ϑ, and α_p. As explained above, α_p is identified because γ_{z2} is identified from equation (5). The parameters γ_θ and α_θ are identified because there are many individuals in each region. The parameter γ_ϑ is identified because the exclusion restriction, x_{ir2}, allows us to identify the correlation of the error terms in selection models.

Concerning the identification of equation (3), since the probability of y_j for $j=1,\ldots, J$ must sum to one, it is customary to normalize the coefficients of one alternative j to zero. In this case, we normalize the coefficients of the first alternative to zero, i.e. $\beta_{1w}=\beta_{1d}= \beta_{1\vartheta} = \beta_{1\theta}=0$. Equations (4) and (3) constitute a multinomial logit model with one endogenous regressor, as in Terza (2002). Identification requires that there is at least one variable in x_{ir1}, x_{ir2}, or z_{ir2} that is excluded from w_{ir}. Below, we discuss the exclusion restrictions that we will impose. The parameters $\beta_{j\theta}$ are identified separately from $\beta_{j\vartheta}$ because we observe many individuals in each region.

3.3 Estimation

The model could be estimated by considering two different and separate estimations. Equations (4) and (5) could be estimated using a standard Heckman selection model. Equations (3) and (4) could be estimated using the method proposed by Terza (2002). However, this strategy has two problems: first, it delivers two different estimates for the parameters in equation (4) and second, it does not provide estimates for the covariance between the estimates of β and γ that are required to obtain standard errors for the effects of the tax reform. Consequently, we estimate equations (1), (2) and (3) jointly.

The contribution to the likelihood function of individual i if $y_{ir}=j$ and $d_{ir}=1$ is:

$$L_{1i} = \iint \Phi\left(a_{ir}\right)\Pr(y_{ir} = j \mid w_{ir}, d_{ir}, \theta_r, \vartheta_i,)\left(\frac{1}{\sigma}\right)\phi(\frac{g_{ir}}{\sigma})\phi(\vartheta_i)\phi(\theta_r)d\theta_r d\vartheta_i,$$

where:

$a_{ir} = x_{ir}\alpha_x + p_{ir}\alpha_p + \theta_r\alpha_\theta + \vartheta_i$

$g_{ir} = p_{ir} - z_{ir}\gamma_z - \theta_r\gamma_\theta - \vartheta_i\gamma_\vartheta$, and

$\Phi(.)$ is the cumulative distribution function of the Normal distribution with zero mean and unit variance, and $\phi(.)$ is the density function of the Normal, also with zero mean and unit variance. The contribution to the likelihood is the product of the individual contributions of the three endogenous variables: the premium, the probability of having PMI and the probability that y_{ir} takes the value j. This is the case because the error terms are independent, once we have conditioned on θ_r and ϑ_i which must be integrated out because they are unobserved.

The contribution to the likelihood function of individual i if $y_{ir}=j$ but $d_{ir}=0$ is:

$$L_{0i} = \iiint [1-\Phi\left(a_{ir}\right)]\Pr(y_{ir} = j \mid w_{ir}, d_{ir}, \theta_r, \vartheta_i)\left(\frac{1}{\sigma}\right)\left(\frac{g_{ir}}{\sigma}\right)\phi(\frac{b_{ir}}{\sigma})\phi(\theta_r)\phi(\vartheta_i)dp_{ir}d\theta_r d\vartheta_i,$$

where in this case, we also integrate out the log of the insurance premium, p_{ir} , because it is not observed for individuals who do not buy PMI.

Rather than computing the integrals in L_{1i}, and L_{0i} using numerical approximations, that can be computationally unstable, we prefer to estimate the model using Simulated Maximum Likelihood (Gourieroux and Monfort, 1996). In this case, the contributions to the simulated likelihood are:

$$\hat{L}_{1i} = \frac{1}{H}\sum_{h=1}^{h=H} \Phi\left(\tilde{a}_{irh}\right) * \Pr(y_{ir} = j \mid w_{ir}, d_{ir}, \tilde{\theta}_{rh}, \tilde{\vartheta}_{ih}) * \left(\frac{1}{\sigma}\right)\phi\left(\frac{\mathring{g}_{irh}}{\sigma}\right),$$

$$\hat{L}_{0i} = \frac{1}{H}\sum_{h=1}^{h=H} [1 - \Phi\left(\hat{a}_{irh}\right)] * \Pr(y_{ir} = j \mid w_{ir}, d_{ir}, \tilde{\theta}_{rh}, \tilde{\vartheta}_{ih}),$$

where:

$$\tilde{a}_{irh} = x_{ir}\alpha_x + p_{ir}\alpha_p + \tilde{\theta}_{rh}\alpha_\theta + \mathring{\vartheta}_{ih},$$

$$\hat{a}_{irh} = x_{ir}\alpha_x + \mathring{p}_{irh}\alpha_p + \tilde{\theta}_{rh}\alpha_\theta + \mathring{\vartheta}_{ih},$$

$$\mathring{p}_{irh} = z_{ir}\gamma_z + \tilde{\theta}_{rh}\gamma_\theta + \tilde{\vartheta}_{ih}\gamma_\vartheta + \sigma\mathring{\omega}_{ih},$$

$$\mathring{g}_{irh} = p_{ir} - z_{ir}\gamma_z - \tilde{\theta}_{rh}\gamma_\theta - \mathring{\vartheta}_{ih}\gamma_\vartheta,$$

where $\tilde{\vartheta}_{ih}$, $\tilde{\theta}_{rh}$ and $\tilde{\omega}_{ih}$ are the h^{th} draws for individual i from region r from the Normal distribution with zero mean and unit variance. The number of draws is given by H. We use Halton draws (Halton, 1960) because they have better coverage properties than pseudo-random numbers and the draws are negatively correlated, thus reducing simulation bias (Train, 2003).[7] A GAUSS program to estimate the model is available upon request from the authors.

3.4 Health care services, explanatory variables and exclusion restrictions

The variable y_{ir} in equation (3) represents the type of health care service used by individual i living in region r. We consider both outpatient and inpatient treatments. Due to data limitations, and for the sake of tractability, we consider separately outpatient and inpatient episodes.[8] In the outpatient model, y_{ir} can take values 1, 2, 3 or 4. The variable y_{ir} takes the value 1 if individual i visited a public GP in the fifteen days prior to the interview, 2 if the individual visited a public specialist, 3 if the individual visited any private doctor, and 4 if the individual did not visit any doctor in the fifteen days prior to the interview. We define these categories in order to estimate the probabilities of utilization of services that generate either a cost or a saving for the public sector. We differentiate between public GPs and specialists because they impose

[7] See Train (2000) p. 231 for references that show the superiority of Halton draws over pseudo random draws. Halton draws have been recently used by Deb and Trivedi (2006). We use 500 Halton draws for each unobserved variable. We discard the first 20 draws for each sequence.

[8] Notice that we observe the use of outpatient services in the last fifteen days, and hospitalizations in the last 12 months.

different costs on the public sector. However, we do not differentiate between private GPs and private specialists because the cost for the public sector is zero in both cases.[9] In the inpatient treatment model, y_{ir} can take the values 1, 2 or 3. The variable y_{ir} takes the value 1 if individual i had an hospitalization in a public outlet, 2 if the individual had an hospitalization in a private outlet, and 3 if the individual did not have any hospitalization in the 12 months prior to the interview.[10]

In all equations of our model we include the following exogenous variables related to the individual: age, gender, education, whether or not (s)he was born in the current area of residence, self-assessed health, number of chronic conditions suffered, whether or not (s)he suffered an accident in the previous 12 months. Information about the household is limited in the ESCAT, but we include the head of household's age and education, as well as the number of household members.[11] Precise definitions of these variables are provided in Table 2.

The vectors w_{ir} and x_{ir2} include a set of binary variables for household income bands, but they are excluded from equation (5) in order to satisfy the first identification condition that we discussed in section 3.2. We justify excluding income from the premium equation because vertical differentiation is not an important feature of the market for PMI in Spain. According to OCU (1997), for a couple with two children all of the private insurance companies analyzed were assessed between good and acceptable, but none of them received a rating of either very good or bad. This limited degree of vertical differentiation in the private market lends support to our exclusion restriction. That is, if vertical differentiation was important then we would expect that the rich would buy better (and possibly more expensive) PMI than the poor. In that situation, income would influence the premium directly. The limited range of quality for

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[9] The frequency of visits to private GPs is particularly low: only 0.74% individuals visited a private GP in the fifteen days previous to the interview.

[10] We have very limited information about inpatient episodes other than the latest one. Consequently we consider a discrete choice model for the use of inpatient services in a year, neglecting the fact that some people might have had two or more inpatient episodes in a year. We believe that this to be of minor importance for our purposes as the vast majority had just one inpatient episode (84.4% of those that had at least one episode).

[11] In the ESCAT, income is a categorical variable. About one third of the sample does not provide a response to the income question. For this group we impute its category using an interval regression over household socio-demographic characteristics.

PMI is consistent with the presence of a NHS because consumers will not be willing to pay for low quality insurance if there is a free public alternative.

As discussed in section 3.2, identification of the model above requires that there is at least one variable included in x_{ir1}, x_{ir2}, or z_{ir2}, that is excluded from w_{ir}. For this, we use a variable reflecting the conditions faced by the supply side of the market for PMI, the average fee paid for each visit by a large insurance company to doctors in the region where the individual lives. This is a very important source of variation, as it is independent of individual characteristics. Introducing supply side data is, whenever available, a common source of identification in models of demand with endogenous regressors. The crucial assumption is that the geographical variation in the fees paid to doctors by PMI companies is uncorrelated with the determinants of health care use, conditional on w_{ir} and d_{ir}. This would be violated if, for instance, the variability in fees for service is due to different degrees of bargaining power between insurance companies and the doctors of the region.[12]

Table 2 presents the descriptive statistics for the variables included in the model, separately for individuals with single and double coverage. On average, individuals with double coverage tend to have higher levels of education, to live in richer households and to report better self-assessed health than individuals with single coverage.

4 **Model estimates**

In this section we comment briefly on the estimates of the parameters of equations (1) through (3), and in the following section we comment on the main question of the paper, that is, on whether subsidies to PMI are self-financing or not. The second columns of Tables 3 and 4 show the results for the estimates of the parameters of the outpatient and inpatient model respectively. The second column of Tables 3 and 4 show that the main determinants of the PMI log per capita premium are the individual's age and the head of the household's age, whether or not the individual was born in the

[12] Town and Su (2003) also exploit variation in the supply of hospitals and beds at the county level to identify demand models. Their argument is that the supply of health care services will influence Health Maintenance Organization relative bargaining power.

current area of residence, the number of members in the household, the individual's and the head of the household's education, whether or not the individual suffers from a chronic condition, and importantly for our identification strategy, the average fee paid by the insurance companies to the doctors in the region, that is, our supply side indicator. The coefficient on gender is not statistically different from zero, which is in accordance with the results of the survey published by OCU(1997), where only two insurance companies charge different premia by gender.

The third columns of each of Tables 3 and 4 show the results for equation (1) that explains whether or not the individual has PMI, again for the outpatient and inpatient model respectively. As expected, the log of the per capita insurance premium influences negatively whether an individual has PMI. This is an important result for us because it implies that more individuals will buy PMI if the premium is subsidized. Other determinants of whether or not an individual has PMI are their education as well as the education of the household head, income, the number of household members, and whether an individual is living in the area where (s)he was born.

The fourth, fifth, and sixth columns of Table 3 show the estimates of the parameters of the outpatient health care model. The estimates of the parameters related to age, gender, education, income, health status, and whether or not the individual currently lives in the area where (s)he was born are statistically different from zero at usual confidence levels. The last two columns of Table 4 show the estimates of the parameters of the inpatient health care model. The estimates of the parameters related to age, gender, and health status, are statistically significant at conventional confidence levels. One of the coefficients corresponding to the double coverage variable is significant at the 1% level. Education, income, and whether or not the individual currently lives in the area where (s)he was born are less important for hospitalization than for outpatient visits. The last two rows of Tables 3 and 4 shows the estimates of the loading factors associated with the unobserved variables. The loading factors associated with the premium equation are negative and statistically significant. This implies that unobserved variables that increase the likelihood of having PMI decrease the premium paid. This could be the case if individuals that engage in risk-reducing behaviour are more likely to have private health insurance (PHI), as Cutler et al (2008) find for the US. The loading factors associated with health care use are not statistically significant at the 5% level.

This could be interpreted as evidence against the existence of adverse selection because unobserved variables that influence PHI do not affect health care use. However, recent literature warns us against this interpretation because heterogeneity in unobserved preference parameters such as risk aversion could also affect both the probability of having insurance and risk occurrence (Finkelstein and McGarry, 2006).

The effect of PMI on health care use is very important to understand the consequences of the reform that we will simulate. This cannot be learnt directly from the estimates in Tables 3 and 4 because our model is non linear. Table 5 shows the effects of PMI on the average probability of using different types of health care services as well as their confidence intervals. According to our estimates, PMI increases by 0.063 the probability that an individual visits a private doctor (GP or specialist) and reduces by 0.053 the probability of having an inpatient episode at a public hospital. The 95% confidence intervals for these effects do not include zero. It is also interesting to analyze whether PMI decreases the probability of not using health services as this might be related to moral hazard in the sense that additional insurance increases health care use. Regarding inpatient use, PMI decreases by 0.004 the probability of not using hospital services. This effect is very small and not different from zero at 95% of confidence. Regarding outpatient services, PMI decreases the probability of not visiting a doctor by 0.104. The 95% confidence interval of this effect contains zero by a slight margin. Hence, we find some evidence that PMI increases outpatient health care use and consequently some evidence of moral hazard. [13]

5. Are tax subsidies self-financing?

We now turn to use our model to estimate the budgetary impact of changes in the fiscal treatment of PMI. We do so by simulating the effect of the removal of the income tax rebate of 15% on expenditure on PMI premia that Spanish consumers paid prior to 1999.[14] The elimination of this amounts to increasing the net pre-reform price of

[13] One should be careful with this interpretation as we do not think that there exists a theoretical model of moral hazard when both public and private health care systems coexist.

[14] The actual fiscal reform included other changes affecting PMI. First, as mentioned earlier, firms started to be allowed to offer "company plans" to their employees as a tax-free in kind benefit, and, second, health insurance premia started to be exempt from a 6% general tax on insurance premia that was created in 1997 (Rodríguez and Stoyanova, 2008). In this paper we do not evaluate these features, as our main interest resides in isolating the effect of removing the deduction in income tax for individually purchased policies. This is a well-defined measure, likely to be implemented in different countries and therefore of greater interest for an international audience. The subsidy through "company plans" and the exemption of

insurance premia by 17.6%. Therefore we will simulate the models for outpatient and inpatient treatment under both a pre-reform scenario where the value of the individual premium is generated by equation (2) and a post-reform scenario where the value of the individual premium is increased by 17.6%. In this scenario the demand side fully bears the withdrawal of the subsidy. While alternative scenarios with partial translation would also be reasonable, our choice provides an upper bound to the increase in costs for the public sector resulting from the withdrawal of the subsidy, and therefore allows us to test the self-financing hypothesis.

Our outcomes of interest are: the change in the proportion of individuals that buys PMI, the changes in the probabilities of using health care services and, ultimately, the increase in expected costs for the public health care network arising from these changes.

To obtain an estimate of the potential savings associated with the reform, it is necessary to estimate the cost of using health care services. We use different sources to compute the cost of inpatient and outpatient public services. For outpatient services, we use data from a major medical insurance company.[15] These data contain the fees paid by an insurance company for each visit to either a GP or a specialist after attending an insured individual for whom we can observe some demographic characteristics. This allows us to estimate a multivariate regression model for the cost of outpatient services. Details on this estimation are provided in López Nicolás *et al.* 2000. Because we have separate data for GPs and specialists, we can take into account that a GP visit is cheaper than a visit to a specialist. On average a GP visit is valued at € 11.80 (s.e € 6.38), whereas a specialist visit is valued at € 17.70 (s.e. € 9.05).

Our data on inpatient costs is obtained from López-Casasnovas and Sáez (1999). In their Table 1, they report the mean (€ 3,943) and standard deviation (€ 625) of the cost per admitted patient at Spanish public hospitals.[16] Unlike the case of outpatient services, we

health insurance premia from the general tax on insurance premia do not contaminate our results because we use data prior to 1997.

[15] Notice that we are using costs of a private insurance company to impute costs within the public sector. This could be criticised on the grounds that one of the sectors could be more efficient than the other. However we consider this a relatively minor effect which, given the magnitude of the figures we obtain, is unlikely to affect our conclusions in a substantial manner.

[16] We selected the year 1994 as it is the one that corresponds to our health care utilization data. Lopez-Casanovas and Saez (1994) report data for both teaching and non-teaching hospitals. We use the data for non-teaching hospitals as private hospitals usually have non-teaching status.

can rely on public sector costs when estimating the extra cost that the reform will have for the public sector. The downside is that we cannot estimate a cost function for inpatient services over demographic characteristics, as we do for outpatient services. However, it is well known that demographic characteristics explain very little of the proportion of the variance of observed costs for hospitalizations.

Let P_{ij} denote the estimates of the probability that individual i uses service j. Let C_{ij} denote the estimate of the cost to the public system that individual i generates from using service j. The expected cost of service j caused by individual i is $EC_{ij} = P_{ij} * C_{ij}$.

In our model the probabilities of health care use depend on whether or not the individual has PMI (equation (3)), which depends on the net insurance premium (equation (1)). Hence, we can estimate the change in the probability that different types of health care services are used due to the abolition of the tax rebate. Figures for the overall population are computed using the grossing-up factors (sampling weights) provided in the survey. Given that our data for outpatient health care utilization refer to the fifteen days prior to the interview, we multiply our figure by 26.07 in order to obtain an annual estimate.
Table 6 presents estimates of the outcomes of interest. The confidence intervals for these estimates are calculated by simulation.[17] Table 6 first presents the estimated change in the proportion of individuals with PMI according to equation (1). This estimate is available from both the model for outpatient episodes and inpatient episodes, and as expected, the two figures are very similar. Both models produce an estimate for the decrease in the percentage of individuals with private insurance of about 1.5%, and this is statistically different from zero. Since the baseline percentage of individuals with PMI is 16.4%, the implied price elasticity is -0.5. A previous study for the Catalan population in 1999 obtains very similar elasticity estimates from an independent data source (Costa and García, 2003). Moreover, this price elasticity is very close to the corresponding estimates in countries where PMI has a double coverage nature akin to the Spanish case. For Australia, French et al. (2003) report an estimate of -0.37, and Butler (1999) reports a range of estimates between -0.35 and -0.5. Similarly King and

[17] As suggested by Cameron and Trivedi (2005) we use the Cholesky decomposition of the variance-covariance matrix obtained by Maximum Simulated Likelihood in order to draw from the distribution of estimates and then simulate the model to obtain the outcomes of interest and their standard errors. In the process we also take into account the uncertainty arising from the fact that we use estimates for the cost per episode.

Mossialos' (2005) analysis for the English population report an estimate of -0.5. All of these estimates are greater (in absolute value) than the corresponding estimates for non-group insurance in the US, where the Congressional Budget Office (2005) reports estimates around -0.08.[18] As King and Mossialos (2005) point out, a more price elastic demand is to be expected where individuals have the free at the point of delivery public network alternative, and our estimate conforms with such an expectation.

The model for outpatient services estimates that the policy change, through its subsequent drop in the proportion of individuals with private insurance, causes a statistically significant decrease in the average probability of visiting a private doctor. This effect is mirrored by an increase in the average probability of not visiting a doctor.[19] However, the confidence interval for this effect contains zero by a slight margin. In any case, the reform causes a change in demand for outpatient health care away from the private network, but this does not lead to an increase in outpatient episodes in the public network. The estimates for the financial impact due to extra costs from outpatient episodes are consequently not statistically significant.

We obtain a negative point estimate for the effect of the reform on the probability of using a private hospital, and its confidence interval does not contain zero. This is mirrored by a positive estimate for the effect of the reform on the probability of episodes at public hospitals, but its confidence interval contains zero. As a consequence, the estimate for the expected increase in public hospital costs is not statistically significant at 5%.

Together with the estimate of the increase in costs from outpatient episodes, the impact of the reform on costs for the public network sums to € 16.18 million, but its confidence interval ranges from a saving of € -15.56 million to an increase in costs of € 47.35 million . Therefore we do not find significant evidence of an increase in costs for the public health care network as a consequence of eliminating the subsidy. Moreover, as discussed in section 2, the fiscal expenditure associated with this subsidy amounts to €

[18] This estimate is for the arc elasticity, obtained from simulating the effects of a 25% subsidy to PMI.
[19] Notice that the probabilities of the type of health care used in Table 6 are averages across the sample, and hence, they already incorporate that the change in the probability of holding PMI is low.

92.52 million. Clearly, our results reject the self-financing hypothesis by a very large margin.

As mentioned in section 2, our dependent variable for inpatient hospitalization might be subject to measurement error. Since we do not actually observe whether an inpatient episode is public or private, we have used an algorithm based on other questions of the survey to impute an inpatient episode as public or private. In order to assess the robustness of our conclusions to this assumption we take the most extreme scenario and compute the corresponding figures. Using the figures from Table 5, we estimate that the abolition of the tax deduction decreased the probability of an individual having PMI by about 0.015. This implies that 91,510 individuals will switch from double coverage to single coverage due to the policy. Using the figures from Table 1, out of these 91,510 individuals, 7,888 will have an inpatient episode. The most extreme scenario to check for robustness would be a case in which each of these 7,888 individuals had the inpatient episode at a private hospital before the reform, but used a public hospital after the reform. In these circumstances the public health care costs would increase by € 31.10 million. Consequently, even in this very extreme scenario, the extra cost is a long way from reaching the value of the subsidy.

6. Summary and conclusion

This paper has proposed an empirical strategy to analyze whether tax subsidies to private medical insurance are self-financing. We constructed a simulation routine based on a micro-econometric discrete choice model that allows us to evaluate the impact of premium changes on the probability that individuals have PMI, and to assess how this affects health care use at the outpatient and inpatient levels. Our methodology used pre-reform data to estimate the impact of the reform. This means that our methodology can be applied to different countries before reforms take place. This highlights the potential applicability of our methodology to public policy of this nature.

As an application of our methodology, we simulated on the Catalan population one important feature of the 1999 Spanish income tax reform: the abolishment of an income tax deduction of 15% on private medical insurance premia. Prior to the reform, tax expenditures arising from deductions after the purchase of private insurance amounted €

92.52 million per year. We found that the elimination of the subsidies to private policies did not generate a statistically significant increase in costs for the public sector. This result is driven by both a price inelastic demand for PHI and small/insignificant average treatment effects of PHI coverage on the probabilities of using public health care outlets. Consequently, we did not find evidence in support of the self-financing hypothesis. The large difference between the estimated extra public health care costs and foregone tax expenditures is consistent with our qualitative conclusion.

We simulated the impact of subsidies to purchase of PMI, offered via income tax. But as the income tax subsidy was eliminated in 1999, the Spanish fiscal system began to subsidize PMI through corporate tax reliefs to firms that offer PMI plans to their employees. Do our results shed light on whether PMI subsidies through corporate tax relief are self-financing? Lack of relevant data prevent us from calculating the trade-off between utilization of public outlets and tax expenditures in the new situation. However, the ample difference shown by our results would suggest that the subsidy is not self-financing.[20] This statement is, however, informed speculation, rather than a direct result of our research. In fact, subsidies through corporate taxation could be self-financing if purchase of PMI through the company was much more elastic than individual purchase. However, we cannot investigate this issue with the data available, and view it as an interesting topic for further research.

Given the lack of support for self-financing, the question remains as to whether the subsidies help with other policy goals. Undoubtedly, the existence of a PMI market augments consumer choice. This possibly generates much-valued shortening of waiting times for PMI holders. However, there is no evidence either for Spain or for other OECD countries that waiting lists for the publicly insured are relieved by the presence of PMI (Hurst and Siciliani, 2003). This lack of relief might be due to human resources being drained from public to private outlets. The Preferred Provided Organization structure of provision for PMI services in Spain could indeed generate incentives conducive to this phenomenon, as remuneration in the public sector is through salaries

[20] Before 1999, the deduction in the income tax was 15% of the PMI premium. After 1999, the deduction varies between 30% and 35% (the standard rates for company tax) of the PMI premium. *Ceteris paribus*, the government would be granting even larger deductions with the post-1999 system than with the pre-1999. Therefore it is difficult to believe that subsidies through corporate taxation would be self-financing.

whereas private insurers tend to pay fees for service, and dual practice is allowed (i.e. professionals can run consultancies in both networks simultaneously).

The fiscal support to the PMI market could also be justified as a means of promoting overall health care sector efficiency through competition. There is no evidence on this issue specifically for the Spanish case. However, the OECD (2004) review of PMI markets finds no general support for this motive. According to this review, the failings of PMI to promote cost efficiency are related to a series of factors, all of which can arguably be said to be present in the Spanish case, namely i) the fact that insurers do not engage in selective contracting since this conflicts with their main dimension of differentiation, i.e. choice of provider, ii) the provision through PPO networks rather than through managed care institutions makes it difficult to introduce cost-effectiveness criteria in the delivery of care, iii) informational failures make it unlikely that individual consumers "vote with their feet" and, particularly relevant for the Spanish case, iv) dual practice allows a substantial degree of leverage for doctors to shift costly procedures to the public network.

While the existence of the market is clearly desirable, the question remains as to whether substantive tax expenditures need to be incurred to guarantee such an existence. In this sense the UK experience, where PMI also provides "double coverage", is a useful reference, since the withdrawal of tax incentives from the purchase of PMI has not led to a collapse of the PMI market. In any case, the full social welfare analysis of the PMI subsidies is an open issue in the research agenda.

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Table 1. Health care utilization by insurance status.

Outpatient services		
	Single Coverage	Double Coverage
Without any visit	78.22(0.4)	78.54(0.4)
Visit Public GP	10.53(0.3)	4.43(0.2)
Visit Public Specialist	6.90(0.2)	2.37(0.15)
Visit Private GP	0.74(0.05)	3.37(0.3)
Visit Private Specialist	3.58(0.2)	11.25(0.6)
Total	100	100
Inpatient stays		
	Single Coverage	Double Coverage
Without any inpatient stay	92.07(0.3)	91.38(0.3)
Public hospital stay	7.44(0.3)	2.59(0.1)
Private hospital stay	0.48(0.1)	6.02(0.23)
Total	100	100

Percentage of people in each category
Standard error in parenthesis

Table 2. Descriptive statistics by insurance status. Means and standard deviations.

Variable		Single coverage	Double coverage
Fee	Average fee paid for each visit by PMI companies to doctors in the region where the individual lives. (Pesetas of 1994)	2171	2155
		(300.00)	(269.00)
LnFee		7.672	7.667
		(0.16)	(0.14)
Doublecov	Dummy=1 if double coverage	0.000	1.000
		(0.00)	(0.00)
Premium	Net per capita insurance premium (hundreds of € of 1994)	N.A.	2.16
			(1.38)
LNPremium	Log. of net per capita insurance premium in what and divided by what	N.A.	0.562
			(0.71)
Age	Age	39.600	40.958
		(23.08)	(22.20)
Age2	(Age*Age)/1000	2.101	2.170
		(1.99)	(1.90)
AgeH	Age of head of hosuehold	52.285	51.775
		(14.00)	(14.86)
Age2H	(AgeH*AgeH)/1000	2.929	2.901
		(1.54)	(1.64)
Female	1 if female, 0 otherwise	0.526	0.521
		(0.50)	(0.50)
Female40	1 if female older than 40, 0 othersie	0.263	0.256
		(0.44)	(0.44)
Local	1 if individual was born in current residence area, 0 otherwise	0.702	0.847
		(0.46)	(0.36)
EduP	1 if individual has primary education, 0 otherwise	0.573	0.470
		(0.49)	(0.50)
EduS	1 if individual has secondary education, 0 otherwise	0.156	0.242
		(0.36)	(0.43)
EduU	1 if individual has university education, 0 otherwise	0.040	0.142
		(0.20)	(0.35)
EduP_H	1 if household head has primary education, 0 otherwise	0.662	0.489
		(0.47)	(0.50)
EduS_H	1 if household head has secondary education, 0 otherwise	0.129	0.259
		(0.33)	(0.44)
EduU_H	1 if household head has university education, 0 otherwise	0.056	0.207
		(0.23)	(0.41)
Acc	1 if individual had an accident in the previous 12 months, 0 otherwise	0.160	0.125
		(0.37)	(0.33)
Hea_Good	1 if individual reports very good or good self assessed health, 0 otherwise	0.230	0.272
		(0.42)	(0.45)
Hea_Bad	1 if individual reports very bad or bad self assessed health, 0 otherwise	0.259	0.194
		(0.44)	(0.40)
Chron_any	1 if individual reports suffering any chronic disease, 0 otherwise	0.545	0.519
		(0.50)	(0.50)
Chron_N	Number of chronic diseases reported	1.398	1.244
		(1.81)	(1.69)
Members	Number of persons in the household	3.705	3.461
		(1.45)	(1.29)
Inc1	1 if yearly household income between 6000 and 9000 € of 1994, 0 otherwise	0.229	0.131
		(0.42)	(0.34)
Inc2	1 if yearly household income between 9000 and 12000 € of 1994, 0 otherwise	0.236	0.179
		(0.42)	(0.38)
Inc3	1 if yearly household income between 12000 and 15000 € of 1994, 0 otherwise	0.178	0.167
		(0.38)	(0.37)
Inc4	1 if yearly household income between 15000 and 18000 € of 1994, 0 otherwise	0.092	0.147
		(0.29)	(0.35)
Inc5	if yearly household income between 18000 and 30000 € of 1994, 0 otherwise	0.074	0.195
		(0.26)	(0.40)
Inc6	1 if yearly household income above 30000 € of 1994, 0 otherwise	0.023	0.105
		(0.15)	(0.31)
N		11572	2275

Table 3. Estimates of outpatient treatment model

	γ	α	β_2	β_3	β_4
Constant	1.9403**	-4.5668**	-0.5087	-1.5938**	2.4422**
	(0.106)	(2.305)	(0.673)	(0.540)	(0.555)
Age	-0.2427**	0.3114	-1.2401**	-0.8022**	0.0581
	(0.094)	(0.334)	(0.322)	(0.328)	(0.244)
Age2	0.1332	0.1446	0.4681	0.2959	-0.3033
	(0.093)	(0.294)	(0.312)	(0.324)	(0.223)
AgeH	0.3148**	-0.8630	-0.2328	-0.8170**	-0.6755**
	(0.127)	(0.573)	(0.433)	(0.433)	(0.316)
Age2H	-0.2679**	1.0110	0.1676	0.7433*	0.6528**
	(0.131)	(0.632)	(0.451)	(0.449)	(0.316)
Female	-0.0473	-0.0561	-0.4847**	-0.1817	-0.4776**
	(0.042)	(0.130)	(0.152)	(0.155)	(0.127)
Female40	0.0211	0.3418	0.5858**	0.3657*	0.5428**
	(0.059)	(0.237)	(0.191)	(0.206)	(0.154)
Local	-0.2415**	1.4394**	-0.0802	0.4611**	0.2833**
	(0.045)	(0.696)	(0.142)	(0.174)	(0.126)
EduP	-0.0134	0.5975*	-0.2995*	0.4198**	0.1659
	(0.063)	(0.331)	(0.166)	(0.193)	(0.132)
EduS	-0.0976	0.6945*	-0.4240*	0.4604*	0.1354
	(0.078)	(0.390)	(0.234)	(0.248)	(0.180)
EduU	-0.2776**	1.5625**	0.0285	0.7650**	0.5728*
	(0.089)	(0.782)	(0.407)	(0.383)	(0.319)
EduP_H	0.0494	0.0250	0.3669**	-0.0037	0.0401
	(0.051)	(0.162)	(0.160)	(0.168)	(0.115)
EduS_H	-0.1575**	0.9490*	0.6759**	0.3120	0.2099
	(0.059)	(0.487)	(0.224)	(0.228)	(0.178)
EduU_H	-0.0973	0.6186*	0.7955**	0.8051**	0.5263
	(0.077)	(0.376)	(0.422)	(0.379)	(0.335)
Acc	0.0470	-0.4185*	-0.0146	-0.2474	-0.5511**
	(0.046)	(0.238)	(0.147)	(0.181)	(0.146)
Hea_Good	0.0142	0.2474	-0.0020	0.3393**	0.4128**
	(0.041)	(0.167)	(0.169)	(0.171)	(0.140)
Hea_Bad	0.0136	-0.1922	0.3113**	-0.1612	-0.5181
	(0.048)	(0.166)	(0.150)	(0.190)	(0.148)
Chron_any	0.0845*	-0.1206	-0.2286	-0.2942*	-0.3526**
	(0.050)	(0.161)	(0.170)	(0.171)	(0.125)
Chron_N	0.0032	-0.0175	-0.0568	-0.1076	-0.4209**
	(0.029)	(0.081)	(0.090)	(0.129)	(0.105)
Members	-0.1428**	-0.8757**	-0.1058*	-0.2271**	-0.0852**
	(0.020)	(0.414)	(0.059)	(0.069)	(0.044)
Inc1		0.7916**	0.2669*	0.4963**	0.2287**
		(0.411)	(0.151)	(0.195)	(0.115)
Inc2		1.5680**	0.1481	1.0260**	0.4866**
		(0.756)	(0.189)	(0.244)	(0.170)
Inc3		2.1871**	0.3297*	0.8968**	0.4661**
		(1.039)	(0.202)	(0.255)	(0.177)
Inc4		2.9318**	0.3842	1.3908**	0.7867**
		(1.381)	(0.273)	(0.330)	(0.251)
Inc5		3.6508**	0.1235	1.4704**	0.6323**
		(1.717)	(0.305)	(0.347)	(0.268)
Inc6		5.0496**	0.0278	1.9545**	0.9762**
		(2.377)	(0.530)	(0.519)	(0.431)

LN(Fee)	0.0728**				
	(0.017)				
LN(Premium)		-1.9140**			
		(0.930)			
DoubleCov			1.0797	1.1371	0.1133
			(1.122)	(0.863)	(0.793)
σ	0.6745**				
	(0.073)				
Loading factor for individual effect	-0.4728**		-0.8347	-0.9473	-0.7277
	(0.149)		(0.751)	(0.956)	(0.795)
Loading factor for regional effect	-0.5219**	2.3493	-0.3284	1.0111	0.8329
	(0.124)	(1.529)	(0.727)	(0.866)	(0.713)

All the parameters are estimated jointly using Simulated Maximum Likelihood.
Standard errors in parenthesis.
** Significant at 5%
*   Significant at 10%

Table 4. Estimates of inpatient treatment model

	γ	α	β_2	β_3
Constant	1.9762**	-4.6603**	-6.0056*	4.1477**
	(0.106)	(1.440)	(3.565)	(1.405)
Age	-0.2466**	0.3175	-2.2008**	0.1824
	(0.095)	(0.305)	(0.945)	(0.314)
Age2	0.1338	0.1441	2.0021**	-0.5407
	(0.094)	(0.290)	(0.968)	(0.354)
AgeH	0.3139**	-0.8720*	0.0736	1.2184**
	(0.128)	(0.460)	(1.118)	(0.539)
Age2H	-0.2671**	1.0113**	-0.5045	-0.9175*
	(0.131)	(0.486)	(1.131)	(0.493)
Female	-0.0431	-0.0598	0.7605*	-0.2209
	(0.042)	(0.127)	(0.412)	(0.180)
Female40	0.0166	0.3432*	-0.0407	1.0242**
	(0.059)	(0.200)	(0.565)	(0.381)
Local	-0.2467**	1.4527**	-0.1035	0.1998
	(0.045)	(0.400)	(0.380)	(0.172)
EduP	-0.0149	0.6028**	0.8814	-0.1545
	(0.063)	(0.238)	(0.580)	(0.185)
EduS	-0.1006	0.6984**	0.7731	0.0963
	(0.077)	(0.283)	(0.584)	(0.235)
EduU	-0.2916**	1.5573**	1.6210*	-0.1545
	(0.090)	(0.484)	(0.820)	(0.377)
EduP_H	0.0508	-0.0035	-0.6236	0.1778
	(0.051)	(0.161)	(0.453)	(0.189)
EduS_H	-0.1613**	0.9451**	-0.1500	-0.1358
	(0.060)	(0.302)	(0.419)	(0.237)
EduU_H	-0.0969	0.6166**	-0.3818	0.2493
	(0.078)	(0.284)	(0.660)	(0.383)
Acc	0.0440	-0.4191**	0.2141	-0.7465*
	(0.046)	(0.169)	(0.433)	(0.264)
Hea_Good	0.0070	0.2357	-0.6242	0.5123
	(0.041)	(0.137)	(0.467)	(0.228)
Hea_Bad	0.0123	-0.2203	-0.3478	-0.9525**
	(0.048)	(0.150)	(0.379)	(0.314)
Chron_any	0.0859*	-0.1285	0.5621	-0.1678
	(0.051)	(0.154)	(0.409)	(0.171)
Chron_N	0.0051	-0.0101	0.0225	-0.3640
	(0.029)	(0.082)	(0.211)	(0.133)
Members	-0.1419**	-0.8669**	-0.0639	-0.0391
	(0.020)	(0.217)	(0.170)	(0.065)
Inc1		0.7912**	-0.4052	0.0763
		(0.267)	(0.567)	(0.164)
Inc2		1.5691**	0.1948	0.3466*
		(0.428)	(0.515)	(0.212)
Inc3		2.1808**	0.7173	0.1777
		(0.572)	(0.532)	(0.216)
Inc4		2.9221**	0.8420	0.4216
		(0.750)	(0.594)	(0.295)
Inc5		3.6353**	0.5119	0.4934
		(0.922)	(0.647)	(0.364)
Inc6		5.0544**	0.5169	-0.1665

		(1.272)	(0.798)	(0.467)
LN(Fee)	0.0774**			
	(0.017)			
LN(Premium)		-1.8367**		
		(0.521)		
DoubleCov			4.2044**	0.9716
			(1.694)	(1.101)
σ	0.6898**			
	(0.061)			
Loading factor for individual effect	-0.3104**		-1.1951	2.0172*
	(0.086)		(1.604)	(1.170)
Loading factor for regional effect	-0.6357**	2.4035**	0.2531	-1.0801
	(0.088)	(0.862)	(0.981)	(0.800)

All the parameters are estimated jointly using Simulated Maximum Likelihood.
Standard errors in parenthesis.
** Significant at 5%
* Significant at 10%

Table 5.Marginal effects (Average Treatment Effects) of private health insurance on the probability of utilization

Outpatient episodes	
Visiting a public GP	-0.0223
	(-0.0918, 0.0691)
Visiting a public Specialist	0.0633
	(-0.0337, 0.1902)
Visiting a private GP or Specialist	0.0631
	(0.0203, 0.1367)
Not visiting either a GP or a Specialist	-0.104
	(-0.2416, 0.0050)
Inpatient episodes	
Inpatient episode at public hospital	-0.0494
	(-0.1088, 0.0073)
Inpatient episode at private hospital	0.0537
	(0.0089, 0.1689)
Not using hospital services	-0.0042
	(-0.1324, 0.0088)

95% Confidence intervals in parenthesis

Table 6. Results of the reform

	Outpatient episodes	Inpatient episodes
Change in % of individuals holding PHI	-1.56	-1.5
	(-2.21, -0.68)	(-2.04, -1.04)
Change in average probability of		
Visiting a public GP	0.0001	
	(-0.0007, 0.0015)	
Visiting a public Specialist	-0.0003	
	(-0.0015, 0.0003)	
Visiting a private GP or Specialist	-0.0012	
	(-0.0023, -0.0002)	
Not visiting either a GP or a Specialist	0.0013	
	(-0.0001, 0.0003)	
Inpatient episode at public hospital		0.0007
		(-0.00009, 0.0024)
Inpatient episode at private hospital		-0.0008
		(-0.0018, -0.0002)
Not using hospital services		0.00004
		(-0.0019, 0.0013)
Change in yearly costs for public network		
Visits to GP	302469	
	(-1226974, 2695793)	
Visits to Specialist	-804998	
	(-3959748, 1001745)	
Inpatient episodes		16720710
		(-1678547, 56976974)
Total change in yearly costs	16218181	
	(-15568639, 47354965)	

95% confidence intervals in parentheses