Health Insurance

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Chapter 2

A Dynamic Analysis of the Demand for Health Insurance and Health Care

2.1 Introduction

This chapter empirically tests for the presence of (adverse/advantageous) selection and moral hazard in a market for health insurance. Textbook insurance models predict adverse selection: those with bad risks and thus higher expected health care expenditures buy health insurance with more extensive coverage. Some recent literature points, however, to possible advantageous selection (Hemenway, 1990; De Meza and Webb, 2001; Finkelstein and McGarry, 2006; Cutler, Finkelstein and McGarry, 2008; Fang, Keane and Silverman, 2008; Buchmueller, Fiebig, Jones and Savage , 2008). The idea is that risk may be negatively related to other factors that positively influence the demand for insurance. This may happen, for instance, if those who are more risk averse buy more insurance and also have lower risks because they exert more preventative effort. The empirical literature on advantageous selection is small and mainly from the US and for a specific segment of the health insurance market, namely the elderly.[1] Finkelstein and McGarry (2006) find a negative correlation between long-term care coverage and the use of nursing home care for the oldest old in the US. They show that this advantageous selection is caused by differences in wealth and precautionary behavior. Fang, Keane and Silverman (2008) find advantageous selection for US Medigap insurance, which they mainly attribute to cognitive ability. Both Finkelstein and McGarry (2006) and Fang, Keane and Silverman (2008) find that once they condition on the sources for advantageous selection, there is a positive relation between health risk and insurance coverage.

Elderly are generally subject to more health risks and higher expenditures and are

[1] An exception is the paper by Buchmueller, Fiebig, Jones and Savage (2008).

likely to have different risk preferences than the non-elderly (working age) population. Therefore, the findings for the US cannot straightforwardly be translated to the situation of other countries. Quite a few countries have a system of basic health insurance for the entire population with voluntarily supplementary private health insurance (e.g. Canada, France, Germany, Switzerland, The Netherlands and Ireland). In this paper we will take a closer look at the market for supplementary private health insurance in Ireland, and test whether moral hazard and/or selection (either adverse or advantageous) are present. The choice to study Ireland is motivated by the architecture of the Irish health insurance system, which is an ideal setting for studying adverse/advantageous selection.

Ireland has a national insurance system that covers all citizens and is characterized by substantial copayments. Supplementary private health insurance can be bought to cover the costs of copayments and to provide additional and better quality care. In the early 1960's only about 5% of the population had supplementary private health insurance, in 2005 this had risen to about 50%. One of the characteristics that makes the Irish health care system ideal for studying adverse/advantageous selection is that providers of supplementary private health insurance are by law not allowed to deny applicants and are obliged to use community rating when setting their premiums. This limits the scope for cream skimming of applicants by insurers. Furthermore, until 1997 there was only a single provider for supplementary private health insurance. This provider was state-backed and not-for-profit. Since supplementary private health insurance reduces copayments, health care utilization might increase with insurance purchase if there is moral hazard.

We construct a simple static model where utility is generated from consumption and health and show how in the context of this model both adverse and advantageous selection may arise. We focus on the decision to take supplementary private health insurance and relate this to individual health, shocks in health and past health care utilization. A simple empirical test based on Chiappori and Salanié (2000) shows the presence of asymmetric information. However, disentangling moral hazard from selection into insurance empirically is not straightforward. An individual's health status influences the demand for health care services and might also influence the decision to buy supplementary private health insurance as people will use their current health as a proxy for future health status. In the presence of moral hazard the insurance decision affects health care utilization and health care utilization might again improve the health status. This shows the interrelation of health, insurance status and health care consumption. However, it should also be taken into account that current health is the result of past behavior and health investments, which are affected by individual preferences and health risk. These individual preferences and health risk also affect insurance decisions and future health investments. The unobserved nature of individual preferences and health risk cause that there are severe endogeneity problems.

To obtain insight in the underlying factors affecting individual decisions, we estimate dynamic panel data models. These models have the advantage that they allow for individ-

ual specific effects, which might, for example, be related to heterogeneity in preferences and health risk. Our empirical models differ in this aspect from the static empirical frameworks of Bajari, Hong and Kwhaja (2006), Fang, Keane and Silverman (2008) and Buchmueller, Fiebig, Jones and Savage (2008). The data we use to estimate these models are from the Living in Ireland Survey, which contains panel data from 1994 to 2001. The data contain information on health and socioeconomic characteristics, insurance status and medical consumption. Our empirical results show that the uptake of supplementary private health insurance can mainly be explained by a time trend, state dependence and individual fixed effects. Health shocks do not have an effect on insurance status, and recent health care utilization has only a very small (positive) impact. Also, we do not find any evidence for moral hazard, i.e. those with private insurance do not have a higher level of health care utilization. The fixed effect absorbs all time-invariant effects and to get better insight in what drives the fixed effect that plays such an important role in the uptake of supplementary private health insurance, we decompose them. We find that supplementary private health insurance coverage is negatively correlated to health care utilization. Those with high levels of health care utilization are less likely to have supplementary private health insurance. Even after controlling for income, education is found to be strongly related with the finding of advantageous selection; higher educated individuals are more likely to insure themselves, have lower health risks and have lower levels of health care utilization.

This paper is organized as follows. In section 2.2 we provide some theory. Section 2.3 discusses background information of the Irish health care system. Section 2.4 provides details of the Living in Ireland Survey and in section 2.5 we present the empirical models. In section 2.6 the results of the empirical analyses are discussed. Section 2.7 concludes.

2.2 Theoretical framework

Below we present a simple static model of health insurance status and health investments. From this model we derive conditions under which adverse or advantageous selection arises. We also discuss extending the model to a dynamic framework.

Suppose a household earns income Y, which can be spent on consumption C and medical expenses M such that $Y = C + M$.[2] The household derives utility from consumption and health H. The household can positively influence health by making health investments. This assumption is similar to Bajari, Hong and Kwhaja (2006), who assume that agents derive utility from consumption and health investments. The relative preference for health and consumption is driven by a parameter α.

$$U = u(C)^{\alpha} H^{1-\alpha} \tag{2.1}$$

[2]Like Bajari, Hong and Kwhaja (2006), Brown and Finkelstein (2008) and Fang, Keane and Silverman (2008) we assume that income is exogenously given and thus does not depend on health.

A low α corresponds to a low preference for consumption and a high preference for health. The utility the household derives from consumption and health also depends on the level of risk-aversion of the household. We allow for this via a common constant relative risk aversion (CRRA) specification:

$$u(C) = \frac{C^{1-\gamma}}{1-\gamma} \tag{2.2}$$

This CRRA utility of consumption is also used by Brown and Finkelstein (2008) and Fang, Keane and Silverman (2008). Risk-averse households ($\gamma > 0$) have a strong preference to avoid the risk of large shocks in consumption and they may prefer to insure against shocks.

Medical expenses depend on whether the household has (supplementary private) health insurance I and the volume of health investments V. Health insurance lowers the price $p(I)$ of health investments, but increases medical expenses with the premium r that has to be paid. So total medical expenses M can be written as

$$M = rI + p(I)V \tag{2.3}$$

For ease of exposition we consider both $p(I)$ and V to be unidimensional, but they can also considered to be vectors with $p(I)$ containing the prices of different types of health investments V.

Health is not only a function of health investments V, but also depends on existing health conditions μ and health shocks Δ:

$$H = f^H(V, \Delta, \mu) \tag{2.4}$$

Health is strictly positive and higher values of H are associated with better health. It is assumed that f^H is decreasing in Δ and μ and increasing in V. So V can be used to repair negative effects of existing conditions μ or health shocks Δ. Health shocks Δ can only take values 0 and 1 and the probability λ of the incidence of a negative health shock ($\Delta = 1$) is known to the household.

The household maximizes expected utility by choosing optimal levels of I and V. The health insurance decision I has to be taken before the realization of the health shock Δ is revealed, while the amount of health investments V is chosen after a possible shock occurred. The optimal health insurance decision thus depends on the existing conditions, $I^* = I(\mu)$. And the optimal level of health investments V is given by $V^* = V(\Delta, I^*, \mu)$.

Conditional on I, Δ and μ the optimal amount of health investments can be derived from:

$$\frac{\partial U}{\partial V} = 0 \qquad \Longleftrightarrow \qquad \frac{C}{H} = \frac{\alpha}{1-\alpha}(1-\gamma)\frac{p(I)}{\partial f^H(V,\Delta,\mu)/\partial V} \tag{2.5}$$

Let us assume that health returns to health investments are either constant or decreasing, $\frac{\partial^2 f^H(V,\Delta,\mu)}{\partial V^2} \leq 0$. The left-hand side of the first-order condition shows the relative share

of consumption over health and is decreasing in V (because C is decreasing in V and H increasing in V), while the right-hand side is non-decreasing in V. The first-order condition basically states that health investments V are lower when the relative weight of consumption in the utility function is higher (α is higher), the price of health investments (medical care) increases and when the household is less risk-averse (γ smaller).

Moral hazard is usually defined as excess demand for health investments due to having health insurance. The uptake of health insurance has two effects: first, it lowers the price of health investments $p(I)$ and second, it reduces the total amount that can be spent on consumption and health investments by the insurance premium r. As already stated above, the reduction in price has a direct positive effect on health investments and households will thus maintain a higher health level. A minimum condition for taking health insurance is that the optimal combination of consumption and health investments after a negative health shock Δ is not in the choice set if the household would not have taken health insurance. This provides the condition

$$\left(p(I=0) - p(I=1)\right) V(\Delta = 1, I^* = 1, \mu) > r \tag{2.6}$$

So those households which decided to take health insurance and experience a negative health shock have a higher health consumption than they would have without health insurance. In our empirical application we will investigate moral hazard in our data by testing whether $V(\Delta, I^* = 1, \mu) > V(\Delta, I^* = 0, \mu)$.

The optimal health insurance decision follows from maximizing expected utility with and without insurance. With insurance expected utility equals

$$E\left[U(C,H)|I=1,\mu\right] = \lambda U(V(\Delta=1, I=1, \mu)) + (1-\lambda)U(V(\Delta=0, I=1, \mu))$$

and without health insurance

$$E\left[U(C,H)|I=0,\mu\right] = \lambda U(V(\Delta=1, I=0, \mu)) + (1-\lambda)U(V(\Delta=0, I=0, \mu))$$

A household chooses to insure if $E\left[U(C,H)|I=1,\mu\right] > E\left[U(C,H)|I=0,\mu\right]$, which implies

$$\begin{aligned} \lambda \left(U(V(\ \Delta=1, I=1, \mu)) - U(V(\Delta=1, I=0, \mu))\right) \\ > (1-\lambda)\left(U(V(\Delta=0, I=0, \mu)) - U(V(\Delta=0, I=1, \mu))\right) \end{aligned} \tag{2.7}$$

Having insurance is always more beneficial in case a negative health shock occurred and health investments are higher than in case no health shock occurred. This imposes that

$$\begin{aligned} U(V(\Delta=1, I=1, \mu)) - U(V(\Delta=1, I=0, \mu)) \\ > U(V(\Delta=0, I=I, \mu)) - U(V(\Delta=0, I=0, \mu)) \end{aligned} \tag{2.8}$$

Conditional on the preference parameters α and γ, and given insurance premium r and price function $p(I)$, we can therefore distinguish three cases.

The first case is where μ is sufficiently low to guarantee that $U(V(\Delta = 1, I = 1, \mu)) < U(V(\Delta = 1, I = 0, \mu))$. This inequality states that even if a negative health shock occurs, the household has a higher utility without health insurance. It will therefore not be beneficial for the household to take health insurance. Recall that a low value of μ implies that the household is very healthy (does not have any existing conditions).

As second case consider a household with many existing health conditions, i.e. a high value of μ. If μ is high enough to ensure that $U(V(\Delta = 0, I = I, \mu)) > U(V(\Delta = 0, I = 0, \mu))$, the household will always insure itself. The household derives more utility from insurance compared to non-insurance even if it is not hit by a negative health shock.

In the third case μ is between these two extremes: it is such that if a negative health shock occurs the household is better off if it has health insurance, $(U(V(\Delta = 1, I = 1, \mu)) > U(V(\Delta = 1, I = 0, \mu))$, while if no shock occurs the household has higher utility if it does not have health insurance $(U(V(\Delta = 0, I = I, \mu)) < U(V(\Delta = 0, I = 0, \mu)))$. Whether or not the household buys health insurance depends on the risk λ that a household is hit by a negative health shock. Obviously, the household is more inclined to take health insurance for higher values of λ.

If households are only heterogeneous in existing health conditions μ, the three cases discussed above clearly show adverse selection. Those with bad health (high μ) always buy health insurance, while those with good health (low μ) never take health insurance. However, within a population households most likely not only differ in existing health conditions μ, but also in preference parameters α and γ.

Above, we showed that households who care more about health (low α) and are more risk-averse (high γ) invest more in health (they have a higher V). These households are thus more likely to benefit from taking health insurance, which implies that the uptake of health insurance decreases in α and increases in γ. However, households with a low α or high γ also had a higher level of health investments in the past and thus maintained higher health levels and are less likely to suffer from many existing health conditions.[3] It is therefore likely that within the population μ is positively correlated to α and negatively correlated to γ.

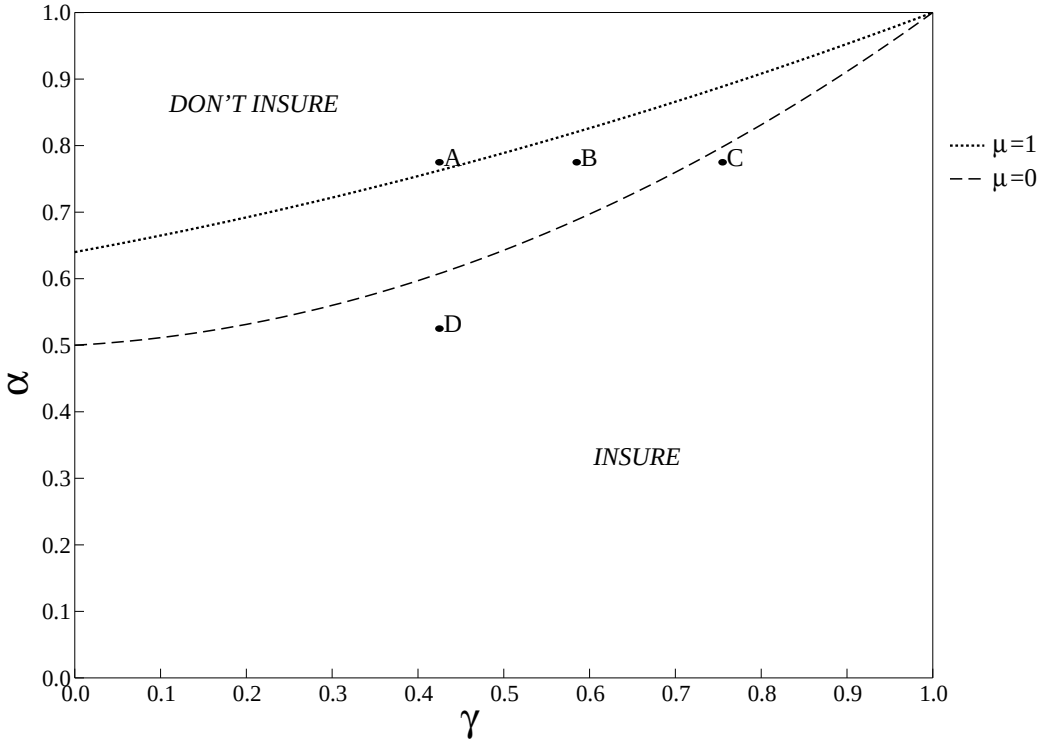
If indeed within the population the variation in α and γ compared to the variation in μ is substantial and there exists strong correlation between these parameters, then advantageous selection arises. Households with a low α and/or high γ and low μ are more inclined to buy health insurance than households with a high α and/or low γ and high μ.

To illustrate this argument we solved the model for different values of α and γ, assuming a linear function for $f^H(V, \Delta, \mu)$.[4] The results are displayed in Figure 2.1. The figure

[3]We follow Bajari, Hong and Kwhaja (2006) and Cardon and Hendel (2001) in interpreting health investments while being in good health as preventive investments.

[4]More specifically, we assumed that $H = 100 + V - 50\Delta - 50\mu$. Income Y equals 100, the insurance premium r is 10, the price of health investments without insurance is $p(I = 0) = 1$ and with insurance $p(I = 1) = 0.5$. The probability of experiencing a negative health shock λ is 0.1.

Figure 2.1: Optimal insurance decision for α/γ-combinations



presents for μ=0 and μ=1 curves where the household is indifferent between buying and not buying insurance. So these should be considered as the relevant curves for healthy households ($\mu = 0$) and unhealthy households ($\mu = 1$). If preferences are such that a household is located below the curve insurance is bought, and above it no insurance is bought.

Indeed the figure shows that *ceteris paribus* the preference for health insurance decreases in α and increases in μ and γ. The usual adverse selection thus occurs if health conditions μ are uncorrelated to preferences α and γ, i.e. the household in point B only insures when having health conditions. Advantageous selection can occur if existing health conditions are correlated with preferences. Consider for example point A and D in the figure. The household in point A has a strong preference for consumption relative to health. This household thus will spend little on health investments and therewith maintain a low health level. For the household in point D the opposite holds: it invests more in health and will thus be in better health. This makes the household in point D likely to suffer from fewer health conditions than the household in point A. However, the household in point D will always buy health insurance, while the less healthier household in point A never takes health insurance. This connects to the 'heterogeneous preferences' explanation of De Meza and Webb (2001) for advantageous selection and is found by Fang, Keane and Silverman (2008) and Finkelstein and McGarry (2006). Another possibility is

that initial health conditions and/or the probability of a shock are correlated with the risk preference-parameter γ. Again the more risk-averse household in point C invests more in health than the less risk-averse household in A, i.e. it undertakes more preventive efforts to sustain good health. Therefore, the household in C that always buys insurance is likely to be in better health than the household in A, that never buys health insurance. This is the 'differences in risk preference' explanation of De Meza and Webb (2001). From this it may be clear that whether adverse or advantageous selection is relevant in a population depends on the joint distribution of α, γ and μ in the population.

Above we already argued that the correlation between the preference parameters α and γ and existing health conditions μ most likely is due to past health investments and preventive health consumption. Indeed, the insurance decision is an inherently dynamic process and households consider long-term consequences of current behavior. Health care consumption depends on insurance status and the decision to insure is driven by expected health care costs. In line with this dynamic process one could specify a dynamic model that includes wealth and where individuals make a sequence of choices to optimize expected lifetime utility. Bolhaar (2009) formulates such a model and shows that the basic results presented above carry over to the dynamic case. In our empirical application we have access to panel data that cover eight years and quite some changes in health insurance status are observed over these eight years. We therefore will specify and estimate dynamic panel data models for the insurance decision and for health care consumption. Our empirical analysis shows that results change dramatically when fixed effects and dynamics are introduced.

2.3 The Irish health care system

Ireland's health care system is a mix of public and private, both in funding and in provision of care. The government provides (funded from general taxation) health care services to all citizens, but with considerable copayments for visits to General Practitioners (GP), outpatient visits to medical specialists and hospital stays. In Table 2.1 copayments for medical services are listed for 2006. For example, the copayment for a visit to a GP is on average € 40, and for a visit to a medical specialist € 60. Statutory charges for public inpatient hospital stays are € 60 a day with a maximum of € 600 per year.

Households with an income below a certain threshold are eligible for a Medical Card. Those covered by a Medical Card do not have to make copayments for visits to the GP or to medical specialists in public hospitals. Furthermore, they don't pay for inpatient care in public hospitals and get dental, aural and ophthalmic care for free as well as prescribed medication. The income threshold for Medical Card eligibility depends on the household composition. Table 2.2 provides the calculation of weekly income thresholds for 2005. Around 30% of the Irish population are covered by a Medical Card.

Table 2.1: Copayments for medical services in Ireland in 2006

GP visit				
if Medical Card, maternity services or Hepatitis C	$\Longrightarrow$	€	0	
others	$\Longrightarrow$	€	40	
Medical specialist visit (as an outpatient)				
if referred by GP, return visit for same illness/accident	$\Longrightarrow$	€	0	
if Medical Card, maternity services	$\Longrightarrow$	€	0	
if child referred from child health clinic/school health examinations	$\Longrightarrow$	€	0	
if child with disability/prescribed illness, babies under 6 weeks	$\Longrightarrow$	€	0	
if not referred by GP	$\Longrightarrow$	€	60	
if want to use private capacity in public hospital (whether referred or not), or see specialist in private clinic	$\Longrightarrow$			the appropriate fee
Hospital stay (inpatient), charges per day				
if Medical Card, maternity services, prescribed infectious disease	$\Longrightarrow$	€	0	
if child referred from child health clinic/school health examinations	$\Longrightarrow$	€	0	
if child with disability/prescribed illness/mental illness (under 16)	$\Longrightarrow$	€	0	
if baby under 6 weeks	$\Longrightarrow$	€	0	
others (treatment in public capacity)	$\Longrightarrow$	€	60	, max. € 600 per year, no consultant charges
treatment in private capacity of public hospital:				
regional/voluntary and teaching hospital	$\Longrightarrow$	€	457	to € 611 + consult. charges
county/voluntary non-teaching hospital	$\Longrightarrow$	€	389	to € 520 + consult. charges
district hospital	$\Longrightarrow$	€	206	to € 257 + consult. charges
private clinic	$\Longrightarrow$			the appropriate fee

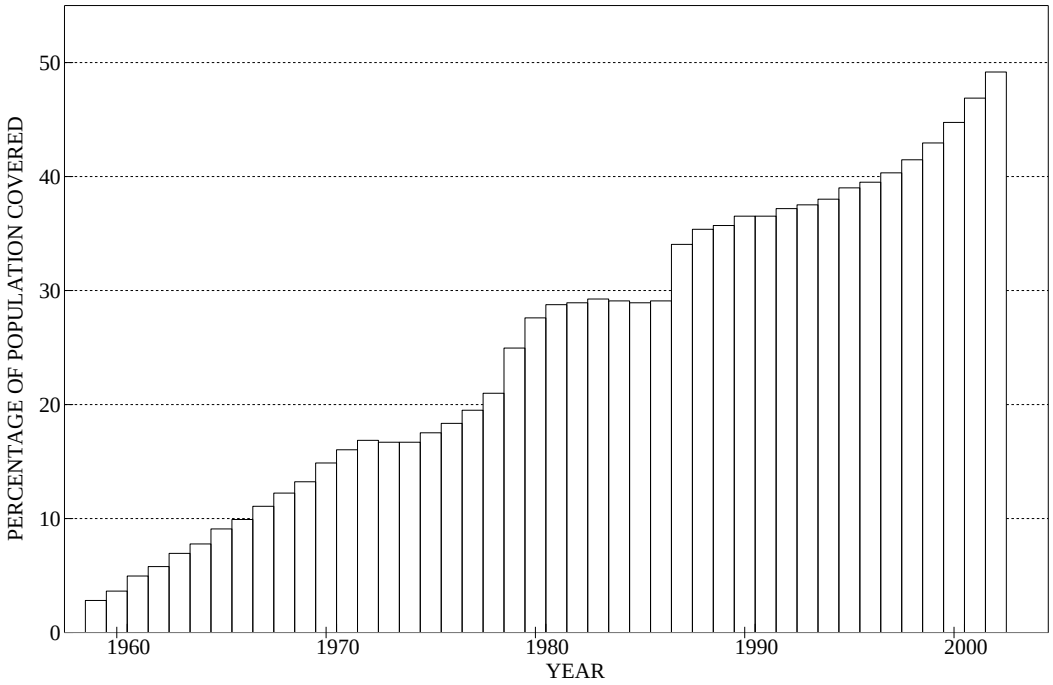
Note: the fee for treatment in the private capacity of a public hospital depends on whether it is only for day-care and if not, whether a private or semi-private room is wanted

Note: people with Hepatitis C who contracted the disease through the use of Human Immunoglobulin-Anti-D or from the receipt within Ireland of any blood product or a blood transfusion and who have a Health Amendment Act Card can use GP services free of charge

Table 2.2: Weekly income thresholds (gross less tax and pay related social insurance) for Medical Card eligibility in 2005 (in euros)

	Under age 66	Age 66 or older
Single person living alone	184.00	201.50
Single person living with family	164.00	173.50
Married couple	266.50	298.00
Lone-parent with dependent children	266.50	298.00
For 1st and 2nd child under age 16	+38.00	+38.00
For 3rd and subsequent children under age 16	+41.00	+41.00
For 1st and 2nd child over age 16 without income	+39.00	+39.00
For 3rd and subsequent children over age 16 without income	+42.50	+42.50
For each dependant over age 16 in full-time non-grant aided third level education	+78.00	+65.00

Figure 2.2: supplementary private health insurance coverage in Ireland



Supplementary private health insurance reimburses part of the copayments and, depending on insurance contract, gives access to care in public and private hospitals and clinics. Moreover, people can opt to buy insurance that covers hospital stays in a private room, or a room with fewer other patients. As a result, individuals with supplementary private health insurance face fewer and shorter waiting lists, have much more flexibility in the choice of medical specialist and have more privacy as inpatient. For private health insurance an adult paid in 2006 a premium of slightly less than € 50 per month. Such an insurance reduces, for example, copayments for the GP with € 20 (for a maximum of 25 visits per year).

Figure 2.2 shows the percentage of the population with private health insurance. The figure shows an increasing trend, from only 4% of the population privately insured in 1960 to almost 50% in 2002. Until 1996 private health insurance was only provided by Voluntary Health Insurance (VHI), which was a state-supported and non-profit provider. Due to European Union regulation the market opened in 1996, and in 1997 a second provider, British United Provident Association Ireland (BUPA Ireland), entered the market. However, VHI still dominates the market. In 2001 only 3.6% of the population had private health insurance from BUPA (Colombo and Tapay, 2004). Both providers are obliged to accept everybody, irrespective of age, health status and other factors. Furthermore, premiums should be based on community rating. These regulations reduce the scope for

insurance companies to select clients with favorable characteristics.[5] Some employers offer to pay part of the insurance premium for their employees or have a group scheme with one of the two insurers which their employees can make use of. Individuals with an employer who offers to insure on their group scheme can thus purchase supplementary private health insurance at a lower price. These group policies can be offered by insurers with a maximum of 10% premium reductions, to avoid too large differences with the premiums on the individual policy market. Only a small number of individuals has supplementary private health insurance paid for completely by their employer, 7% (in November 2002). Another 10% has an employer that pays part of the costs of supplementary private health insurance (Health Insurance Authority, 2003).

Even though supplementary private health insurance has some overlap in coverage with the Medical Card, not only individuals without a Medical Card buy supplementary private health insurance. Harmon and Nolan (2001) document the attitude towards supplementary private health insurance obtained from the regular consumer survey in 1999 of the Economic and Social Research Institute (ESRI). According to this survey the most important reasons for people to buy supplementary private health insurance are 'fear of large medical or hospital bills' (88.5% of the respondents regards this as being 'very important') and 'to be ensured of getting into the hospital quickly when needed' (very important to 86.4%), which refers to the waiting lists in the public health care system. Other reasons included 'being sure of getting good treatment'(77.4%), 'being sure of getting consultant care' (67.5%) and 'arrange hospital treatment when it suits you' (68.7%). Less important was luxury: 'have a private or semi-private room in hospital' was very important to only 27.8%, 'being able to get into a private hospital' to 27.2%. Most private care is delivered by specialists in public hospitals in their time for private practice. When asked to choose the single most important reason to take supplementary private health insurance - waiting lists, quality of care or privacy - 75% of the insured and 70% of the uninsured responded waiting lists. Since the Medical Card only reduces copayments, this explains why also some Medical Card holders buy supplementary private health insurance.

2.4 The data

2.4.1 Sample construction

The data are from the Living in Ireland Survey (LIIS), the Irish contribution to the European Community Household Panel (ECHP) with eight waves of data covering the years 1994-2001. In 1994 a representative sample was drawn from electoral registers. Until

[5]When entering the Irish market for supplementary private health insurance BUPA tried to circumvent community rating by offering (age-related) 'cash plans' rather than insurance. However, the Irish government did not allow for such cream-skimming (Light, 1998).

2001, individuals in this sample and all their household members over age 16 were each year asked to complete a questionnaire. The individual questionnaire contains questions on socioeconomic status, health, income in the previous year, health care coverage, utilization of health services, etc. Furthermore, the head of household (defined as the household member responsible for accommodation) received a household questionnaire. The household questionnaire included questions on, for example, household composition, housing and physical environment, standard of living and sources of household income. The LIIS contains eight waves of data both at the individual and household level.

In total 4048 households participated in the first wave in 1994, which was 57% of the originally sampled households. Table 2.3 shows the attrition pattern. After the initial wave the annual attrition rate was between 12% and 18%. Attrition occurred most often because households moved, refused to participate or could not be contacted. If a household did not complete the questionnaire, no extra effort was made in the next years to contact the household again. As a result 48% of the households that participated in the initial wave were still participating in 2000. Therefore, 1554 new households were added to the sample in 2000 (see Watson, 2004; also for a more extensive discussion of the survey). Nolan, Gannon, Layte, Watson, Whelan and Williams (2002) checked the pattern of attrition in detail and conclude that the main reason for loss of households after the first year was difficulty of tracing households that moved. Relatively many of these households were single young adults. They did not find evidence of disproportionate loss of households in particular parts of the income distribution. Within the households that completed the questionnaire, about 95% of the eligible individuals (those over age 16) were interviewed successfully. In total 2948 individuals participated in all 8 waves. The average number of observations over eight waves is 4.73 for individuals that entered the sample in 1994 and 1.65 for individuals added to the sample in 2000.

To get some more insight in the attrition, we compare households sampled in 1994 that still participated in 2000 with Census data.

Table 2.3: Number of observations in each wave

	1994	1995	1996	1997	1998	1999	2000 orig.	2000 new	2000 total	2001
households										
completed questionn.	4048	3584	3174	2945	2729	2378	1952	1515	3467	2865
response rate	57%	82%	84%	88%	87%	84%	83%	57%	69%	78%
individuals										
completed questionn.	9904	8531	7488	6868	6324	5451	4529	3527	8056	6521
response rate in compl. hsds	95%	94%	95%	95%	96%	95%	95%	89%	93%	93%
compl. all quest. since 1994		7942	6636	5782	5124	4329	3391	0	3391	2948

Source: Watson, 2004

Table 2.4: Comparison between Living in Ireland Survey and Census, both 1996

	Living in Ireland Survey	Census
education		
primary	36.8%	35.3%
lower secondary	21.2%	20.5%
upper secondary	27.3%	30.2%
third, no degree	5.7%	5.0%
third, degree	8.6%	8.9%
age		
20-24 years	10.9%	12.1%
25-29 years	9.3%	10.7%
30-34 years	8.9%	10.8%
35-39 years	9.7%	10.5%
40-44 years	9.4%	9.9%
45-49 years	9.4%	9.3%
50-54 years	8.8%	7.7%
55-59 years	7.6%	6.4%
60-64 years	6.7%	5.7%
65-69 years	5.8%	5.2%
70-74 years	4.9%	4.6%
75-79 years	3.6%	3.5%
80-84 years	2.2%	2.3%
85 years and over	1.1%	1.4%
household size	3.4	3.1
living in city	23.6%	26.8%
female	50.4%	50.4%
economic status		
employed	48.7%	47.3%
unemployed	6.2%	7.2%
full-time education	8.2%	12.3%

Note: as cities we consider Dublin, Cork, Limmerick, Galway or Waterford.

Table 2.5: Classification of incomes from the existing sample into the income percentiles of those newly add, both 2000

income percentiles of newly added observations	percentage of original observations in this percentile
1^{st} percentile	10.9%
2^{nd} percentile	11.7%
3^{rd} percentile	10.6%
4^{th} percentile	10.3%
5^{th} percentile	9.6%
6^{th} percentile	10.7%
7^{th} percentile	9.6%
8^{th} percentile	9.3%
9^{th} percentile	9.1%
10^{th} percentile	8.4%

In Table 2.4 we show distributions of educational levels, age, household size, gender and socioeconomic status in both the LIIS and the Census. Education and gender have very similar distributions, but 20 to 40 year old individuals are somewhat underrepresented and 50 to 60 years are somewhat overrepresented in the LIIS. Therefore, the LIIS also contains less individuals in full-time education, less individuals living in one of the 5 biggest cities and the average household size in the LIIS is slightly higher. This confirms the conclusion of Nolan, Gannon, Layte, Watson, Whelan and Williams (2002) that in particular young single adults are difficult to follow.

The census does not contain income data. Therefore, we use the newly sampled households in 2000 to compare with households sampled in 1994 and still participating in 2000. From the comparison of income distributions it can be seen that households from the original sample have somewhat lower earnings than newly sampled households (see Table 2.5).

2.4.2 Sample and descriptive statistics

To avoid complications in the empirical analyses we only consider households without children or with children under age 16. Older children may be employed or financially independent of their parent(s). Recall that a Medical Card not only covers the holder, but also the spouse and dependent children. Therefore, in households with older children it may occur that only part of the household members have a Medical Card, which affects the joint household decision for supplementary private health insurance. Furthermore, we exclude the 2001-wave observation of individuals over age 70 that were interviewed after 1 July, 2001. At this date an extension of the Medical Card scheme took effect that made all individuals aged 70 or above eligible for a Medical Card irrespective of their means.

In Table 2.6 we show the mobility in our data in supplementary private health insurance status and Medical Card holdership. Both variables are measured at the household

Table 2.6: Transition frequencies of changes in private insurance status and Medical Card holdership

		status in year t				
		only PHI	none	PHI+MC	only MC	
	only PHI	93.6%	4.1%	1.9%	0.4%	100.0%
status in	none	12.1%	79.2%	0.5%	8.2%	100.0%
year $t-1$	PHI and MC	13.0%	4.2%	65.1%	17.7%	100.0%
	only MC	0.7%	6.5%	1.3%	91.5%	100.0%

Note: PHI = supplementary Private Health Insurance, MC = Medical Card

Table 2.7: Transition frequencies of changes in health variables

		status in year t		
		no health problem	health problem	
	no health problem	92.2%	7.8%	100.0%
	health problem	26.7%	73.3%	100.0%
status in				
year $t-1$		no bad mental health	bad mental health	
	no bad mental health	90.5%	9.5%	100.0%
	bad mental health	70.5%	29.5%	100.0%

level. Each year about 6.1% of the households that did not have supplementary private health insurance in the previous year, take supplementary private health insurance. Of the households that had insurance coverage in the previous year, on average 5.6% decides not to renew their coverage. In particular, households with a Medical Card stop their private health insurance.

Table 2.8 provides descriptive statistics of the relevant variables.[6] Around 36% of the households have a Medical Card and among the Medical Card holders 8% of the households take supplementary private health insurance. The uptake of supplementary private health insurance is much higher among households without a Medical Card. In this group more than 67% of the households are privately insured. Women, older individuals, high educated individuals and individuals living in one of the five big cities are more inclined to take supplementary private health insurance. The privately insured are less often unemployed and have on average a higher income.[7] Furthermore, getting an offer for buying supplementary private health insurance from the employer, increases the likelihood that an individual takes supplementary private health insurance.

[6]Not all variables are included in each wave. The number of visits to the GP, dentist and medical specialist are not included in the first wave. Smoking and Body Mass Index are only available from the fifth wave onwards.

[7]Net weekly income is right-censored at £2000 per week. The sample only contains 25 right-censored observations.

Table 2.8: Descriptive statistics

	no PHI no MC	no PHI MC	PHI no MC	PHI MC
HOUSEHOLD LEVEL				
frequencies	21.1%	33.0%	43.0%	2.9%
household size	3.1	2.3	3.2	1.7
number of children under 16	1.3	0.8	1.3	0.2
single	21.8%	41.4%	14.7%	45.3%
single parent	2.7%	8.1%	0.8%	1.7%
couple without children	21.4%	25.9%	29.1%	44.6%
couple with children	54.1%	24.6%	55.5%	8.4%
living in city	25.2%	21.6%	34.9%	31.4%
employer offer private insurance	9.3%	0.8%	21.6%	0.3%
net weekly household income (median)	£296.7	£135.0	£456.3	£144.9
net weekly real household income (median)	£273.6	£125.7	£417.9	£132.4
INDIVIDUAL LEVEL				
female	49.6%	57.5%	53.7%	58.0%
age (in years)	41.4	58.1	44.9	66.8
years of education	9.7	7.7	11.7	9.3
employed	67.9%	17.2%	68.6%	13.3%
unemployed	2.2%	7.5%	0.7%	0.2%
full-time education	0.2%	0.1%	0.4%	0.2%
number of GP visits	2.7	6.7	2.9	6.5
number of specialist visits	0.5	0.8	0.9	1.5
number of hospital nights	0.8	2.0	1.0	3.8
women gave birth	7.5%	3.3%	7.6%	1.2%
bad mental health	11.1%	20.0%	9.4%	15.1%
health problem	11.8%	34.9%	11.9%	41.2%
mental	1.2%	3.6%	0.5%	3.4%
physical type I	4.8%	13.4%	4.8%	16.2%
physical type II	8.0%	26.5%	8.2%	27.6%
Body mass index (BMI)	25.4	25.2	25.0	25.3
Obese (BMI $\geq$ 30)	10.9%	12.7%	8.5%	11.9%
Daily smoker	32.8%	32.0%	15.9%	10.0%

Note: PHI = supplementary Private Health Insurance, MC = Medical Card

Table 2.9: Classification health problems

Mental	Mental handicap/mental retardation
	Mental disorders
	Depression
	Bad nerves - cause not specified
Physical type I	Diseases of the skin
	Musculoskeletal diseases
	Infections and parasitic diseases
	Bad back - cause not specified
	Headaches, pain - cause not specified
Physical type II	Diseases of the blood
	Neoplasms (cancers)
	Diseases of the nervous system
	Diseases of the circulatory system
	Diseases of the digestive system
	Diseases of the genitourinary system
	Congenital anomalies
	Diseases of the respiratory system
	Accidents and/or their consequences
	Endocrine diseases
	Physical handicap

The test score on a mental health questionnaire is used to create an indicator for current mental health being poor.[8] Information in the data on health problems will be used in two ways. First, we define an indicator for the presence of a health problem. And second, we will use a set of three indicators to distinguish different types of health problems: mental health problems and two types of physical health problems. The set of health problems that are expected to be more sensitive to price variations are labeled 'Physical type I' health problems. Health problems that are expected to be less sensitive to the price of care are labeled 'Physical type II' health problems (see Table 2.9 for the classification). Medical Card holders are on average less healthy than individuals without a Medical Card: they have more often a health problem and have worse mental health.

Both within the group of Medical Card holders and the group of non-holders, privately insured individuals have on average better mental health, but slightly worse physical health. At first sight there is no strong indication of adverse selection or advantageous selection into supplementary private health insurance.

Transition probabilities in our data for health problems and bad mental health are shown in Table 2.7. Both are measured on the individual level. The data show that individuals have a probability of 7.8% each year to get a health problem if they did not have one last year. For 73.3 % of the individuals with a health problem their problem persists. This indicates that a substantial part of the health problems is chronic. For bad

[8]The General Health Questionnaire (GHQ) is a twelve-question test developed by Goldberg to measure mental health. The GHQ-12 has proved to work just as well as its larger counterparts with 28 or 60 questions (Banks, Clegg, Jackson, Kemp, Stafford and Wall, 1980). The (conservative) threshold for having 'a realistic chance of having a (mild) mental illness or disorder' is a score of at least 4.

Table 2.10: Raw correlations between having supplementary private health insurance and health care utilization

	individual level	household level
GP visits	-0.132^{***}	-0.180^{***}
specialist visits	0.039^{***}	0.041^{***}
nights in hospital	-0.025^{***}	-0.036^{***}

***=significant at 1% level, **= significant at 5% level, *=significant at 10% level

mental health the persistence rate is much lower. Of all individuals that suffers from bad mental health, only 29.5% still suffers from bad mental health a year later.

Health care utilization variables are observed at the individual level and concern the number of times an individual has visited a GP in the past 12 months, the number of times s/he visited a medical specialist in the past 12 months and the number of nights spent in the hospital in the last 12 months. Medical Card holders on average visit the GP and the specialist more frequently and stay more nights in hospital than individuals without a Medical Card. Both within the group of Medical Card holders and non-holders, those with supplementary private health insurance utilize more health care services than the individuals without supplementary private health insurance. This could suggest that moral hazard plays a role.

There are no substantial differences in Body Mass Index between individuals with and without a Medical Card and supplementary private health insurance. Smokers are less likely to take supplementary private health insurance.

2.4.3 Asymmetric information

Chiappori and Salanié (2000) suggest a simple but robust test for asymmetric information. In the presence of either moral hazard or adverse selection there should be a positive (raw) correlation between health care utilization and having supplementary private health insurance. Since in Ireland insurers are obliged to accept everyone and have to use community rating, we do not have to control for the level of premiums or for characteristics observed by the insurer. Table 2.10 provides the correlations between different measures of health care utilization and health insurance status. It should be noted that both visits to the GP and nights spent in hospital are negatively correlated with insurance purchase. Visits to a medical specialist, on the other hand, is positively correlated with insurance purchase. All correlations are significant. A negative correlation implies advantageous selection possibly in the presence of moral hazard. The correlation is most substantial for visits to the GP. Although the tests clearly indicates that there is asymmetric information, the tests are not informative about different sources of asymmetric information or underlying behavioral mechanisms.

2.5 Empirical model

In this section we empirically investigate the underlying sources of the asymmetric information. In particular we estimate dynamic panel data models for supplementary private health insurance purchase and utilization of health care. This should provide insight in individual behavior.

Concerning the *insurance decision*, we assume that the decision to take supplementary private health insurance (I_{it}) is made at the household level i at different points in time t.[9] State dependence is important in our data (see Table 2.6) and we therefore include lagged insurance status in the model. The decision to take supplementary private health insurance might also depend on whether the household qualifies for a Medical Card MC_{it}. Medical Cards cover for copayments and therefore the benefits of supplementary private health insurance will be lower for Medical Card holders. Household income Y_{it} is also included as potentially important determinant. We interact Y_{it} with MC_{it}, as income effects may differ for households with and without Medical Card.

We include two variables that describe current health H_{it} of the household. The first variable is the fraction of the interviewed household members in bad mental health (i.e. whether GHQ $\geq$4) [10], the other is the fraction of the interviewed household members with a health problem (see Table 2.9). Furthermore, we include variables describing past year health care utilization M_{it-1}. In particular, we include the average number of times household members visited a GP, the average number of times household members went to a specialist and the average number of nights they stayed in hospital. Our model for the household's private health insurance decision is a linear probability model:

$$I_{it} = \beta_1 I_{it-1} + \beta_2 MC_{it} + \beta_3 Y_{it}(1 - MC_{it}) + \beta_4 Y_{it} MC_{it} + \beta_5 H_{it-1} + \beta_6 M_{it-1} + \beta_7 X_{it} + \mu_i + \varepsilon_{it} \tag{2.9}$$

The household specific effect μ_i captures time-invariant characteristics, known to the household, but unobserved by the researcher. It may, for instance, include the rate of risk-aversion, preference for health, both factors that determine whether adverse or advantageous selection is relevant. Because preference parameters and risk aversion affect many of the observed characteristics, such as health status and lagged medical consumption, μ_i should be a fixed effect rather than random effect. Therefore, after estimating equation (2.9) we relate the household specific component to variables observed in our data that may proxy the above mentioned factors. The vector X_{it} captures additional household characteristics that may be important in the insurance decision, like household size and a dummy variable if a baby was born in the household. Household size affects the

[9] Our data show that in almost all households either all household members are covered by supplementary private health insurance or none. Also Harmon and Nolan (2001) assume that in Ireland the decision for supplementary private health insurance is taken at the household level.

[10] Recall that only for household members of age 16 and above variables describing individual characteristics are collected.

income threshold for medical card eligibility and the premium for supplementary private health insurance. Employers may offer workers a compensation for the supplementary private health insurance premium and we therefore include a dummy variable indicating whether the household have such an offer. Since households without employed members cannot receive offers, we add an indicator variable for these households. Finally, X_{it} includes a time-trend, this should pick up for instance the increased popularity of supplementary private health insurance in Ireland.

We model *health care utilization* in the past 12 months (M_{it}) at the individual level. We allow for state dependence in health care utilization. Furthermore, individual health care utilization in the past 12 months will depend on the household's private health insurance status in the past year (I_{it-1}) and whether or not the household was a Medical Card holder in the past year (MC_{it-1}). Income and health status are important factors explaining health care utilization, we therefore include household income in the preceding year (Y_{it-1}) and health status at the beginning of the period H_{it-1} in the regression model. The individual health status is measured by whether or not the individual has bad mental health and a health problem. Our dynamic model for health care utilization is therefore given by

$$M_{it} = \gamma_1 M_{it-1} + \gamma_2 I_{it-1} + \gamma_3 MC_{it-1} + \gamma_4 Y_{it-1} + +\gamma_5 H_{it-1} + \gamma_6 X_{it-1} + \eta_i + \nu_{it} \quad (2.10)$$

where η_i is the individual specific effect, capturing again elements such as risk-aversion, preferences for good health and innate health endowment. In X_{it-1} we include dummy variables for being employed, giving birth, age effects and a time-trend.

We separately estimate the model for the three measures of health care utilization. The first measure is the number of visits to a GP in the past 12 months. The second measure is the number of specialists visits in the past 12 months. In the model for the specialist visits we also include the number of GP visits as explanatory variable. The underlying idea is that Ireland has a referral system and that the GP acts as gatekeeper for specialist (and hospital) care. The third measure is the number of nights the individual stayed in hospital in the past 12 months. In this specification we also include the number of GP visits and specialists visits as explanatory variables.

We use different methods to estimate the models. First, as a baseline case we use pooled OLS. Most empirical research on health insurance and medical care utilization is based on cross-sectional analyses and uses OLS (e.g. Jones, Koolman and Van Doorslaer, 2006; Stabile, 2001; Gruber and Poterba, 1994; Wolfe and Goddeeris, 1991; Savage and Wright, 2003; Harmon and Nolan, 2001; Holly, Gardiol, Domenighetti and Bisig, 1998; Hurd and McGarry, 1997; Blumberg, Nichols and Banthin, 2001; Chernew, Frick and McLaughlin, 1997; Liu and Chen, 2002; Vera-Hernández, 1999; Bundorf, Herring and Pauly, 2005; Ettner, 1997; Cameron, Trivedi, Milne and Piggott, 1988). We use both a specification with Body Mass Index and whether or not the individual smokes daily as regressors and a specification without these regressors. The reason for excluding these

regressors is that these variables are only recorded in four of the eight waves. OLS provides associations that might be informative about selection and moral hazard. To investigate underlying determinants of asymmetric information, we estimate fixed effect models. These models allow for unobserved household (insurance decision) and individual (health care utilization) specific effects. We estimate a static fixed effect model and also estimate dynamic panel data models to distinguish between state dependence and fixed effects.

2.6 Results

2.6.1 Supplementary private health insurance purchase

Table 2.11 shows estimation results of the linear probability model for the household's private health insurance decision. A positive coefficient is associated with a higher probability of insurance purchase. The first three columns refer to OLS estimates, the fourth to fixed effects estimates (using within estimation) and the last column refers to the Arrelano-Bond estimator for the dynamic panel data model. First note that there are substantial differences between the OLS and the panel data estimates. OLS estimates are (in both specifications) almost always significant and covariate effects are relatively large. One may therefore conclude that the association measured by the OLS estimates are not very informative about underlying decision making.

The pooled OLS estimates show that Medical Card holders are about 30 percentage points less likely to purchase of supplementary private health insurance. See also Harmon and Nolan (2001) who find using the 1994 wave of LIIS that Medical Card holdership significantly reduces the probability of having supplementary private health insurance. A similar result is found by Hurd and McGarry (1997), who show that among elderly those covered by Medicaid are 43.1% less likely to buy supplementary private health insurance. However, this effect becomes almost 20 times smaller and insignificant in the panel data estimates, implying that individuals who obtain or lose entitlement to a Medical Card do not immediately change their insurance decision. The selection of individuals entitled to Medical Cards is, therefore, the driving force for the difference in supplementary private health insurance coverage between Medical Card holders and non-holders. Households may thus not consider Medical Cards and supplementary private health insurance as very close substitutes. It should, however, be noted that if we estimate our models again only on the sample of households without a Medical Card the parameter estimates do not change signs or significance.

A similar pattern shows up for income. Pooled OLS estimates indicate a significant positive association between income and private health insurance purchase. However, the panel data estimates are much smaller, implying again that changes in income do not change insurance decisions.

Table 2.11: Estimation results for private health insurance decision

	OLS	OLS	OLS	FE panel (between)	Dyn. panel (Arr.-Bond)
	(1)	(2)	(3)	(4)	(5)
lagged insurance status					0.273***
					(0.051)
medical card holder	−0.296***	−0.300***	−0.315***	−0.019	−0.029
	(0.014)	(0.015)	(0.022)	(0.018)	(0.028)
medical card ∗ net weekly	0.012**	0.013**	0.016**	−0.002	0.002
hsd income/£100	(0.006)	(0.006)	(0.008)	(0.003)	(0.004)
no medical card ∗ net weekly	0.037***	0.037***	0.033***	0.008***	0.003*
hsd income/£100	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
employer offers private insurance	0.150***	0.150***	0.164***	0.030**	0.031
	(0.011)	(0.011)	(0.015)	(0.013)	(0.016)
no employed household members	−0.006	0.001	0.010	0.010	−0.052
	(0.020)	(0.020)	(0.032)	(0.027)	(0.025)
household size	−0.011***	−0.011***	−0.012***	0.022**	0.002
	(0.003)	(0.003)	(0.004)	(0.009)	(0.012)
baby born	0.029*	0.011	0.020	0.0004	−0.005
	(0.016)	(0.017)	(0.024)	(0.013)	(0.014)
fraction with bad mental health	−0.015	−0.023**	−0.032**	−0.006	−0.013
	(0.010)	(0.011)	(0.015)	(0.008)	(0.009)
fraction with health problem	−0.029**	−0.055***	−0.053**	0.001	−0.005
	(0.013)	(0.019)	(0.026)	(0.017)	(0.018)
average number of GP visits		0.002***	0.002**	0.001*	0.001**
		(0.001)	(0.001)	(0.001)	(0.001)
average number of specialist visits		0.008***	0.008**	0.001*	0.003*
		(0.002)	(0.004)	(0.001)	(0.002)
average number of hospital nights		0.001	0.001	−0.0003	0.0002
		(0.001)	(0.001)	(0.0003)	(0.0003)
age oldest household member	0.020***	0.021***	0.022***		
	(0.001)	(0.001)	(0.002)		
age oldest household member squared	−0.0001***	−0.0001***	−0.0001***	−0.0001***	−0.0001**
	(0.00001)	(0.00001)	(0.00002)	(0.00002)	(0.00004)
highest years of education	0.052***	0.052***	0.051***		
	(0.002)	(0.002)	(0.002)		
living in city	0.053***	0.052***	0.049***		
	(0.008)	(0.008)	(0.011)		
fraction obese (BMI>30)			−0.023		
			(0.019)		
fraction daily smokers			−0.056***		
			(0.011)		
trend	−0.010***	−0.011***	−0.006	0.017***	0.014***
	(0.002)	(0.002)	(0.004)	(0.003)	(0.005)
intercept	−0.698	−0.704	−0.716		
	(0.040)	(0.041)	(0.064)		
observations	11132	10592	5422	10650	6955
specification tests for Arrelano-Bond estimator					
H_0 : no 1^{st} order autocorr.		$z = -9.95$		Prob> $z = 0.000$	
H_0 : no 2^{nd} order autocorr.		$z = 1.15$		Prob> $z = 0.251$	
H_0 : overidentifying restrictions are valid		$\chi^2(10) = 21.05$		Prob> $\chi^2 = 0.021$	

***=significant at 1% level, **= significant at 5% level, *=significant at 10% level

This is not only the case for income, but for many variables. The association is much stronger than the effect of changes in the variable, which is often not significant.

It is interesting to focus on the effects of health status and past health care use, as this provides insight in the importance of selection into supplementary private health insurance. The pooled OLS estimates in column (1) indicate a significant negative association between health problems and supplementary private health insurance. This points in the direction of advantageous selection. It should be noted that the association becomes stronger after controlling for past health care utilization (see column (2)), but is no longer significant after the introduction of a household specific effect. The latter suggests that chronic health problems are driving the associations. However, lagged health care use is positively associated to the purchase of supplementary private health insurance and the coefficient remains significant after including fixed effects. The effects though are relatively small. If all household members make an additional visit to the GP, this only increases the likelihood that the household takes supplementary private health insurance by 0.002.

Comparing the results from the different models shows that there is substantial heterogeneity between households, which is absorbed in the fixed effects in the dynamic panel data models. This might, for example, imply that households differ in preferences or risk aversion. Such factors may be important sources for the presence of adverse or advantageous selection. Therefore, in Subsection 2.6.3 we further analyze these fixed effects.

All models show a significant time trend in the purchase of supplementary private health insurance (see also Figure 2.2). Of course, in the panel data models we cannot distinguish between a genuine time trend and age effects. We also added age of the oldest household member squared. The coefficient is negative and significant, but much smaller than the trend effect. Furthermore, there is significant and substantial state dependence in the private health insurance decision. Having supplementary private health insurance in a particular year increases the likelihood of having supplementary private health insurance in the next year with about 0.22. True state dependence may occur because households automatically renew their insurance each year. Also possible costs associated with terminating or applying for supplementary private health insurance may cause state dependence.

2.6.2 Health care utilization

We use three different measures of health care utilization in our empirical analyses: number of GP visits, number of visits to a medical specialist and number of nights in hospital. All three measures are defined as the number of visits/nights in the past 12 months. Sampled individuals are all household members above age 16 in sampled households.

GPs are relatively easy accessible for individuals. To go to a medical specialist through the public system a reference from the GP is required. Therefore, demand induced moral

hazard might be less relevant for medical specialists than for GPs. Hospital nights are expected to be the least elastic to prices of our three measures, as most often an individual only stays in hospital if the diagnosed condition is severe.

The estimation results of the model for care utilization with GP visits as measure are in Table 2.12. The results with specialist visits and nights in hospital are respectively in Table 2.13 and Table 2.14.

Again differences in results between estimation methods are large. For GP visits the OLS estimates show significant positive effects of supplementary private health insurance coverage and presence of a Medical Card on the number of GP visits, which indicates moral hazard. However, these strong effects become much smaller and insignificant in the dynamic panel data model. All specifications condition on health. So, in contrast with OLS, the estimates from the dynamic panel data model do not provide any evidence for the presence of moral hazard. The positive results with OLS must be driven by differences between individuals that are not observed (like preferences and risk aversion), but are absorbed by the individual fixed effect when panel data models are used. Absence of moral hazard was also found by Chiappori, Durand and Geoffard (1998) in the analysis of a natural experiment in France, where a copayment rate was introduced for GP visits. Their differences approach also takes unobserved differences between individuals into account. Stabile (2001) found a small positive and significant effect of supplementary private health insurance on GP visits in Canada, while Pohlmeier and Ulrich (1995) found for Germany a relatively large and significant negative effect. Both papers use a two-stage model that estimates in the first stage the probability an individual has at least one GP visit and in the second stage the number of visits, conditional on at least one visit. Stabile (2001) includes some lagged variables in his estimations, but both papers do not allow for fixed effects.

The estimates for number of visits to a medical specialist and for number of nights in a hospital show a pattern close to that of GP visits for the effect of private health insurance: positive, significant estimates from OLS and much smaller, insignificant estimates from the fixed effects and dynamic panel model. The OLS results are in line with previous research, e.g. Jones, Koolman and Van Doorslaer (2006) and Pohlmeier and Ulrich (1995). None of the papers allows for fixed individual heterogeneity. The effect of a Medical Card on visits to a medical specialist and on the number of nights in hospital is insignificant for all estimation methods. The existing literature on this subject is mixed. Stabile (2001), Hurd and McGarry (1997), Cameron, Trivedi, Milne and Piggott (1988) also do not find significant effects, but Meer and Rosen (2004), Harmon and Nolan (2001), Holly, Gardiol, Domenighetti and Bisig (1998) find significant effects of between 3 and 8% higher probability of a hospital stay.

Both the OLS and dynamic panel data model results are in line with our expectations about the 'hierarchy' in the different measures of utilization with respect to the relevance of moral hazard.

Table 2.12: Number of GP visits in past 12 months

	OLS	OLS	FE panel (between)	Dyn. panel (Arr.-Bond)
	(1)	(2)	(3)	(4)
lagged number of GP visits				0.087**
				(0.032)
private health insurance	0.241**	0.404***	−0.514	−0.182
	(0.106)	(0.135)	(0.389)	(0.339)
medical card holder	2.054***	2.382***	0.836**	0.605
	(0.157)	(0.211)	(0.380)	(0.371)
net weekly hsd income/£100	−0.027	−0.036	−0.030	0.045
	(0.019)	(0.022)	(0.044)	(0.035)
employment	−0.107	−0.294*	0.444	1.094***
	(0.128)	(0.170)	(0.344)	(0.415)
bad mental health	1.054***	1.291***	0.141	−0.007
	(0.178)	(0.254)	(0.204)	(0.185)
health problem	3.612***	3.217***	0.618**	−0.666***
	(0.196)	(0.256)	(0.259)	(0.252)
gave birth	5.536***	5.530***	4.829***	4.484***
	(0.385)	(0.500)	(0.486)	(0.475)
age	−0.136***	−0.166***		
	(0.021)	(0.028)		
age squared	0.001***	0.002***	0.003***	0.002*
	(0.0002)	(0.0003)	(0.001)	(0.001)
years of education	−0.079***	−0.070***		
	(0.021)	(0.027)		
living in city	−0.330***	−0.356***		
	(0.103)	(0.128)		
female	0.892***	0.926***		
	(0.101)	(0.140)		
BMI		0.066***		
		(0.021)		
daily smoker		−0.188		
		(0.157)		
trend	0.077*	0.071	−0.153	−0.106
	(0.030)	(0.054)	(0.109)	(0.123)
intercept	4.945	4.032		
	(0.557)	(0.846)		
observations	12069	7186	12183	8287
specification tests for Arrelano-Bond estimator				
H_0 : no 1^{st} order autocorr.		$z = -2.60$	Prob> $z = 0.009$	
H_0 : no 2^{nd} order autocorr.		$z = 1.25$	Prob> $z = 0.213$	
H_0 : overidentifying restrictions are valid		$\chi^2(14) = 12.91$	Prob> $\chi^2 = 0.534$	

***=significant at 1% level, **= significant at 5% level, *=significant at 10% level

Table 2.13: Number of visits to medical specialists in past 12 months

	OLS	OLS	FE panel (between)	Dyn. panel (Arr.-Bond)
	(1)	(2)	(3)	(4)
lagged number of specialist visits				0.067
				(0.048)
private health insurance	0.267***	0.300***	0.038	−0.068
	(0.072)	(0.072)	(0.109)	(0.081)
medical card holder	−0.047	0.005	−0.019	0.073
	(0.059)	(0.083)	(0.130)	(0.121)
net weekly hsd income/£100	0.024	−0.004	0.001	0.013
	(0.026)	(0.011)	(0.017)	(0.016)
employment	0.051	0.045	0.142	0.124
	(0.050)	(0.069)	(0.117)	(0.104)
bad mental health	0.088	0.184*	−0.037	−0.202**
	(0.068)	(0.100)	(0.071)	(0.076)
health problem	0.659***	0.624***	0.103	−0.187
	(0.092)	(0.101)	(0.106)	(0.115)
gave birth	2.522***	2.743***	2.564***	2.448***
	(0.230)	(0.320)	(0.429)	(0.252)
number of GP visits	0.085***	0.076***	0.069***	0.060***
	(0.013)	(0.017)	(0.016)	(0.019)
age	0.004	0.011		
	(0.008)	(0.010)		
age squared	−0.00004	−0.0001	0.0005	−0.0002
	(0.0001)	(0.0001)	(0.0004)	(0.0004)
years of education	0.016	0.037***		
	(0.010)	(0.011)		
living in city	0.134***	0.146**		
	(0.050)	(0.060)		
female	0.071	0.093*		
	(0.0543	(0.043)		
BMI		0.018***		
		(0.007)		
daily smoker		0.102*		
		(0.065)		
trend	0.016*	0.031	−0.028	0.020
	(0.011)	(0.021)	(0.039)	(0.044)
intercept	−0.398	−1.358		
	(0.245)	(0.367)		
observations	12059	7183	12173	8273
specification tests for Arrelano-Bond estimator				
H_0 : no 1^{st} order autocorr.		$z = -4.58$	Prob> $z = 0.000$	
H_0 : no 2^{nd} order autocorr.		$z = -1.84$	Prob> $z = 0.065$	
H_0 : overidentifying restrictions are valid		$\chi^2(14) = 15.86$	Prob> $\chi^2 = 0.322$	

***=significant at 1% level, **= significant at 5% level, *=significant at 10% level

Table 2.14: Nights in hospital in past 12 months

	OLS	OLS	FE panel (between)	Dyn. panel (Arr.-Bond)
	(1)	(2)	(3)	(4)
lagged number of hospital nights				−0.006
				(0.040)
private health insurance	0.250*	0.301*	−0.102	−0.307
	(0.132)	(0.176)	(0.260)	(0.319)
medical card holder	−0.097	0.163	0.107	−0.391
	(0.165)	(0.231)	(0.335)	(0.303)
net weekly hsd income/£100	−0.005	0.005	0.031	0.034*
	(0.026)	(0.031)	(0.034)	(0.037)
employment	−0.158	−0.105	0.008	−0.202
	(0.119)	(0.158)	(0.204)	(0.132)
bad mental health	0.902***	1.350***	0.203	−0.097
	(0.293)	(0.460)	(0.365)	(0.235)
health problem	0.527**	0.894***	0.018	−0.370
	(0.256)	(0.291)	(0.586)	(0.366)
gave birth	2.162***	2.300***	2.717***	3.223***
	(0.444)	(0.560)	(0.448)	(0.435)
number of GP visits	0.157***	0.110***	0.137***	0.106***
	(0.031)	(0.031)	(0.040)	(0.038)
number of specialist visits	0.478***	0.530***	0.407***	0.342***
	(0.110)	(0.132)	(0.074)	(0.079)
age	−0.097***	−0.049		
	(0.037)	(0.036)		
age squared	0.001***	0.001**	0.003*	0.0001
	(0.0004)	(0.0004)	(0.002)	(0.002)
years of education	−0.024	−0.020		
	(0.024)	(0.033)		
living in city	−0.080	−0.174		
	(0.129)	(0.170)		
female	−0.391**	−0.445**		
	(0.156)	(0.217)		
BMI		−0.027		
		(0.027)		
daily smoker		0.194		
		(0.202)		
trend	0.011	0.014	−0.206	0.110
	(0.031)	(0.059)	(0.143)	(0.142)
intercept	1.978	1.543		
	(0.839)	(1.254)		
observations	12007	7150	12119	8183
specification tests for Arrelano-Bond estimator				
H_0 : no 1^{st} order autocorr.	$z = -4.39$		Prob$> z = 0.000$	
H_0 : no 2^{nd} order autocorr.	$z = -1.08$		Prob$> z = 0.279$	
H_0 : overidentifying restrictions are valid	$\chi^2(19) = 21.81$		Prob$> \chi^2 = 0.294$	

***=significant at 1% level, **= significant at 5% level, *=significant at 10% level

Using OLS, moral hazard is most present for GP visits (both private insurance and the Medical Card induce moral hazard), less for specialist visits (only private insurance induces moral hazard) and only just significantly different from 0 for nights in hospital.

Using dynamic panel data models no evidence for moral hazard is found for any of the utilization measures. Including for GP visits, the measure that was expected to be the most price elastic.[11]

State dependence is found to be important only for GP visits. As we control for health this effect mainly reflects what we found earlier that some individuals more 'easily' go see a doctor than others.

Of the socioeconomic factors, no effect is found of income on GP or specialist visits. This contradicts with Pohlmeier and Ulrich (1995) and Stabile (2001), who find negative effects of income on GP visits and Pohlmeier and Ulrich (1995), Van Doorslaer, Masseria and Koolman (2006) and Vera-Hernández (1999), who find significant income effects on specialist visits. Their income effects might also pick up permanent income effect, which are absorbed in our fixed effects. We will return to this issue later, when decomposing the estimated fixed effects.

Employed individuals visit the GP on average one additional time per year compared to unemployed individuals. A simple explanation might be that sickness absence from work is only allowed with a medical certificate from the GP. No effect of employment is found for visits to specialists, but a negative effect of employment is found for hospital nights. This might partially capture that older and retired individuals are more likely to be hospitalized. Note, however, that we do control for age and trend effects.

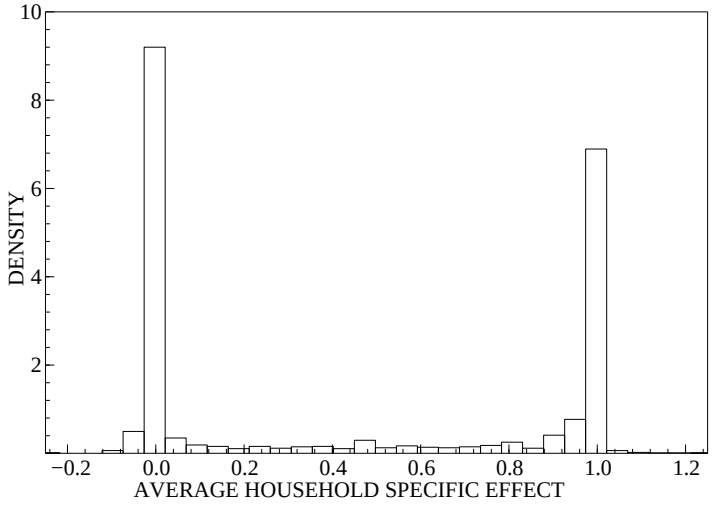
Both health variables, bad mental health and health problem, loose significance and size when a dynamic panel data model is used instead of OLS. As the introduction of a fixed effect absorbs all permanent or chronic health effects, this is not surprising. In contrast, giving birth is a shock variable and keeps its size and significance over all four estimation methods.

2.6.3 Decomposition of fixed effects

The estimation results above clearly show the importance of controlling for fixed effects. Fixed effects capture all characteristics that are time invariant, some observed, like education and gender, some unobserved, like preferences and risk aversion. Because preferences and risk aversion are possible drivers of advantageous selection, this provides additional motivation to take a closer look at the fixed effects.

[11] One remark has to be made on our finding that Medical Card coverage does not induce moral hazard. By using individual specific effects, individuals at the bottom of the income distribution are likely to be ignored in estimating the effect of Medical Card coverage on care utilization. This occurs because people at the bottom of the income distribution are not very likely to 'move out' of their Medical Card coverage and the effect is identified by those that move in and out of Medical Card coverage.

Figure 2.3: Fixed effects insurance decision



The fixed effect for household i in the model for the insurance decision (equation (2.9)) is estimated as

$$\hat{\mu}_i = \bar{I}_i - \hat{\beta}_1 \bar{I}_{i,-1} - \hat{\beta}_2 \bar{MC}_i - \hat{\beta}_3 \bar{Y}_i (1 - \bar{MC})_i - \hat{\beta}_4 \bar{Y}_i \bar{MC}_i - \hat{\beta}_5 \bar{H}_{it-1} - \hat{\beta}_6 \bar{M}_{i,-1} - \hat{\beta}_7 \bar{X}_i \tag{2.11}$$

where $\hat{\beta}$ are the estimated parameters from the dynamic panel data model and $\bar{I}_i$ is the sample mean of the insurance decisions and similar for all other variables included. For the care utilization models similar estimators are used to estimate fixed effects.

Figure 2.3 shows the distribution of the fixed effects in the sample for the model for the insurance decision. The upper left panel clearly demonstrates that fixed effects for the insurance distribution are concentrated around two mass points, 0 and 1. This implies a clear separation between households with and without a strong preference for supplementary private health insurance. The distributions of the fixed effects of the utilization variables are shown in the upper (GP visits), middle (specialist visits) and lower (hospital nights) panel of figure 2.4. The fixed effects of the model for GP visits show the largest variation.

Table 2.15 shows the correlation between the fixed effects from the supplementary private health insurance decision and health care utilization equations.[12] As can be seen, there is a substantial and significant negative correlation between the fixed effect in the supplementary private health insurance decision and the number of GP visits. We find a somewhat smaller negative correlation with nights spent in a hospital and a similar sized positive correlation with visits to a medical specialist. Also Buchmueller, Fiebig, Jones and Savage (2008) find a positive correlation between insurance coverage and the risk of

[12]When computing the correlations we assigned the household fixed effect of the insurance decision to all adults in the household.

Figure 2.4: Fixed effects health care utilization

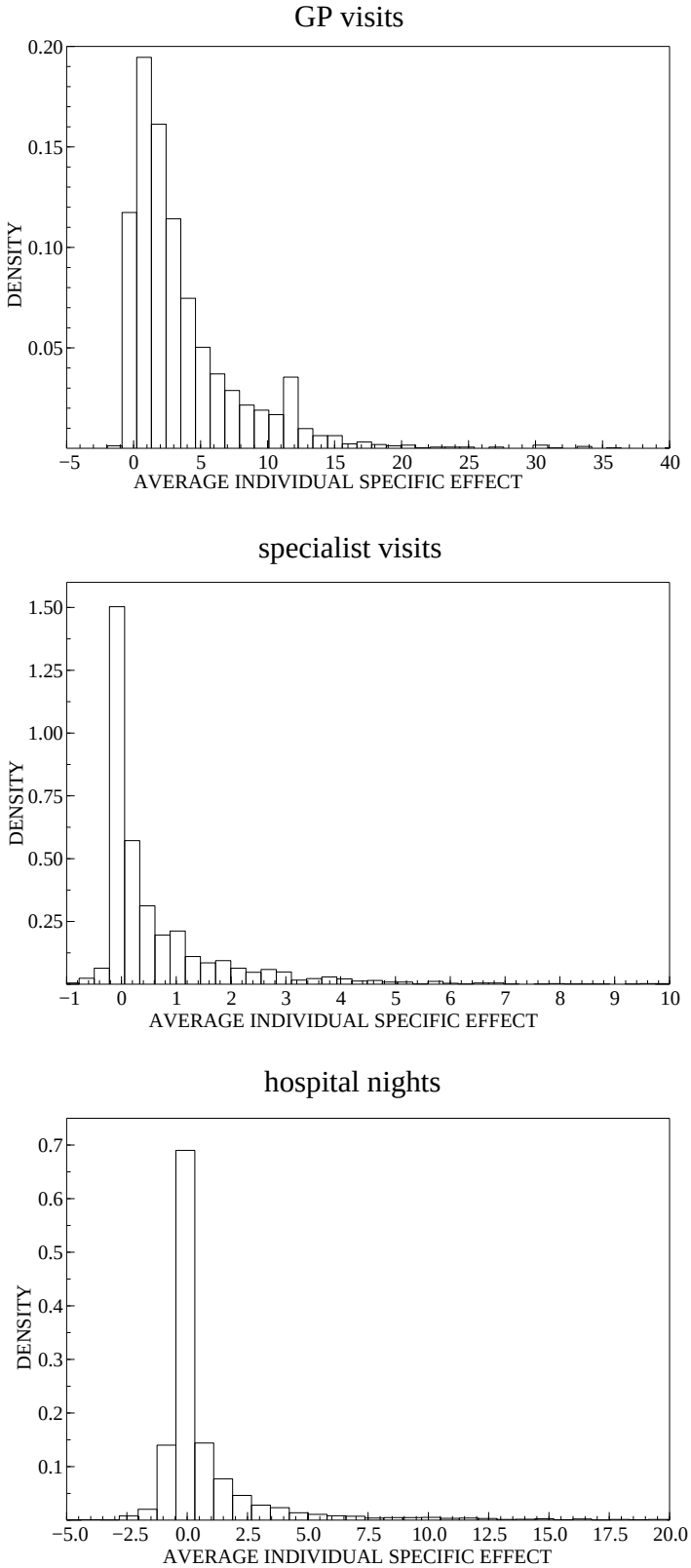


Table 2.15: Correlations between fixed effects from dynamic panel data models

	GP visits	Specialists visits	Hospital nights	Private insurance
GP visits	1.000			
Specialist visits	-0.034^{***}	1.000		
Hospital nights	0.011	0.080^{***}	1.000	
Private insurance	-0.217^{***}	0.135^{***}	0.026^{**}	1.000

***=significant at 1% level, **= significant at 5% level, *=significant at 10% level

hospital admission. The latter variable is seen as an ex post risk measure. To create a composite measure of utilization we sum the fixed effects, after scaling them with their variance:

$$\eta_i^{care\ util.} = \frac{\eta_i^{GP}}{\sigma^2\left(\eta^{GP}\right)} + \frac{\eta_i^{Spec}}{\sigma^2\left(\eta^{Spec}\right)} + \frac{\eta_i^{Hosp}}{\sigma^2\left(\eta^{Hosp}\right)} \tag{2.12}$$

The correlation between this composite measure of the individual fixed effects of care utilization and the fixed effects of the supplementary private health insurance decision is -0.0960 (with a p-value of 0.000). This implies that individuals who have a higher level of medical consumption are less likely to have supplementary private health insurance, which implies advantageous selection.

It is interesting to get some insight in the underlying factors driving the advantageous selection. Therefore, we investigate which (time-invariant) family characteristics relate to the fixed effects and consequently drive the insurance decision and the utilization of care. More specifically, we focus on the association between the take-up of private insurance (the utilization of health care) and health, health behaviors and other characteristics that drive expenditure risk (utilization of services). The results of the decomposition of fixed effects are shown in Table 2.16. The first column refers to the fixed effects from the insurance decision, columns (2)-(4) refer to the fixed effects from the different care utilization measures.

Information on smoking and Body Mass Index is only available in four out of the eight waves of data. By excluding these two variables from the decomposition of the fixed effects, the number of observations increases. Results of this decomposition without smoking and Body Mass Index are shown in Table 2.17 and do not essentially differ from the ones shown in Table 2.16.

Gender, age and location are significant factors in both the insurance decision and the utilization of health care services.[13] Couples are more likely to privately insure than singles or single parents and having children reduces the likelihood of taking supplementary private health insurance.

[13]The positive effect of living in city on insurance purchase may reflect that private health care is better available in more densely populated areas, which is confirmed by the finding that individuals living in a city go less to GP's and go more often to medical specialists.

Table 2.16: Decomposition of the household specific effects (insurance decision) and individual specific effects (care utilization), including BMI and smoking as covariates

	Insurance	Care Utilization		
	Decision	GP	specialist	hosp.nights
female		1.441***	0.108**	−0.347**
		(0.146)	(0.049)	(0.167)
lives in city	0.040***	−0.491***	0.183**	−0.198
	(0.013)	(0.162)	(0.077)	(0.195)
smokes daily †	−0.068***	0.269	0.121	0.023
	(0.014)	(0.180)	(0.075)	(0.196)
BMI †	−0.028	0.063***	0.009	0.006
	(0.026)	(0.023)	(0.007)	(0.022)
age ‡	0.017***	−0.155***	0.018*	−0.097**
	(0.002)	(0.034)	(0.010)	(0.044)
age squared	−0.00001***	−0.001***	−0.000005	0.001**
	(0.00002)	(0.0003)	(0.0001)	(0.0005)
years of education ‡	0.043***	−0.096***	0.048***	0.024
	(0.003)	(0.027)	(0.011)	(0.037)
net weekly hsd income/£100	0.041***	−0.098***	0.001	−0.040
	(0.004)	(0.030)	(0.015)	(0.034)
mental health problem †	−0.100*	5.352***	0.590	6.392**
	(0.051)	(0.927)	(0.531)	(3.200)
physical health problem type I †	−0.064**	4.167***	0.998***	0.631
	(0.030)	(0.456)	(0.195)	(0.607)
physical health problem type II †	−0.048**	5.910***	1.130***	2.459***
	(0.021)	(0.397)	(0.137)	(0.544)
single parent	−0.123***	0.458	0.059	0.463
	(0.027)	(0.610)	(0.268)	(0.572)
couple without children living in household	−0.042	0.132	0.538***	−0.037
	(0.035)	(0.582)	(0.166)	(0.698)
couple with children<16 living in household	−0.064***	−0.226	−0.164**	0.290*
	(0.018)	(0.201)	(0.074)	(0.172)
intercept	−1.179	7.003	0.018	1.028
	(0.065)	(0.826)	(0.298)	(1.021)
observations	2205	3614	3614	3604

***=significant at 1% level, **= significant at 5% level, *=significant at 10% level

Note: 'single' is the omitted householdtype

Note: on the household level, variables indicated with † are measured as 'fraction of the household' and variables indicated with ‡ are measured as the maximum among the interviewed household members. Instead of BMI the fraction of the household that is obese is used

Table 2.17: Decomposition of the household specific effects (insurance decision) and individual specific effects (care utilization)

	Insurance	Care Utilization		
	Decision	GP	specialist	hosp.nights
female		1.264***	0.050	−0.044***
		(0.132)	(0.060)	(0.155)
lives in city	0.044***	−0.467***	0.129	−0.084
	(0.012)	(0.170)	(0.087)	(0.191)
age ‡	0.015***	−0.158***	0.013	−0.104***
	(0.002)	(0.031)	(0.010)	(0.038)
age squared	−0.00005***	−0.0006**	0.00001	0.001***
	(0.00002)	(0.0003)	(0.0001)	(0.0004)
years of education ‡	0.045***	−0.106***	0.019	0.009
	(0.002)	(0.025)	(0.025)	(0.036)
net weekly hsd income/£100	0.038***	−0.080***	0.005	−0.051
	(0.004)	(0.031)	(0.042)	(0.035)
mental health problem †	−0.202***	4.680***	0.751	5.066*
	(0.043)	(0.873)	(0.501)	(2.695)
physical health problem type I †	−0.070***	4.341***	1.004***	0.284
	(0.025)	(0.530)	(0.178)	(0.542)
physical health problem type II †	−0.070***	6.026***	1.051***	2.642***
	(0.019)	(0.378)	(0.126)	(0.541)
single parent	−0.129***	0.726	−0.064	0.499
	(0.025)	(0.601)	(0.238)	(0.485)
couple without children living in household	−0.040	−0.261	0.553***	0.363
	(0.031)	(0.557)	(0.158)	(0.677)
couple with children<16 living in household	−0.059***	−0.237	−0.339**	0.226
	(0.016)	(0.189)	(0.171)	(0.167)
intercept	−1.165	9.046	−1.290	1.473
	(0.058)	(0.854)	(0.479)	(0.839)
observations	2008	2871	2869	2855

***=significant at 1% level, **= significant at 5% level, *=significant at 10% level

Note: 'single' is the omitted householdtype

Note: on the household level, variables indicated with † are measured as 'fraction of the household' and variables indicated with ‡ are measured as the maximum among the interviewed household members. Instead of BMI the fraction of the household that is obese is used

Children are not covered by their parents' insurance, but can also be covered by the parental insurance at a reduced premium. For single parents or couples with children it is therefore more expensive to buy supplementary health insurance for the household than it is for those without children.

Very interesting are the sizeable effects of education. Each additional year of education increases the probability of obtaining supplementary private health insurance with more than 0.06. This is in line with Fang, Keane and Silverman (2008), who find that more educated individuals are more likely to buy private insurance. The difference in lowest and highest level of education is about 10 years, which indicates that the highest educated individuals have a 0.6 higher probability of having supplementary private health insurance than the lowest educated households. A one standard deviation difference in education (3.16 years), implies a 0.20 difference in the probability of supplementary private health insurance take-up. The effect of education is independent of the effect of permanent income, health and health behaviors (as measured by smoking behavior and Body Mass Index), that each have a significant effect on supplementary private health insurance purchase. Education may be related to preferences for health, risk attitude and time discount rates. Moreover, education is strongly related to cognition. As argued by Fang, Keane and Silverman (2008), cognition may affect an individual's ability to evaluate the costs and benefits of insurance and hence the insurance decision and it may influence an individual's information about health risks. Therefore, the education effect is possibly picking up effects of strongly related unobserved characteristics causing advantageous selection.

Education is strongly correlated with good health (a correlation of -0.228 with the presence of a health problem and -0.113 with bad mental health). Moreover, education reduces health care utilization, the higher educated have fewer GP visits. Each additional year of education reduces GP visits by about 0.10. This means that more education is associated with lower health risks (as measured by GP visits). Combined with the strong positive effect on the probability to take supplementary private health insurance, this confirms our earlier finding that education may be an important underlying factor of advantageous selection. The effect of education on visits to a specialist is positive. Note, however, that the higher educated have less GP visits and that the number of GP visits has a significant positive effect on specialist visits (Table 2.13). This indirect negative effect of education via GP visits reduces the positive direct effect of education on specialist visits. Redoing the analysis with total number of visits (to both GP and specialist) we find that the overall effect of education is negative.

To fully understand the effects of education, we should also focus on the effects of income, health and health behaviors. Those with higher incomes have better health (correlation of -0.201 between net weekly household income and health problems and -0.122 with bad mental health). Furthermore, the health insurance uptake increases with 0.07 for every additional £100 of net weekly income. The effect of a one standard deviation

change in income is only slightly smaller than that of a one standard deviation change in years of education. One standard deviation of net weekly household income is £255, associated with a change in the probability to buy supplementary private health insurance of 0.18. Like Fang, Keane and Silverman (2008) we thus find independent effects of both income and education on insurance purchase.

Individuals in poor health (with a mental health problem or a physical health problem of type I), and, therefore, with higher expenditure risk, are significantly less likely to have supplementary private health insurance. The effects of the health variables are sizeable, in particular for the mental health variable. This may be related to individual preferences for health. Recall from our theoretical model that those with low preferences for health have worse health and are less likely to obtain supplementary private health insurance. It should be noted that those with bad health have higher health care utilization. Individuals with a health problem have between 3.5 (physical conditions of type I, the illnesses that are expected to be more sensitive to the price of care) and 5 (mental conditions and physical conditions of type II) additional GP visits. These effects are very substantial as the average annual number of GP visits is 3.9 (with a median of 2). Results for specialist visits and hospital nights show similar substantial positive effects of poor health. All three types of health problems have about 1 additional visit to a specialist per year and 1.6 (physical conditions of type I) to 8 (mental conditions) additional hospital nights every year. So individuals in bad health have high expected health care costs and are also less inclined to buy supplementary private health insurance, which points again towards advantageous selection.

Preferences and risk attitude are important in explaining how advantageous selection can arise. The theoretical prediction is that more risk-averse individuals invest more in health, maintain higher health levels and take more insurance coverage. Therefore, it is interesting to investigate the effects of smoking behavior, which is often considered to be directly related to risk attitude (e.g. Buchmueller, Fiebig, Jones and Savage, 2008). We find a significant negative effect of smoking (-0.087) on the probability of having supplementary private health insurance. Smoking is also negatively related to health (correlation of 0.321 with health problem, when taking age into account). So indeed as predicted in the case of advantageous selection in our theoretical model, smokers are less healthy and are less likely to have insurance. This coincides with Khwaja, Silverman, Sloan and Wang (2007), who examine the relationship between time discounting, other sources of time preferences and choices about smoking. They find that time discount factors revealed through choice experiments are not related to smoking behavior, but that other measures of time preference and self controls, like impulsiveness and length of financial planning horizon, are related to smoking behavior. It is conceivable that these factors are also relevant for the health insurance decision (and for education investment decisions).

Table 2.18: Health insurance frequencies, sample of only the elderly

	All	Elderly
only PHI	42.4%	24.0%
none	22.4%	9.2%
PHI and MC	2.1%	5.2%
only MC	33.1%	61.6%

Note: PHI = supplementary Private Health Insurance, MC = Medical Card

Table 2.19: Transition frequencies of changes in private insurance status and medical card holdership, sample of only the elderly

		status in year t				
		only PHI	none	PHI and MC	only MC	
status in year $t-1$	only PHI	93.1%	2.8%	3.2%	0.9%	100.0%
	none	9.0%	73.4%	0.0%	17.6%	100.0%
	PHI and MC	3.4%	0.0%	75.2%	21.4%	100.0%
	only MC	0.4%	1.2%	1.3%	97.1%	100.0%

Note: PHI = supplementary Private Health Insurance, MC = Medical Card

Table 2.20: Transition frequencies of changes in health variables, sample of only the elderly

		status in year t		
		no health problem	health problem	
status in year $t-1$	no health problem	82.0%	18.0%	100.0%
	health problem	23.3%	76.7%	100.0%
		no bad mental health	bad mental health	
	no bad mental health	87.5%	12.5%	100.0%
	bad mental health	63.6%	36.4%	100.0%

So from the effects of income, health and health behaviors one can infer that preferences for health, risk attitude and time preference are likely to be important drivers of advantageous selection. As we already conditioned on income, health and health behaviors, the sizable effect of education suggests that also other factors like cognition are likely to be important. This is in line with the findings of Fang, Keane and Silverman (2008) and Wolfe and Goddeeris (1991) for a sample of older American individuals.

2.6.4 Analyses for a sample of older individuals

A very substantial share on the evidence on the presence of advantageous selection in health insurances comes from older individuals in the US (e.g. Brown and Finkelstein,

2008; Cutler, Finkelstein and McGarry, 2008; Fang, Keane and Silverman, 2008; and Finkelstein and McGarry, 2006). It is, therefore, interesting to restrict our sample to individuals age 65 and above and to repeat the analyses. First, it should be noted that among the elderly medical card holdership is about twice as high as among the full sample, Table 2.18 shows that 61.6% of the elderly has a Medical Card. In particular, among the elderly without a Medical Card, supplementary private health insurance coverage rates are high. Transition frequencies for insurance status and Medical Card holdership are shown in Table 2.19. Elderly are, compared to the full sample, more likely to move away from having neither supplementary private health insurance nor a Medical Card. They especially move into having only a Medical Card more often. As expected, transition rates between different health states are more common among the elderly, as can be seen from the transition frequencies for the health variables in Table 2.20.

The estimation results for the dynamic panel data model for buying supplementary private health insurance do not show some evidence for adverse selection (see Table 2.22). The number of visits to a medical specialist in the past year is positively related to the probability supplementary private health insurance is bought. As in the full sample, the effect however is quite small. The dynamic panel data models for health care utilization also do not show evidence for the presence of moral hazard (Table 2.23).

We also performed the decomposition of fixed effects. The correlation pattern between the different fixed effects is similar as for the full population (see Table 2.21). The results for the decomposition of the health care utilization variables are very similar to earlier findings (see Table 2.24). Again education is strongly related to insurance purchase. The effects of health problems are reduced and no longer significant for insurance purchase, implying weaker evidence for advantageous selection than in the full sample. The main conclusion is that advantageous selection also seems to be important for elderly in Ireland, but the evidence is less strong than for the full population.

Table 2.21: Correlations between fixed effects from dynamic panel data models, sample of only the elderly

	GP visits	Specialists visits	Hospital nights	Private insurance
GP visits	1.000			
Specialist visits	−0.059***	1.000		
Hospital nights	−0.061***	0.213***	1.000	
Private insurance	−0.141***	0.159***	0.008	1.000

*** = significant at 1% level,**= significant at 5% level,*=significant at 10% level

Table 2.22: Estimation results for supplementary private health insurance decision, sample of only elderly

	Dyn. panel (Arr.-Bond)	
lagged insurance status	0.080	
	(0.088)	
medical card holder	−0.064*	
	(0.036)	
medical card∗ net weekly hsd income/£100	0.001	
	(0.006)	
no medical card∗ net weekly hsd income/£100	−0.001	
	(0.002)	
employer offers private insurance	0.006	
	(0.004)	
no employed household members	−0.038	
	(0.061)	
household size	0.033	
	(0.033)	
baby born		
fraction with bad mental health	0.0002	
	(0.008)	
fraction with health problem	0.007	
	(0.019)	
average number of GP visits	0.001	
	(0.001)	
average number of specialist visits	0.005*	
	(0.002)	
average number of hospital nights	0.0002	
	(0.0003)	
age of oldest household member		
age of oldest household member squared	−0.0001	
	(0.0001)	
highest years of education in		
living in city		
fraction obese (BMI>30)		
fraction daily smokers		
trend	0.622	
	(0.251)	
observations	2149	
specification tests for Arrelano-Bond estimator		
H_0 : no 1^{st} order autocorr.	$z = -4.21$	Prob> $z = 0.000$
H_0 : no 2^{nd} order autocorr.	$z = -1.28$	Prob> $z = 0.199$
H_0 : overidentifying restrictions are valid	$\chi^2(10) = 10.83$	Prob> $\chi^2 = 0.371$

***=significant at 1% level, **= significant at 5% level, *=significant at 10% level

Table 2.23: Visits to GP, visits to a medical specialist and nights in hospital in past 12 months, sample of only the elderly

	GP visits (Arrel.-Bond)	specialist visits (Arrel.-Bond)	hospital nights (Arrel.-Bond)
lagged dependant variable	−0.038	0.035	0.016
	(0.049)	(0.049)	(0.056)
private insurance	0.480	−0.322*	−0.574
	(0.462)	(0.144)	(1.691)
medical card holder	1.198	−0.022	−0.120
	(1.308)	(0.154)	(0.485)
net weekly hsd income/£100	0.029	0.032	0.129
	(0.053)	(0.034)	(0.247)
employment	0.028	0.001	−0.039
	(0.468)	(0.255)	(0.524)
bad mental health	0.462**	−0.064	−0.805
	(0.295)	(0.067)	(0.619)
health problem	−0.526*	−0.095	−0.152
	(0.273)	(0.081)	(0.542)
gave birth	-	-	-
number of GP visits		0.036***	0.196*
		(0.007)	(0.077)
number of specialist visits			0.856***
			(0.296)
age			
age squared	0.002	−0.001	−0.003
	(0.002)	(0.001)	(0.004)
years of education			
living in city			
female			
BMI			
daily smoker			
trend	0.103	0.181**	0.819
	(0.360)	(0.101)	(0.605)
observations	2212	2209	2192

specification tests for Arrelano-Bond estimator

GP visits	H_0 : no 1^{st} order autocorr.	$z = -5.22$	Prob$> z = 0.000$
	H_0 : no 2^{nd} order autocorr.	$z = 0.95$	Prob$> z = 0.342$
	H_0 : overidentifying restrictions are valid	$\chi^2(14) = 18.11$	Prob$> \chi^2 = 0.202$
Specialist visits	H_0 : no 1^{st} order autocorr.	$z = -4.36$	Prob$> z = 0.000$
	H_0 : no 2^{nd} order autocorr.	$z = 0.15$	Prob$> z = 0.879$
	H_0 : overidentifying restrictions are valid	$\chi^2(14) = 8.33$	Prob$> \chi^2 = 0.871$
Hospital nights	H_0 : no 1^{st} order autocorr.	$z = -3.36$	Prob$> z = 0.000$
	H_0 : no 2^{nd} order autocorr.	$z = -1.04$	Prob$> z = 0.300$
	H_0 : overidentifying restrictions are valid	$\chi^2(19) = 24.31$	Prob$> \chi^2 = 0.185$

***=significant at 1% level, **= significant at 5% level, *=significant at 10% level

Table 2.24: Decomposition of the household specific effects (insurance decision) and individual specific effects (care utilization), sample of only the elderly

	Insurance	Care Utilization		
	Decision	GP	specialist	hosp.nights
female		0.050	−0.095	−0.651
		(0.359)	(0.088)	(0.437)
lives in city	0.079***	−0.894***	0.301***	−0.088
	(0.030)	(0.335)	(0.115)	(0.502)
smokes daily †	0.045	−0.983**	0.022	0.348
	(0.029)	(0.402)	(0.121)	(0.573)
BMI †	0.032	0.085	−0.015	−0.020
	(0.050)	(0.061)	(0.012)	(0.045)
age ‡	−0.008	0.894**	0.190*	−0.386
	(0.029)	(0.433)	(0.114)	(0.754)
age squared	0.0001	−0.007**	−0.0003	0.007
	(0.0002)	(0.003)	(0.001)	(0.005)
highest years of education ‡	0.063***	−0.239***	0.072***	−0.011
	(0.005)	(0.056)	(0.019)	(0.069)
net weekly hsd income/£100	0.048***	−0.232***	−0.020	−0.153
	(0.012)	(0.072)	(0.042)	(0.139)
mental health problem†	−0.147	7.871***	−0.467	−0.282
	(0.090)	(1.782)	(0.383)	(1.664)
physical health problem type I†	−0.054	3.435***	0.682***	−0.298
	(0.041)	(0.587)	(0.219)	(0.779)
physical health problem type II†	−0.094	5.219***	0.947***	1.704**
	(0.033)	(0.484)	(0.184)	(0.852)
single parent	−0.320***	−0.458	0.878***	−4.288***
	(0.100)	(1.063)	(0.188)	(0.850)
couple without children living in household	−0.098	−0.772	0.484**	0.145
	(0.061)	(0.895)	(0.226)	(1.208)
couple with children<16 living in household	−0.089	0.345	0.032	−0.269
	(0.082)	(0.930)	(0.481)	(1.200)
intercept	0.588	−27.751	−12.825	−7.906
	(1.084)	(16.172)	(4.238)	(26.874)
observations	684	926	926	924

*** = significant at 1% level,**= significant at 5% level,*=significant at 10% level

Note: 'single' is the omitted householdtype

Note: on the household level, variables indicated with † are measured as 'fraction of the household' and variables indicated with ‡ are measured as the maximum among the interviewed household members. Instead of BMI the fraction of the household that is obese is used

2.7 Discussion and conclusion

This paper's main objectives were to investigate moral hazard and advantageous or adverse selection in the Irish health care system. In Ireland, the government provides basic care to all citizens, but with considerable copayments. Supplementary private health insurance can be bought to reduce the copayments and to give access private care. Our analyses focus on the decision to take supplementary private health insurance and on health care utilization.

The data clearly show the presence of asymmetric information. We use panel data models to further investigate the determinants of this asymmetric information. The dynamic panel data model shows that the insurance decision is mainly explained by the lagged insurance decision, a time trend and household fixed effects. Therefore, we examined the covariance structure of the fixed effects of the insurance decision and health care utilization and observed determinants of the fixed effects.

The correlations between fixed effects reveals that those with a higher level of health care consumption are less likely to have supplementary private health insurance, implying advantageous selection. The main determinant of this negative correlation is education, which may, therefore, be considered as an important underlying factor of advantageous selection. But also income, health and healthier behavior (non-smokers) are important.

The remaining question concerns the mechanism underlying advantageous selection. *Cream skimming* of insurers is not likely to drive the results found in this study. Insurers are obliged to accept everybody, irrespective of age, health status and other factors (such as education or occupation). Furthermore, premiums should be based solely on community ratings and the - by far - most dominant player on the Irish market for supplementary private health insurance is a former quasi-public non-profit organization. In our theoretical model we show that advantageous selection can arise as a result of heterogeneity in health preference or risk aversion. Smoking behavior is often used a proxy for *risk attitude*. Indeed we find that smoking is associated with worse health and negatively related to insurance purchase. This result coincides with Buchmueller, Fiebig, Jones and Savage (2008) who use tobacco use and gambling behavior to proxy risk attitude and conclude that risk attitude is an important factor for advantageous selection. Fang, Keane and Silverman (2008) use direct measures of risk tolerance (opposite of risk aversion) and find these to be correlated with Medigap purchase, but not to be correlated with worse health. It should be noted that smoking behavior may also be related to *time discount rates* and *other measures of time preference* (see Khwaja, Silverman, Sloan and Wang, 2007). We, therefore, cannot rule out that these factors are also important determinants for advantageous selection. Furthermore, the smoking effect is quantitatively small. Income and education are the two strongest factors associated with the advantageous selection effect. The health effect suggest that *preferences for health* are important drivers of the advantageous selection effect. The education effect may include a range of factors, such as time

discount rates, risk attitude and health preferences. A next step would be to determine the importance and relevance of each of the possible pathways mentioned and the role that education plays in these pathways.