Institute for Advanced Development Studies

Development Research Working Paper Series

No. 10/2008

What is the Impact of Duplicate Coverage on the Demand for Health Care in Germany?

by:

Martin H. Vargas
Majed Elhewaihi

December 2008

WHAT IS THE IMPACT OF DUPLICATE COVERAGE ON THE DEMAND FOR HEALTH CARE IN GERMANY?

M. H. VARGAS AND M. ELHEWAIHI

Abstract. Duplicate coverage involves those individuals who hold compulsory health insurance with the public sector and have additional coverage with the private sector. The additional insurance covers costs for outpatient and inpatient care, income loss and hospital daily allowances. The number of persons who took out additional coverage has been steadily increased.

This increase can be linked to two main factors: the shortage in the benefits package and the introduction of the reform act (January the 1st 2004). Basically, members of the public insurance sector have to make co-payment of 10 percent for all health care services and drug prescription (maximum 2 percent of the annual pre-tax income). Costs of transportation and dental prosthesis have been also excluded from the benefits package.

It uses the SOEP German database for estimate an demand model for health services, given the simultaneity of the choices to take duplicate coverage and the level of health services (measured like number of visits), we estimate a negative binomial model to measure the impact of the duplicate coverage on the health service demand, we also estimate a a Full Information Maximun Loglikelihood (FIML) known in this case as an Endogenous Switching Poisson Count Model and we compare this results with the standard maximum log likelihood (ML) estimators of the negative binomial model.

The Results show that there is a positive difference on the level of health services demanded when there is a duplicate coverage. We found also that there is evidence to think that in Germany there is a feedback between duplicate coverage and the demand of health services.

1. Introduction

The German health system is a two-tier system. While around 88 percent of the population is covered by the statutory health insurance (SHI), about 10 percent is covered by the private health insurance (PHI). The approximately remain 2 percent is covered other governmental insurance schemes (such as military and police officers) [2].

Contributions to the (SHI) sector are dependent on income while in within the (PHI) sector contribution rates depend on individual health risks. The (SHI) provides it's members with free primary health care (until January 2005, where individuals have to pay 10 Euros per each three months for a visit to general practitioners and specialists. In general, individuals have the possibility to obtain health care for free through the statutory insurance sector, alternatively they can pay for the health care services or purchase (PHI), especially, some health care services are not covered by the statutory insurance such as psychological and some dental care.

Renumeration of physicians shows some difference between the two insurance sectors. Although the fee-for-services are quite the same within both sectors, physicians are allowed to charge up to 3.5 times if an individual holds private insurance policy and the health problem is complicated [13]. This motivates physicians to first serve the privately insured individuals. On the other side, individual seeks private insurance coverage for several reasons; to overcome the restrictions that have been put by the statutory insurance sector such as limited choice of doctors, shorter waiting times and lists and maybe the perceived quality of both sectors are different. Some individual may perceive the comfortable waiting rooms and the friendly treatment of medical personal as better quality.

The statutory insurance is compulsory for employees, whose gross annual income does not exceed 42,740 Euro (is called income ceiling limit and changed every year). Tenured civil servants, self-employed and employees whose gross annual income is above the income ceiling limit are allowed to switch to the private insurance sector [4].

The topic of health insurance and demand for health services it is a interesting and challenging issue. In the decade of sixties, forty years ago Arrow (1963) identified the problem of *moral hazard* consequence of the existence of health insurance, He foresee that the insurance systems without incentives to providers and users to seek the low-cost services were going to increase the expenditure in health services. Grossman (1972) studied the demand for health under the basis that health demand does not depend only on the price of the health services, follower of Gary Becker he postulated that the demand for health services depend also on the *health capital* and he postulated that more educated individuals invest more in their health capital and for this reason they will demand a lower quantity of health services when they become older. Cameron etal (1986) modeled the interaction between insurance and the demand for health services using a model of two periods, they arguing that the insurance choice was determined by the expected level of future health services to be used. In the case of duplicate coverage Vera-Hernandez (1997) extended the Cameron's model for study the impact of the duplicate coverage on the healths services demand but his empirical results were didn't show a clear judge against on in favor of the Cameron's model.

In the latest years many studies ere directed to the health demand services in Germany, Pohlmeier (1995) et al. introduce a negative binomial distributed hurdle model that specifies the two stages of the decisionmaking process as different stochastic processes for to study the demand of health services and the insurance scheme, they argued that while at the first stage, it is the patient who decides whether to visit the physician, it is essentially up to the physician to determine the intensity of treatment and then the demand of health services. Jochmann (2004) They used a random effects model specified in a semiparametric Bayesian for analyze the demand for health services, they found a positive effect of the additional coverage on the demand of the health services but the don't analyze the endogeneity in the duplicate coverage.

Our objectives in this study will be, Finding the impact of duplicate coverage in the health demand services and analyzing if the mechanism that the individuals use in Germany fits in the Cameron's Model, by using the SOEP database 2005.

2. The German health care system

The German health care system have passed for many reforms, in the period between 1977 and 1983 there were some reform acts which were aiming to contain spending the health sector (Herles 2000). In 1989 a new reform act was implemented, this act aimed among other things at extending the opt-out option. By passing this act blue-collars whose income is above the income ceiling were eligible to opt out of the statutory insurance sector. A further reform act came into force in 1993, core points of this act were cost-containment and enhancing efficiency. The cost-containment has been emphasized by increasing co-payments and introduction of fixed budgets. The cost-containment policy was also among the aims of the reform act which passed in 1997, this involved more co-payment in addition to exclusion of some rehabilitative care benefits. In 1999 and 2000, the government released another decree which forced sickness funds to global budget (to spend what they have collected from the contributions of the insured individuals). However, these reform acts have not contributed the escalating costs of health care. The sickness funds were obliged to increase the contribution rates (from 13.6 to 14 percent between 2000 and 2003). As a response by 2004 a new reform act has been passed, in which patients have to make co-payment for almost all services. For example, glasses were excluded from benefit package except for children and adolescents and also transportation and impregnation have been also rationed. Also patient has to pay 10 Euros each three months for visit to general practitioner and if individual to go to specialist without referral he has also to pay 10 Euros.

Regulations and membership of the (SHI) are set up by the Social Code Book (SGB V). The (SGB V) determines the individuals groups who are entitled to join the (SHI) and the services package. The total number of the sickness funds was 136 , of which the regional sickness funds (5), the company-based sickness funds (110), guild-sickness funds (9), substitution sickness funds (9), and three other funds. Generally, there is marked difference among these sickness funds; the only slight difference is the contribution rate and the nature of additional health services. Membership in the (SHI) is either compulsory or voluntary. It is compulsory for employees whose income is below the income ceiling (42.750 Euro per year, called in German Beitragsbemessungsgrenze), unemployed, students, retirees and agriculturists. Family members of insured individuals such as unemployed wives and children are insured for free. On the other side, is the voluntary (SHI) which offers more flexible and individually determined coverage. This type of coverage includes employees whose income is above the income ceiling as well as self-employed and civil servants.

Contributions to the (SHI) are equally divided by the employees and their employers, which are drawn from pre-tax income; this was based between 11.9% and 15.9% depending on the sickness fund. Financing within the (SHI) is made on pay-as-you-go base and health services provided regardless of the individuals contributions. The services package of the (SHI) covers all primary, hospital as well as dental care. Starting in 2005, members of (SHI) have to make co-payment of 10 Euros each three months for visit to general practitioner, and if individual goes to specialist without referral from the general practitioner he/she has to pay 10 Euros. Furthermore, members of the (SHI) have to pay between 5 to 10 Euros for drugs.

The (SHI) sector constituted of 27 percent of persons who were insured for free and around 5 percent retirees which means that the percentage of insured individuals whose income is high is low. Basically, each sickness fund is obliged to insure each one, therefore, large sickness funds such as the General Regional Sickness Fund (AOK) ends up with large proportion of high risk group.

Table 1. Population according to the type of health insurance coverage

Type of health insurance	Percentage
SHI	88.35
PHI	9.35
Others	2.01
No coverage	0.23
No answer	0.06

Source: (Federal statistical office 2003)

The private insurance sector covers around 12 percent of total spending on health (OECD 2004). In 2004, the German insurance market contained around 54 insurance companies. The total numbers of individuals who joined the private health insurance 16 millions, of which around 8.2 millions had complete coverage and 7.8 millions had supplementary coverage . The number of the complete insured individuals is frequently changing, this because of death or changing of the income ceiling.

Eligible for the private health insurance coverage are each person who does not fit under the eligibility criteria of the (SHI) sector. Such as self-employed, civil servants and employees whose income is above the income ceiling limit. Like the (SHI) payments for the statutory coverage is also equally divided between employers and employees. Unlike the (SHI) sector, contribution rate to the private insurance coverage is determined upon individual risk group. Contracting within the private sector is also individually, that means the more health care services you contract, the higher is the premium . Premiums are also dependant on individual's age at entry, and some money of the premium are being saved for later.

The provision of health care services within the private insurance sector functions of reimbursement base. When an individual goes to doctor he gets a bill, he can either send this bill to his insurance company directly which in turn pays the doctor or pays the costs directly and getting reimbursed by own insurance company. The insurance company can decide on the insurance of individuals and the scope of health problems. That means each insurance company when contracts an insurance policy, it can exclude previous health problems from the coverage, and therefore they send individuals to medical check up.

As we mentioned before, the private insurance sector offers either complete or supplementary coverage. The complete coverage provides the amount of health services which the statutory sector provides. While the supplementary insurance covers what the statutory does not cover . Example of the supplementary insurance is the coverage of optional hospital benefits, outpatient care, and loss of income in case of illness, hospital daily allowances and foreign travel coverage.

3. Health services demand and duplicate coverage demand

In this section we develop a small microeconomic model for analyze the interaction between demand for health services and duplicate coverage. We based the model in the following expression

$$h_{t+1} = H((1-\delta_t)h_t, I_t) \tag{1}$$

that means that the health stock at time $t+1$ depends on the stock at the past period h_t, some natural depreciation δ_t (caused i.e. by the age meaning older less health), and some investment in health (for example sports, good food, preventive and curative medical care), this three elements are carried to the next period using a transformation function H function that we will recognize as the Health function production[9], for now we will suppose that is increasing and strictly concave in all the arguments.

Unfortunately (1) can be affected at least for two uncertainty factors the first one the fatality (accidents, diseases, shocks in the individual's health) and the second the effectiveness of treatments, incorporate this factors imply transform (1) in

$$h_{t+1} = H((1-\delta_t)h_t + \epsilon, I_t\mu) \tag{2}$$

Where ϵ and μ are random variables with $E[\epsilon] = 0$ and $E[\mu] = 1$, ϵ represents the uncertainty related to the determinants of health status and μ represents the effectiveness of the medical care[5].

Now instead of considerer a many periods model we analyze the situation only in one period of time[1] subdivided in two moments[2] , at $t = 0$ the individual know his/her current level of health (h_0) but he doesn't know the level of health through the period and neither the final level of health at the end of the period (h_1).

We assume that the individuals have an compulsory health insurance that covers a limited set of health problems and for covered different issues they need to buy a duplicate coverage (supplementary insurance coverage [3]) and at the very beginning he/she needs to decide about this insurance policy (to buy or not a duplicate coverage). In some point ($\tau = 1$) during the period the individual realizes his/her level of health (pre-treatment level of health h) and decides how much health care he/she wants[3], [8](see Figure 1) based in his/her budget constraint and preferences.

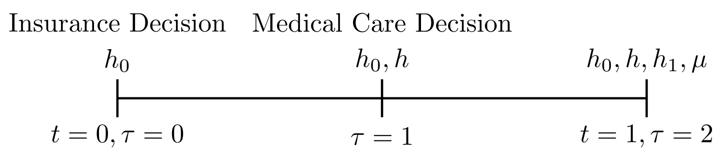

FIGURE 1. Decisions schedule and information

The individual wants to maximize a von Neumann Morgenstern utility function $U(c, h_1)$ where c is a composite consumption good and h_1 is the final health status. We assume that U has the standard property that utility is strictly increasing and strictly concave in both arguments goods $U_1.U_2 > 0$ and $U_{11}, U_{22} < 0$. The individual chooses the insurance policy (take $dc = 1$ or not a duplicate coverage $dc = 1$), the level of health care v (measured as visits to the physician) and the level of c in order to maximize $U(c, h_1)$.

We assume the existence of a co-payment $k > 0$ and a price $p_v > 0$ for each visit and if the individual decides to take a duplicate coverage pays a premium P, then,

[1]The period begins at $t = 0$ and finishes at $t = 1$

[2]The first moment begins at $\tau = 0$ and ends at $\tau = 1$ and the second moment begins at $\tau = 1$ and ends at $\tau = 2$

[3]Supplemental health insurance is a type of insurance policy designed to cover the gaps that the regular/compulsory health insurance may have.

if we suppose that the income of the individual is Y, he faces the following budget constrain

$$Y - dcP = c + v\left[(1 - dc)p_v + k\right] \tag{3}$$

Because the individual takes decision in a sequential form we solve the problem backwards, that means that at first we assume as given level of pretreatment health($\bar{h}$) and the insurance policy ($\bar{dc}$) and we find a expression for the demand of health care measured as number of visits V[4] and we use this expression for find the demand for health insurance DC. At time $\tau = 1$, given a insurance policy ($\bar{dc}$) and a health status ($\bar{h}$) the individual's problem is

$$\max_V U\left\{Y - \bar{dc}P - v\left[(1 - \bar{dc})p_v + k\right], \tilde{H}((1 - \delta(\mathbf{A}))\bar{h}, v)\right\} \tag{4}$$

Notice that in (4) instead of h_1 we used $\tilde{H}((1 - \delta(\mathbf{A}))\bar{h}, v)$[5] where $\mathbf{A}$ is a vector of characteristics of the individual (like age, gender and others that determine the deterioration of the health of the individual), because the individual evaluates his own health at $\tau = 1$ we assume that there is not unexpected shocks, that means $epsilon = 0$ and we also assume without loss of generality that exists H such that $h_1 = H((1 - \delta(\mathbf{A}))\bar{h}, v)$.

using the solution $V(Y, h, dc, \mathbf{A})$ at the moment $\tau = 0$, we find the following expected utilities corresponding to the choices $dc = 1$ and $dc = 0$

$$\dot{U} = \int U\left\{Y - P - kV, H((1 - \delta(\mathbf{A}))h_0 + \epsilon, V)\right\} F_\epsilon(\epsilon|\mathbf{Z})\, d\epsilon \tag{5}$$

$$\ddot{U} = \int U\left\{Y - (p_v + k)V, H((1 - \delta(\mathbf{A}))h_0 + \epsilon, V)\right\} F_\epsilon(\epsilon|\mathbf{Z})\, d\epsilon \tag{6}$$

where we assume that

$$h_1 = H((1 - \delta(\mathbf{A}))h_0 + \epsilon, V) \tag{7}$$

We also assume that ϵ is a random variable with cumulated distribution $F(\epsilon|\mathbf{Z})$ where $\mathbf{Z}$ is a vector of variables that determines the likelihood of occurrence of health shocks[18].

Because dc take only two values the choice is make it in base to a simple comparison between the expected utilities in the two cases, then $DC(Y, h_0, \mathbf{A}, \mathbf{Z}) = 1$ if $\dot{U} \geq \ddot{U}$ and 0 if it not the case.

4. Econometric methods

In this section we analyze maximum log likelihood (ML) methods for to study the impact of the insurance policy DC (duplicate coverage)on the demand of health care V_i (measured as number of visits to the doctor), as we saw in the past section V depends on the duplicate coverage DC, the level of health at the point $\tau = 1$ h, the income Y and a vector of characteristics of the individual $\mathbf{A}$. Because $V = 1, 2, 3, \cdots$ we can use methods of count variables, then at first time we describe

---

[4]We use V for denotate the demand of health care measured as number of visits

[5]$\tilde{H}$ acts in this case as a transformation of the health level at $\tau = 1$ to the time $\tau = 2$

the basic ideas behind the method for a single equation and afterward we extend this method for deal with the endogeneity of DC.

Now we will assume that we have a sample of size N, every element represents an individual and we assign an index $i = 1, \dots, N$ for to represent him/her generically, now let V_i the dependent count variable (in our case the number of visits), a difference of linear model in count models we are interested in the probability that the count (V_i) assumes a given value $n = 1, 2, 3, \cdots$ this probability is $f(V_i = n|\Psi, \mathbf{x}_{1i}, DC_i)$ (density function), $\mathbf{x}_{1i}$ it is a vector of explanatory variables and DC_i it is the duplicate coverage index variable.

The ML procedure find the set of parameters $\hat{\Psi}$ that maximizes

$$\ell(\Psi) = \sum_{i=1}^{N} \ln f(V_i = n|\Psi)$$

different kind of densities give different kind of models. The Poisson model is based on the assumption that V_i has a Poisson distribution

$$f_P\left(V_i|\Psi_P, \mathbf{x}_{1i}, DC_i\right) = \frac{\exp(-\lambda_i)\lambda_i^{V_i}}{V_i!} \tag{8}$$

where $\lambda_i = \exp(\theta DC_i + \mathbf{x}'_{1i}\beta)$, and $\Psi_P = (\delta, \beta)$ is the set of parameters.

A more general model that the Poisson model is the Negative Binomial model (NB) that results of assume that V_i is distributed under a Negative Binomial distribution

$$f_{NB}(V_i|\Psi_{NB}, \mathbf{x}_i, DC_i) = \frac{\Gamma(\alpha^{-1} + V_i)}{\Gamma(\alpha^{-1})\Gamma(1 + V_i)} \left(\frac{\alpha^{-1}}{\alpha^{-1} + \lambda_i}\right)^{\alpha-1} \left(\frac{\lambda_i}{\alpha^{-1} + \lambda_i}\right)^{V_i} \tag{9}$$

where $\lambda_i = \exp(\theta DC_i + \mathbf{x}'_{1i}\beta)$ and $\Psi_P = (\alpha, \delta, \beta)$ is the set of parameters parameters of this model.

Notice that in both models the conditional mean specified is

$$E(V_i|\Psi, \mathbf{x}_{1i}, DC_i) = \exp(\theta dc_i + \mathbf{x}'_{1i}\beta) \tag{10}$$

Under suitable assumptions this models can be estimated using the ML method, but as consequence of the results and the theoretical analysis of the previous section, in this case there is the possibility of endogeneity between the number of visits (V_i) and the duplicate coverage index variable (DC_i), if this is the case ML estimators are no more reliable and we need to use methods of simultaneous equations. At date there are a good quantity of methods for to deal with the problem of endogeneity, a good survey of this methods can be found in Schellhorn [15], Romeu et al. [14] and Terza et al. [17].

An natural solution for our case is the extension of the basic count model to a count model with endogenous switching (ES)[16] that implies to analyze the probability density function $f(V_i|\Gamma_v, \mathbf{x}_{1i}, DC_i, \zeta_{1i})$ where Γ_v is a set of parameters the variable DC_i is the bivariate switching variable, such that

$$DC_i = \begin{cases} 1 & \text{if } \mathbf{x}'_{2i}\gamma + \zeta_{2i} > 0 \\ 0 & \text{otherwise} \end{cases} \tag{11}$$

where ζ_{1i} and ζ_{2i} are jointly normal with mean zero and covariance matrix

$$\Sigma = \begin{bmatrix} \sigma^2 & \rho\sigma \\ \rho\sigma & 1 \end{bmatrix}$$

Under this assumptions

$$f(V_i, DC_i|\Gamma, \mathbf{x}_{1i}, \mathbf{x}_{2i}) = \int_{-\infty}^{\infty} f(V_i|\Gamma_v, \mathbf{x}_{1i}, DC_i, \zeta_{1i}) \times \tag{12}$$
$$\times \left[DC_i\Phi^*(\zeta_{1i}) + (1 - DC_i)(1 - \Phi^*(\zeta_{1i})\right] f_{\zeta_{1i}}(\zeta_{1i}|\Gamma, DC_i, \mathbf{x}_{1i}, \mathbf{x}_{2i})\, d\zeta_{1i}$$

where

$$\Phi^* = \Phi\left(\frac{\mathbf{x}'_{2i}\gamma + (\rho/\sigma)\zeta_{1i}}{\sqrt{1-\rho^2}}\right)$$

and $f_{\zeta_{1i}}(\zeta_{1i}|\Gamma, DC_i, \mathbf{x}_{1i}, \mathbf{x}_{2i})$ is normal with mean zero and variance σ^2, now if we use the change of variable $\xi_i = \zeta_{1i}/(\sigma\sqrt{2})$

we obtain that

$$f(V_i, DC_i|\Gamma, \mathbf{x}_{1i}, \mathbf{x}_{2i}) = \frac{1}{\sqrt{\pi}} \int_{-\infty}^{\infty} f(V_i|\Gamma_v, \mathbf{x}_{1i}, DC_i, \xi_i\sigma\sqrt{2}) \times \tag{13}$$
$$\times \left[DC_i\Phi_i^*(\xi_i\sigma\sqrt{2}) + (1 - DC_i)(1 - \Phi^*(\xi_i\sigma\sqrt{2})\right] \exp(-\xi_i^2)\, d\xi_i$$

Where $\Gamma = \Gamma_v \cup \gamma, \sigma, \rho$ is the set of parameters and like in the basic count model different specifications of $f(V_i|\Gamma_v, \mathbf{x}_{1i}, DC_i, \xi_i\sigma\sqrt{2})$ derivate in different kind of models i.e. we can specify a Poisson distribution or a Negative Binomial distribution, Γ can be estimated using the Full Information Maximum Log likelihood method (FIML) maximizing the following log likelihood function

$$\ell(\Gamma) = \sum_{i=1}^{N} \ln f(V_i, DC_i|\Gamma, \mathbf{x}_{1i}, \mathbf{x}_{2i})$$

In the case of Poisson we have that

$$f_{ESP}\left(V_i|\Gamma_{vP}, \mathbf{x}_{1i}, DC_i, \xi_i\sigma\sqrt{2}\right) = \frac{\exp(-\lambda_i + \xi_i\sigma\sqrt{2})(\lambda_i + \xi_i\sigma\sqrt{2})^{V_i}}{V_i!} \tag{14}$$

where as before $\lambda_i = \exp(\theta DC_i + \mathbf{x}'_{1i}\beta)$, and $\Gamma_{vP} = (\delta, \beta, \sigma)$ is the set of parameters.

In the case of a NB distribution we have that

$$f_{NB}\left(V_i|\Gamma_{vNB}, \mathbf{x}_{1i}, DC_i, \xi_i\sigma\sqrt{2}\right) = \frac{\Gamma(\alpha^{-1} + V_i)}{\Gamma(\alpha^{-1})\Gamma(1 + V_i)} \times \tag{15}$$
$$\times \left(\frac{\alpha^{-1}}{\alpha^{-1} + \lambda_i + \xi_i\sigma\sqrt{2}}\right)^{\alpha - 1} \left(\frac{\lambda_i}{\alpha^{-1} + \lambda_i + \xi_i\sigma\sqrt{2}}\right)^{V_i}$$

where as always $\lambda_i = \exp(\theta DC_i + \mathbf{x}'_{1i}\beta)$, and $\Gamma_{vNB} = (\alpha, \delta, \beta, \sigma)$ is the set of parameters.

5. The Study Data

The data for this study have been driven from the Socio-economic Panel (SOEP). The (SOEP) is a longitudinal as well as cross-sectional national survey representing the persons and the households living in the Federal Republic of Germany (FRG) and done by the German Institute for Economic Research. The (SOEP) contains among other things data on the health care consumption and the socio-economic status of people in the (FRG) [10]. As we saw in the previous theoretical analysis we need information about six groups variables the Endogenous variables (Health care demand and duplicate coverage), Individual characteristics ($\mathbf{A}$), Income (Y), pre treatment health status (h), previous health status (h_0), and variables related with the likelihood of health shocks (Occupation, and others).

The sub-sample that we use for our study was the people with more than 16 years old in the compulsory system, that means 9,330 observations, the variables used in our study are listed in Table 2.

For measure the level of health services we used the number of doctor visits in the last 3 months (VISITS) but unfortunately with the information in the wave 2005 is not possible to classified the type of this visits (Specialist, GP and so on), we also create a variable (DC) that represents the duplicate coverage and this variable is equal to 1 if the individual declares that he has a supplemental private insurance having been at the public insurance system.

For measure the level of income we used the household monthly net income (INC) measured in thousand of euro, we include a variable (REGION) for analyze the impact of to be in a more richer region (West Germany) and the number of member in the household expecting that households has less income per person if there is more members in the household.

For measure the health status through the period we used the self-reported health status (HEA) in 2005 (how individual would evaluate their health status on an ordinal scale) and the existence of disability (DISAB) for the same year. In the case of the previous status we used self-reported health status (HEA0) for 2004 and two additional variables that we expect that are more related with the kind of health problems that are covered with the duplicate coverage, the first one is related to the physical condition of the individual (PHYS) and the second one is related with the mental health (PRESSED)[6].

In the individual characteristics we include 3 variables the gender of the individual (GENDER), the age (AGE, AGE2=AGE^2) and for the education level we used the education level with respect to High School (EDUHS). Finally we use four variables to analyze the impact of the risk, at first we use only two occupational categories (Blue collars and White collars), we use too a variable to identify the head of the household (PRI), another one for the level of education of the head (EDUHSPRI) and one variable that represents the level of physical activity (PHYS).

[6]Unfortunately PRESSED and PHYS are only available in the new module of health that SOEP began at 2002 and has been revised and put into a two year replication period.

Table 2. Summary of variables

Dependent	
DC	0 without and 1 if duplicated coverage.
VISITS	number of visits in the last 3 months.
Income	
INC	Income categories, the dummy variables are: 0-1000 (1, omitted), 1000-1500 (2), 1500-2000 (3), 2000-3000 (4), 3000-4000 (5), 4000,... (6).
WG	1 for West Germany and 0 for East Germany.
NHH	Number of members in the Household
Health	
HEA	Health Status (2005), the dummy variables are: (hea1, omitted) Very good,(hea2) Good, (hea3) Satisfactory, (hea4) Poor or bad.
DISAB	0 without and 1 if there is present disability.
Individual Characteristics	
GENDER	1 for females and 0 for males.
AGE	years divided by 100.
EDUHS	Education With Respect to High School , the dummy variables are: (1, omitted) Less than H S, (2) High School, (3) More than H S
Risk likelihood	
PRI	1 for head of household and 0 i.a.c.
EDUHSPRI	Education level of the head ,
the dummy variables are:	
	(1, omitted) Less than H S, (2) High School, (3) More than H S
OCCUP	Occupation, the dummy variables are: Blue collars , White collars , Others(omitted).
SPORT	Frequency of sport or exercise (Almost never or never 1 Several times a year 2,At least once a month 3, At least once a week 4)
Previous Health Status	
HEA0	Health Status (2004), the dummy variables are: (hea1, omitted) Very good,(hea2) Good, (hea3) Satisfactory, (hea4) Poor or bad.
PRESSED	Pressed for time in the last 4 Weeks (Always 1, Often 2, Sometimes 3, Almost Never 4, Never 5)
PHYS	Strong Physical Pain in the last 4 Weeks (Always 1, Often 2, Sometimes 3, Almost Never 4, Never 5)

6. Results

In this section we presents the empirical results of the study, our strategy was estimate different type of models and compare them, at first we estimate a Poisson and a Negative Binomial model for explain the number of visits to the doctor in last three months (V) in both cases we use as explanatory variables the duplicate coverage (DC), Income variables (INC2-6, WG, NHH), Health variables (HEA2-4, DISAB, PRESSED, PHYS), Individual characteristic variables (GENDER, AGE, AGE2, AGE_SQR, EDUHS2, EDUHS3).

We also estimate a Probit model to explain the Duplicate Coverage index (DC) dependent on Income variables (INC2-6, WG, NHH), Previous Health variables (HEA02-04, PRESSED, PHYS), Individual characteristic variables (GENDER, AGE, AGE2, AGE_SQR, EDUHS2, EDUHS3) and variables related with the likelihood of health shocks (PRI, EDUHSPRI2-3, BLUE_CO, WHITE_CO, SPORT). Finally we estimate a Endogenous Switching model using a Poisson distribution taking in account the same variables as were used in the count and Probit models.

The Table 3 presents the results of the estimation using the Poisson,Negative Binomial model (NB) and the ES and additionally we present an auxiliary probit regression used to compare the impact on DC in different scenarios the first one (probit) without considering the correlation between the duplicate coverage (DC) and the number of visit to the doctor (VISITS) and the second scenario under the ES model.

A general view of the results shows that unless some specific cases the results are quite similar in terms of significance and in the major of the cases in the sign and value of the parameters. In first time we observe a **positive impact of the duplicate coverage** (DC) over the demand of health services measured as the number of visit to the doctor (VISITS), in the three models we observe significance but under ES the effect is greater, the second important aspect is the significance of $\rho = -.615$ meaning that there is feedback between the duplicate coverage and the health services demand, in consequence **DC is endogenous**.

Analyzing the impact of the personal characteristics GENDER has a expected positive impact over VISITS and over DC also, in the case of AGE we saw a **U** impact over VISITS and no impact over DC, the level of education of the individual has no effect on VISITS a difference of the duplicate coverage where we see a positive impact this can be explained by the fact that individual more educated enjoy more the quality of the services and in Germany duplicate coverage gives a privileged service (no waiting lists and private beds in hospitals are a good example).

The Income variables shows an expected behavior in the case of INC shows a not so notorious **U** impact on VISITS fact can related with the fact that more richer people have access a best services and have a better disposition to improve their health easier, for other side INC has an expected impact on DC meaning more income more insurance, in the case of the variables WG and NHH the ES model since our point of view gives a more intuitive result meaning that WG has effect over DC but not over VISITS and NHH over VISITS and over DC.

For to analyze the impact of the current health we use the variable (HEA) and as we saw the impact over VISITS is the expected meaning less health more VISITS, we include too two variables more related with health PRESSED and PHY assuming that this variables are more related to the kind of services that

TABLE 3. Health care estimations (n= 10,327)

MODEL	NB2 VISITS	POIS VISITS	ES VISITS	ES DC	PROBIT DC
DC	0.112*	0.116*	0.739*		
GENDER	0.078*	0.072*	0.077*	0.086*	0.094*
AGE	-1.008*	-0.801*	-0.946*	0.088	0.204
AGE_SQR	0.954*	0.749*	1.008*	-0.408	-0.497
EDUHS2	-0.015	-0.015	-0.037	0.342*	0.347*
EDUHS3	0.002	-0.002	-0.025	0.377*	0.370*
INC2	0.087*	0.103*	0.068*	0.238*	0.242*
INC3	0.093*	0.101*	0.077*	0.357*	0.403*
INC4	0.071	0.076	0.038	0.609*	0.632*
INC5	0.037	0.048	-0.015	0.760*	0.782*
INC6	-0.012	-0.009	-0.136*	1.058*	1.081*
WG	0.083*	0.093*	0.026	0.357	0.410*
NHH	0.001	0.000	0.024*	-0.128*	-0.130*
HEA2	0.122*	0.117*	0.127*		
HEA3	0.383*	0.381*	0.375*		
HEA4	0.913*	0.911*	0.881*		
DISAB	0.247*	0.243*	0.268*		
PRESSED	-0.015	-0.018	-0.007	-0.063*	-0.060*
PHYS	-0.050*	-0.049*	-0.050*	0.013	0.013
HEA02				-0.075	-0.047
HEA03				-0.053	-0.020
HEA04				0.030	0.027
PRI				0.121*	0.110*
EDUHSPRI2				0.060	0.106
EDUHSPRI3				0.148	0.211*
BLUE_CO				-0.168*	-0.121*
WHITE_CO				-0.069	-0.040
SPORT				0.121*	0.110*
CONS	1.053*	1.010*	0.801*	-2.127*	-2.297*
ALPHA	0.290*				
SIGMA			0.587*		
RHO			-0.615*		

* *significant at 5%*

the duplicate coverage can be support [7], we can see that only PRESSED not has impact over the number of visits.

We can see that the previous general level of health (HEA0, PHYS) doesn't have any impact on the duplicate coverage, the reason in quite simple, if we suppose that our health status it is really bad we expect go a lot to the doctor and buy a insurance will be a good choice in this case the fact is that in general many of the health problems are covered for the compulsory system then is expected that

[7] Unfortunately this variables are only available for 2002,2004,and 2006 then we use the values of the wave 2004 for PRESSED and PHYS

HEA0 doesn't have any impact on DC, but this is not the case with PRESSED that is more related with the type of diseases that DC covers.

Finally we will discuss the impact of the likelihood of health shocks on DC, like in the case of the variables related to the initial health status it is important take in mind that DC not covers every kind of disease instead is better think that covers only small problems that are not covered by the compulsory system. PRI has a positive impact because the head in the major of the cases gives more resources to the familiar budget then the potential risk in augmented by this fact, in other side the negative impact of BLUE_CO is explained by the fact that duplicate coverage in Germany cover correctives like glasses and Blue collars are less affected for this health problems, finally the positive sign of SPORTS meaning more exercise more probability to get DC is explained by the fact that people that are doing exercise often is more risky to suffer complex problems of health, problems that can be need a specialist to solve them, and the other option is only because some DC policies covers part of price of access to the gym.

7. Discussion

Using a negative binomial model, the determinants of the demand for medical services as measured by the number of visits to physicians (general practitioners and specialists) in one quarter are estimated, the results show that the duplicate coverage have a positive impact in the demand for healths services, the acquisition of a duplicate coverage increase the number of visits. Our empirical results emphasize the importance of health status and the duplicate coverage insurance as determinants of health-care demand, and the higher importance of income variables for to get a duplicate coverage.

On the basis of the a count data model estimated using the FIML methodology we found enough evidence for reject the hypothesis of exogeneity in the choice of duplicate coverage respect to the use of health services.

References

1. K.J. Arrow, *Uncertainty and the Welfare Economics of Medical Care,*, American Economic Review **53** (1963), no. 5, 941–73.
2. R. Busse and A. Riesberg, *Health Care Systems in Transition.*, WHO Regional Officce for Europe on behalf of the European Observatory on Health Care Systems and Policies, 2004.
3. AC Cameron, PK Trivedi, F. Milne, and J. Piggott, *A Microeconometric Model of the Demand for Health Care and Health Insurance in Australia*, The Review of Economic Studies **55** (1988), no. 1, 85–106.
4. F. Colombo, N. Tapay, Labour, Social Affairs Committee Employment, Organisation for Economic Co-operation, and Development, *Private Health Insurance in OECD Countries: The Benefits and Costs for Individuals and Health Systems*, Organisation for Economic Co-operation and Development, Directorate for Employment, Labour and Social Affaires, Employment, Labour and Social Affairs Committee, 2004.
5. V. Dardanoni and A. Wagstaff, *Uncertainty and the demand for medical care.*, Journal of Health Economics **9** (1990), 23–38.
6. P. Deb and P.K. Trivedi, *Demand for Medical Care by the Elderly: A Finite Mixture Approach*, Journal of Applied Econometrics **12** (1997), no. 3, 313–336.
7. V. der privaten Krankenversicherung, *Private health insurance: facts and figures 1999/2000*, 2000.
8. Ç. g atay Koç, *The Effects of Uncertainty on the Demand for Health Insurance*, The Journal of Risk and Insurance **71** (2004), no. 1, 41.
9. M. Grossman, *On the Concept of Health Capital and the Demand for Health*, The Journal of Political Economy **80** (1972), no. 2, 223–255.

10. JP Haisken-DeNew and JR Frick, *DTC–Desktop Companion to the German SocioEconomic Panel Study (SOEP), DIW, Berlin*, Online: http://www. diw. de/english/sop/service/dtc/(accessed 10th Jan. 2006) (2005).
11. M. Jochmann and R. Leon-Gonzalez, *Estimating the Demand for Health Care with Panel Data: A Semiparametric Bayesian Approach*, Health Economics **13** (2004), no. 10, 1003–1014.
12. W. Pohlmeier and V. Ulrich, *An Econometric Model of the Two-Part Decisionmaking Process in the Demand for Health Care*, The Journal of Human Resources **30** (1995), no. 2, 339–361.
13. J.P. Rohweder, *Nachfrage nach Krankenversicherung: Eine Untersuchung des Wahlverhaltens der freiwillig Versicherten in Deutschland*, VVW, 1996.
14. A. Romeu and M. Vera-Hernandez, *Counts with an endogenous binary regressor: A series expansion approach*, The Econometrics Journal **8** (2005), no. 1, 1–22.
15. M. Schellhorn, *A Comparison of Alternative Methods to Model Endogeneity in Count Models: An Application to the Demand for Health Care and Health Insurance Choice*, SEDAP Research Program, 2001.
16. J.V. Terza, *Estimating count data models with endogenous switching: Sample selection and endogenous treatment effects*, Journal of Econometrics **84** (1998), no. 1, 129–154.
17. J.V. Terza, A. Basu, and Rathouz P.J., *Two-Stage Residual Inclusion Estimation: Addressing Endogeneity in Health Econometric Modeling*, Journal of Health Economics (2007).
18. A.M. Vera-Hernandez, *Duplicate coverage and demand for health care. The case of Catalonia*, Health Economics **8** (1999), no. 7, 579–598.

E-mail address: `mvargasbarrenechea@wiwi.uni-bielefeld.de`
URL: `http://www.wiwi.uni-bielefeld.de/~imw/members/mvargas.php`

E-mail address: `melhewaihi@wiwi.uni-bielefeld.de`

Bielefeld University, Postfach 100131, 33501 Bielefeld, Germany