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

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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 health insurance coexist. 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 utilisation of outpatient and inpatient health care services. As an application, we simulate the main feature of the 1999 Spanish income tax reform that abolished the individual tax deduction for expenditures on private health insurance. We find evidence suggesting that the fiscal subsidy is far from self-financing. This result is driven by the fact that private medical insurance holders make concurrent use of public services and by the low price elasticity of the demand for policies.

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Introduction

Private medical insurance (PMI) is an important ingredient of health systems in most OECD countries. Despite the heterogeneous arrangements in each country, public policy invariably has to contend with the implications of PMI in terms of equity in access, and efficiency in the delivery of health care, quality, innovation, and costs for the public budget. Concerning costs, policies in some countries have tried to use PMI to induce shifts in demand from public towards private outlets in order to reduce the pressure on the public network. A typical arrangement consists in allowing PMI to cover the same contingencies as the public health system (effectively permitting "duplicate" coverage). This is indeed the case of Australia, Ireland, United Kingdom, and Spain (Colombo and Tapay 2004). A natural policy tool is then to subsidize the take up of PMI policies. While in some instances the government of these countries has eliminated pre-existing subsidies to PMI (e.g. the UK), in the majority of cases there exists some form of subsidy either via personal income tax or company tax. Moreover, similar arrangements might be expected in markets in transition with comprehensive and universal public coverage where PMI might develop in the future such as the Czech Republic, Hungary or the Slovak Republic.

This paper proposes an empirical strategy to evaluate whether subsidies to PMI are self-financing. We will illustrate this strategy with an application for the Spanish health care market. However, it should be said from the outset that our methodology could potentially be applied to a variety of countries and contexts, as we do not exploit any exclusive feature of the Spanish system.

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 enjoy duplicate coverage from a PMI policy. The Spanish fiscal system treats generously the take up of PMI. Up to 1999, 15% of every euro spent on health care (including PMI policies) was deducted off total liabilities from the personal income tax bill. After 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 would imply a 35% (the company tax standard rate) subsidy for each euro spent by the company on

PMI. Our paper will focus on income tax subsidies to individually purchased private health insurance, though our results will shed some light on subsidies through corporate taxation. PMI.

The desire to evaluate the fiscal treatment of private health insurance has generated studies such as Gruber and Poterba (1994), who analyse the effect of tax subsidies for the self-employed in the United States. More recently, Emmerson *et al*. (2001) analyse 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. Gruber and Washington (2003) analyze the role of subsidies to employee health insurance as a mean to improve 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. In the Spanish case, the 1999 reform affected the whole population so we resort to a somehow more structural approach. In the absence of an exogenous control group, our strategy for the identification relies on the existence of an exogenous policy instrument that affects individual choices in a model of behaviour. Our data are particularly well suited for that purpose, as we have information on not only the demand side but also on supply determinants, which constitute useful instruments when estimating, demand equations with endogenous variables.

In particular, our strategy is to formulate and estimate a micro econometric model of health care utilisation distinguishing between outpatient and inpatient episodes 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 utilisation. This model will have two basic elements. First, it will allow us to examine how changes in the premium faced by the consumer influence the purchase of private medical insurance. This is important since there is probably a part of the population that will purchase private medical insurance, even without tax relief. The elasticity of private medical insurance with respect to the premium is a crucial parameter in this respect. Second, it will predict the patterns of health care consumption according to whether the individual has/has not purchased private medical insurance. In our specification we use both supply and demand determinants to identify the effect of tax changes in a model where the insurance premium is potentially endogenous.

The patterns of health care consumption will influence the costs of each individual in the public system. Several dimensions are of interest. First, individuals with PMI also use the public network for both outpatient and inpatient services, and therefore the relief for the public budget is not full. Secondly, given the gatekeeper role of the General Practitioner (GP) in the SNHS, individuals with only public insurance use Specialist services less frequently than individuals with private insurance. 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 smaller than in the private sector. Thus, in order to obtain estimations of the changes in health care expenditures arising from changes in the patterns of utilisation, we need data on the cost of both a GP and a Specialist service. Similarly, we combine estimates for the model of inpatient episodes with estimates for the cost of a hospital stay. Together with the representative sample for the Catalan population, this constitutes a micro simulation model for the budgetary effects of changes in the fiscal treatment of private insurance.

We use this model to simulate one of the main features of the 1999 reform: the elimination of the subsidy to PMI via personal income taxes. When modelling the reform, we take into account the fact that the three largest private insurance companies in Spain amounted for a 52% of the market share in 1994 (Oliva and Carles 1999). As market power is substantial, one would expect that private insurance companies would

partially absorb the abolishment of the subsidy. This feature is incorporated within our simulation routine by means of allowing for partial shifting. Given the absence of a proper control group and/or individual data on post reform premia, the degree to which the tax change is absorbed by the supply side is derived from changes in aggregate price indices. In particular, our strategy consists in comparing the aggregate private insurance medical price index with a general composite good price index in order to take into account macroeconomic effects.

Our approach combines two branches of the literature. One branch tries to explain the purchase of private medical insurance when a free public insurance scheme is available (King and Mossialos 2002, 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 premium and income. Here we focus our attention on the effects the net insurance premium, as it is a proper policy instrument. In particular, we take into account the endogeneity of insurance premium by relying on instruments that come from the supply side of the market. Though our data are good for this purpose, it is 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 another branch of the literature on health care utilization in the context of a NHS where both public and private alternatives are available (Windmeijer and Santos Silva 1997, Vera-Hernández 1999, Propper 2000, López-Nicolás *et al*. 2000, López-Nicolás 2001, Jones et al. 2002, 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 in a NHS. Taking this mix into consideration is necessary to analyze the redistributive consequences of the system (Besley and Coate 1991), as well as understanding 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 utilisation and studies of insurance choice by letting changes in policy instruments feed through to changes in utilisation via changes in insurance tenure. This is a novel feature that ultimately allows us to estimate 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 system together with the pattern of utilisation of outpatient and inpatient services in Catalonia according to insurance status. This motivates the discrete choice model for utilisation that we present in section 3. Section 4 is devoted to estimate how the abolishment of the tax revenue rebate influenced the market premium. Section 5 discusses the cost simulation methodology and its results for the fiscal reform that eliminated the tax relief for expenditures on health care. Section 6 concludes.

2. Duplicate coverage and patterns of health care services utilisation

We consider that an individual has duplicate coverage if he (or she) is entitled to receive free health care from the public network and, additionally, he is covered by a privately purchased insurance policy which covers private health care. By analogy, we shall denote as single coverage the situation where individuals are only entitled to free health care from the public network. Note that individuals with single coverage that visit a private provider pay out of pocket the full cost of treatment.

Table 1 shows the number of individuals belonging to each of the types of coverage in Catalonia at the time when the data were collected. From a total population of 6059484 in 1994, the Enquesta de Salut de Catalunya (ESCAT) shows that approximately 20% enjoyed duplicate coverage whereas 77% only had single coverage.[1] The individuals who enjoy duplicate coverage report an annual average premium payment per household of € 989.70 (all money figures in the paper have been adjusted for inflation

[1] The remaining 3% of the population corresponded to individuals who have used their right to obtain free health care to opt out of the public network in favour of a private provider. This option is only available to civil servants and, while effectively enjoying the same services as those available under the additional policy for an individual in duplicate coverage, this is a situation of single coverage because the possibility

up to May 2002). The sample weights allow us to construct an estimate for aggregate expenditure on premia, which amounts to € 461.33 M for Catalonia. Foregone taxes from the deductions associated to these expenditures are calculated at € 69.2 M (15% of € 461.33 M.)

The ESCAT contains detailed information on the last visit to a physician in the fifteen days previous to the interview. In particular it is possible to know whether an individual has visited either a GP or a Specialist and whether the visit has been to either a public or a private provider.[2] The third row of Table 2 shows that the proportion of individuals without any visit is practically identical for single and duplicate coverage groups. This suggests that the insurance status does not affect the probability of an outpatient episode. This is also observed with data representative for the whole of the Spanish population (López Nicolás 2001 and Alvarez 2001). Rows from fourth to eight in Table 2 show that people with single coverage mostly visit public outlets while those with duplicate coverage mostly visit private outlets. This suggests that public health care costs can increase if the amount of people with single coverage increases. Notice also that people with duplicate coverage concentrate their health care consumption in visits to the private Specialist. However, people with single coverage mostly visit the public GP. Consequently, insurance seems to influence very importantly the utilization profile (GP vs. Specialists), but not whether to visit a doctor.

As for inpatient episodes, 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 within the previous 12 months. However they are not asked whether this stay was at a public or a private outlet. We will determine this using the answer to the question "What coverage did you use more frequently along the year?". We adopt the following criterion for individuals that declare to have undergone an inpatient episode: we assume that the inpatient episode is at a public outlet if the individual declares to have used the public coverage more frequently along the year. Otherwise it is considered as an inpatient episode at a private outlet. This assignment procedure is based on the reasonable

to use the public network has been foregone. Given the peculiarity of this regime these individuals are excluded from our analysis.

[2] This information is only available for the last visit of the previous 15 days prior to the interview. Consequently we only consider the expenditure caused by this last visit. We believe that this is of minor

assumption that an individual will report to have used public (private) outlets more intensively if indeed he has undergone an inpatient episode at a public (private) outlet within the previous 12 months. At the end of the paper we will see that our qualitative conclusions are robust to this assumption.

The bottom part of Table 2 shows that insurance status does not influence the probability of having an inpatient episode. As in the case of outpatient visits, individuals with single coverage mostly use public inpatient services, as they would have to pay out of pocket to use private ones. Individuals with duplicate coverage mostly use private outlets but a non-negligible fraction uses public outlets. This is because, as in the British context (Besley *et al*. 1999), the private sector in Spain deals with elective surgery when waiting lists are long, but major surgical interventions are most frequently carried out within the public sector. Moreover, private insurance policies cover some but not all hospital expenses. According to OCU (1997) many companies limit to 30 days the number of hospital days that will be paid for within a given year, with stricter limits to the number of days in intensive care.[3] 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 patients might resort to public outlets for hospitalisations even when they enjoy private insurance.

3. Econometric model

3.1 Specification

As we have seen above, while insurance status does not influence the probability of demanding health care, it affects whether consumption takes place at either a public or a private outlet. Consequently our empirical model is specified with a view to estimate the probabilities of utilisation of services that generate either a cost or a saving for the public sector and, in particular, how the price of a private health insurance affects these

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

[3] 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.

probabilities. We will consider the two most important dimensions of health care utilization: outpatient visits and hospital inpatient episodes.

Individuals who use outpatient services within fifteen days before the interview can be observed visiting either a GP or a Specialist at either a public or a private outlet. On the other hand these individuals can have either only single coverage or duplicate coverage. We therefore consider the following mutually exclusive events in which, conditional on usage of outpatient services, any individual in the population might be observed:

State 1: Single coverage only, visit to a GP at a public outlet
State 2: Single coverage only, visit to a Specialist at a public outlet
State 3: Single coverage only, visit to either a GP or a Specialist at a private outlet
State 4: Duplicate coverage, visit to a GP at a public outlet
State 5: Duplicate coverage, visit to a Specialist at a public outlet
State 6: Duplicate coverage, visit to either a GP or a Specialist at a private outlet

Note that it is important for our purposes to distinguish between Specialist and GP use in the public network. In the public network, GPs have a gatekeeper role. Consequently individuals with single coverage have a lower probability of visiting a Specialist, which is more expensive. As we are only concerned with public expenditures, we are not interested in distinguishing the differential use of GP or Specialist in the private network.

During the 12 months prior to the interview, individuals might have undergone an inpatient episode at either a public or a private outlet.[4] On the other hand these individuals can have either only public coverage or duplicate coverage. We therefore consider the following mutually exclusive events in which, conditional on usage of inpatient services, any individual in the population might be observed:

State 1: Single coverage only, inpatient episode at a public outlet

[4] We have very limited information about inpatient episodes other than the latest. Consequently we consider a discrete choice model for the use of inpatient services in a year, neglecting the fact that some people might have two or more inpatient episodes in a year. We believe that this is 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).

State 2: Single coverage only, inpatient episode a private outlet
State 3: Duplicate coverage, inpatient episode at a public outlet
State 4: Duplicate coverage, inpatient episode at a private outlet

In similarity to previous studies that address utilisation of health services in a discrete choice context (see e.g. Gertler *et al*. 1987, Bolduc *et al*. 1996 or Propper 2000),[5] let $U_{ji}=U(H_j,Y_i, P_j)$ denote the utility derived from receiving care from provider j by the ith individual, where H_j is the expected health status after treatment, Y_i is consumption of the rest of goods and P_j is the price of health care from provider j. The individual chooses the provider j within his budget set such that $U_{ij}>U_{ik}\ \forall\ k\neq j$.

By choosing a linear (in parameters) functional form and adding a random disturbance to $U_j(.)$, we obtain the following expression

$$U_{ij} = y_{ij}\beta_1 + P_{ij}\beta_2 + X_i\gamma_j + \varepsilon_{ij} \tag{1}$$

where y_{ij} contains variables that vary between alternatives (and possibly individuals), P_{ij} is the price for consumer *i* of obtaining health care through provider *j*, and X_i contains variables that vary among individuals.

Note that the probability of observing any state can be derived in the following way:

$$\begin{aligned} &U_{ij} - U_{ik} = (y_{ij} - y_{ik})\beta_1 + (P_{ij} - P_{ik})\beta_2 + X_i(\gamma_j - \gamma_k) + \varepsilon_{ij} - \varepsilon_{ik} = \\ &U_{ij} - U_{ik} = y^d_{ijk}\beta_1 + P^d_{ijk}\beta_2 + X_i\gamma^d_{jk} + \varepsilon^d_{ijk} \Rightarrow \\ &P(U_{ij} > U_{ik}\ \forall j \neq k) = P(y^d_{ijk}\beta_1 + P^d_{ijk}\beta_2 + X_i\gamma^d_{jk} < \varepsilon^d_{ijk}\ \forall j \neq k) \end{aligned} \tag{2}$$

The above discrete choice model encompasses the multinomial logit, the conditional logit, the nested multinomial logit and the multinomial probit. In recent years, due to the

[5] For similar econometric models in the area of labour supply and participation in welfare programs see Keane and Moffitt 1998 and Bingley and Walker 2001.

availability of powerful computers, the multinomial probit model has become the preferred model to deal with discrete choice problems. This is because it leaves the variance covariance matrix of the error terms unrestricted, allowing for any correlation pattern among unobservables. However, this comes at a cost. In order to identify the model, one needs at least one continuous variable that takes different values in each alternative (Keane 1992). A natural candidate is the price of medical care when it varies across alternatives. This is possibly the case of some health care systems like the French one where the fees or copayments charged by GP's will be different from those charged by Specialists. However, in the context of a NHS where medical care is free at the point of consumption, the monetary price for GP and Specialist is the same: zero. Other candidates could be waiting time or travel time but we do not observe these non-monetary prices. Consequently, given that neither our institutional set-up nor our data give us enough variation to estimate the multinomial probit, we have used the conditional logit as our econometric specifications. For the same reason, Deb and Trivedi (2002) choose a multinomial logit instead of a multinomial probit for their application to the US health care system.[6] Possibly due to similar problems, the logit models are still widely used in the literature of insurance and provider choice (see, e.g. Abraham *et al.* 2002, Propper 2000, Puig-Junoy *et al*. 1998, and Royalty and Solomon 1999).

3.2 Explanatory variables and estimation results

3.2.1 Estimation of the private insurance premium

Prior to the estimation of the above model for both outpatient and inpatient episodes[7], we need to discuss how the insurance premium is obtained. The insurance premium is an important regressor in the above specification since the net insurance premium is the policy tool of interest. Data on insurance premium can only be observed for those individuals with private medical insurance. Consequently we need to estimate the value

[6] Notice that a Nested Logit in which first consumers choose insurance status, and then choose health care use in a second stage is not an alternative either. In order to achieve non-parametric identification of that model, one would also require a variable that varies with respect to health care provider. Otherwise, the inclusive value of the second stage would be a function of the variables already included in the first stage.

of the insurance premium in order to deal with this sample selection issue (Heckman, 1979). In similarity to other studies (see e.g., Costa and Garcia 2003, Bolduc *et al*. 1996, Gertler *et al*. 1987), we resort to a hedonic price model that allows us to predict the premium for the entire set of individuals, using a Heckman two-stage procedure that uses the Mills ratio to control for sample selection. This is the same strategy that Bingley and Walker (2001) use in a model of labour supply and Attanasio *et al.* (2001) use in an educational enrolment model where wages are only observed for those that work. Specifically the model used is

$$\begin{aligned} d_i &= 1[Z_{1i}\varphi_1 + v_1 > 0], \\ \ln(premium) &= Z_2\varphi_2 + v_2, \quad if\ d = 1, \end{aligned} \tag{3}$$

where d takes value 1 if the individual enjoys duplicate coverage, the error term vector, (v_1,v_2), follows a bivariate normal distribution, and Z_1 and Z_2 are exogenous regressors. The first equation is a reduced form discrete choice model for duplicate coverage and the second equation determines insurance premium. Previous research has identified socioeconomic variables of the head of the household as determinants of duplicate coverage. Hence in Z_1 we include variables referring to the head of the household where the individual resides: age, social class, education, job category, and labour supply status. We also include variables pertaining to the individual himself: smoking status, migration status and variables referring to the whole household: household income and controls for different types of household. The vector Z_2 contains the age of the head of the household, the type of household and, importantly, the average payments from a large insurance company to the doctors in the region where the individual lives.[8] This is a very important source of variation, since it is independent of individual characteristics (the variables X and y) in the utility function. Introducing supply side data is, whenever

[7] Since outpatient and inpatient episodes are measured over a different time window, we estimate the corresponding models separately.

[8] Notice that we exclude all the socio-economic variables, including income, from the equation for the insurance premium. These exclusions, which are necessary in order to achieve non-parametric identification of the model, are motivated by the perception that there is not an important degree of vertical differentiation in the market. Indeed, according to OCU (1997), for a couple with two children all the private insurance companies analyzed were assessed between good and acceptable, but none of them received either a rate of very good or a rate of bad. This limited degree of vertical differentiation in the private market gives support to our exclusion restrictions. That is, if vertical differentiation were important we would expect that the rich would buy better (and possibly more expensive) private insurance than the poor. In that circumstance, income would influence the premium directly. However it seems that vertical differentiation is not an important feature of the health care insurance market in Spain.

available, a common source of identification in models of demand with endogenous regressors. Our assumption is that the geographical variation in the prices paid to doctors by insurance companies is uncorrelated with the error term of the utility function. This would be the case when the variability in prices paid to doctors is due to different degrees of bargaining power between insurance companies and the doctors of the region. Town and Su (2003) also exploit the variation in the supply of hospitals and beds at the county level to identify parameters of the utility function. Their argument is that the supply of health care services will influence Health Maintenance Organization relative bargaining power The variables in Z_1 and Z_2 that are not included in either X or y_j will identify the model, that is, they will tell apart the premium effect from the effect of X or y_j in the discrete choice model of equation (2). [9]

The insurance premium is the price paid by individuals in states 4, 5 and 6 of the outpatient model and states 3 and 4 of the inpatient model. This is the main price in our specification as it is the policy tool affected by fiscal policies. Still, it is not the only price that consumers pay. Visiting a public GP or Specialist is free, regardless of having duplicate coverage. Hence states 1, 2, 4 and 5 do not require additional payments, apart from the private insurance premium that we have discussed above. State 3 requires the individual to pay the full amount of the visit out of pocket, as they do not have a private insurance contract. We do not have data for this price, which most likely depends on the medical speciality and the reason for the visit. This means that we ignore the effect of the fiscal reform via the change in the after tax price of services paid out of pocket. However, we do not expect an important change in this sector as less than 5% of outpatient episodes for individuals with single coverage are visits to private outlets. Although we do not observe it in our data, consumers in state 6 will in some occasions have to pay a small flat fee for service, in addition to the premium. According to OCU (1997) this flat fee varies from zero to 1.8 euros depending on the insurance company.

[9] For the sake of brevity we do not include the estimates for this model of insurance premium. Nevertheless it is worth mentioning that the expected premium increases with household size, age of the head of the household and our measure of costs from the supply side. These results are in accordance with data published by OCU (1997). According to this survey, the premium varies according area of residence. In our specification this is captured by the regional cost proxies, which affect positively the expected premium. The OCU survey also reveals that only two companies charge a different premium according to sex. That might be a reason why sex did not appear to be significant in the estimation. Another reason for that might be that most policies are contracted for the entire household. This is why the type of household turns out to be significant in the estimation. The entire set of estimates for this model is available on request.

Given that it is a very small quantity, it is quite unlikely that its omission introduces any substantial bias.[10]

3.2.2 Estimation of health care utilization models

In this section, we will comment on the results of the estimation of both outpatient and inpatient health care utilization models. One of our key regressors is the insurance premium since it will be one of the main determinants of the probability of having private medical insurance. As it is a predicted regressor, we report bootstrapped standard errors. The rest of the explanatory variables are demographic characteristics such as age, categorical household income, labour status, education level for the head of the household, sex and health related variables (chronic diseases, accidents, limiting conditions and self assessed health).11

Table 3 presents the descriptive statistics and gives the definition of the variables. Tables 4 and 5 show the parameter estimates for the conditional logit specification of outpatient and inpatient utilization, respectively. The estimation of the models requires the normalisation of the parameters corresponding to one of the alternatives. In this case the parameters of state 1 are set equal to zero for both models. For our final specification, we only retained those variables that were either significant or close to be significant.[12] That is why there are some empty cells in both Table 4 and 5. Individuals with only single coverage will not pay the insurance premium. That is why the latter does not enter in states 2 and 3 of the outpatient model and state 2 of the inpatient model. Notice that we restrict the coefficient of the insurance premium across states 4, 5 and 6 of the outpatient model, and states 3 and 4 of the inpatient model. This is because the premium affects the probability of buying private medical insurance, but not the type of service used once the insurance status has been chosen.

Concerning the estimates for the coefficient associated to the premium, note that they are negative, as expected, and statistically significant different from zero at the 95%

[10] Given the limited information with respect to these prices, previous studies have also been unable to control them in an explicit way, see for instance Propper 2000 and Vera-Hernandez 1999.
[11] In the ESCAT 1994, income is a categorical variable. About one third of the sample does not answer the income question. For this group of people we impute its category using an interval regression over household socio demograPMIc characteristics.

confidence level. Note also that coefficients are very similar in the outpatient model (-1.59) and the inpatient model (-1.547). The price elasticity of private medical insurance obtained from the outpatient model is –1.14 (standard error 0.24), which is very close the figure obtained from the estimates for the inpatient model, -1.09 (standard error 0.34).

Although the effect the net price of a policy is our main parameter of interest, it is also worthwhile noting that both income and education positively influence the tenure of private coverage and the use of private health care. Being self-employed also increases the probability of buying private medical insurance, suggesting that self-employed individuals have a higher opportunity cost of waiting.

4. The influence of the tax reform on the private insurance premium

In the remaining sections section we illustrate how the econometric model that we have presented in the previous section can be used to simulate changes in the fiscal treatment of PMI. In order to do so, we start by estimating the effect of the Spanish income tax reform on the equilibrium level of the private insurance premium. In 1999 the possibility to obtain a rebate of 15% on all expenditures on health care, including premium of individually purchased PMI, was abolished. If the market price of the insurance premium had remained constant in real terms, private insurance would have been 17.6% more expensive for consumers after the tax reform. However it would be unrealistic to assume that the tax change was fully shifted to consumers. As market power was a prominent feature of the private insurance market, one would expect that the private insurance companies would absorb part of the 17.6% increase in costs.[13] In turn, if the companies absorbed most of the increase in real costs, the patterns of utilisation would not change much as a result of the tax reform. This would imply a small increase in public health care costs that would be more than compensated by the reduction in tax expenditures associated to the abolition of the rebate. It is therefore important to establish the degree of shifting in order to estimate the budget

[12] For this purpose, we use standard errors computed using the outer product of the gradient.
[13] According to Oliva and Carles (1999), the three largest private insurance companies in Spain amounted for a 52% of the market share in 1994. This indicates that market power is substantial.

consequences of the reform. As we mentioned in the introduction, due to data limitations we cannot use a difference-in-difference strategy in order to estimate the influence of the reform on the private insurance premium. Consequently, we are forced to rely on a Before-After strategy. Of course, this requires strong assumptions on the evolution of private insurance premium, but these are more reasonable than simply assuming that the reform was fully absorbed by consumers. Indeed, given the large and sharp decrease in the private medical insurance price index that we will report below, we believe that the full shifting assumption would be untenable.

Table 6 shows the rate of increase of the Consumer Price Index (CPI) and individually purchased Private Medical Insurance Index (PMII) for Catalonia, the Spanish region whose population is represented by our data. From the third column, it is clear that the inflation rate for the PMII was no less than a 7% per year between 1994 and 1998. In 1999, the year that the reform took place; the inflation rate of PMII fell to 1.55%. Before 1999, the PMII inflation rate was larger than the CPI inflation rate, while it was smaller in 1999 and 2000. Consequently, in the year of the reform and the following one, the market price of private medical insurance sharply decreased in real terms. This seems to imply that the private insurance companies absorbed part of the increase of the net insurance premium resulting from the tax reform.

By comparing the inflation rate of PMII before and after the reform it seems that the tax reform did have a considerable effect on the market price of private medical insurance. However, Before-After comparisons would be misleading if they attribute to the reform any other unrelated contemporaneous effect (Heckman *et al.* 1999). In fact we can see from Table 6 that macroeconomic effects might affect PMII. The large decrease in CPI inflation between 1996 and 1997 might be related to the sharp decrease in PMII inflation between 1996 and 1997. Consequently, we would like to net out any potential macroeconomic effect that might have influenced PMII in the years of the reform but was unrelated to it. The last column of Table 6 shows the quotient between the CPI and the PMII. This is done in order to clean the evolution of PMII from macroeconomic shocks. The influence of the reform remains clear, since this ratio varied between 1.5 and 3.6 in the years preceding the reform but fell to 0.5 in the reform year and remained at 0.7 in the following year.

Consequently, in order to estimate the impact of the tax reform on the market premium we consider the following counterfactual: what would the insurance premium be had the reform not taken place. We estimate this by obtaining the geometric mean of the ratios in the last column of Table 6 for the years preceding the reform. Notice that these ratios should be clean of macroeconomic effects. We obtain 2.56 which means that, had the reform not taken place, the market premium inflation rate would have been more that twice the CPI inflation rate.[14]

When a temporal dimension is used to evaluate the impact of a reform, the dates in which the effects of the reform start and end are usually important assumptions (Heckman *et al.* 1999). The reform was announced in 1998 together with the public budget for 1999 and was part of a wide package of measures aimed at simplifying the tax code. Moreover, the reform was done by a conservative government, which, *a priori,* would be expected to favour private health insurance. It is not surprising then to find little evidence for anticipatory effects in the price indices: the ratio for 1998 is very close to that for 1997. We will assume that the effects of the reform lasted for 1999 and 2000, that is, the year of the reform and the following one. In these two years the PMII inflation rate was smaller than the CPI inflation rate and hence the market premium price decreased in real terms. It seems that it took two years for the companies to partially absorb the effect of the tax reform. In 2001, the PMII inflation rate was larger than CPI, as in the periods previous to the reform, and consequently we assume that the influence of the tax reform is over at the end of 2000.

Using the data from Table 6, which contains the effects of the tax reform, a private insurance premium with a market price of 100 monetary units at the end of 1998 would have cost 104.3 at the end of 2000. If the reform had not taken place, under the assumption that PMII inflation would have been 2.56 times larger than CPI inflation rate, we estimate that the market premium would have been 117.67 monetary units. However, given the 15% tax rebate, the net price for consumers would be 100.02. Compared with 104.3, this means that the cost of private insurance premia for consumers increased by 4.3% as a result of the tax reform. This is quite different from

[14] Although it seems a large quantity, note that in the two years preceding the reform the value of the ratio was even higher.

the estimate of 17.6% that we would have obtained if we had assumed that private insurance companies did not partially absorb the effect of the tax reform.

5. Are tax subsidies self-financing?

Since our aim is to obtain an estimation of the potential savings associated to a smaller frequency of utilisation of public outlets of individuals with duplicate coverage, it is important to count with a valuation of 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. These data contain the amount of money that the insurance company paid to either a GP or a Specialist for a visit and also a series of demographic characteristics for each patient. This allows us to estimate a multivariate regression model for the cost of outpatient services. Details about this estimation are given 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. 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 are about to obtain, is unlikely to affect our conclusions in a substantial manner.

Our data on inpatient cost is obtained from López-Casasnovas and Sáez (1999). In their Table 1, they report the mean (€ 3468) and standard deviation (€ 550.3) of the cost per admitted patient at Spanish public hospitals.[15] Contrary to the case of outpatient services, we can rely on public sector costs when estimating the extra cost that the reform will cause to 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 proportion of the variance of observed costs for inpatient episodes.

[15] We selected the year 1994 as it is the one that corresponds with 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 a Non-teaching status.

Concerning the computation of the expected public health care costs, consider the case of outpatient episodes. Let P_{ij} denote the estimates for the probability that individual i is observed in state j. Let C_{ij} denote the estimate for the cost to the public system that individual i generates under state j. Given these ingredients, it is straightforward to compute an estimate of the cost that the public sector can expect for each individual by means of the following expression

$$\begin{aligned} EC_i &= d_i^o \sum_{j=1}^{6} P_{ij} C_{ij} \\ C_{i3} &= C_{i6} = 0 \\ i &= 1..N \\ j &= 1..6 \end{aligned} \tag{4}$$

Where d_i^o equals 1 if the ith individual uses outpatient services and 0 otherwise. The probabilities of different states depend on the private insurance premium. As discussed in the previous section, we estimate that the reform increases the premium by 4.3%. Using this estimate, our micro econometric model allows us to predict the change in each of the six estimated probabilities for each individual due to the reform: ΔP_{ij}. Thus, an estimate for the expected increase in costs to the public sector for each individual is given by the following expression

$$\begin{aligned} \Delta EC_i &= d_i^o \sum_{j=1}^{6} \Delta P_{ij} C_{ij} \\ C_{i3} &= C_{i6} = 0 \\ i &= 1..N \\ j &= 1..6 \end{aligned} \tag{5}$$

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 refers to the fifteen days previous to the interview, we multiply our figure by twenty-four in order to get an annual estimate. Also, we calculate standard errors by bootstrapping. Note that the cost estimates are subject to two sources of uncertainty. The first is the fact that we are using regression estimates for the cost per visit to a GP or a Specialist. The second is associated to the estimation of the multinomial model

reported in the previous section. Our procedure combines the two sources of uncertainty by replicating the estimation of aggregated expected costs 500 times, with each of the replications combining one bootstrapped set of estimates for the cost per visit with a bootstrapped set of estimates for the multinomial choice model.[16]

The procedure to obtain the expected increase in public inpatient cost is analogous to the case of outpatient services described above except for the fact that, given the data at hand, we use the average cost for the whole population rather the expected cost conditional on patient's demographic characteristics. During the bootstrap process for inpatient costs, we obtain draws from the lognormal distribution estimated by means of the average and standard deviation of inpatient costs reported in López-Casasnovas and Sáez (1999).

Our estimate for the annual expected increase in costs from outpatient episodes is € 1475263, with a standard error of € 325200. The corresponding figure for inpatient episodes is € 7447830 with a standard error of € 2392993. Thus the estimated increase in costs derived from a greater utilisation of public health care services resulting from the abolition of the partial rebate to private insurance costs, at € 8.9 M., is far smaller than the € 69.2 M. associated to the tax deductions for the expenditure on insurance policies. Therefore our results do not support the self-financing hypothesis.

Robustness Analysis

Given that the difference between the expected increase in public health care costs and the forgone tax expenditures associate to the deductions is very large, it seems that our conclusion that subsidies to private health care costs are not self financing should be very robust. For the sake of completeness, however, we think it is useful to discuss two issues that provide further support to the main result.

First, as we mentioned in section 2, our dependent variable for inpatient hospitalization might be subject to measurement error. As explained in section 2, we do not actually observe whether an inpatient episode is public or private, but we use an algorithm based

[16] The re sampling procedure uses as initial sample the set of individuals which are observed using health care services.

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 place ourselves in the worst possible scenario and compute the corresponding figures. Using the estimates for price elasticity (-1.14) and the increase in net premium paid by the consumer (4.3%), the reform is estimated to reduce by 4.9% the number of individuals with duplicate coverage. This means that 60674 individuals will switch from duplicate coverage to single coverage due to the reform. According to Table 2, out of these 60674 individuals, 4793 will have an inpatient episode. Assume the worst scenario for our qualitative conclusions: every one of these 4793 individuals had the inpatient episode at a private hospital before the reform but after the reform they use a public hospital. In these circumstances the public health care costs would increase by € 16.6 M. Consequently, even in this very pessimistic scenario, the extra cost is very far from reaching the forgone tax expenditures due to the reform.

Second, we observe a large decrease in the post reform market price of private medical insurance in our aggregate data of Table 6. This large decrease partially offsets the abolishment of the tax reform. But it could be the case that the pure effect of the reform had driven the market price to an even lower level than what the data show. This would be the case if, as one might expect, less healthy individuals are less price elastic (as they probably have a valuable long term relationships with their doctors). As the reform increases the net price paid by consumers, this would mean that the post reform pool of privately insured individuals would have worse health status than the pool previous to the reform. Consequently, to the extent that our aggregate datum of 104.3 is being inflated because the post reform pool of individuals with duplicate coverage is less healthy than the pre reform pool, a representative individual would face a post reform premium smaller than 104.3. If this were the case, even less people would drop their private medical insurance policies after the reform. This effect would tend to increase the gap between foregone tax expenditures and increased cost in the public sector thus reinforcing our qualitative results that subsidies to private medical insurance are not self-financing in the Spanish NHS.

5. Summary and conclusion

This paper has proposed an empirical strategy to analyse whether tax subsidies to private medical insurance are self- financing. We construct a simulation routine based on a micro econometric discrete choice model that allows us to evaluate the impact of premium changes on health care utilisation at the outpatient and the inpatient levels. In our illustration we have shown how to deal with the fact that the PMI industry tends to be concentrated and therefore legal changes in the fiscal treatment of PMI might not be fully shifted to the consumers. Our methodology mostly uses pre-reform data to estimate the impact of the reform. Post-reform data are only used to estimate the effect of the reform on the private insurance premium equilibrium level. This means that our methodology can be applied to different countries before reforms take place if one is ready to adopt a similar assumption on the impact of the reform on the equilibrium level of the premium. This highlights the potential of our methodology for public policy.

As an application of our methodology, we simulate a feature of the 1999 Spanish income tax reform that abolished the tax deduction for expenditures on individually purchased private health insurance using a representative sample of the Catalan population. Prior to the reform, tax expenditures arising from deductions after the purchase of private insurance amounted € 69.2 M. per year. The elimination of the subsidies to private policies is estimated to generate an extra cost of about € 8.9 per year. Consequently, we conclude that the abolishment of the tax rebate generated a surplus to the public sector. The large difference between the estimated extra public health care costs and forgone tax expenditures gives robustness to our qualitative conclusion.

Our paper has simulated the impact of subsidies to individual purchase of private health insurance through the income tax. But as the income tax subsidy was eliminated in 1999, the Spanish fiscal system started to subsidize PMI through corporate taxation to those firms that offer PMI plans to their employees. Do our results shed some light about whether PMI subsidies through corporate taxation are self-financing? Lack of relevant data prevent us from calculating the trade off between utilisation of public outlets and tax expenditures in the new situation. However, the ample difference shown by our results would suggest the hypothesis that the subsidy is not self-

financing.[17]Notice that this is an 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. This is an interesting topic for further research. For the moment it seems that the justification for the subsidy must be sought in terms of other relevant policy goals. On the equity front, evidence for Spain by Van Doorslaer et al. (2002) and Jones et al. (2002) shows that PMI actually contributes to pro-rich inequity in the access to specialists. Together with the evidence shown in this paper, these findings would cast doubt on the adequacy of subsidising PMI. However, the implications of subsidies for waiting lists in the public system, as well as the welfare gains of those that buy PMI are still open issues in the research agenda.

[17] In the situation before 1999, the deduction in the income tax was a 15% of the PMI premium. After 1999, the deduction is a 35% (the standard corporate rate tax) of the PMI premium. Ceteris paribus, the government would be granting even larger deductions with the post 1999 system than before 1999. Therefore it is hard to believe that subsidies through corporate taxation would be self-financing.

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Table 1. Distribution of expenditure on private insurance premia.

First quartile	460.19
Median	920.27
Third quartile	1303.72
Mean	989.70
Standard deviation	707.26
Grossed up expenditure (Million Euro)	461.33
Grossed up deductions (Million Euro)	69.20
Number of people with duplicate coverage	1237745
Number of people with single coverage	4689393

Note: 2002 Euros.

Table 2. Health care utilisation profile according to insurance. Percentage of people in each category

	Single Coverage	Duplicate Coverage
Outpatient services		
Without any visit	82.7(0.4)	83.8(0.8)
Visit Public GP*	9.16(0.3)	3.4(0.3)
Visit Public Specialist*	6.76(0.2)	2.3(0.3)
Visit Private GP*	0.23(0.05)	2.37(0.3)
Visit Private Specialist*	1.10(0.1)	7.9(0.6)
Total	100	100
Inpatient stays		
Without any inpatient stay	92.10(0.28)	91.43(0.61)
Public hospital stay*	7.41(0.28)	2.44(0.31)
Private hospital stay*	0.42(0.06)	6.09(0.54)
Total	100	100

(*) The difference between single and duplicate coverage is statistically different from zero at the 95% confidence.
Standard error in parenthesis

Table 3 Descriptive statistics for outpatient visits estimating sample

	Mean and (S.d.)	Definition
Female	0.48 (0.45)	=1 if individual is female, 0 otherwise
SAH excellent or very good	0.16 (0.37)	=1 if self-assessed health is either excellent or very,0 otherwise
SAH poor or very poor	0.40 (0.49)	=1 if self-assessed health is either poor or very poor, 0 otherwise
Age	43.79 (24.41)	Individual's age
Limiting condition	0.14 (0.34)	=1 if individual has presented a limiting condition in the 12 months previous to the interview, 0 otherwise
Number of chronic diseases	2.10 (2.19)	
Accident in previous year	0.20 (0.40)	=1 if individual has suffered an accident in the previous year,0 otherwise
Primary school	0.53 (0.50)	=1 if head of the household has completed primary school, 0 otherwise
Secondary school	0.14 (0.35)	=1 if head of the household has completed secondary school, 0 otherwise
Intermediate university	0.02 (0.14)	=1 if head of the household has completed intermediate university, 0 otherwise
Superior university	0.02 (0.15)	=1 if head of the household has completed superior university, 0 otherwise
Unemployed without benefits	0.03 (0.18)	=1 if head of the household is unemployed and does not receive benefits
Self-employed	0.06 (0.24)	=1 if head of the household is self-employed
Second income bracket	0.23 (0.42)	=1if household income is between 6010 and 9016 Euros, 0 otherwise
Third income bracket	0.21 (0.41)	=1if household income is between 9016 and 12021 Euros, 0 otherwise
Fourth income bracket	0.16 (0.36)	=1 if household income is between 12021 and 15027 Euros, 0 otherwise
Fifth income bracket	0.09 (0.28)	=1 if household income is between 15027 and 18032 Euros, 0 otherwise
Sixth income bracket	0.09 (0.28)	=1 if household income is between 18032 and 30054 Euros, 0 otherwise
Seventh income bracket	0.03 (0.18)	=1 if household income is larger than 30054 Euros, 0 otherwise.
Log Premium	12.24 (0.26)	Predicted log insurance premium

Standard deviations in brackets.

Table 4. Parameter estimates for the outpatient conditional logit (bootstrapped standard errors in brackets)

	Opt.2	Opt. 3	Opt. 4	Opt. 5	Opt.6
Constant	-0.534	-1.269*	14.05*	14.35*	15.66*
	(0.314)	(0.339)	(4.300)	(4.433)	(4.293)
SAH excellent or very good		0.321*			
		(0.131)			
SAH poor or very poor		-0.349*			
		(0.138)			
Dummy female over 40					0.432*
					(0.165)
Age	0.005	-0.018*	0.024*	0.003	0.007
	(0.121)	(0.003)	(0.006)	(0.009)	(0.005)
Age^2/1000	-0.23				
	(0.12)				
Age below 15	1.513*	0.977*	1.806*	2.836*	2.259*
	(0.285)	(0.259)	(0.519)	(0.605)	(0.337)
Limiting condition	0.256	-0.215	-0.024	0.811*	-0.443
	(0.130)	(0.185)	(0.283)	(0.327)	(0.227)
Number chronic diseases					-0.058
					(0.044)
Accident in previous year					-0.399*
					(0.169)
Primary education	0.064	0.672*	1.377*	0.720*	0.825*
	(0.121)	(0.163)	(0.313)	(0.317)	(0.177)
Secondary education	0.206	0.882*	1.270*	1.634*	1.608*
	(0.198)	(0.223)	(0.457)	(0.511)	(0.255)
Intermediate university	0.706	1.528*	2.348	2.574	1.984*
	(0.446)	(0.487)	(3.22)	(3.845)	(0.506)
Superior university	0.289	1.192*	2.441	2.832	2.513*
	(0.572)	(0.495)	(2.643)	(2.554)	(0.450)
Unemployed without benefits		-0.851*			-0.671
		(0.388)			(0.501)
Self employed		0.319	0.778		1.282*
		(0.237)	(0.390)		(0.218)
Fourth income bracket	0.222	0.326	-0.318	0.133	0.534*
	(0.140)	(0.203)	(0.301)	(1.005)	(0.249)
Fifth income bracket	0.057	0.770*	0.385	0.576	1.067*
	(0.154)	(0.190)	(0.313)	(1.015)	(0.262)
Sixth income bracket	0.257	0.599*	0.810*	1.106	1.277*
	(0.170)	(0.226)	(0.350)	(1.008)	(0.281)
Seventh income bracket	0.328	0.920*	1.510*	1.152	2.041*
	(0.226)	(0.268)	(0.413)	(1.061)	(0.298)
Eight income bracket	0.145	1.272*	1.923*	1.724	2.646*
	(0.250)	(0.262)	(0.361)	(0.985)	(0.297)
Dummy top income bracket	-0.106	1.319*	1.183	2.272*	3.044*
	(0.465)	(0.439)	(6.864)	(1.057)	(0.410)
Log premium			-1.594*	-1.594*	-1.594*
			(0.350)	(0.350)	(0.350)
Log likelihood	-4185.31				
Sample size	3182				

(*) Statistically significant from zero at the 95% confidence level

Table 5. Parameter estimates for the inpatient conditional logit (bootstrapped standard errors in brackets)

	Opt.2	Opt. 3	Opt. 4
Constant	-2.428*	14.58*	16.64*
	(1.173)	(6.420)	(6.282)
SAH very poor	-0.872	-1.467	-0.787
	(16.00)	(11.85)	(0.513)
Dummy female over 40	0.978*	0.508	0.568*
	(0.400)	(0.335)	(0.288)
Age	-0.090*	0.002	-0.063
	(0.030)	(0.008)	(0.210)
Age^2/1000	0.694*		0.607*
	(0.327)		(0.232)
Limiting condition			
Dummy chronic diseases		0.817*	
		(0.300)	
Accident in previous year			-0.420
			(0.259)
Primary education	1.161*	0.667	0.710*
	(0.473)	(0.360)	(0.315)
Secondary education	1.289*	0.623	1.394*
	(0.647)	(0.473)	(0.405)
Intermediate university	0.764	0.583	1.722*
	(35.71)	(7.42)	(0.617)
Superior university	2.891	0.748	2.406*
	(1.77)	(6.78)	(0.582)
Self employed		0.814	1.173*
		(0.456)	(0.332)
Fourth income bracket	0.156	0.370	-0.276
	(1.163)	(0.474)	(0.471)
Fifth income bracket	0.702	1.03*	0.748
	(1.098)	(0.471)	(6.786)
Sixth income bracket	0.982	1.111*	1.119*
	(1.101)	(0.473)	(0.400)
Seventh income bracket	1.006	0.645	1.502*
	(1.173)	(2.785)	(0.454)
Eight income bracket	1.371	1.724*	1.940*
	(2.086)	(0.554)	(0.474)
Dummy top income bracket	0.982	2.000	2.065*
	(1.101)	(2.423)	(0.501)
Log premium		-1.547*	-1.547*
		(0.520)	(0.520)
Log likelihood		-832.11	
Sample size		1173	

(*) Statistically significant from zero at the 95% confidence level

Table 6 Evolution of the rate of Increase of Consumer Price and Private Medical Insurance Index

Year	(1) CPI	(2) PMII	(2)/(1)
1994	4.54%	7.20%	1.587
1995	4.55%	9.94%	2.182
1996	3.86%	10.04%	2.603
1997	2.19%	7.96%	3.637
1998	2.13%	7.20%	3.385
1999	2.78%	1.55%	0.559
2000	3.84%	2.73%	0.711
2001	3.55%	5.93%	1.669