European Economic Review 56 (2012) 669–690

Contents lists available at SciVerse ScienceDirect

European Economic Review

journal homepage: www.elsevier.com/locate/eer

A dynamic analysis of the demand for health insurance and health care

Jonneke Bolhaar [a,*], Maarten Lindeboom [a,b], Bas van der Klaauw [a]

[a] VU University Amsterdam and Tinbergen Institute, De Boelelaan, 1105, 1081 HV Amsterdam, The Netherlands
[b] Netspar, The Netherlands and HEB, Bergen, Norway

ARTICLE INFO

Article history:
Received 26 May 2010
Accepted 15 March 2012
Available online 1 April 2012

JEL classification:
I11
D82
G22
C33

Keywords:
Supplementary private health insurance
Health care utilization
Asymmetric information
Moral hazard
Panel data

ABSTRACT

We find that asymmetric information is important for the uptake of supplementary private health insurance and health care utilization. We use dynamic panel data models to investigate the sources of asymmetric information and distinguish short-run selection effects into insurance from long-run selection effects. Short-run selection effects (i.e. responses to shocks) are adverse, but small in size. Also long-run effects driven by differences in, for example, preferences and risk aversion, are small. But we find some evidence for multidimensional asymmetric information. For example, mental health causes advantageous selection. Estimates of health care utilization models suggest that moral hazard is not important.

1. Introduction

This paper empirically tests for the presence of (adverse/advantageous) selection and moral hazard in a market for health insurance. Textbook insurance models predict adverse selection, where those with bad risks and higher expected health care expenditures buy health insurance with more extensive coverage (e.g. Rothschild and Stiglitz, 1976). This type of selection was found by Ettner (1997) and Wolfe and Goddeeris (1991) for the US Medigap market. Outside the US evidence for adverse selection was found in Portugal (Jones et al., 2006), Australia (Cameron et al., 1988; Savage and Wright, 2003) and the UK (Olivella and Vera-Hernández, in press). Some recent literature points, however, to possible advantageous selection (Hemenway, 1990; De Meza and Webb, 2001; Finkelstein and McGarry, 2006; Cutler et al., 2008; Fang et al., 2008; Buchmueller et al., 2008).

The idea of advantageous selection is that risk is 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 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

* Corresponding author. Tel.: +31 20 5986155.
E-mail addresses: j.a.bolhaar@vu.nl (J. Bolhaar), m.lindeboom@vu.nl (M. Lindeboom), b.vander.klaauw@vu.nl (B. van der Klaauw).

[1] An exception is Buchmueller et al. (2008).

0014-2921/$ - see front matter © 2012 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.euroecorev.2012.03.002

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 et al. (2008) find advantageous selection for US Medigap insurance, which they mainly attribute to cognitive ability. Cutler et al. (2008) show that the observed advantageous selection in the Medigap insurance market cannot be explained by risk aversion, in contrast to the market for long-term care insurance. Both Finkelstein and McGarry (2006) and Fang et al. (2008) find that once they condition on the sources of advantageous selection, there is a positive relation between health risk and insurance coverage.

Elderly are generally subject to more health risks and higher medical expenditures and are likely to have different risk preferences than the non-elderly (working age) population. Therefore, the findings for the US are not straightforwardly translated to the situation in other countries. Quite a few countries have a system of basic health insurance for the entire population with voluntary supplementary private health insurance (e.g. Canada, France, Germany, Switzerland, The Netherlands and Ireland). In this paper we 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. We distinguish between short-run selection effects (i.e. responses to shocks) and long-run selection effects (driven by differences in, for example, preferences and risk aversion). The choice to study Ireland is motivated by the architecture of the Irish health insurance market, which has an ideal setting for studying 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 1960s only about 5% of the population had supplementary private health insurance, in 2005 this had been increased to about 50%. One of the characteristics that makes the Irish health insurance market 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. 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 can 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. Two simple empirical tests based on Chiappori and Salanié (2000) and Finkelstein and McGarry (2006) indicate the presence of (multidimensional) 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 their future health status. In the presence of moral hazard the insurance decision affects health care utilization, and health care utilization might again improve health status. This shows the interrelation of health, insurance status and health care utilization. However, 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 individual 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 et al. (2006), Fang et al. (2008) and Buchmueller et al. (2008). An advantage of using dynamic models is that we can distinguish between short-run and long-run selection effects in insurance choice. We define short-run selection effects as responses to shocks, while long-run selection effects describe long-term choices resulting from heterogeneity in time-invariant factors, such as rate of risk aversion, (health) preferences and cognition.

In the empirical analyses we use the Living in Ireland Survey, which is 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 is mainly explained by a time trend, state dependence and a household fixed effect. Health shocks do not have an effect on insurance status, and recent health care utilization has only a very small impact. Short-run selection effects thus seem not to be very important. We do not find any evidence for moral hazard, i.e. those with supplementary private health insurance do not have a higher level of health care utilization, conditional on health. The fixed effects absorb all time-invariant effects. We investigate the fixed effects to get insight in long-run selection effects. We do not find evidence for a strong correlation between the fixed effects in the insurance decision and health care utilization. However, poor mental health is negatively correlated with supplementary private health insurance coverage and positively correlated with health care utilization. Also, selection effects are found that are correlated with age. We find associations of both education and income with insurance purchase, but not with health care utilization.

This paper is organized as follows. In Section 2 we provide some theory. Section 3 discusses background information of the Irish health care system. Section 4 provides details of the Living in Ireland Survey and in Section 5 we provide the results of a simple empirical test for asymmetric information. Section 6 presents the empirical models. In Section 7 the results of the empirical analyses are discussed. Section 8 concludes.

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:

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

The household can positively influence health by making health investments. This assumption is similar to Bajari et al. (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. 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:

$$u(C) = \frac{C^{1-\gamma}}{1-\gamma} \tag{2}$$

This CRRA utility of consumption is also used by Brown and Finkelstein (2008) and Fang et al. (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.

We consider a household that is only entitled to basic public health insurance, including (substantial) copayments. This excludes Irish households holding a medical card, which we ignore in the remainder of the paper (see Section 3 for a more extensive discussion). Medical expenses depend on whether the household has (supplementary private) health insurance I and the volume of health investments V. Health insurance reduces the price $p(I)$ of health investments, but increases medical expenses with the insurance premium r that has to be paid. So total medical expenses M can be written as

$$M = rI + p(I)V \tag{3}$$

In Ireland, where community rating and open enrollment are required by law, the market for health insurance is dominated by a single non-profit and (formerly) state-owned provider (see Section 3). This provider aims at providing the socially desired contract, only restricted by the condition that it should break-even.[3] Therefore, we assume that the level of the premium r is exogenously given. For ease of exposition we consider both $p(I)$ and V to be unidimensional, but they can also be considered as 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:

$$H = f^{H}(V, \Delta, \mu) \tag{4}$$

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 the realization of a shock. Conditional on preferences, risk aversion, income, etc., the optimal health insurance decision 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 follows from the first-order condition:

$$\frac{\partial U}{\partial V} = 0 \;\Leftrightarrow\; \frac{C}{H} = \frac{\alpha}{1-\alpha}(1-\gamma)\frac{p(I)}{\partial f^{H}(V,\Delta,\mu)/\partial V} \tag{5}$$

See Appendix for the derivation. Let us assume that health returns to health investments are either constant or decreasing, $\partial^2 f^{H}(V,\Delta,\mu)/\partial V^2 \leq 0$. The left-hand side of the first-order condition 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 (Pauly, 1968). 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 maintain a higher

[2] Like Bajari et al. (2006), Brown and Finkelstein (2008) and Fang et al. (2008) we assume that income is exogenously given.

[3] One could view the Irish setting as integration of the regulator and dominant provider, as opposed to managed care markets where these are separated (Glazer and McGuire, 2000).

health level. A necessary 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:

$$(p(I=0)-p(I=1))V(\Delta=1,I^*=1,\mu)>r \tag{6}$$

So those households that decide to take health insurance and experience a negative health shock have more health consumption than they would have without the health insurance. In our empirical application we investigate moral hazard by testing whether the insured use more care, given their health status: $V(\Delta,I^*=1,\mu)>V(\Delta,I^*=0,\mu)$.

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

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

and without health insurance:

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

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

$$\lambda\{U(V(\Delta=1,I=1,\mu))-U(V(\Delta=1,I=0,\mu))\}>(1-\lambda)\{U(V(\Delta=0,I=0,\mu))-U(V(\Delta=0,I=1,\mu))\} \tag{7}$$

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

$$U(V(\Delta=1,I=1,\mu))-U(V(\Delta=1,I=0,\mu))>U(V(\Delta=0,I=1,\mu))-U(V(\Delta=0,I=0,\mu)) \tag{8}$$

Conditional on the preference parameters α and γ, and given the insurance premium r and price function $p(I)$, we can 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 health conditions).

As second case consider a household with many health conditions, i.e. a high value of μ. If μ is high enough to ensure that $U(V(\Delta=0,I=I,\mu))>U(V(\Delta=0,I=0,\mu))$, then 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. If a negative health shock occurs, the household is better off with 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 without health insurance $(U(V(\Delta=0,I=1,\mu))<U(V(\Delta=0,I=0,\mu)))$. 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. Therefore, if in a population μ is positively correlated to α and/or negatively correlated to γ, advantageous selection may arise. In particular when within the population the variation in α and γ compared to the variation in μ is substantial and there is a strong correlation between these parameters.

To illustrate the possibility of different types of selection, 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 shown in Fig. 1. The figure presents for $\mu=0$ and $\mu=1$ curves where the household is indifferent between buying and not buying insurance. So these should be considered as the relevant thresholds 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 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 preferences α and/or γ are negatively correlated with risk occurrence (existing health conditions) and positively correlated with the probability to buy insurance. Consider for example point A and D in the figure. The household in point A has a stronger preference for consumption relative to health (a higher α) than the household in point D. Suppose the household in point A is in bad health ($\mu=1$) and the household in point D is in good health ($\mu=0$). Despite being in bad health, the household in point A

[4] 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.

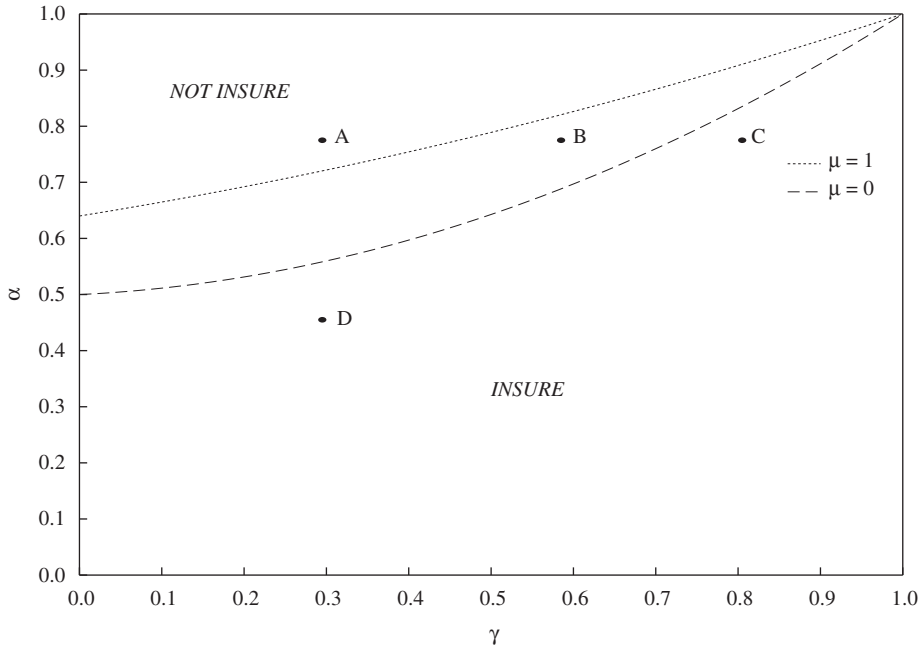

Fig. 1. Optimal insurance decision for α/γ-combinations.

will not buy insurance, whereas the household in point *D*, that is in good health, will buy insurance. This connects to the 'heterogeneous preferences' explanation of De Meza and Webb (2001) for advantageous selection and is found by Fang et al. (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. If the more risk-averse household in point *C* that always buys insurance is in good health and the less risk-averse household in *A* that never buys insurance is in bad health, again a pattern of advantageous selection is observed. 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.

Correlation between the preference parameters α and γ and existing health conditions μ is most likely to arise from the effect α and γ had on health investments in the past.[5] 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 (2010) formulates such a model, and shows that the basic results presented above carry over to the dynamic case.

So far, we discussed selection which may arise due to heterogeneity in health and risk preference. This may be considered as *long-run* selection, because preferences are relatively constant over time. Such long-run selection may be different from short-run selection. *Short-run* selection arises in a dynamic case if households decide to take health insurance in the period after having experienced a health shock ($\Delta = 1$). Since experiencing a health shock reduces the health level, the household will be induced to take health insurance to invest more in health. Short-run selection is likely to be adverse, even if long-run selection is advantageous.

In our empirical application we have access to panel data that cover a time period of eight years and quite some changes in health insurance status are observed. We start by performing the tests for asymmetric information proposed by Chiappori and Salanié (2000) and Finkelstein and McGarry (2006). Next we consider dynamics by exploiting the panel structure of our data. This allows to explore underlying dynamics. Fixed effects can capture heterogeneity in α and γ among individuals. Key advantages of dynamic panel data models are that these can separate state dependence from individual heterogeneity in the insurance decision and health care consumption and that they can separate short-run from long-run selection effects.

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

[5] We follow Bajari et al. (2006) and Cardon and Hendel (2001) in interpreting health investments while being in good health as preventive investments.

General Practitioners (GP), outpatient visits to medical specialists and hospital stays. In Table 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 when not been referred by a GP. 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 pay copayments for visits to the GP or medical specialists in public hospitals. Furthermore, they do not 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 household composition. Table 2 provides the calculation of weekly income thresholds for 2005. Around 30% of the Irish population are covered by a Medical Card.

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 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 supplementary 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).

Table 1
Average copayments for medical services in Ireland in 2006.

GP visit			
If Medical Card, maternity services or Hepatitis C	⇔	€0	
Other	⇔	€40	
Medical specialist visit (as an outpatient)			
If referred by GP, return visit for same illness/accident			
If Medical Card, maternity services	⇔	€0	
If child referred from child health clinic/school health examinations	⇔	€0	
If child with disability/prescribed illness, babies under 6 weeks	⇔	€0	
If not referred by GP	⇔	€60	
If want to use private capacity in public hospital (whether referred or not), or see specialist in private clinic	⇔		The appropriate fee
Hospital stay (inpatient), charges per day			
If Medical Card, maternity services, prescribed infectious disease	⇔	€0	
If child referred from child health clinic/school health examinations	⇔	€0	
If child with disability/prescribed illness/mental illness (under 16)	⇔	€0	
If baby under 6 weeks	⇔	€0	
Others (treatment in public capacity)	⇔	€60	Max. €600 per year, No consultant charges
Treatment in private capacity of public hospital:			
Regional/voluntary and teaching hospital	⇔	€611	+consult.charges
County/voluntary non-teaching hospital	⇔	€389	To €520+consult.charges
District hospital	⇔	€206	To €257+consult.charges
Private clinic	⇔		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 requested.
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
Weekly income thresholds (gross less tax and pay related social insurance) for Medical Card eligibility in 2005.

	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 first and second child under age 16	+€38.00	+€38.00
For third and subsequent children under age 16	+€41.00	+€41.00
For first and second child over age 16 without income	+€39.00	+€39.00
For third 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

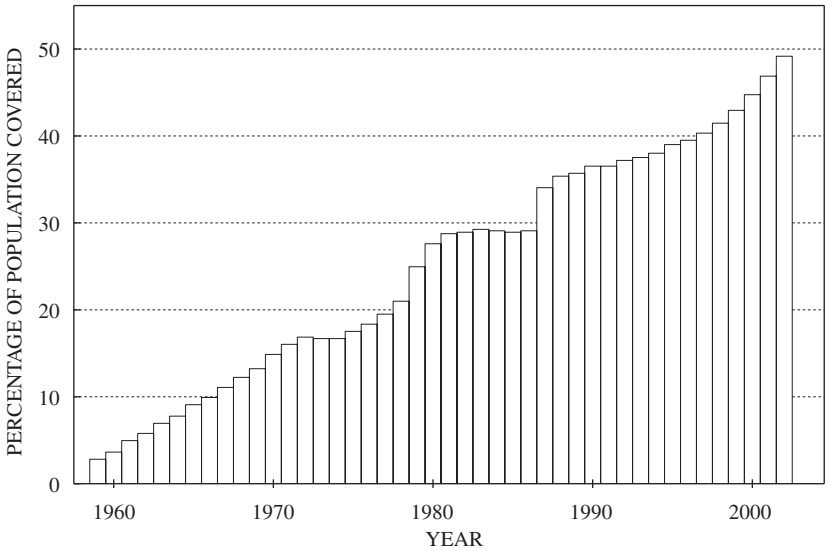

Fig. 2. Supplementary private health insurance coverage in Ireland.

Fig. 2 shows the percentage of the population with supplementary 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 supplementary 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 supplementary 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 and lifetime cover guarantees annual renewability of insurance coverage. These regulations reduce the scope for insurance companies to select clients with favorable characteristics.[6] Some employers offer to pay part of the insurance premium for their employees or have a group scheme with one of the two insurers. Individuals with an employer who offers to insure on their group scheme can 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 overlaps in coverage with the Medical Card, still a small percentage of Medical Card holders 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 regard 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.

4. The data

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

[6] 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).

electoral registers. Until 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 insurance status, 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.

In total 4048 households participated in the first wave in 1994, which was 57% of the originally sampled households. Table 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 et al. (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 eight 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. In Table 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 20–40 year old individuals are somewhat underrepresented and 50–60 years are somewhat overrepresented in the LIIS. Therefore, the LIIS contains also less individuals in full-time education, less individuals living in one of the five biggest cities and the average household size in the LIIS is slightly higher. This confirms the conclusion of Nolan et al. (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 who were 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 5).

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). Furthermore, we exclude all households in which someone is entitled to a Medical Card, mainly because Medical Card holders are covered without costs for relatively extensive insurance. Recall that a Medical Card not only covers the holder, but also the spouse and dependent children. For these households the choice to buy supplementary private health insurance is different than for the other households and also does not follow our theoretical model. 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 and above eligible for a Medical Card irrespective of their means.

In Table 6 we show the mobility in our data in supplementary private health insurance status. The health insurance choice is measured at the household level. In the table we also include Medical Card holders, mainly to show that households with a Medical Card tend to terminate their supplementary private health insurance. 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% decide not to renew their coverage.

Table 3
Number of observations in each wave.

	1994	1995	1996	1997	1998	1999	2000 (orig.)	2000 (new)	2000 (total)	2001
Households										
Completed questionnaires	4048	3584	3174	2945	2729	2378	1952	1515	3467	2865
Response rate (%)	57	82	84	88	87	84	83	57	69	78
Individuals										
Completed questionnaires	9904	8531	7488	6868	6324	5451	4529	3527	8056	6521
Response rate within completed hsdS (%)	95	94	95	95	96	95	95	89	93	93
Completed all surveys since wave 1		7942	6636	5782	5124	4329	3391	0	3391	2948

Source: Watson (2004).

Table 4
Comparison between Living in Ireland Survey and Census of 1996.

	Living in Ireland Survey (%)	Census (%)
Education		
Primary	36.8	35.3
Lower secondary	21.2	20.5
Upper secondary	27.3	30.2
Tertiary, no degree	5.7	5.0
Tertiary, 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

*As cities we consider Dublin, Cork, Limmerick, Galway or Waterford.

Table 5
Classification of incomes from the existing sample into the income percentiles of those newly sampled in 2000.

Income percentiles of newly added observations	Percentage of original observations in this percentile (%)
First decile	10.9
Second decile	11.7
Third decile	10.6
Fourth decile	10.3
Fifth decile	9.6
Sixth decile	10.7
Seventh decile	9.6
Eighth decile	9.3
Ninth decile	9.1
Tenth decile	8.4

Table 6
Transition frequencies of changes in supplementary private health insurance status and Medical Card holdership.

	Status in year t				
	Only PHI (%)	None (%)	PHI+MC (%)	only MC (%)	
Status in year $t-1$					
Only PHI	93.6	4.1	1.9	0.4	100
None	12.1	79.2	0.5	8.2	100
PHI and MC	13.0	4.2	65.1	17.7	100
Only MC	0.7	6.5	1.3	91.5	100

Note: PHI=supplementary private health insurance, MC=Medical Card.

Table 7
Descriptive statistics.

	No insurance	Insurance
Household level		
Frequencies	31.8%	68.2%
Household size	3.1	3.2
Number of children under 16	1.3	1.4
Single	21.5%	14.9%
Single parent	2.5%	0.9%
Couple without children	21.3%	28.2%
Couple with children	54.7%	56.0%
Living in city	24.6%	35.0%
Employer offer private insurance	9.3%	21.7%
Net weekly household income (median)*	£289.1	£441.1
Net weekly real household income (median)*	£271.5	£410.7
Individual level		
Female	47.8%	52.3%
Age (in years)	40.8	44.1
Years of education	9.7	11.8
Employed	69.8%	70.8%
Unemployed	2.0%	0.6%
Full-time education	0.2%	0.3%
Number of GP visits	2.5	2.8
Number of specialist visits	0.5	0.9
Number of hospital nights	0.8	0.9
Women that gave birth	7.7%	8.2%
Poor mental health (GHQ ≥ 4)	9.4%	7.6%
Health problem	11.9%	12.1%
Obese (BMI $\geq$ 30)	10.8%	8.5%
Daily smoker	31.6%	15.9%

*The euro conversion rate of the Irish pound was £1 = €1.2697.

Table 7 provides descriptive statistics of the relevant variables. The upper panel presents descriptives at the household level, the unit of analysis for the insurance decision, and the lower panel presents descriptives at the individual level, the unit of analysis for health care utilization. Variables are observed in all eight waves of the survey, except for visits to the GP and specialist, obesity and smoking. The number of visits to a GP and the number of visits to a specialist are only available from the second wave onwards, obesity and smoking only from the fifth wave onwards. In our sample of individuals without a Medical Card 68% of the households take supplementary private health insurance. Women, older individuals, high educated individuals and individuals living in one of the five big cities more often have supplementary private health insurance. The privately insured are less often unemployed and have, on average, higher incomes.[7] Furthermore, getting an offer for buying supplementary private health insurance from the employer increases the likelihood of taking up supplementary private health insurance.

The test score on a mental health questionnaire is used to create an indicator for poor mental health.[8] Information in the data on health problems is used to create an indicator for the presence of a health problem. Privately insured individuals have, on average, better mental health, but slightly more often a health problem. 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 poor mental health are shown in Table 8. Both are measured at the individual level. The data show that each year individuals without health problems have a probability of 5.1% to get a health problem the next year. For 67.5% of the individuals with a health problem their problem persists. This indicates that a substantial part of the health problems is chronic. For poor mental health the persistence rate is much lower. Of all individuals with poor mental health, only 33.4% still have poor mental health one year later.

Health care utilization variables are observed at the individual level and concern the number of times an individual visited a GP in the past 12 months, the number of times a medical specialist was visited in the past 12 months and the number of nights spent in the hospital in the last 12 months. Those with supplementary private health insurance utilize more health care services than individuals without supplementary private health insurance.

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

[8] The General Health Questionnaire (GHQ) is a 12-question test developed by Goldberg to measure mental health. The GHQ-12 has proven to work just as well as its larger counterparts with 28 or 60 questions (Banks et al., 1980). The conservative threshold for having 'a realistic chance of having a (mild) mental illness or disorder' is a score of at least 4. This is the threshold used for our indicator variable.

Table 8
Transition frequencies of changes in health variables.

	Status in year t (%)		
	No health problem	Health problem	
Status in year $t-1$			
No health problem	94.9	5.1	100
Health problem	32.5	67.5	100
	No poor mental health	Poor mental health	
No poor mental health	94.2	5.8	100
Poor mental health	66.6	33.4	100

Individuals are classified as obese if they have a Body Mass Index of 30 or higher. Obese individuals and smokers are less likely to have supplementary private health insurance.

5. Testing for asymmetric information

Chiappori and Salanié (2000) suggest a simple test for the presence of asymmetric information. They assume that the only private information individuals have is knowledge about their risk type. The correlation between insurance purchase and the incidence or value of claims (i.e. health care utilization) is in that case informative about the presence of asymmetric information. Both moral hazard and adverse selection will cause a positive correlation between health care utilization and being covered by supplementary private health insurance (conditional on all information used by the insurer).

Finkelstein and McGarry (2006) argue that in the case of multidimensional private information (for example, risk type, health preferences and risk aversion), a positive correlation is neither a necessary nor a sufficient condition for the presence of asymmetric information.[9] If one dimension of private information has a positive (adverse selection and/or moral hazard) effect on the correlation between insurance purchase and expected care utilization, but another dimension of private information has a negative (advantageous selection) effect on this correlation, the two effects may partially or fully offset each other. Finkelstein and McGarry (2006) stress that all information not used by the insurer but known to the econometrician can indicate asymmetric information if it correlates with both insurance purchase and health care utilization. If such an individual characteristic has similar signs for both correlations, there should be adverse selection and/or moral hazard. Opposite signs indicate the presence of advantageous selection.

We will perform both tests. Recall that in Ireland insurers are obliged to accept everyone and premiums are determined by community rating. This implies that in both the Chiappori and Salanié (2000) and the Finkelstein and McGarry (2006) tests, there are no individual characteristics for which we should control. It is also clear that within such an institutional setting as in Ireland individuals have private information. We are, therefore, not so much interested in the question whether there is asymmetric information, but more in how this private information affects insurance purchase and health care utilization.

Table 9 shows the raw correlations between insurance status and different measures of health care utilization. All correlations are positive and significant, which in the Chiappori and Salanié (2000) framework points towards the presence of adverse selection and/or moral hazard. Table 10 reports results from pooled OLS estimation. By comparing covariate effects in the model for insurance status and the models for care utilization, we can test for the presence of multidimensional private information (Finkelstein and McGarry, 2006). Some characteristics indicate the presence of private information. Giving birth is positively correlated both to having supplementary private health insurance and to all types of health care utilization. Poor mental health is positively associated with all types of health care utilization and negative with having supplementary private health insurance. The association between age and utilization is U-shaped. Up to age 45 the association is negative, for 45 and up it is positive. The association between age and insurance is positive for all ages. The test proposed by Finkelstein and McGarry (2006) thus indicates the presence of multidimensional private information, but the evidence for the direction is mixed.

6. Empirical model

In this section we provide an empirical model to investigate the underlying sources of asymmetric information. The theoretical model from Section 2 provides insight in the potential sources of selection, but is a static model. Bolhaar (2010) shows that the insights from the static model carry over to the dynamic case. In this section we specify dynamic panel data

[9] In our theoretical model existing health conditions μ and the risk of health shocks λ can be considered as describing risk type. Other dimensions of private information are health preferences α and risk aversion γ.

Table 9
Raw correlations between having supplementary private health insurance and health care utilization.

	Individual level	Household level
GP visits	0.025***	0.036***
	(0.010)	(0.003)
Specialist visits	0.075***	0.090***
	(0.000)	(0.000)
Nights in hospital	0.020**	0.034***
	(0.040)	(0.004)

***=significant at 1% level, **=significant at 5% level, *=significant at 10% level *p*-values in parentheses.

Table 10
OLS estimates to test for multidimensional private information.

	Insurance decision	Care utilization		
		GP	Specialist	Hospital
Net weekly hsd income/£100	0.034***	−0.020	0.050*	0.010
	(0.003)	(0.022)	(0.029)	(0.025)
Employer offers private insurance	0.166***	0.054	0.152**	−0.011
	(0.019)	(0.165)	(0.075)	(0.163)
No employed household members	−0.090			
	(0.100)			
Household size	−0.011			
	(0.007)			
Gave birth	0.042**	5.455***	3.335***	4.379***
	(0.019)	(0.404)	(0.256)	(0.347)
Poor mental health	−0.046*	1.133***	0.241*	1.121***
	(0.027)	(0.263)	(0.127)	(0.421)
Health problem	0.055	3.414***	1.160***	1.161***
	(0.039)	(0.306)	(0.185)	(0.321)
Age oldest household member	0.025***	−0.146***	−0.030*	−0.093**
	(0.004)	(0.034)	(0.016)	(0.040)
(Age oldest household member)^2	−0.0002***	0.002***	0.00003**	0.001***
	(0.00004)	(0.0004)	(0.0002)	(0.0004)
Years of education	0.064***	−0.003	0.009	−0.027
	(0.004)	(0.025)	(0.016)	(0.035)
Living in city	0.058***	−0.208	0.079	−0.024
	(0.019)	(0.130)	(0.072)	(0.128)
Female		0.996***	0.267***	0.159*
		(0.121)	(0.065)	(0.094)
Year dummies	Yes	Yes	Yes	Yes
Intercept	−1.055	4.592	0.461	2.059
	(0.106)	(0.806)	(0.455)	(0.957)
Observations	6750	7909	8102	7916
Households/individuals	1850	2852	2851	2886

***=significant at 1% level, **=significant at 5% level, *=significant at 10% level, standard errors in parentheses.

models for supplementary private health insurance purchase and utilization of health care. The reasons for estimating dynamic panel models are threefold. First, heterogeneity in preferences and/or risk aversion may have dynamic effects (differences in preferences and/or risk aversion lead to differences in the level of health investments and hence in health in subsequent periods). Second, dynamic panel data models allow us to separate state dependence from individual heterogeneity. Therefore, they provide more insight in individual behavior. Third, these models allow us to distinguish between long-run and short-run selection effects. In a dynamic panel data model, short-run selection effects in insurance choices are the result of shocks in health status. Long-run selection effects are more related to the fixed effects, which absorb time-invariant characteristics such as preferences, risk-aversion and cognition.

The optimal insurance status in our theoretical model depends on the optimal health investments in both insurance states, $V^*_{I=0}$ and $V^*_{I=1}$, the insurance premium r, income Y, preferences α and risk aversion γ. As the insurance decision has to be made before the health shock is revealed, the insurance decision will be based on the expectation λ that a shock will occur and hence the expected health and the expected level of health care utilization.

In the empirical model, we assume, like Harmon and Nolan (2001) that the decision to take supplementary private health insurance I_{it} is made at the household level i in each period t.[10] Household income Y_{it} is included as an explanatory variable. The expectation of the household about the optimal level of health investments is based on previous years' health and previous years' care utilization, H_{it-1} and V_{it-1}. The household level equivalent of the health variables described above is used, such as the fraction of adult household members with poor mental health (i.e. GHQ ≥ 4) and the fraction of adult household members with a health problem.[11] For health care utilization variables included in the insurance choice model we use the average number of visits to a GP, visits to a specialist and nights in hospital of the adult household members. Furthermore, household characteristics X_{it} and a household fixed effect θ_i are included in the linear probability model that describes the household's insurance decision at time t:

$$I_{it} = \beta_1 I_{it-1} + \beta_2 Y_{it} + \beta_3 H_{it-1} + \beta_4 V_{it-1} + \beta_5 X_{it} + \kappa_t + \theta_i + \varepsilon_{it} \tag{9}$$

where the household specific effects θ_i capture time-invariant characteristics such as the rate of risk-aversion and preferences for health, which are known to the household but unobserved by the econometrician. Within our eight year observation window it is likely that household specific preference parameters, but also other characteristics that capture household specific effects, like cognition, remain constant. These are factors that determine whether adverse or advantageous selection is relevant in the long-run. Because preference parameters are correlated to many observed characteristics, such as health status and lagged medical consumption, θ_i should be a fixed effect rather than a random effect. This also explains why we use a linear probability model instead of, for example, a logit model. Estimating nonlinear models including lagged endogenous variables, fixed effects and many time-varying regressors is problematic (e.g. Honoré and Kyriazidou, 2008).

In the vector X_{it} we include 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 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 has such an offer. Since households without employed members cannot receive offers, we add an indicator variable for these households. Finally, κ_t are year dummies describing the time trend. This should pick up, for instance, the increased popularity of supplementary private health insurance in Ireland. In the dynamic panel data model the coefficients associated with the vector X_{it} describe the effects of shocks in covariates on the insurance decision. These can be interpreted as short-term responses, and are thus short-run selection effects. The fixed effects absorb time-invariant characteristics such as the rate of risk aversion, health preference and cognition. Such characteristics may be informative about long-run selection effects. After estimating the model we relate the fixed effects to (time-invariant) variables observed in the data. This provides insight in long-run selection in insurance status.

In our theoretical framework, the optimal amount of health investments could be derived from Eq. (5). This is a function of insurance status I, the price of health investments $p(I)$, income Y, existing health conditions μ, health shocks Δ, preference for consumption relative to health α and risk aversion γ, $V^* = g(I, p(I), \mu, \Delta, Y, \alpha, \gamma)$.

In the empirical model, health investments are defined as health care utilization in the past 12 months (V_{it}). Health care utilization is measured at the individual level. Following the theoretical framework, we include as explanatory variables the household's private health insurance status in the past year (I_{it-1}), and income in the past year (Y_{it-1}). For these regressors, and also for health, past years' values are used as this refers to their value at the start of the 12 month period over which utilization is measured. This also applies to health.

We have two variables that describe health status: an indicator for having a health problem and an indicator for poor mental health (GHQ ≥ 4). Changes in these variables denote health shocks. Existing (chronic) conditions, however, will be absorbed in the individual fixed effect.

Our dynamic model for health care utilization of individual i at time t is, therefore, given by

$$V_{it} = \delta_1 V_{it-1} + \delta_2 I_{it-1} + \delta_3 Y_{it-1} + \delta_4 H_{it-1} + \delta_5 X_{it-1} + \tau_t + \eta_i + v_{it} \tag{10}$$

where individual specific effects η_i capture time-invariant characteristics. The vector X_{it-1} captures additional (time-varying) individual characteristics that may be important in determining the optimal amount of health care utilization, like a dummy variable if the individual gave birth to a child, a dummy variable for being employed and age effects. Employment can affect care utilization if, for example, employees require a doctors' statement to be eligible for sickness benefits. Finally, we include year dummies τ_t to capture the 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.

[10] Our data show that in almost all households either all household members are covered by supplementary private health insurance or none.

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

Most empirical research on health insurance decisions and medical care utilization is based on cross-sectional analyses and uses OLS (e.g. Jones et al., 2006; Stabile, 2001; Gruber and Poterba, 1994; Wolfe and Goddeeris, 1991; Savage and Wright, 2003; Harmon and Nolan, 2001; Holly et al., 1998; Hurd and McGarry, 1997; Blumberg et al., 2001; Chernew et al., 1997; Liu and Chen, 2002; Vera-Hernández, 1999; Bundorf et al., 2005; Ettner, 1997; Cameron et al., 1988). Besides estimating dynamic panel data models, we will therefore estimate a 'baseline' model with pooled OLS. The baseline model includes time-invariant variables, but no fixed effects (so $\delta_1 = \beta_1 = 0$ and $\eta_i = \theta_i = 0$).

For the health insurance decision, we next estimate a static fixed effect model that takes into account unobserved household specific effect but does not allow for state dependence ($\beta_1 = 0$). Finally, for both the insurance decision and health care utilization we consider dynamic panel data models that are able to distinguish between state dependence and fixed effects. For the estimation of the dynamic panel data models the Arellano–Bond estimator is used. After taking first differences, this estimator uses lagged levels of both the dependent variable and covariates as instruments to deal with endogeneity of the first difference of the lagged dependent variable. In particular, one lag of the dependent and independent variables are used as instruments.

7. Results

7.1. Supplementary private health insurance purchase

Table 11 shows the estimation results of the linear probability model for the household's insurance decision. A positive coefficient is associated with a higher probability of insurance purchase. The first column refers to pooled OLS estimation, which ignores state dependence ($\beta_1 = 0$) and household fixed effects ($\theta_i = \beta_0$).[12] In the second column we report the results allowing for fixed effects, but still without state dependence ($\beta_1 = 0$). The results are obtained from within estimation, which eliminates time-invariant characteristics from the model (e.g. level of education and gender). Finally, we present in the third column the estimation results for the model also including state dependence, estimated using the Arellano–Bond estimator. At the bottom of the table we show specification tests for the Arellano–Bond estimator. The key identifying assumption is that there is no second-order autocorrelation. Furthermore, we report Sargan tests for overidentifying restrictions.

There are substantial differences between the OLS and the panel data estimates. OLS estimates are more often significant and covariate effects are relatively large. The pooled OLS estimates indicate a significant positive association between income and supplementary private health insurance purchase. The panel data estimates are much smaller, implying that changes in income do not immediately change the insurance decision. This is the case 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 poor mental health and supplementary private health insurance. The association between having a health problem and supplementary private health insurance is also negative, but insignificant. Negative associations point in the direction of advantageous selection. After including a household specific effect, the association with poor mental health diminishes and is no longer significant, suggesting that chronic poor mental health is driving the associations found in the OLS regressions.

Lagged utilization of GP and specialist is positively associated with the purchase of supplementary private health insurance. Lagged utilization of inpatient hospital services is negatively associated with insurance purchase. The positive effects of visits to a GP and visits to a specialist point to adverse selection, where the negative effect of hospital nights points to advantageous selection. These short-run selection effects are all 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 0.004. To summarize, the dynamic panel data model shows some evidence for short-run selection effects (related to past health care utilization), but the size of this selection is modest.

Comparing the results from the different models shows that there is substantial heterogeneity between households, which is absorbed in the fixed effects. This might, for example, imply that households differ in preferences or risk aversion. Such factors can be important sources for the presence of adverse or advantageous selection (in the long-run). Therefore, in Section 7.3 we further analyze the fixed effects.

The estimates from the dynamic panel data model show significant state dependence in the 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 0.24. Such state dependence may occur because households automatically renew their insurance each year. This may be the consequence of possible costs associated with terminating or applying for supplementary private health insurance. Recall from Section 4.2 that, on average, 94% of the households with supplementary private health insurance decide to renew. So about one-quarter of this can be explained from state dependence, which implies that preferences and household characteristics are important in insurance decisions.

[12] Adding obesity status and smoking behavior as explanatory variables gives similar results, but reduces the sample by 50%. Both variables have a negative effect on the insurance decision (-0.038 and -0.115 for respectively obesity and smoking), but only the effect of smoking is significant.

Table 11
Estimation results for insurance decision.

		OLS (1)	Fixed eff. panel (within) (2)	Dynamic panel (Arell.–Bond) (3)
Lagged insurance status				0.240***
				(0.067)
Net weekly hsd income/£100		0.034***	0.009***	0.005**
		(0.003)	(0.002)	(0.002)
Employer offers private insurance		0.166***	0.035**	0.032*
		(0.019)	(0.014)	(0.017)
No employed household members		−0.073	0.040	−0.233*
		(0.107)	(0.106)	(0.121)
Household size		−0.011	0.032***	0.004
		(0.007)	(0.012)	(0.022)
Gave birth		0.012	−0.004	−0.002
		(0.020)	(0.015)	(0.018)
Poor mental health		−0.059**	0.001	−0.013
		(0.028)	(0.015)	(0.016)
Health problem		−0.036	−0.025	0.003
		(0.057)	(0.030)	(0.031)
GP visits		0.004**	0.002	0.003*
		(0.002)	(0.001)	(0.002)
Specialist visits		0.012***	0.002	0.005
		(0.003)	(0.001)	(0.004)
Nights in hospital		−0.001	−0.001*	−0.001**
		(0.001)	(0.001)	(0.001)
Age oldest household member		0.025***		
		(0.004)		
(Age oldest household member)^2		−0.0002***	0.0001***	0.0001***
		(0.00004)	(0.00002)	(0.00003)
Years of education		0.063***		
		(0.004)		
Living in city		0.054***		
		(0.019)		
Intercept		−1.068		
		(0.106)		
Year dummies		Yes	Yes	Yes
Observations		6601	6626	4165
Households		1842	1845	1260
Specification tests for dynamic panel data model				
H_0: no 1st-order autocorr.	z =			−7.778
	Pr > z =			0.000
H_0: no 2nd-order autocorr.	z =			1.361
	Pr > z =			0.173
Sargan test:	$\chi2(5)$ =			8.408
	Pr > $\chi2$ =			0.135

***=significant at 1% level, **=significant at 5% level, *=significant at 10% level standard errors in parentheses.

7.2. 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. GPs are relatively easy accessible for individuals. To go to a medical specialist through the public system a referral 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 are in Table 12, with estimation results for GP visits in columns (1)–(2), results for specialist visits in columns (3)–(4) and results for nights in hospital in columns (5)–(6). For all three measures the first column reports the OLS estimates and the second column reports the results from dynamic panel data estimation. Again differences in results between estimation methods are large. There is only significant state dependence for GP visits. The difference between the pooled OLS estimates and the dynamic panel data estimates is thus largely due to allowing for fixed effects.

For GP visits the OLS estimates show a significant positive effect of supplementary private health insurance coverage. However, this strong positive effect is no longer significant and switches sign in the dynamic panel data model. All specifications condition on health problems and poor mental health. The estimates from the panel data models do not

Table 12
Estimation results for health care utilization.

	GP visits		Specialist visits		Hospital nights	
	OLS	Dyn. panel	OLS	Dyn. panel	OLS	Dyn. panel
Lagged utilization		0.103**		0.073		0.038
		(0.048)		(0.06)		(0.093)
Supplementary private health insurance	0.275**	−0.258	0.195**	−0.040	0.093	0.108
	(0.134)	(0.431)	(0.080)	(0.099)	(0.098)	(0.242)
Net weekly hsd income/£100	−0.032	−0.014	0.045	−0.004	−0.003	0.066
	(0.022)	(0.036)	(0.031)	(0.020)	(0.026)	(0.044)
Employment	0.019	1.302***	0.146**	0.079	−0.064	0.312
	(0.162)	(0.480)	(0.073)	(0.138)	(0.156)	(0.254)
Poor mental health	1.473***	−0.604**	0.043	−0.117	0.729**	0.154
	(0.317)	(0.240)	(0.123)	(0.149)	(0.364)	(0.375)
Health problem	3.283***	−0.492	0.700***	−0.077	0.112	−0.848**
	(0.291)	(0.404)	(0.171)	(0.200)	(0.309)	(0.375)
Gave birth	5.430***	4.108***	2.571***	2.679***	2.238***	2.703***
	(0.395)	(0.508)	(0.257)	(0.275)	(0.487)	(0.575)
Number of GP visits			0.140***	0.119***	0.217***	0.210***
			(0.014)	(0.022)	(0.038)	(0.057)
Number of specialist visits					0.287***	0.327***
					(0.086)	(0.106)
Age	−0.140***		−0.017		−0.057	
	(0.030)		(0.016)		(0.041)	
$(\text{Age})^2$	0.001***	0.001**	0.0002	−0.0001	0.001*	−0.001
	(0.0003)	(0.0005)	(0.0002)	(0.0003)	(0.0005)	(0.001)
Years of education	−0.020		−0.002		−0.034	
	(0.025)		(0.013)		(0.033)	
Living in city	−0.240*		0.107		0.005	
	(0.126)		(0.070)		(0.124)	
Female	0.946***		0.128**		−0.124	
	(0.118)		(0.062)		(0.093)	
Intercept	4.477		0.444		1.056	
	(0.755)		(0.416)		(0.985)	
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8119	5063	8115	5058	8075	5003
Individuals	2884	1829	2884	1828	2878	1814
Specification tests for dynamic panel model						
H_0: no 1st-order autocorr. z =		−6.029		−3.356		−3.616
Pr > z =		0.000		0.001		0.0003
H_0: no 2nd-order autocorr. z =		0.594		−0.985		−0.387
Pr > z =		0.553		0.325		0.698
Sargan test: $\chi2(4)$ =		5.019		2.387		0.472
Pr > $\chi2$ =		0.285		0.665		0.976

***=significant at 1% level, **=significant at 5% level, *=significant at 10% level standard errors in parentheses.

provide any evidence for the presence of moral hazard. The associations estimated by OLS are thus driven by fixed effects which may include health preferences, risk aversion, etc. The absence of moral hazard has also been found by Chiappori et al. (1998) in the analysis of a natural experiment in France, where a copayment rate was introduced for GP visits. 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 the number of visits to a medical specialist show a pattern close to that of GP visits. Again supplementary private health insurance shows a positive and significant association in the pooled OLS estimation, but a much smaller, negative and insignificant effect in the dynamic panel data models. The OLS results are in line with previous research, e.g. Jones et al. (2006) and Pohlmeier and Ulrich (1995). None of these papers allows for fixed individual heterogeneity. For the number of nights in hospital we find insignificant effects of supplementary private health insurance for all estimation methods. The existing literature on this subject is mixed. Stabile (2001), Hurd and McGarry (1997), and Cameron et al. (1988) also do not find significant effects, but Meer and Rosen (2004), Harmon and Nolan (2001), and Holly et al. (1998) find significant effects of between 3% and 8% higher probability of a hospital stay.

Of the socioeconomic factors, no effect is found of income on GP or specialist visits or on nights in hospital. This contradicts with Pohlmeier and Ulrich (1995) and Stabile (2001), who find negative effects of income on GP visits and

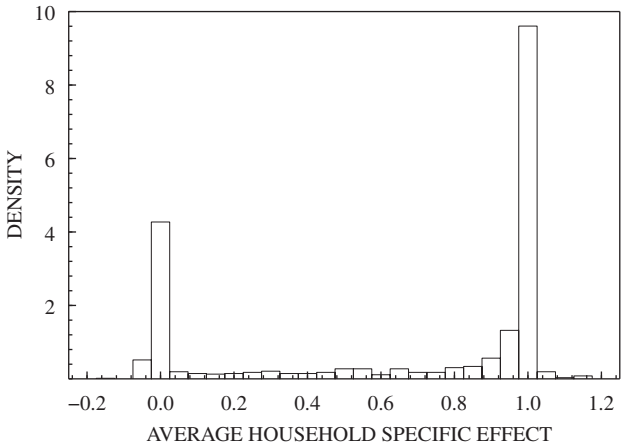

Fig. 3. Fixed effects for supplementary private health insurance decision.

Pohlmeier and Ulrich (1995), Doorslaer et al. (2006) and Vera-Hernández (1999), who find significant income effects on specialist visits. Their income effects might also pick up permanent income effects, which are absorbed in our fixed effects. We will return to this issue when decomposing the estimated fixed effects. Recall, furthermore, that our sample only includes individuals without a Medical Card, and, therefore, excludes those with the lowest incomes.

Employed individuals visit the GP, on average, one additional time per year. A straightforward explanation may 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 and for hospital nights. Both health variables, poor mental health and having a health problem have much smaller effects that are often not significant in the dynamic panel data model than in the pooled OLS estimation. The fixed effects thus absorb a substantial part of the health problems, which is not surprising since many are chronic. Finally, giving birth keeps its size and significance over all estimations.

7.3. Decomposition of fixed effects

The estimation results indicate the presence of asymmetric information. But when controlling for fixed effect most covariate effects become small and often insignificant. This suggests that long-run (selection) effects are more important than short-run effects. In this subsection we take a closer look at the fixed effects. These capture all characteristics that are time invariant, some observed, like education and gender, some unobserved, like preferences and risk aversion.

The fixed effect for household i in the model for the insurance decision (Eq. (9)) is estimated as

$$\hat{\theta}_i = \overline{I}_i - \hat{\beta}_1 \overline{I}_{i,-1} - \hat{\beta}_2 \overline{Y}_i - \hat{\beta}_3 \overline{H}_{i,-1} - \hat{\beta}_4 \overline{V}_{i,-1} - \hat{\beta}_5 \overline{X}_i - \hat{\kappa} \tag{11}$$

where $\hat{\beta}$ are the estimated parameters from the dynamic panel data model and $\overline{I}_i$ 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.

Fig. 3 shows the distribution of the fixed effects for the insurance decision. The distribution is 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 health care utilization variables are shown in Fig. 4. Table 13 shows the correlations between the fixed effects in the insurance decision (θ_i) and health care utilization equations (η_i).[13] As expected the fixed effects for the different health care utilization variables are positively and significantly correlated to each other. The correlations with the fixed effects from the insurance decision are, however, small and insignificant. Only for specialist visits the correlation is significant.

The correlations do not provide evidence for long-run selection effects, on average, either being adverse on advantageous. However, this does not rule out that there are multidimensional aspects to selection. Above we already saw that there may be multiple dimensions of private information. Therefore, we decompose the fixed effects to investigate if there are drivers for possible long-run selection. Fixed effects are not necessarily independent of the time-varying characteristics included in the dynamic panel data model. Therefore, in the decomposition we include long-run averages of time-varying characteristics, like income and health status. The interpretation may be that the dynamic panel estimations reflect the effect of a *shock* in, for example, income (short-run selection effects), and a decomposition of the fixed effect reflects the effect of the average income *level*. However, we should not give a causal interpretation to the

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

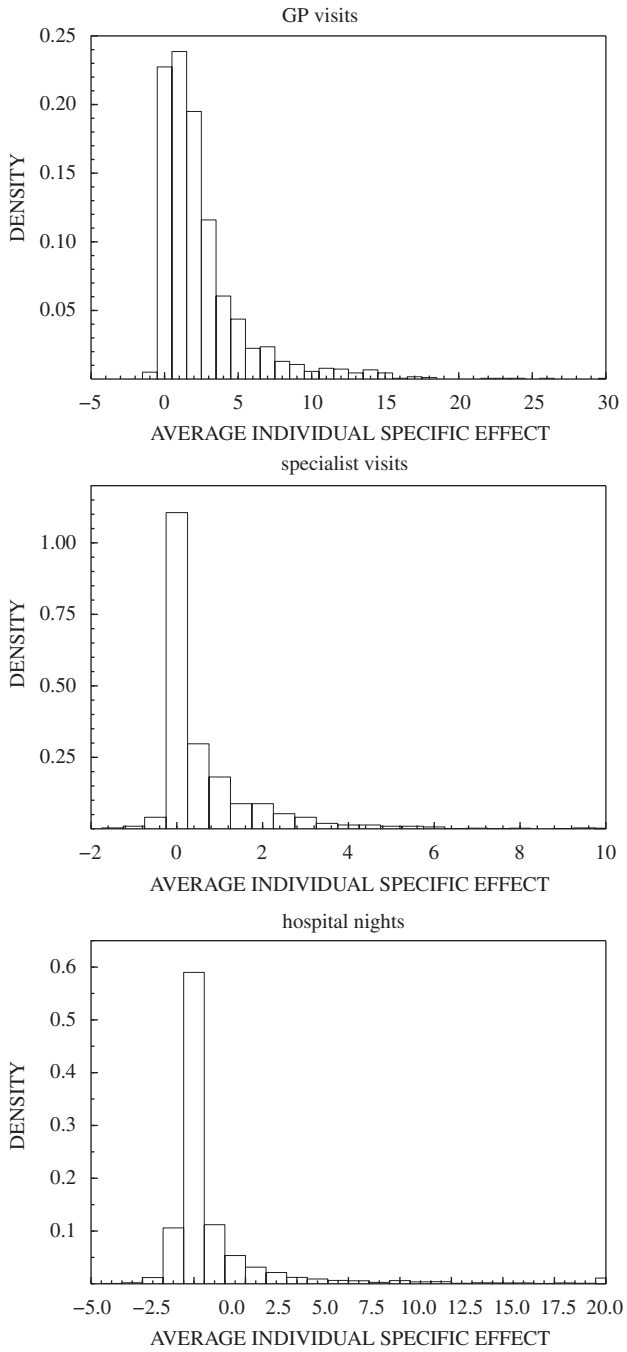

Fig. 4. Fixed effects for health care utilization.

results of the decomposition, since the estimates reflect associations. There are characteristics such as risk preference and discount rates which are important but unobserved.

First, we relate the estimated fixed effects to health status. Recall from Table 8 that having a physical health problem does not change much between years, which suggests that many physical health conditions are chronic. Mental health changes much more between years. Table 14 shows that both poor mental health and physical health problems are associated with more health care utilization. Furthermore, poor mental health is significantly negatively associated to insurance purchase. Recall from our theoretical model that those with low preferences for health have worse health and are less likely to obtain health insurance. Poor mental health may be a cause of long-run advantageous selection.

Next, we extend the analysis by including more (time-invariant) characteristics. The results are shown in Table 15. The characteristics explain about 28% of the variation in the fixed effect in the insurance decision. For health care utilization

Table 13
Correlations between fixed effects from dynamic panel data models.

	GP visits	Specialists visits	Hospital nights	Private insurance
GP visits	1.000			
Specialist visits	0.252***	1.000		
	(0.000)			
Hospital nights	0.216***	0.181***	1.000	
	(0.000)	(0.000)		
Private insurance	0.022	0.061**	0.032	1.000
	(0.368)	(0.010)	(0.178)	

***=significant at 1% level, **=significant at 5% level, *=significant at 10% level *p*-values in parentheses.

Table 14
Effect of health on the fixed effect.

	Insurance decision	Care utilization		
		GP	Specialist	Hospital
Poor mental health	−0.195**	4.630***	1.110**	1.982**
	(0.085)	(1.371)	(0.552)	(0.978)
Health problem	−0.039	9.026***	2.619***	5.406***
	(0.095)	(1.064)	(0.593)	(1.257)
Intercept	0.679	1.626	0.457	0.350
	(0.015)	(0.123)	(0.033)	(0.101)
Number of observations	1260	1829	1828	1814

***=significant at 1% level, **=significant at 5% level, *=significant at 10% level standard errors in parentheses.

Table 15
Decomposition of the household specific effects (insurance decision) and individual specific effects (care utilization).

	Insurance decision	Care utilization		
		GP	Specialist	Hospital
Poor mental health[a]	−0.122*	4.422***	1.052*	1.993**
	(0.071)	(1.394)	(1.145)	(0.962)
Health problem[a]	0.018	9.073***	2.748***	4.550***
	(0.088)	(1.142)	(0.592)	(1.352)
Years of education[b]	0.062***	0.024	−0.003	−0.019
	(0.005)	(0.032)	(0.026)	(0.049)
Net weekly hsd income/£100	0.045***	−0.021	0.113	−0.017
	(0.006)	(0.038)	(0.077)	(0.052)
Female		1.012***	0.392***	0.298*
		(0.195)	(0.076)	(0.164)
Lives in city	0.069***	−0.418**	−0.008	−0.111
	(0.022)	(0.204)	(0.130)	(0.209)
Age[b]	0.016***	−0.182***	−0.076**	−0.129***
	(0.005)	(0.046)	(0.038)	(0.049)
$(\text{Age})^2$	−0.0001*	0.002***	0.001	0.002***
	(0.0001)	(0.0005)	(0.0004)	(0.001)
Single parent	−0.197	−0.586	−0.719*	−0.740
	(0.124)	(0.623)	(0.347)	(0.477)
Couple without children	−0.126*	1.227*	0.029	0.287
	(0.073)	(0.671)	(0.354)	(0.613)
Couple with children	−0.013	−0.128	−0.026	0.266
	(0.030)	(0.214)	(0.115)	(0.203)
Constant	−0.734	4.814	1.582	2.562
	(0.143)	(1.019)	(0.827)	(1.190)
Number of observations	1260	1819	1818	1804

***=significant at 1% level, **=significant at 5% level, *=significant at 10% level standard errors in parentheses.
Note: 'single' is the omitted householdtype.
[a] Variables are measured as 'fraction of the household'. Instead of BMI the fraction of the household that is obese is used.
[b] Variables are measured as the maximum among the interviewed household members. Instead of BMI the fraction of the household that is obese is used.

this ranges from 20% for GP visits to 7% for hospital nights. Due to heteroskedasticity in the fixed effects, we cannot give these percentages the same interpretation as the *R*-squared. Adding additional heterogeneity slightly reduces the association between poor mental health and the insurance decision. Age is negatively correlated with health care utilization until age 50 and positively correlated with health care utilization above age 50. This implies long-run advantageous selection for individuals younger than 50 and adverse selection for individuals above 50.[14]

Fang et al. (2008) stress the importance of education as a cause for advantageous selection. This does not concur with our empirical findings. We find that each additional year of education increases the probability of having supplementary private health insurance with almost 0.06. 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. However, we do not find an association between education and health care utilization. Income has a positive significant correlation with insurance purchase. For every additional £100 of net weekly income the uptake of supplementary private health insurance increases with 0.05. An one standard deviation change in net weekly household income (£138) changes the probability to buy supplementary private health insurance by 0.06. Our results on insurance purchase are line with Fang et al. (2008), but we do not find evidence that income and education are sources of long-run selection.

7.4. Older individuals

Most evidence on the presence of advantageous selection in health insurances comes from older individuals in the US (e.g. Brown and Finkelstein, 2008; Cutler et al., 2008; Fang et al., 2008; Finkelstein and McGarry, 2006). We have repeated our analyses on a sample containing only individuals age 65 and above.[15]

Among the elderly about 61.6% have a Medical Card, which is about twice as high as in the full population. The raw correlations between having supplementary private health insurance and health care utilization are positive, although only significant for specialist visits, and somewhat stronger than for the entire sample. The estimation results for dynamic panel data models for insurance purchase and health care utilization are comparable to those for the full sample. The most important difference is that there is no significant state dependence anymore for GP visits and for the insurance decision, and that state dependence is found for nights in hospital which was not found in the full sample (for specialist visits there is no state dependence in both samples).

The correlation pattern between the fixed effects shows a positive, non-significant correlation between insurance purchase and GP visits and hospital nights, and a positive significant correlation with specialist visits. The decomposition of the fixed effects on health variables only shows that having a health problem is associated with more health care use of all three types of care and that having poor mental health is associated with more GP visits. The associations with specialist visits and nights in hospital are not significant. The effect on the insurance decision is still negative for poor mental health, but it is no longer significantly different from zero. Adding more variables to the decomposition of the fixed effects does not change the effect of the health variables on insurance purchase or care utilization. As for the full sample, education and income are found to be positively associated with insurance purchase. We now also find a positive effect of education on specialist visits. The main conclusion is that also for the elderly, there is no strong evidence for advantageous selection.

8. Conclusions

The main objective of this paper is to obtain insight in insurance decisions and health care use 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 copayments and to give access to private care. Our analyses focus on the decision to take supplementary private health insurance and on health care utilization.

The data show presence of multidimensional asymmetric information (Finkelstein and McGarry, 2006). 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. Short-run selection effects (i.e. responses to shocks) are not very important, while long-run effects (caused by differences in preferences, risk aversion, health risk, etc.) are more important. Therefore, we examined the covariance structure of the fixed effects of the insurance decision and health care utilization, and decomposed the fixed effects.

Poor mental health and to a lesser extent (physical) health problems are negatively associated with buying supplementary private health insurance and positively correlated with health care utilization. This suggests that long-run selection is advantageous. Education and income are important in explaining insurance purchase, but are not associated to health care utilization. Age and living in the city affect both insurance purchase and health care use. This again suggests advantageous selection, in particular until age 50.

[14] This result is robust to using indicators for age groups rather than a second-order polynomial.

[15] Estimation results are available on request.

Even though, on average, we do not find evidence for selection, there is some indication for advantageous selection for specific subgroups. 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). 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. Fang et al. (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 bad health.

Acknowledgment

We thank Jaap Abbring, Martin Browning, Pierre-André Chiappori, Eddy van Doorslaer, two anonymous referees, and the participants of the RTN-conference 2006 in Madrid, IHEA 2008 and ESEM 2008 for useful comments. We thank the Irish Economic and Social Research Institute for providing the data of the Living in Ireland Survey. Jonneke Bolhaar and Maarten Lindeboom acknowledge financial support from Netspar. Bas van der Klaauw acknowledges financial support from an ERC grant.

Appendix A. Derivations

In this appendix we briefly discuss the derivation of the results in Section 2. The utility function in Eq. (1) states

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

Households optimize their utility over health investments V, which gives the first-order condition:

$$\frac{\partial U}{\partial V} = \alpha \frac{\partial u(C)}{\partial V} u(C)^{\alpha-1} H^{1-\alpha} + (1-\alpha) \frac{\partial H}{\partial V} u(C)^{\alpha} H^{-\alpha} = 0$$

which simplifies to

$$\alpha \frac{\partial u(C)}{\partial V} H + (1-\alpha) \frac{\partial H}{\partial V} u(C) = 0 \tag{12}$$

Using $u(C) = C^{1-\gamma}/(1-\gamma)$ from Eq. (3) gives

$$\frac{\partial u(C)}{\partial V} = C^{-\gamma} \frac{\partial C}{\partial V}$$

Next combining the budget constraint $Y = C + M$ and Eq. (3),

$$C = Y - M = Y - rI - p(I)V$$

which implies

$$\frac{\partial C}{\partial V} = -p(I)$$

and thus also

$$\frac{\partial u(C)}{\partial V} = \frac{\partial C}{\partial V} C^{-\gamma} = -p(I) C^{-\gamma} \tag{13}$$

The first derivative of H with respect to V comes from the health production function:

$$\frac{\partial H}{\partial V} = \frac{\partial f^{H}(V, \Delta, \mu)}{\partial V} \tag{14}$$

Now substitution of Eqs. (13) and (14) in Eq. (12) gives

$$\frac{\alpha}{1-\alpha}(1-\gamma) \frac{p(I)}{\partial f^{H}(V, \Delta, \mu)/\partial V} = \frac{C}{H} \tag{15}$$

which is Eq. (5).

References

Bajari, P., Hong, H., Khwaja, A., 2006. Moral Hazard, Adverse Selection and Health Expenditures: A Semiparametric Analysis. NBER Working Paper 12445.

Banks, M.H., Clegg, C.W., Jackson, P.R., Kemp, N.J., Stafford, E.M., Wall, T.D., 1980. The use of the general health questionnaire as an indicator of mental health in occupational studies. Journal of Occupational Psychology 53, 187–194.

Blumberg, L.J., Nichols, L.M., Banthin, J.S., 2001. Worker decisions to purchase health insurance. International Journal of Health Care Finance and Economics 1, 305–325.

Bolhaar, J., 2010. Advantageous Selection in a Dynamic Framework, mimeo.

Brown, J.R., Finkelstein, A., 2008. The interaction of public and private insurance: medicaid and the long-term care insurance market. American Economic Review 98, 1083–1102.
Buchmueller, T.C., Fiebig, D., Jones, G., Savage, E., 2008. Advantageous Selection in Private Health Insurance: The Case of Australia. CHERE Working Paper 2008/2.
Bundorf, M.K., Herring, B., Pauly, M., 2005. Health Risk, Income, and the Purchase of Private Health Insurance. NBER Working Paper 11677.
Cameron, A.C., Trivedi, P.K., Milne, F., Piggott, J., 1988. A microeconometric model of the demand for health care and health insurance in Australia. Review of Economic Studies 55, 85–106.
Cardon, J.H., Hendel, I., 2001. Asymmetric information in health insurance: evidence from the national medical expenditure survey. The RAND Journal of Economics 32, 408–427.
Chernew, M., Frick, K., McLaughlin, C., 1997. The demand for health insurance coverage by low-income workers: can reduced premiums achieve full coverage? Health Services Research 32, 453–470.
Chiappori, P.A., Durand, F., Geoffard, P.Y., 1998. Moral hazard and the demand for physician services: first lessons from a French natural experiment. European Economic Review 42, 499–511.
Chiappori, P.A., Salanié, B., 2000. Testing for asymmetric information in insurance markets. Journal of Political Economy 108, 56–78.
Colombo, F., Tapay, N., 2004. Private Health Insurance in Ireland: a Case Study. OECD Working Paper 10.
Cutler, D., Finkelstein, A., McGarry, K., 2008. Preference heterogeneity in insurance markets: explaining a puzzle. American Economic Review Papers and Proceedings 98, 157–162.
De Meza, D., Webb, D.C., 2001. Advantageous selection in insurance markets. The RAND Journal of Economics 32, 249–262.
Doorslaer, E. van, Jones, A.M., Koolman, X., 2006. The impact of having supplementary private health insurance on the use of specialists. Annales d'Économie et de Statistique 83/84, 251–275.
Ettner, S.L., 1997. Adverse selection and the purchase of medigap insurance by the elderly. Journal of Health Economics 16, 543–562.
Fang, H., Keane, M.P., Silverman, D., 2008. Sources of advantageous selection: evidence from the medigap insurance market. Journal of Political Economy 116, 303–350.
Finkelstein, A., McGarry, K., 2006. Multiple dimensions of private information: evidence from the long-term care insurance. American Economic Review 96, 938–958.
Glazer, J., McGuire, T.G., 2000. Optimal risk adjustment with adverse selection: an application to managed care. American Economic Review 90, 1055–1071.
Gruber, J., Poterba, J., 1994. Tax incentives and the decision to purchase health insurance: evidence from the self-employed. Quarterly Journal of Economics 109, 701–733.
Harmon, C., Nolan, B., 2001. Health insurance and health services utilization in Ireland. Health Economics 10, 135–145.
Health Insurance Authority, 2003. The Private Health Insurance Market in Ireland.
Hemenway, D., 1990. Propitious selection. Quarterly Journal of Economics 105, 1063–1069.
Holly, A., Gardiol, H., Domenighetti, G., Bisig, B., 1998. An econometric model of health care utilization and health insurance in Switzerland. European Economic Review 42, 513–522.
Honoré, B.E., Kyriazidou, E., 2008. Panel data discrete choice models with lagged dependent variables. Econometrica 68, 839–874.
Hurd, M.D., McGarry, K., 1997. Medical insurance and the use of health care services by the elderly. Journal of Health Economics 16, 129–154.
Jones, A.M., Koolman, X., Van Doorslaer, E., 2006. The impact of having supplementary private health insurance on the use of specialists. Annales d'Economie et Statistiques 83/84, 251–275.
Light, D.W., 1998. Keeping competition fair for health insurance: how the Irish beat back risk-rated policies. American Journal of Public Health 88 (5), 745–748.
Liu, T., Chen, C., 2002. An analysis of private health insurance purchasing decisions with national health insurance in Taiwan. Social Science & Medicine 55, 755–774.
Meer, J., Rosen, H.S., 2004. Insurance and the utilization of medical services. Social Science & Medicine 58, 1623–1632.
Nolan, B., Gannon, B., Layte, R., Watson, D., Whelan, C.T., Williams, J., 2002. Monitoring Poverty Trends in Ireland: Results from the 2000 Living in Ireland Survey, Dublin. Economic and Social Research Institute.
Olivella, P., Vera-Hernández, M. Testing for Asymmetric Information in Private Health Insurance. Economic Journal, http://dx.doi.org/10.1111/j.1468-0297.2012.02520.x, in press.
Pauly, M.V., 1968. The economics of moral hazard. American Economic Review 58–3, 531–537.
Pohlmeier, W., Ulrich, V., 1995. An econometric model of the two-part decision making process in the demand for health care. Journal of Human Resources 30, 339–361.
Rothschild, M., Stiglitz, J., 1976. Equilibrium in competitive insurance markets: an essay on the economics of imperfect information. Quarterly Journal of Economics 90, 629–649.
Savage, E., Wright, D.J., 2003. Moral hazard and adverse selection in Australian private hospitals: 1989–1990. Journal of Health Economics 22, 331–359.
Stabile, M., 2001. Private insurance subsidies and public health care markets: evidence from Canada. Canadian Journal of Economics 34, 921–942.
Vera-Hernández, M., 1999. Duplicate coverage and demand for health care. The Case of Catalonia. Health Economics 8, 579–598.
Watson, D., 2004. Living in Ireland Survey- Technical Overview. Irish Social Science Data Archive.
Wolfe, J.R., Goddeeris, J., 1991. Adverse selection, moral hazard, and wealth effects in the medigap insurance market. Journal of Health Economics 10, 433–459.