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Selection, Incentives and Search

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VRIJE UNIVERSITEIT

Health Insurance
Selection, Incentives and Search

ACADEMISCH PROEFSCHRIFT

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de Vrije Universiteit Amsterdam,
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door

Jonne Annemarie Bolhaar

geboren te Breda

promotoren: prof.dr. M. Lindeboom
prof.dr. B. van der Klaauw

Preface

Although I only really started this research in spring 2006 for my MPhil thesis, the very foundations of this PhD thesis go back much further. I was following one of Maarten's courses when he made me enthousiastic about persuing a PhD and going to Tinbergen Institute's MPhil programme. Not long afterwards I started my first 'real' research project as a research assistant to Maarten and Bas on disability insurance. After this, a second assistantship followed, on health economics. My enthousiasm to go to the Tinbergen Institute grew and I really liked working on these policy relevant topics. During my MPhil years at Tinbergen Institute, I had to work harder than I was ever used to in my life, but obviously learned a lot. I did not change my mind during the programme and after two years still wanted to do policy relevant research in applied microeconom(etr)ics. I very much enjoyed working with Bas and Maarten again. They're an ideal couple ..... as supervisors. Maarten was always encouraging when I came to him with new ideas and his enthousiasm gave the mental support when I had problems with seeing the bright side of PhD-life. Bas was always there for technical questions and for a very thourough read through my writings. I'm very grateful to them both for having learned so much the past three years and having had some fun too. Bas, it was an honor to me that you offered me the postdoc position you had available from your ERC grant. I enjoy working with you and look forward to the next 1.5 years.

Health insurance was the topic of my MPhil thesis, and therewith became the topic of the first chapter of this thesis. In the choice of my subject of research, I was influenced by the reform in the Dutch health insurance system that took place on 1 January, 2006. The first chapter used data from Ireland and of course, I wanted to do something with Dutch data in the end as well. Unfortunately, this turned out not to be easy to realize. There was no central data collector collecting what I wanted, nor were insurance companies very keen on supplying data. I am therefore very gratefull to NIVEL (the Netherlands Institute for Health Services Research), and especially Judith de Jong, for granting me access to the data of their Health Care Consumer Panel. Working on a topic that is in the heart of the public debate has been very rewarding to me.

Thanks to financial support of the C. Willemsstichting I had the opportunity to visit the University of Bristol and the University of York during my PhD. I would like to thank Carol Propper and Frank Windmeijer for hosting my stay in Bristol and Andrew Jones

and Nigel Rice for hosting my stay in York. During my stay in the UK, but also at conferences and in Netspar workshops, I received valuable comments when I presented my work.

The nice office-mates I had made my days at the VU much more enjoyable. Our chats and lunches made PhD-life a lot less solitaire and lonely. Thanks Linda, Marta, Robert and Georgios! I would also like to thank my family, especially my parents, and all my friends for support and indispensable moments of relaxation and not thinking about this thesis at all.

But most of all, I would like to thank Menno. You cheered me up, calmed me down, tried to boost my self-confidence when needed, and so much more. Without you, there would not have been a thesis. But more important, without you I would not be who I am today. With you life is just so much better.

Jonneke Bolhaar

Amsterdam
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Contents

Chapter 1

Introduction

In today's ageing society, increasing health care costs are a major concern. Public health insurance systems are under pressure, as the costs per insuree increase and the working population that pays for the larger part of the costs of public health insurance diminishes. As the ageing of the society and the ratio of inactives per active have not yet reached their peak, the pressure on public health insurance systems will only get stronger. While some countries, like the Netherlands and Switzerland, have already implemented major reforms in their health insurance system, other countries like the US are seriously considering such reforms.

This thesis contains four studies on health insurance, all from a microeconometric point of view. Each of the chapters is based on one of my (working) papers and can be read independently from the other chapters.

The second chapter, based on Bolhaar, Lindeboom and Van der Klaauw (2008), investigates the presence of moral hazard and selection in a market for supplementary private health insurance. Moral hazard refers to a situation in which individuals are more likely to make the costs they are insured for, or on average make higher costs for what they are insured for (in this case health care costs) than they would have if they were not insured. Selection occurs if individuals with a particular risk profile are more likely to insure themselves. The textbook example of selection is *adverse* selection, where the bad risks (those with highest expected costs) are most likely to insure themselves. Recent work by various authors however, brings forward another type of selection, *advantageous* selection. Advantageous selection refers to exactly the opposite of adverse selection: not those with high expected costs are the ones that buy insurance, but those with low expected costs, the good risks. One of the possible explanations for advantageous selection is that individuals may differ in risk aversion and that more risk averse individuals are both more inclined to buy insurance *and* exert more effort to avoid risk, for example by having a healthier lifestyle, leading to better health. The recent empirical evidence for advantageous selection was found in the market for (supplementary) private health insurances for elderly Americans , like Medigap and long-term care insurance. In Europe,

systems with basic public health insurance and private supplementary coverage are not limited to the elderly, but cover the entire population. In terms of health risks and preferences, the elderly may be different from the general population. Results for the elderly therefore do not necessarily hold for the entire population.

For our analysis data from Ireland are used. Ireland is a particularly interesting case to study because of the design of its health insurance system. Ireland has a public health insurance that covers the entire population, but with considerable copayments for the use of health care services, medication, etc. There is a provision for the one-third of the population with lowest incomes that exempts them from these copayments. On the private market supplementary coverage is offered that reduces copayments (usually by 50 %). Thus, there are three separate groups in terms of copayments: no copayments, partial copayments and full copayments. This heterogeneity provides an ideal environment for studying moral hazard. Community rating (i.e. one premium irrespective of age, risk profile, health) and the obligation to accept everyone wanting to buy private supplementary health insurance on the other hand form an excellent setting to study selection effects. Disentangling these moral hazard and selection effects is, however, not straightforward. As health influences the insurance decision and insurance status may in turn affect health, there is a serious endogeneity problem. By making use of panel data we can deal with this endogeneity problem. The dynamic panel data models we use give more insight in the underlying factors of the behavior of individuals.

In the third chapter, based on Bolhaar (2009), I investigate how advantageous selection can occur in a dynamic framework. It is not obvious that the dynamic model works in the same way and needs the same assumptions as its static counterpart. In a framework that allows for investing in health, preferences and risk aversion do not only have a *direct* effect on the choices an individual makes. This period's choices also affect next periods' health, which in turn will influence next periods' choices. I show that due to this kind of *dynamic effects*, the correlation between health and preferences (or risk aversion) arises *automatically*. This is in contrast with the static model that needed to *assume* this correlation to generate advantageous selection. It is also not necessary to assume that individuals in good health have a smaller probability of being hit by a health shock than individuals in bad health. Even if the probability of a health shock is the same for all individuals, irrespective of their health, the correlation between health and preferences (or risk aversion) arises automatically. And with this correlation also advantageous selection.

Selection and moral hazard are effects that directly relate to the way in which the health insurance system is designed. But there can also be more *unexpected* effects of the design of a health insurance system. In the fourth chapter, that mirrors Bolhaar and Van der Klaauw (2009), the effect of the health insurance system on retirement behavior is analyzed. For this purpose, the focus is again on the Irish case and in particular on the *Medical Card* scheme that provides copayment-free health care to low-income households. Eligibility for the Medical Card scheme is based on a sharp income limit:

households with an income below the threshold receive the full benefits of the Medical Card scheme, households above the limit pay full copayments or have to buy private supplementary health insurance to get partial reduction of the copayments. It is known that with age, health care expenditures increase rapidly as health deteriorates and health shocks occur more often. For those not covered by a Medical Card, out-of-pocket medical expenditures can rise sharply when getting older. It may therefore become beneficial for some individuals to leave the labor force, therewith lowering their income to a level below the threshold for a Medical Card, and receiving free health care. In this chapter we investigate whether the provision of Medical Cards to low-income households has an accelerating effect on exit out of the labor force into retirement. To do this, we develop a structural model of health insurance and retirement choices between the ages 50 and 75, in which individuals are uncertain about future health, health shocks and employment opportunities. We allow for heterogeneity in risk aversion and preferences among individuals, as we know from chapters 2 and 3 that this heterogeneity can be important in explaining the patterns observed in the data. The model is estimated for a sample of couples of which only one spouse is/was working, where we take into account that the health of the non-working spouse may influence the (retirement) decisions made by the other (working) spouse. Dynamic programming and numerical methods are used to solve the model. A new simulated maximum likelihood (SML) estimator, proposed by Keane and Sauer (2009), is applied to estimate the model parameters. This estimator uses the rate of correct predictions of a number of key variables the simulated data entails. The obtained estimates can be used to simulate the effect of possible policy changes and interventions in the Medical Card system on retirement behavior.

The new health insurance system that was introduced in The Netherlands in January 2006 is the subject of the fifth chapter, that closely resembles Bolhaar, Lindeboom and Van der Klaauw (2009). Before this reform The Netherlands had a mixed public-private health insurance system. The public system provided compulsory insurance for the lower incomes at a low premium. Those above the income threshold for public insurance were not obliged to purchase health insurance, but if they wanted to they were dependent on the private market. The reform introduced a system of managed competition where insurers compete with each other within the rules of the game that are set by the government. In this new system all individuals are obliged to be insured for at least the standard insurance package, the content of which is decided on by the government. A risk equalization fund compensates insurers in case of a disproportionate concentration of insurees with very high health care expenses. A system of managed competition critically hinges on consumers that search. Only if consumers search, insurers will have an incentive to offer insurance at a low premium and improve efficiency to still be profitable at this low premium. In this chapter we will take a closer look at the search behavior of consumers in the health insurance market. The complete change of system created a situation where all consumers had to chose with which insurer to insure themselves, and simply renewing the contract

one had the year before was not at all the most obvious choice. For the analysis a consumer search model that incorporates the main features of the new health insurance system is used. This type of models has been widely used to describe various markets, but there are only few applications of this type of models in the field of health economics. The theoretical predictions of the model are tested with the data to see how well the consumer search model can explain the observed patterns in the data. Where the data do not confirm the predictions of the model, it will be discussed how the simple model we started with can be extended to be able to capture the patterns in the data more accurately.

Finally, the sixth chapter of this thesis gives a brief summary of the results from the four studies on health insurance the thesis is comprised of.

Chapter 2

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

2.1 Introduction

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

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

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

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

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

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

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

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

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

2.2 Theoretical framework

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

and without health insurance

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

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

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

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

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

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

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

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

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

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

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

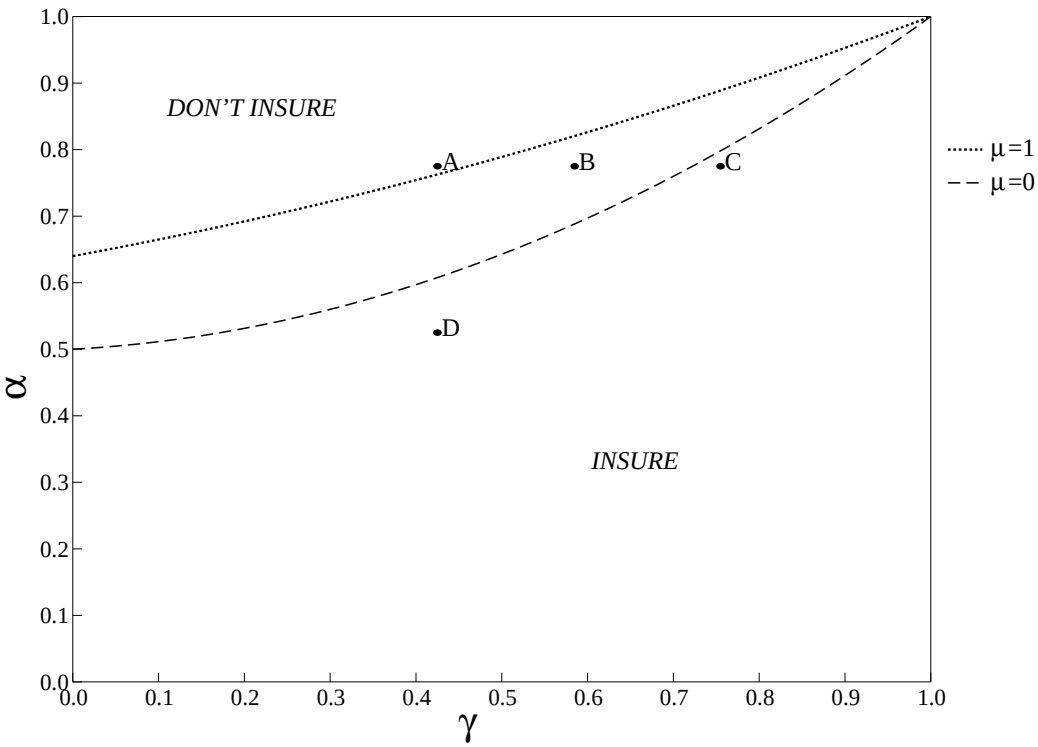
If indeed within the population the variation in α and γ compared to the variation in μ is substantial and there exists strong correlation between these parameters, then advantageous selection arises. Households with a low α and/or high γ and low μ are more inclined to buy health insurance than households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

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

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

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

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



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

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

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

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

2.3 The Irish health care system

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

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

Table 2.1: Copayments for medical services in Ireland in 2006

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

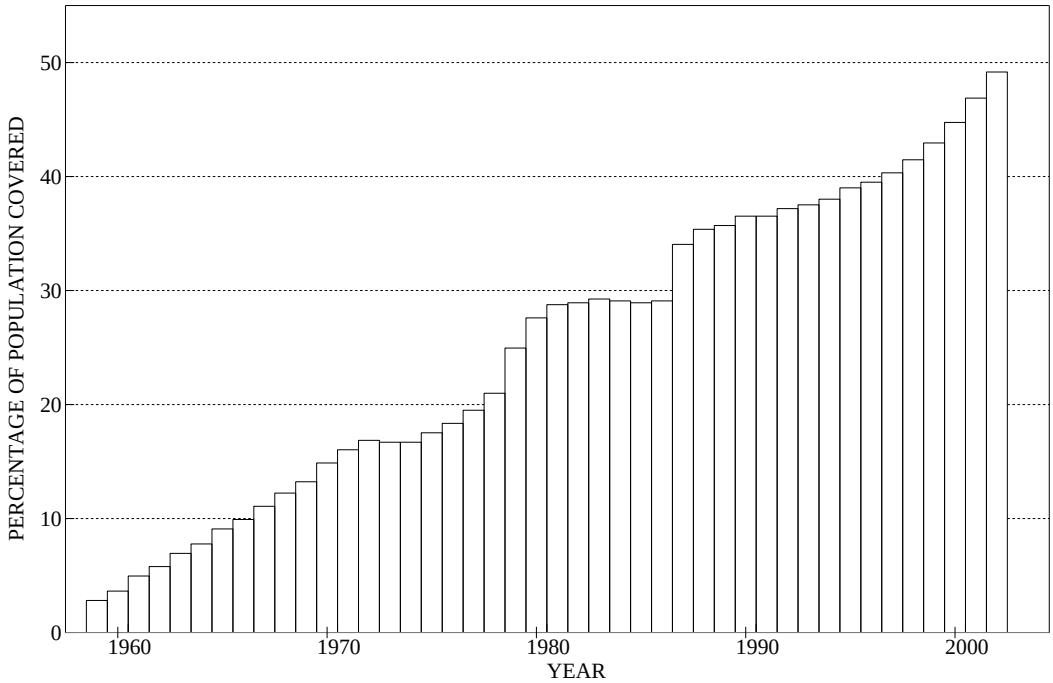
Note: the fee for treatment in the private capacity of a public hospital depends on whether it is only for day-care and if not, whether a private or semi-private room is wanted

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

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

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

Figure 2.2: supplementary private health insurance coverage in Ireland



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

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

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

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

2.4 The data

2.4.1 Sample construction

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

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

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

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

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

Table 2.3: Number of observations in each wave

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

Source: Watson, 2004

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

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

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

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

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

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

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

2.4.2 Sample and descriptive statistics

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

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

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

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

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

Table 2.7: Transition frequencies of changes in health variables

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

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

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

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

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

Table 2.8: Descriptive statistics

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

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

Table 2.9: Classification health problems

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

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

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

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

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

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

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

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

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

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

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

2.4.3 Asymmetric information

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

2.5 Empirical model

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

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

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

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

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

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

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

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

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

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

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

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

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

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

2.6 Results

2.6.1 Supplementary private health insurance purchase

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

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

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

Table 2.11: Estimation results for private health insurance decision

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

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

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

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

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

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

2.6.2 Health care utilization

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

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

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

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

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

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

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

Table 2.12: Number of GP visits in past 12 months

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

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

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

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

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

Table 2.14: Nights in hospital in past 12 months

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

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

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

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

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

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

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

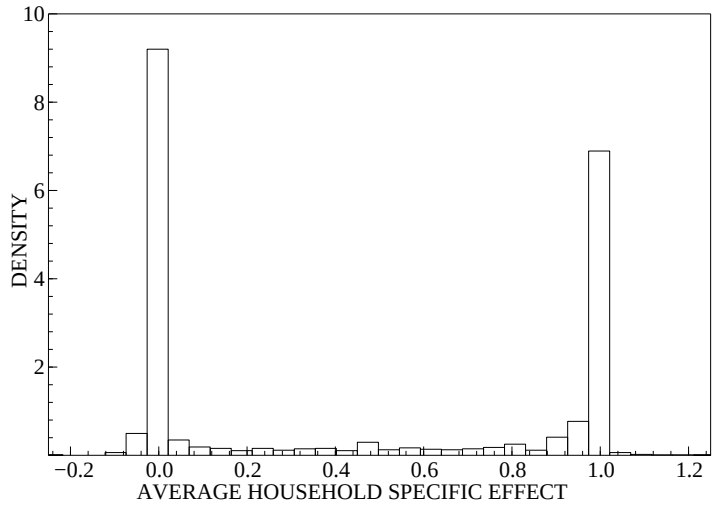
Both health variables, bad mental health and health problem, loose significance and size when a dynamic panel data model is used instead of OLS. As the introduction of a fixed effect absorbs all permanent or chronic health effects, this is not surprising. In contrast, giving birth is a shock variable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

2.6.3 Decomposition of fixed effects

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

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

Figure 2.3: Fixed effects insurance decision



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

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

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

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

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

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

Figure 2.4: Fixed effects health care utilization

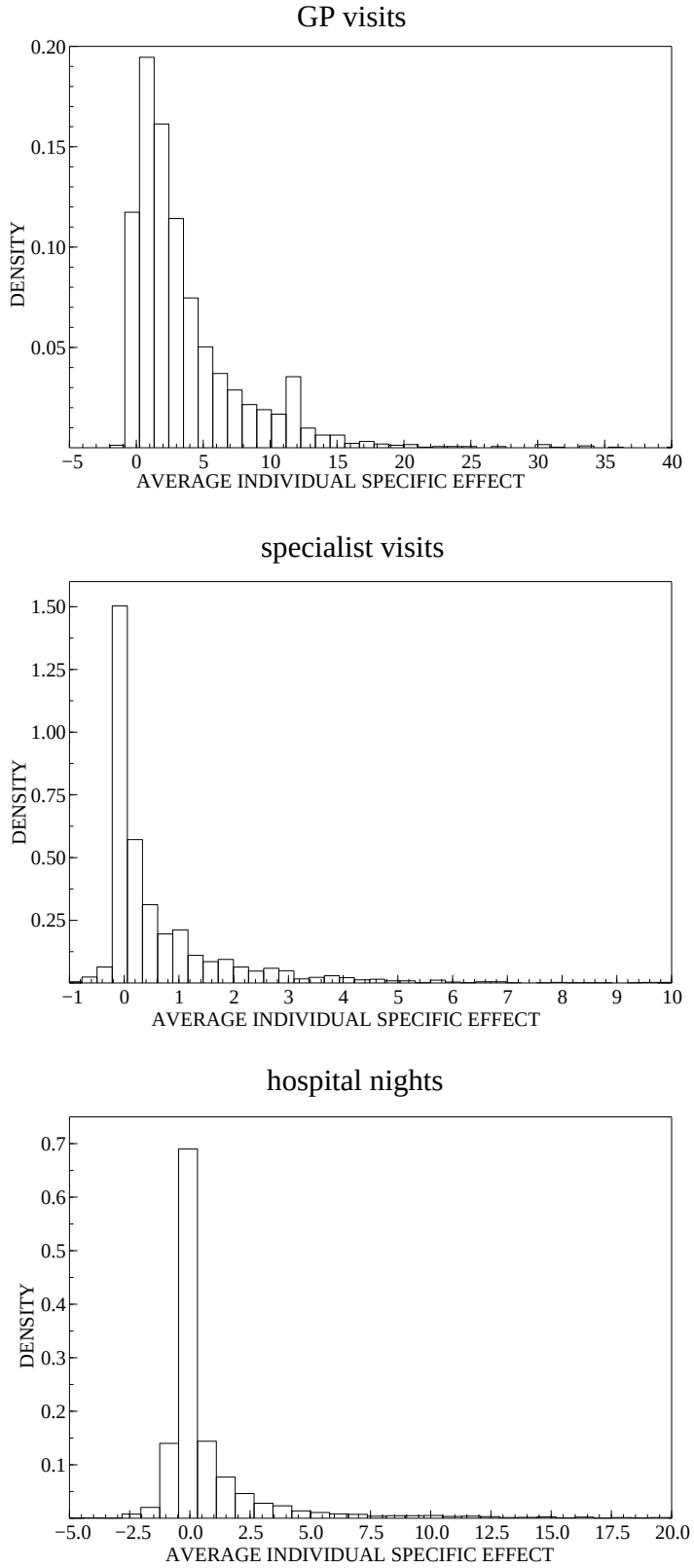


Table 2.15: Correlations between fixed effects from dynamic panel data models

	GP visits	Specialists visits	Hospital nights	Private insurance
GP visits	1.000			
Specialist visits	−0.034***	1.000		
Hospital nights	0.011	0.080***	1.000	
Private insurance	−0.217***	0.135***	0.026**	1.000

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

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

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

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

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

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

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

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

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

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

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

Note: 'single' is the omitted householdtype

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

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

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

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

Note: 'single' is the omitted householdtype

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

2.6.4 Analyses for a sample of older individuals

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

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

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

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

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

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

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

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

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

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

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

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

specification tests for Arrelano-Bond estimator

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

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

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

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

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

Note: 'single' is the omitted householdtype

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

2.7 Discussion and conclusion

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

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

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

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

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

Chapter 3

Advantageous Selection in a Dynamic Framework

3.1 Introduction

The textbook example of selection in the market for health insurance describes individuals that only differ in health status, and therewith expected health care costs. The higher expected health care cost of unhealthy individuals implies that they will benefit more from having insurance. This results in unhealthy individuals being more likely to buy insurance than healthy individuals: the typical case of adverse selection. Recent empirical evidence on selection in health insurance markets, however, shows *advantageous* selection instead of *adverse* selection. This result was found, *inter alia*, by Finkelstein and McGarry (2006), Fang, Keane and Silverman (2008), Cutler, Finkelstein and McGarry (2008) and Bolhaar, Lindeboom and Van der Klaauw (2008).

Advantageous selection is a counterintuitive concept: why would healthy people with low expected medical costs, the so-called 'good risks', insure themselves for health care expenses while the less healthy refrain from doing so? De Meza and Webb (2001) argue that the key to advantageous selection lies in the willingness to buy insurance and undertaking precautionary effort being positively correlated. This positive correlation may arise if risk preferences are heterogeneous among agents. More risk averse agents are more likely to buy insurance and will also be more inclined to undertake precautionary effort, resulting in a better health. Alternatively, heterogeneity in 'optimism' can be another situation in which insurance purchase and precautionary effort are correlated according to De Meza and Webb (2001). Optimistic agents will not feel the need to buy insurance, and their '*it won't happen to me*' attitude towards risk will not encourage precautionary behaviour, resulting in a lower level of health.

In the empirical literature on advantageous selection, Finkelstein and McGarry (2006) look at the market for insurance covering the costs of long-term care (in particular nursing homes) in the US. They find that wealthier individuals and individuals that are more

cautious are both more likely to buy insurance and less likely to use long-term care. Fang, Keane and Silverman (2008) find that individuals purchasing Medigap insurance (which covers care not covered by Medicare) tend to be healthier than agents that don't do so. Information on risk preferences is used to investigate the hypothesis that advantageous selection is driven by heterogeneity in risk preferences. Interestingly, they do not find evidence to support this hypothesis: more risk averse individuals buy more insurance, but are not healthier. The information on risk preferences, however, comes from questions about financial risk taking behaviour. Risk preferences concerning financial risks might differ from risk preferences concerning health risks. Furthermore, where financial risk preferences might be correlated with wealth, health risk preferences are less likely to do so. It is therefore not so clear whether the heterogeneity in risk preferences is not causing advantageous selection here, or whether risk preferences are not well observed. Cutler, Finkelstein and McGarry (2008) use more health related measures of risk aversion to look at different insurance markets. Individuals engaging in risky behaviours (smoking, having 3 or more alcoholic drinks per day, job-related mortality risk) and not undertaking precautionary effort (use of preventative health care, use of seat belts) are found to be less likely to buy any of the five insurance types considered in the paper (term life insurance, acute health insurance, an annuity, Medigap insurance and long term care insurance). At the same time, the expected claims of these individuals are high for term life insurance and long term care insurance, pointing to advantageous selection that runs via heterogeneity in risk aversion. For Medigap and acute health insurance the more risky behaving individuals do not have a higher level of expected costs and the advantageous selection most likely runs via another pathway than heterogeneity in risk aversion.

The source(s) of advantageous selection might differ between markets, due to differences in institutions, market characteristics, etc. Heterogeneity in either risk aversion or preferences therefore might play a role in some insurance markets and not in other. There might also be pathways different from the ones mentioned by De Meza and Webb via which advantageous selection runs. Fang, Keane and Silverman (2008) mention in this respect cognitive ability as another source.

In the existing literature, theoretical models are of a static nature (De Meza and Webb, 2001; Bajari, Hong and Khwaja, 2006, and Fang, Keane and Silverman, 2008). This chapter will investigate how advantageous selection can arise if the theoretical model is extended to a dynamic framework. It will be shown that the dynamic model requires less strong assumptions to generate advantageous selection as its static counterpart. In a framework that allows for investing in health, preferences and risk aversion do not only have a direct effect on the choices an individual makes. This period's choices also affect next periods' health, which in turn will influence next periods' choices. I will show in this chapter that due to this kind of *dynamic effects*, the correlation between health and preferences (or risk aversion) arises *naturally*. This is in contrast with the static model that needed to *assume* this correlation to generate advantageous selection. It also turns out

not to be necessary to assume that individuals in good health have a smaller probability of being hit by a health shock than individuals in bad health. Even if the probability of a health shock is the same for all individuals, irrespective of their health, the correlation between health and preferences (or risk aversion) arises automatically. And with this correlation also advantageous selection.

The dynamic framework offers the possibility, in contrast with a static framework, to also include wealth in the theoretical model and therewith the opportunity for individuals to use accrued savings as an alternative to insurance. This will complicate the model, but also makes it much more realistic.

The aim of this chapter is not to derive general results, but to show how advantageous selection can arise in a dynamic framework and how much heterogeneity is needed to get to this result. Heterogeneity in just one structural parameter, the relative preference of consumption over health, will shown to be sufficient to change the selection pattern from adverse to advantageous. However, with only heterogeneity in the risk aversion parameter, this result is more difficult to obtain and requires unrealistic values of this parameter. In addition, this chapter provides a formalization of De Meza and Webb's arguments.

The remainder is organized as follows: section 3.2 sets up the framework for the analysis by defining a model in which individuals can insure themselves against the (health care) costs that come with health shocks by purchasing health insurance. Subsequently, this section discusses the numerical procedure by which the model is solved. Section 3.3 describes a number of experiments in which the model is simulated using different specifications and analyzes the selection pattern that occurs in each of these experiments. Section 3.4 concludes.

3.2 Model

3.2.1 Setup

Consider an individual with a stock of health H_t and a stock of wealth W_t. In each period the individual tries to optimize the present value of future utility. The individual derives utility in every period from current consumption C_t (which includes all types of consumption except health care consumption), and from the current stock of health H_t. The per period utility function is specified to be Cobb-Douglas, with α representing the relative preference for consumption as compared to health, as

$$U(C_t, H_t) = (u(C_t))^{\alpha} H_t^{1-\alpha} \tag{3.1}$$

We follow the existing literature (Brown and Finkelstein, 2006; Bajari, Hong and Khwaja, 2006; Fang, Keane and Silverman, 2008) and assume a CRRA function for the

utility of consumption $u(C_t)$, with risk aversion parameter γ:

$$u(C_t) = \frac{C_t^{1-\gamma}}{1-\gamma}$$

Risk averse individuals (with $\gamma > 0$) have a strong preference to avoid large fluctuations in consumption. In this model, fluctuations in consumption can be caused by the occurence of a health shock. An individual faces the risk of being hit by an (adverse) health shock in every period t. Let Δ_t denote an indicator which equals one in case of a shock. The probability with which shocks occur is exogenous.

Individuals can improve their health by making health investments Z_t. Investing in health can be done in reaction to the deterioration of health over time or a health shock, but also with a preventive goal. This follows Bajari, Hong and Khwaja (2006) and Cardon and Hendel (2001), who also allow for medical expenditures for preventive purposes. For ease of exposition it is assumed that Z_t is unidimensional, but Z_t can also be a vector with different types of health investments. It is assumed that in reaction to a health shock Δ_t some health investments have to be made immediately. The size of these acute investments is ϕ. The acute investments do not fully restore the individual's health to the level before the shock. The difference between health before the shock and health after the shock and the acute investment is of size β_3. Restoring health completely to its level before the shock by making enough health investments to undo β_3 is optional. The individual can choose to (partly) restore it now, in the future, or not at all.

The health stock H_t in each period is thus a function of previous period's health stock, the health shock indicator Δ_t and health investments Z_t. The specification used here for the health 'production function' is additive in all its determinants,

$$H_t = \beta_0 + \beta_1 H_{t-1} + \beta_2 Z_t - \beta_3 \Delta_t \tag{3.2}$$

Individuals have the possibility to insure themselves against the costs of medical care. Health insurance I_t reduces the out-of-pocket cost of health investments with a fraction κ and is charged a per period premium q. Total medical expenses M_t are now defined as the sum of health care costs and (if applicable) the insurance premium

$$M_t = (1 - \kappa I_t)(\phi \Delta_t + Z_t) + q I_t$$

The individual has to decide on buying health insurance before it is revealed to him whether he is hit by a health shock that period. The way health shocks are modelled, with acute investments that have to be made the same period of size ϕ, ensures that there is a value to holding health insurance when there is insecurity about being hit by a shock. Would the complete health shock be modelled as optional to restore, it would be optimal for individuals to wait with making any investments in health untill health insurance is bought and the same investments can be made at lower cost. In that case

health insurance would be like a discount card you can buy when you know you will make large investments. Insurance, however, implies that there is uncertainty about whether you will incur the costs you are insured for. Modelling a part of the shock as compulsory to restore in period t also matches reality much closer, as for most health shocks a treatment is hard to postpone.

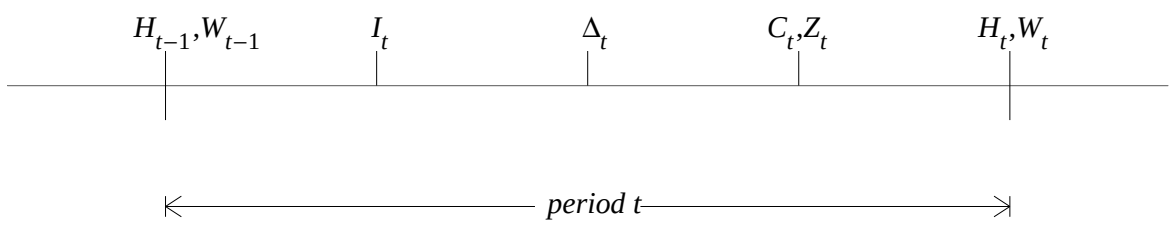
Individuals are constrained in their budget by their income Y_t, which is assumed to be constant over time ($Y = Y_t$), and accumulated wealth. Like Bajari, Hong and Khwaja (2006), Brown and Finkelstein (2006) and Fang, Keane and Silverman (2006) we assume that income is exogenous and predetermined, it does for example not depend on the individual's health status. Wealth can be accumulated (saved) and used (dissaved), but there can never be a negative stock of wealth, so $W_t \geq 0$. The budget constraint can be written as

$$W_t = Y + (1 + \delta) W_{t-1} - C_t - M_t \tag{3.3}$$

The possibility to accumulate a stock of wealth that can be used (dissaved) when needed creates an alternative for insurance as a way to smooth consumption.

To summarize, the timing of events is thus as follows:

Figure 3.1: Timing of events



Individuals enter period t with a health and wealth stock, H_{t-1} and W_{t-1}, and first have to decide on whether to insure themselves. Only after the insurance decision is made it is revealed to them whether they are hit by a health shock. Given insurance status I_t and the revealed health shock Δ_t, they subsequently decide how much to spend on the consumption good C_t, on health investments Z_t and how much is left to save S_t. This in turn results in a new health stock H_t and a new wealth stock W_t, with which period t ends and period $t + 1$ starts.

The dynamic setting implies that individuals will take into account the effect the choices they make today, will have on their future utility as they maximize total *lifetime* utility. Let ρ denote the individual's (subjective) valuation of future utility. Each period's value function can now be written as

$$V_t(H_{t-1}, W_{t-1}) = \max_{I_t} \mathrm{E}_{\Delta_t} \left[\max_{C_t, Z_t} U(C_t, H_t) + \rho V_{t+1}(H_t, W_t) \right] \tag{3.4}$$

The individual decides to take health insurance in period t if, given his health H_{t-1} and wealth W_{t-1}, the present value of future utility (the value function) for $I_t = 1$ exceeds the present value of future utility for $I_t = 0$.

3.2.2 Solution method

For a given choice of parameters, we use numerical techniques to solve the model and investigate its behavior. Assume an individual makes decisions based on an infinite horizon. The individual's health and wealth will converge to a stationarity state.

In the stationary state it must hold that for every possible combination of H_{t-1} and W_{t-1}, we have a function $V(\ )$ for which holds that

$$V(H_{t-1}, W_{t-1}) = \max_{I_t} {}_{\Delta_t} \left[\max_{C_t, Z_t} U + \rho V(H_t, W_t) \right] \quad \forall t \tag{3.5}$$

As proven by Stokey and Lucas (1989), there is a unique value function $V(\ )$ that solves equation (3.5). Furthermore, this unique value function can be found by value function iteration using any initial vector for $V(\ )$.

The iterative process works as follows:

1. Create a grid of combinations of $H = 0, ...,$H and $W = 0, ...,$W.
2. Set the initial value function V^0 at each point of this grid to 0, $V^0(H_t, W_t) = 0$.
3. For each point (H_{t-1}, W_{t-1}) on the HW-grid:
   (a) For each combination of $I_t = 0, 1$ and $\Delta_t = 0, 1$, find the levels of Z_t and C_t that maximize $V(H_{t-1}, W_{t-1}|I_t, \Delta_t) = U(C_t, H_t) + \rho V^0(H_t, W_t)$, taking into account that $Z_t \geq 0$, $C_t \geq 0$, $Z_t \leq \frac{Y - qI_t}{1-\kappa I_t} - \phi\Delta_t$ and $C_t \leq Y + (1+\delta)W_{t-1}$. Use interpolation on the HW-grid to find the value of $V^0(H_t, W_t)$
   (b) Select the insurance status that maximizes the expected value of the value function, $\max_{I_t=0,1} (kV(H_{t-1}, W_{t-1}|I_t, \Delta_t = 1) + (1-k)V(H_{t-1}, W_{t-1}|I_t, \Delta_t = 0))$
   (c) The updated value function, V^1, at this combination of H_{t-1} and W_{t-1} equals the expected value of the value function under the optimal insurance status.
4. If the distance d between the updated and the original value function (V^1 and V^0) is smaller than 0.0001 for each point (H_{t-1}, W_{t-1}) on the HW-grid, the process ends. Else, step 3 is repeated with value function V^1 to obtain a new updated value function, V^2 etc.

The obtained valuefunction $V(H, W)$ can be used to generate profiles of the long-run levels of health and wealth and profiles on consumption and health investments at different levels of health and wealth.

3.3 Simulation experiments

The model will be used for some simulation experiments. After having defined a baseline experiment, the experiments assess the impact of different types of heterogeneity in structural parameters. In all experiments the main interest is the type of selection that occurs. Therefore, I focus on the correlation between the health status at the start of the period H_{t-1} and the insurance decision in that period I_t. By using the health status *before* the health insurance decision is taken, contamination of selection effects by moral hazard is prevented. Finding a negative correlation coefficient is a sign of adverse selection, a positive correlation points to advantageous selection.

3.3.1 Model without wealth

To start with, a model is assessed in which it is not possible to save or borrow and hence $W_t = 0$ for all t. The model is solved using the set of parameter values depicted in Table 3.1. The relative preference of consumption over health is set at 0.85, equal to 1 minus the fraction of GDP that the US spends on health care. Individuals are assumed to be not very risk averse, with a risk aversion parameter of 0.05. As health deteriorates only slowly over time during most of the lifetime, state dependence in health is taken to be high, at 0.9. A health shock requires a direct investment of 40% of the income in health. The subjective discountrate is 0.95. Health shocks occur with probability 0.1, resulting in an expected per period acute health investment of 4. The cost reduction health insurance offers is set at 50%, as most insurance contracts include some disincentive for unlimited health care use, like a deductible or a copayment rate. Health insurance therefore reduces the expected per period acute investment to 2. Insurance companies will only offer insurance at a premium above this expected per period forced investment. The insurance premium is therefore set at 6.

Table 3.1: Parameter values for baseline simulation

relative preference for consumption over health	α	0.85
risk aversion	γ	0.05
intercept health production function	β_0	0
state dependence in health	β_1	0.9
return to medical consumption	β_2	1.1
health loss from shock	β_3	15
acute investment if health shock	ϕ	40
subjective discount rate	ρ	0.95
probability of health shock		0.1
income	Y	100
insurance premium	P	6
cost reduction offered by health insurance	κ	0.5
interest rate	δ	0.01

The optimal levels of the choice variables at these parameters are shown in Figure 3.2. The upper left panel of this figure shows the values of function V and the upper right panel the optimal insurance decision in the steady state at different health levels. If health is below 20, it's optimal for the individual to buy insurance. Is health at or above this level, not buying insurance is the optimal decision. The optimal level of consumption and health investments in the steady state depends on the occurence of a shock in the particular period. The lower four panels in Figure 3.2 give the optimal consumption and health investment levels for both cases. The panels on the left reflect the case with no health shock, and show a lower level of health investments and a higher level of consumption than the panels on the right, that reflect the case of a health shock.

The steady state level of health does not depend on the initial health level. Starting from different initial health levels, there is convergence to the same steady state level of health. To illustrate this, the model is simulated for 100 periods with four different initial levels of health. For each of the four different initial health levels, 250 simulations are performed. These 250 simulations only differ in the sequence of draws from the distribution of health shocks. The results of these simulations are shown in Figure 3.3. Within 6 periods health converges to its steady state level, even if the initial level of health is four times the steady state level or a quarter of the steady state level. The long-term level of health is not just one health level. Due to the health shocks the long term health level fluctuates between 10.5 and 34.5. The average of the mean health level in periods 30 to 100 is 22.29, 22.25, 22.24 and 22.21 for respectively $H_0 = 5$, $H_0 = 20$, $H_0 = 40$ and $H_0 = 80$.

Changing one of the parameters has an effect on what the optimal choices of the individual are. Figure 3.4 shows how the optimal insurance decision is rendered when α is changed. The baseline level of α, 0.85, is changed to 0.6. For individuals with a higher α (i.e. a stronger preference for consumption over health), buying health insurance is the optimal choice only for lower levels of health compared to those with a lower α. If the higher value of α also leads to a lower steady state level of health, advantageous selection may occur as lower health levels coincide with a lower probability of buying insurance ($\alpha = 0.85$) and higher health levels coincide with a higher probability of buying insurance ($\alpha = 0.6$). Figure 3.5 shows how the steady state level of health changes when α decreases from 0.85 to 0.6. Indeed, the higher value of the preference parameter leads to a lower steady state level of health.

To further investigate whether there is advantageous selection, the model is simulated for 100 periods. 250 simulations are performed, that only differ in the sequence of draws from the distribution of health shocks. For every period the correlation between the health status at the start of the period H_{t-1} and the insurance decision in that period I_t is calculated. As health fluctuates around a steady state level, there is slight variation over the periods in the correlation between health and the insurance decision.

Figure 3.2: Optimal choices in model without wealth

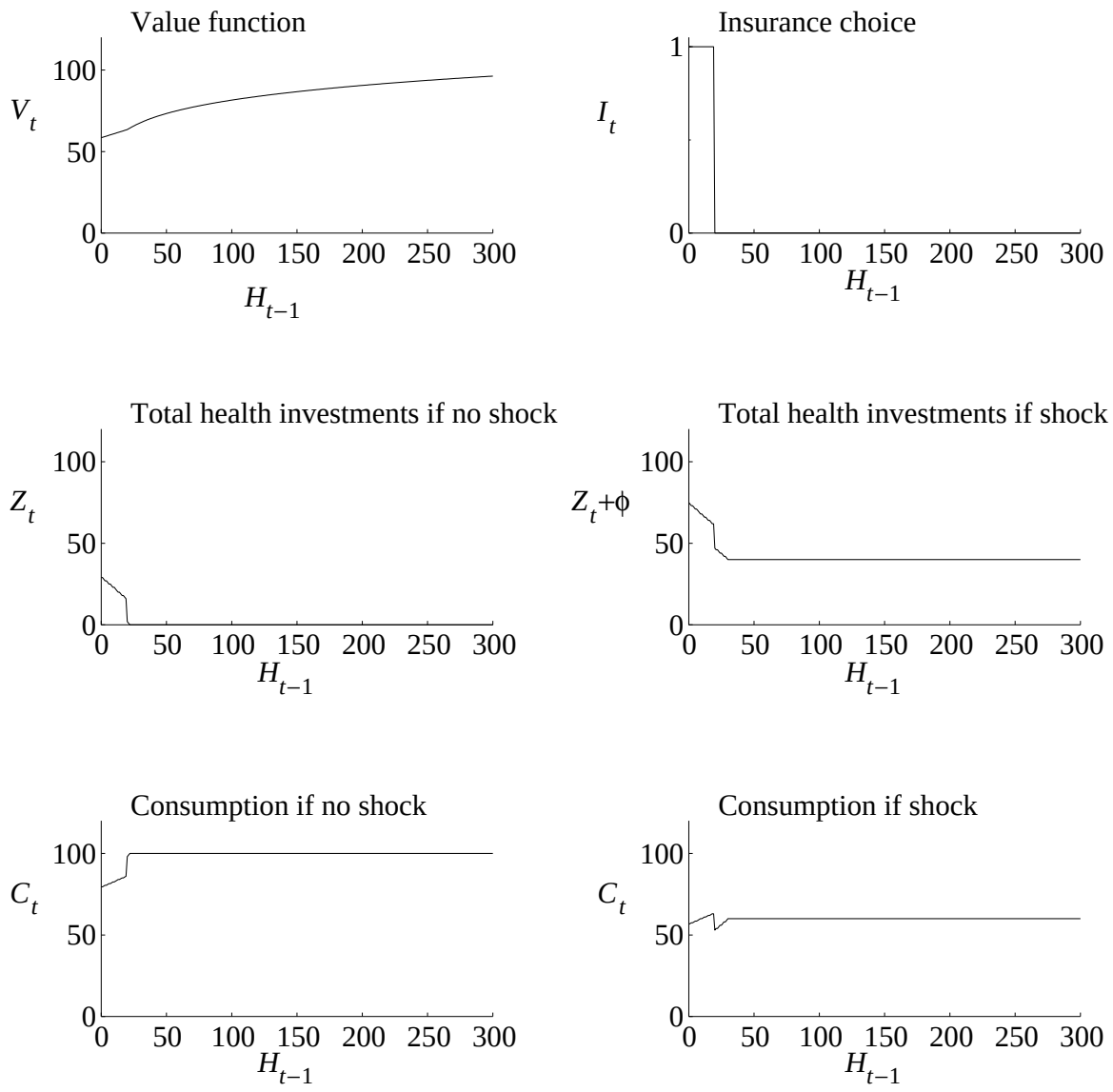


Figure 3.3: Steady state level of health, starting from different initial health levels

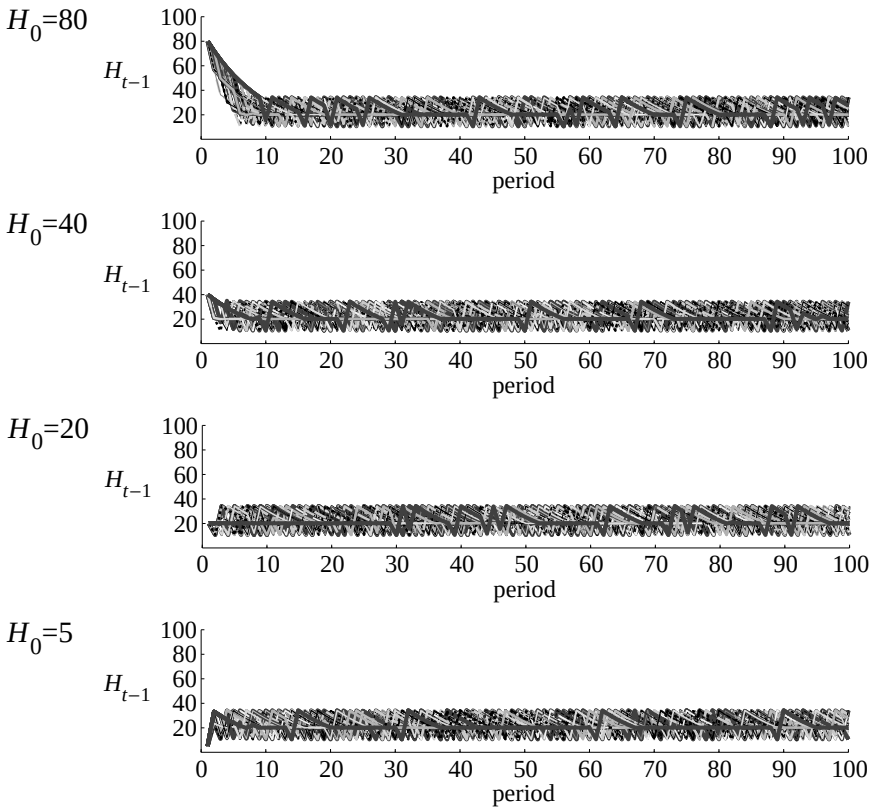


Figure 3.4: Optimal insurance decision for different values of α

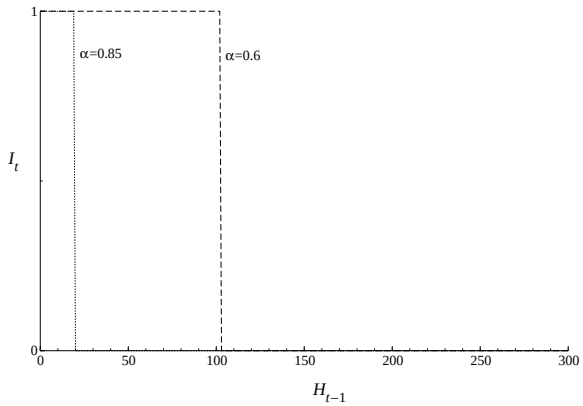


Figure 3.5: Steady state health level at different values of α

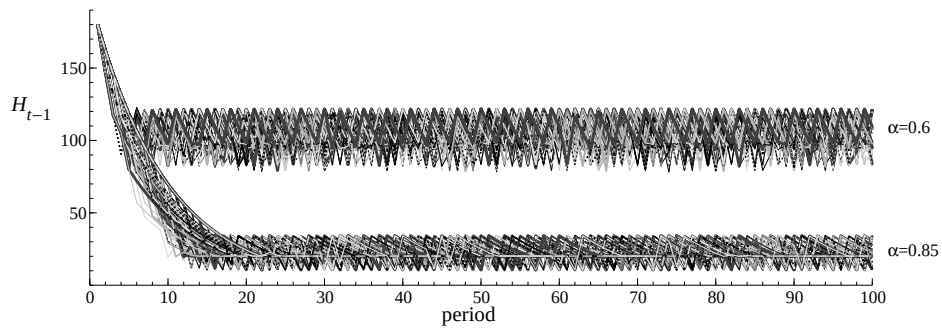


Table 3.2: (Average) correlation coefficients of health and insurance choice for a sample with 50% individuals with the baseline value for α and γ and 50% individuals with $\alpha = \alpha\prime$ and $\gamma = \gamma\prime$, model without wealth

	$\alpha\prime = 0.85$	$\alpha\prime = 0.80$	$\alpha\prime = 0.75$	$\alpha\prime = 0.70$	$\alpha\prime = 0.65$	$\alpha\prime = 0.60$
$\gamma\prime = 0.05$	-0.596^{***}	-0.321^{***}	-0.126	0.0001	0.093	0.171^{**}
$\gamma\prime = 0.10$	-0.577^{***}	-0.247^{***}	-0.104	0.017	0.151^{*}	0.178^{***}
$\gamma\prime = 0.15$	-0.501^{***}	-0.221^{***}	-0.035	0.036	0.175^{**}	0.190^{***}
$\gamma\prime = 0.20$	-0.451^{***}	-0.182^{***}	-0.018	0.055	0.169^{***}	0.200^{***}
$\gamma\prime = 0.25$	-0.392^{***}	-0.151^{**}	-0.000	0.125	0.174^{**}	0.277^{***}
$\gamma\prime = 0.30$	-0.342^{***}	-0.120	0.0202	0.182^{***}	0.191^{***}	0.291^{***}

*** = in 95% of periods the correlation is significant at 1% level, **= in 95% of periods the correlation is significant at 5% level, *= in 95% of periods the correlation is significant at 10% level
Note: Listed here is the average correlation coefficient over 80 periods, starting 20 periods after the initial period

The upper left cel of Table 3.2 summarizes the correlation between health and the insurance decision for a sample with $\alpha = 0.85$ and $\gamma = 0.05$. This homogeneous sample is our baseline. The given correlation of -0.596 is the average of the correlation between health and the insurance decision in periods 20 to 100 of the simulation. The first 20 periods are ignored, as in these periods the steady state might not yet have been reached. Instead of normal standard errors, significance is displayed as the significance level at which 95% of the per period correlations is significant.

The other cels of Table 3.2 report the correlation between health and the insurance decision for a sample with individuals that are heterogeneous in α, γ, or both. The heterogeneous sample is comprised of 50% individuals with the baseline value of α and γ, and 50% individuals with the value for α and γ that is specific for that cel. For example, the upper right cel of Table 3.2 gives the correlation between health and the insurance decision for a sample of 50% individuals with $\alpha = 0.85$ and $\gamma = 0.05$ and 50% individuals with the same γ ($\gamma = 0.05$), but with $\alpha = 0.6$. Moving from the upper left cel towards the right, the heterogeneity in preference parameter α increases. Moving from

the upper left cel below, the heterogeneity in risk aversion γ increases. Increasing the heterogeneity in α while holding γ at the same level, changes the correlation between health and the insurance decision from significantly negative to significantly positive. In other words, increasing the heterogeneity in preferences causes the selection pattern to switch from adverse into advantageous. By introducing heterogeneity in only risk aversion parameter γ, it is much harder to generate positive correlation. Increasing γ from 0.05 to 0.30 lowers the negative correlation from -0.596 to -0.342, but the negative sign remains and is highly significant. An unrealisticly high value of γ would be needed to generate a positive correlation between health and the insurance decision due to heterogeneity in only γ (even a value for γ of, for example, 0.7 is still not enough to generate this positive correlation). Having heterogeneity in both α and γ accelerates the movement towards a positive correlation between health and the insurance decision compared to having heterogeneity in only one of these parameters.

Note that the change of sign in the correlations is only generated by a difference in dynamic effects resulting from a difference in preferences (α) or risk aversion (γ), and that all individuals have the *same* probability of a shock, irrespective of α and γ.

3.3.2 Full model

In the full model, individuals can save part of their income Y to use at a later moment (see budgetconstraint in equation (3.3)). The optimal level of the choice variables now not only varies with the health level at the start of the period, H_{t-1}, but also with the wealth level at the start of the period, W_{t-1}. Figure 3.6 is the full model-equivalent of Figure 3.2 and shows the optimal levels of the choice variables at different levels of H_{t-1} and W_{t-1}. The upper left panel of the figure shows valuefunction V_t, as estimated with the fixed point procedure from subsection 3.2.2. The optimal insurance decision is shown in the upper right panel. The probability that buying insurance is optimal increases when health decreases and/or if wealth increases. The four lower panels show the optimal levels of total health investments and consumption when the individual is not hit by a shock (on the left) and when he is hit by a shock (on the right).

As for the model without wealth, the full model is simulated for 100 periods to investigate whether healh and insurance choice are negatively or positively correlated. Again, 250 simulations are performed that only differ in their sequence of draws from the distribution of health shocks. Table 3.3 is analogous to Table 3.2 and gives the correlation between health and insurance status for different compositions of a heterogeneous sample.

Clearly, the baseline model without any heterogeneity leads to a pattern of adverse selection (upper left cel). The first row shows how introducing more and more heterogeneity in α changes this pattern gradually into one of advantageous selection.

Figure 3.6: Optimal choices in full model with $\alpha = 0.85$

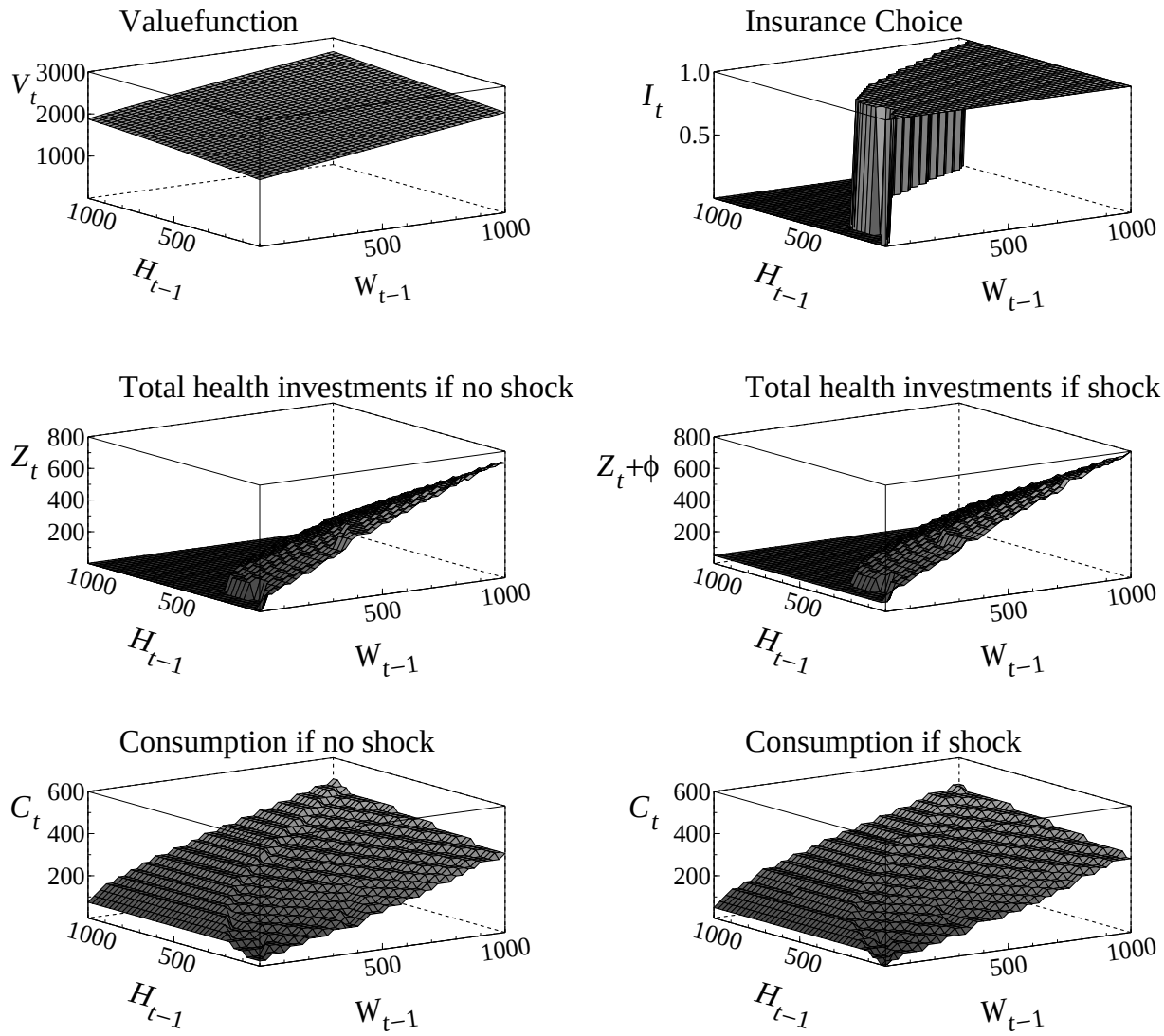


Table 3.3: (Average) correlation coefficients of health and insurance choice for a sample with 50% individuals with the baseline value for α and γ and 50% individuals with $\alpha = \alpha\prime$ and $\gamma = \gamma\prime$, full model

	$\alpha\prime = 0.85$	$\alpha\prime = 0.80$	$\alpha\prime = 0.75$	$\alpha\prime = 0.70$	$\alpha\prime = 0.65$	$\alpha\prime = 0.60$
$\gamma\prime = 0.05$	-0.514^{***}	-0.231^{***}	-0.178^{**}	-0.075	0.046	0.134
$\gamma\prime = 0.10$	-0.350^{***}	-0.158^{**}	-0.074	0.040	0.077	0.142^{*}
$\gamma\prime = 0.15$	-0.393^{***}	-0.174^{**}	-0.044	0.117	0.059	0.164^{**}
$\gamma\prime = 0.20$	-0.346^{***}	-0.143	0.007	0.134^{*}	0.108	0.161^{*}
$\gamma\prime = 0.25$	-0.313^{***}	-0.079	0.067	0.124	0.157^{***}	0.210^{***}
$\gamma\prime = 0.30$	-0.313^{***}	-0.070	0.076	0.080	0.171^{**}	0.300^{***}

*** = in 95% of periods the correlation is significant at 1% level, **= in 95% of periods the correlation is significant at 5% level, *= in 95% of periods the correlation is significant at 10% level
Note: Listed here is the average correlation coefficient over 80 periods, starting 20 periods after the initial period

Again, as for the model without wealth, generating patterns of advantageous selection due to heterogeneity in only γ turns out to be much more difficult and would require unrealistic values of γ, but heterogeneity in γ does reinforce the effect of having heterogeneity in α.

3.4 Conclusion

This chapter showed that in a simple model with homogeneous individuals, except that they differ in the realization of the sequence of (possible) health shocks, adverse selection will arise in the market for health insurance. Individuals that are more often hit by a health shock and consequently have a lower health stock are the ones that are most likely to buy health insurance. De Meza and Webb (2001) argue that the empirical finding of exactly the opposite of this textbook example of selection, advantageous selection, where the good risks instead of the bad risks insure themselves, can be explained by precautionary effort and insurance purchase being positively correlated. They reason that this positive correlation can arise when there is heterogeneity among individuals in their risk aversion or preferences. In this chapter a model in which utility is derived from both health and consumption, and that allows for investing in health, was simulated for multiple periods. I showed that in this dynamic setting the positive correlation between precautionary effort (health investments) and insurance purchase arises naturally with the introduction of just one of the types of heterogeneity mentioned by De Meza and Webb. However, with only heterogeneity in preferences this result was much easier to obtain than with only heterogeneity in risk aversion.

Chapter 4

Health, Health Insurance and Retirement Behavior

4.1 Introduction

Social insurance programs often provide perverse incentives. Yelowitz (1995), for example, describes the *Medicaid notch*, where women with dependent children on welfare might lose entitlement to Medicaid when they start working. Rust and Phelan (1997) discuss that due to Medicare men without a retiree health insurance plan have a strong incentive to continue working until age 65. Additionally, social security creates incentives to retire at age 62 (early retirement) and 65 (retirement). These unintended *lock-in* effects of social insurances might increase costs and diminish public support

In this chapter, we investigate how the existing Medical Card scheme in Ireland affects labor force participation among couples around retirement. This scheme provides free health care to all individuals with earnings below some threshold. Other individuals have considerable copayments when using national health services. To reduce copayments, one can take private supplementary health insurance. For older individuals with deteriorating health and increasing health care costs, it might be beneficial to retire (earlier) and accept a lower income to become entitled to a Medical card. Our key research question is how the existing Medical Card scheme affects the age of retirement.

It is well known that health insurance decisions, health and labor supply behavior are strongly interrelated. Both the health insurance and labor supply decision depend on an individual's health status. However, health might be affected by work. Also, there might be heterogeneity in individual preferences, which jointly affect health, labor supply and the health insurance decision. Ideally, one would exploit exogenous variation in the entitlement rules for the Medical Card to investigate its impact on the age of retirement. However, during our observation period no relevant policy reforms occurred. Therefore, we structurally estimate a dynamic programming model for the retirement behavior of married males between age 50 and 75. An advantage of the latter approach is that the

estimated model can be used to simulate the effect of policy changes, such as changing the eligibility rules for the Medical Card scheme and increasing the age at which individuals become eligible for collecting social security and pension benefits.

Our structural model starts following males, who are labor market participants at age 50. We only focus on couples where the woman is nonparticipant, which is the most common household situation of elderly in Ireland. While working, men can contribute to pension funds, but they can also lose their job. Working up to an older age can thus increase the level of pension benefits, but also may increase health deterioration. Households that are not eligible for a Medical Card might take supplementary private health insurance to deal with the costs of bad health or the risk of health shocks. In our model we allow for heterogeneity in preference and risk aversion parameters to capture that there are various types of individuals who make different choices.

In the empirical analyses we use data from Living in Ireland Survey. This survey follows households from 1994 to 2001. Each year individuals are surveyed about their labor market and health status. Furthermore, information is collected on health insurance choices and health care use. We use simulation techniques to estimate the structural parameters. In particular, we adopt the estimator proposed by Keane and Sauer (2009), which is a classification error approach.

Recently, for the US a number of papers have estimated structural models for retirement decisions (French, 2005; Rust and Phelan, 1997; French and Jones, 2004; Van der Klaauw and Wolpin, 2003, and Blau and Gillieskie, 2006). Most papers have mainly focussed on the effects of social security and/or Medicare. Exceptions are Blau (2004) who considered consumption patterns at older ages and Bound, Stinebrickner and Waidmann (2008) who focused on different exit routes such as disability insurance. Our work connects to the first group of papers, but uses a different institutional setting with different incentives. This mainly has consequences for the way health insurance choices are modeled. Within the European context health insurance is not so much connected to employers as in the US.

Our model relates to French (2005) and Blau (2007), who consider the retirement behavior of men without modeling the behavior of spouses explicitly. Gustman and Steinmeier (2004), Blau and Gilleskie (2006) and Van der Klaauw and Wolpin (2005) explicitly model the labor market behavior of spouses. It should, however, be noted that they consider a situation where most often both spouses work, which is not common for older couples in Ireland. We make three main contributions to this literature. First, we treat wealth more flexible. Whereas other papers considered wealth as a discrete variable, we allow it to be continuous. Second, we allow for unobserved heterogeneity in preference parameters. Heterogeneity in preference parameters might be important to explain health insurance choices. Bolhaar, Lindeboom and Van der Klaauw (2008) find evidence in favor of advantageous selection (also for older individuals), which can only be explained from

heterogeneity in structural parameters (see Bolhaar, 2009).[1] Third, most structural analyses for retirement behavior and health insurance decisions consider the US. We provide evidence from another institutional environment, one that is much closer to that in most European countries.

Section 4.2 gives more detail about the Irish institutional context. The model is outlined in section 4.3, after which the data are discussed in section 4.4. Section 4.5 explains the method of estimation used, 4.6 presents the parameter estimates and the results from policy simulations. Finally, section 4.7 concludes.

4.2 Institutional background

4.2.1 Pensions

The Irish pension system is built on two pillars. The first pillar consists of social security, the second of occupational and private pensions. There are two main schemes for social security, which differ in generosity. Individuals are entitled to one of the social security schemes from age 65 or 66 onwards. Occupational and private pensions function as supplement to the social security benefits.

The first social security scheme is the Old Age Contributory Scheme, which is not means-tested. Only individuals who made sufficient social insurance contributions during their working life are entitled to benefits from this scheme. Most employees with a full-time job compulsory pay social insurance contributions. Earnings are taken into account for the level of the contribution made by the employee. Employers also pay their share. The benefit level from the Old Age Contributory Scheme *only* depends on household composition, not on earnings at retirement. Beneficiaries of this pension scheme are allowed to work without any reduction in the payment. Individuals with enough contributions can already retire at age 65 and receive a transition pension. The transition pension has the same benefit level as the Old Age Compulsory Scheme, but additional earnings are not allowed.

The second social security scheme is the Old Age Non-Contributory Scheme, which covers all individuals without (sufficient) social security contributions. This scheme is means-tested and its benefit level, therefore, depends on additional income and/or capital of the individual. Capital is only assessed above a threshold and benefits are lowered proportional to the additional income and capital. The full payment rates are somewhat lower than those of the Contributory scheme, but this gap is to be closed in the future.

Almost 90% of the elderly receive some social security pension (Hughes and Watson, 2005). The number of recipients of the Contributory scheme has been rising over the last

[1] See also Finkelstein and McGarry (2006), Fang, Keane and Silverman (2008) and Cutler, Finkelstein and McGarry (2008), who provide evidence for advantageous selection in health insurance markets for the elderly.

Table 4.1: Social welfare pension rates (in pounds per week)

	Nominal rates (in £)		Real rates (in 1994 £)	
Year	Contributory	Non-Contributory	Contributory	Non-Contributory
1994	71.00	61.00	71.00	61.00
1995	72.80	62.50	71.01	60.96
1996	75.00	64.50	71.92	61.85
1997	78.00	67.50	73.73	63.80
1998	83.00	72.50	76.65	66.96
1999	89.00	78.50	80.81	71.27
2000	96.00	85.50	82.60	73.56
2001	106.00	95.50	86.93	78.32

Source: Pension Board, 1998

twenty years, and at the same time the number of recipients of the Non-Contributory scheme has declined (Pensions Board, 1998).

Both social security schemes take account of the household composition in determining the benefits level. In particular, supplements are added on top of the basic insurance level for a dependent spouse and children under age 18 (or age 22 when in full-time education). Table 4.1 gives for our observation period the basic level of both types of social security benefits. The benefits levels are increasing over time, not only in nominal terms but also in real terms. The increase is however lower than the average increase in (real) wages in this period. In Table 4.2 we provide the supplements for a dependent spouse and children, the spousal supplement depends on the income and age of the spouse. Social security benefits are relatively low. The replacement rate for a worker with average earnings is only 30.6%, which is the lowest in the OECD (OECD, 2005).

The second pillar of the pension system are the occupational and private pensions. Three main types can be distinguished. *Public service pensions* cover civil servants, teachers, health workers, local authority employees, etc. on a pay-as-you-go basis. The typical public service pension arrangement is to provide a total retirement income (including the social security benefits), which is 1/80th of the last year's wage for each working year (with a maximum of 40 years). *Occupational pensions* are set up by employers for their employees. These plans are most often defined benefits schemes, but can also be defined contribution. Total retirement pension income is usually 1/60th of the last wage for each working year. It is usually possible to start collecting public service pensions and occupational pensions from age 60 onwards. The third type are *personal pensions*, which are fully arranged by individuals. Especially self-employed individuals have to rely on this last type of pension provision. A survey from the Economic and Social Research Institute (ESRI) in 1995 found that about 38% of the employees in the private sector participated in a second pillar pension scheme, compared to 83% in the public sector, and 27% of the self-employed. Full-time workers and workers in large firms and high-income workers are most likely to participate in a second pillar pension scheme (Pensions Board, 1998).

Table 4.2: Rates of supplements for spouse and children for 1998

Contributory Pension		
full rate	£	83.00
max. supplement for spouse aged < 66	£	52.50
max. supplement for spouse aged ≥ 66	£	59.90
child supplement if no spouse or spouse that qualifies for supplement	£	15.20
child supplement if spouse does not qualify for supplement	£	7.60
Non-contributory Pension		
full rate	£	72.50
max. supplement for spouse aged < 66	£	41.20
spouse aged ≥ 66 can apply in own name for Non-Contrib. Pension	£	72.50
child supplement if no spouse or spouse that qualifies for supplement	£	13.20
child supplement if spouse does not qualify for supplement	£	6.60

Source: Department of Social, Community and Family Affairs

4.2.2 Health insurance

Below we give a brief description of the Irish public and private health insurance system. A more extensive discussion can be found in Bolhaar, Lindeboom and Van der Klaauw (2008).

Ireland has publicly funded national health insurance. However, there are (considerable) copayments for use of medical services. For example, in 2007 the copayment for a GP visit was €40. Low-income households are eligible for a Medical Card, which exempts them from copayments and provides them also with free optical, aural and dental care and prescribed drugs and medicines. The income threshold for eligibility depends on household composition and age of the head of the household. About one-third of the total Irish population is covered by such a card. Among the 65+ the coverage rate is twice as high, around two-third of them have a Medical Card.

Supplementary health insurance is available on the private market. These insurances offer partial reimbursement of copayments, but also provide access to privately provided health care (in both public and private hospitals). The latter mainly serves as a way to circumvent waiting lists. By law insurance companies can only use community rating in determining their premiums. Additionally they are obliged to accept everybody, irrespective of age or health status. For long there was only one, state-supported en non-profit, provider of private supplementary health insurance, Voluntary Health Insurance (VHI). European regulations forced opening of the market to other providers in 1996 and a year later a second player, British United Provident Association Ireland (BUPA Ireland), entered the market. VHI still dominates the market: in 2001 BUPA Ireland insured only 3.6% of the population, VHI the other 45%. Private supplementary health insurance coverage has not always been at this level. In 1960 coverage was only 4%, but it has been (and still is) rising ever since. Currently, more than 50% of the population is covered.

Obviously, private supplementary health insurance is more valuable to individuals without Medical Card. In our data close to 60% of the individuals without a Medical Card has private supplementary health insurance, while this is only 5% among Medical Card holders. The insurance premium for an adult was just below €50 per month in 2006.

4.3 Model

Our model describes the labor market participation and health insurance decisions of married males with a non-working partner, which is the most common household composition in Ireland. We focus on males around the age of retirement and assume that their objective is to optimize the present value of total household utility.

4.3.1 Outline

Each period t a household derives utility from the total consumption C_t and the health of both the male H_t and his spouse H_t^s. The spouse is always non-working, but the male can either be retired ($R_t = 1$) or when not being retired employed ($E_t = 1$) or unemployed ($E_t = 0$). Labor market status also directly generates (dis)utility, the level of which depends on the male's age. Furthermore, private supplementary health insurance (I_t) not only reduces the costs of health care, but may also be valued for the possibility to circumvent waiting lists and the free choice of care provider. Having private supplementary health insurance, therefore, also affects utility directly. The instantaneous utility function is

$$U_t = \left(\frac{C_t^{1-\nu}}{1-\nu}\right)^{\beta} u\left(H_t, H_t^s, R_t, E_t, A_t, I_t\right)^{1-\beta}$$

where β captures the relative preference for consumption and non-consumption attributes. A high value of β corresponds to a high relative preference for consumption. Parameter ν is the risk-preference parameter in a CRRA-type specification for the utility of consumption. Individuals are more risk-averse for higher values of ν.

Each period an individual can choose to retire $R_t = 1$. Retirement is, however, an absorbing state, implying that if $R_{t-1} = 1$, then also $R_t = 1$. If the individual is not retired, he can either be employed or unemployed. Being employed follows from a stochastic process, where the current employment probability depends on the previous labor market status. In particular, transition probabilities between unemployment and employed equal

$$\Pr\left[E_t = 1 | E_{t-1} = 0\right] = \zeta$$

and

$$\Pr\left[E_t = 1 | E_{t-1} = 1\right] = \xi$$

Obviously, if ξ is larger than ζ, there is state-dependence in labor market status.

When being employed an individual receives a predetermined wage $WAGE_t$ and unemployed workers receive a benefits level B_t. Retired individuals receive a pension P_t, the level of which depends on age A_t, the wage at retirement $WAGE_{ret}$ and employment history $E_{t-1}, E_{t-2}, \ldots$. Institutional details are used to create a pension profile for each individual (see subsection 4.2.1). The individual earnings in period t are, therefore,

$$Y_t = WAGE_t \cdot (1 - R_t) \cdot E_t + B_t \cdot (1 - R_t) \cdot (1 - E_t) + P_t(A_t, WAGE_{ret}, E_{t-1}, E_{t-2}, \ldots) \cdot R_t$$

Households can use their earnings for consumption, medical expenditures M_t and savings S_t

$$Y_t = C_t + S_t + M_t$$

Savings can both be positive and negative, but we do not allow for borrowing. This implies that individuals can never dissave more than their current wealth. Since our model describes the period around retirement, we think that for these individuals borrowing for consumptive purposes is almost impossible. Wealth W_t follows

$$W_t = (1 + \delta)W_{t-1} + S_t$$

where δ is the interest rate.

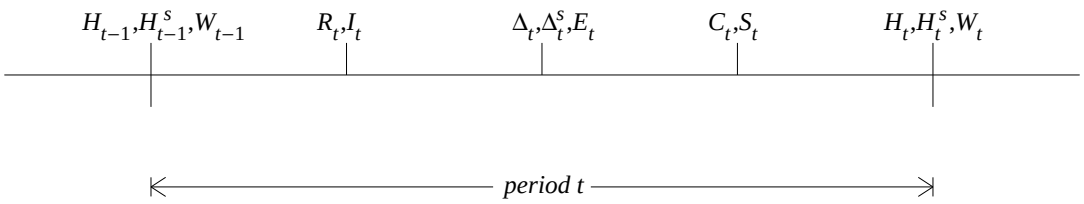
Medical expenditures depend on the amount of health care used by both spouses, their Medical Card status and insurance status. The health status of the individual and his spouse and wether or not they experience health shocks Δ_t, Δ_t^s determine the level of health care that is used. Health can only take two values, it can either be good ($H_t = 1$) or bad ($H_t = 0$). Bad health is an absorbing state, so if ($H_t = 0$) we know with probability one that $H_\tau = 0$ for all $\tau > t$. Thus, following De Nardi, French and Jones (2006) and Palumbo (1999), health care is modeled as a forced investment that has to be made and cannot be used to improve individual health. The price p_t associated with health care depends on whether or not an individual has a Medical Card $1(Y_t \leq \bar{Y})$ or private supplementary health insurance I_t. Eligibility to a Medical Card only depends on having earnings below the threshold $\bar{Y}$, but having private supplementary health insurance is a choice variable of the household. A Medical Card reduces the price of health care with fraction π_1 and private supplementary health insurance reduces the price with fraction π_2, where $\pi_1 > \pi_2$. The price level of health care is

$$p_t = 1 - \pi_1 \cdot 1(Y_t \leq \bar{Y}) - \pi_2 \cdot 1(Y_t > \bar{Y}) \cdot I_t$$

Medical Card holders only buy private supplementary health insurance if the direct utility they get from it is high. The costs of obtaining private supplementary health insurance are q. So total medical expenditures are

$$M_t = p_t \cdot \big(2\omega_0 + \omega_1 \cdot (\Delta_t + \Delta_t^s) + \omega_2 \cdot (2 - H_{t-1} - H_{t-1}^s)\big) + 2q \cdot I_t$$

Figure 4.1: Timing of events



This implies that a household has a higher level of medical costs if individuals in the household are in bad health or if they experience health shocks. The probability with which health shocks occur, depends on the health status of the individual,

$$Pr(\Delta_t = 1 | H_{t-1} = 0) = \phi$$

and

$$Pr(\Delta_t = 1 | H_{t-1} = 1) = \varphi$$

One might expect individuals in bad health to be more likely to experience a health shock, i.e. $\varphi > \phi$.

Whereas health shocks describe temporary health problems, the health indicator H_t describes permanent health conditions (recall that bad health is an absorbing state). The transition probability from good health to bad health depends on age A_t and the labor market status, so

$$\Pr(H_t = 0 | H_{t-1} = 1, A_t, R_t, E_t)$$

This implies that working, unemployment and retirement can have a direct impact on the health of an individual. For the non-working spouse the transition probability from good to bad health reduces to a function of only age.

Figure 4.1 shows the timing of events. At the start of period t, the state variables are health H_{t-1}, the health of the spouse H^s_{t-1}, household wealth W_{t-1} and previous period's labor market states R_{t-1} and E_{t-1}. Based on information on these state variables, the household has to decide about taking health insurance for period t and if $R_{t-1} = 0$ whether or not to retire this period. Next, the household experiences health shocks and employment shocks. After the household learned about the shocks the household has to decide about the level of consumption and savings. The chosen level of savings determines the new wealth level W_t, and a new health status H_t is drawn depending on age and the chosen labor market state, E_t and R_t.

We use the model to describe behavior between age 50 and 75. So, age $A_t = 50$ at $t = 0$ and in final period $T = 25$ the individual's age is 75. During this period, households

optimize lifetime utility, which implies the Bellman equation

$$V_t(W_{t-1}, H_{t-1}, H^s_{t-1}, E_{t-1}, R_{t-1}) = \max_{I_t, R_t} \mathrm{E}_{E_t, \Delta_t, \Delta^s_t} \left[\max_{C_t} U_t + \rho \mathrm{E}_{H_t, H^s_t} \left[V_{t+1}(W_t, H_t, H^s_t, E_t, R_t) \right] \right]$$

where ρ is the rate at which future utility is discounted. Furthermore, we impose

$$V_{T+1} = (W_T)^\kappa$$

where κ is a parameter. Households thus derive utility from leaving wealth after the last observation period. If T is interpreted as the age of death, then V_{T+1} gives the utility from leaving bequest. However, V_{T+1} can also be interpreted as the present value of expected utility beyond T. This additional term avoids that the model predicts strong dissaving towards age 75.

4.3.2 Parametrization

The non-consumption contribution to the instantaneous utility function depends on health, labor market status and insurance status. In particular, we adopt a linear specification

$$u(H_t, H^s_t, R_t, E_t, I_t) = \\ \alpha_0 + \left(\alpha_1 + \alpha_2 A_t + \alpha_3 A_t^2\right) E_t + \alpha_4 R_t + \alpha_5 H_{t-1} + \alpha_6 R_t H_{t-1} + \alpha_7 I_t + \alpha_8 H^{sp}_{t-1}$$

in which we allow the (dis)utility of working to depend on the individual's age. Furthermore, we include the possibility of an interaction effect between retirement and health to capture that (voluntary) leisure might generate more utility when being in good health.

Next, we have to parameterize the transition probability from good health to bad health. For the male in the household, this is

$$\Pr(H_t = 0 | H_{t-1} = 1, A_t, R_t, E_t) = \\ \frac{\exp(\gamma_0 + \gamma_1 A_t + \gamma_2 A_t^2 + \gamma_3 E_t + \gamma_4 R_t + \gamma_5 A_t (1 - R_t) + \gamma_6 A_t^2 (1 - R_t))}{1 + \exp(\gamma_0 + \gamma_1 A_t + \gamma_2 A_t^2 + \gamma_3 E_t + \gamma_4 R_t + \gamma_5 A_t (1 - R_t) + \gamma_6 A_t^2 (1 - R_t))}$$

The specification allows the transition probability of health to differ in the way it depends on age with participation in the labor force. For the non-working spouse, this transition probability simplifies to

$$\Pr(H^s_t = 0 | H^s_{t-1} = 1, A^s_t) = \frac{\exp(\gamma^s_0 + \gamma^s_1 A^s_t + \gamma^s_2 (A^s_t)^2)}{1 + \exp(\gamma^s_0 + \gamma^s_1 A^s_t + \gamma^s_2 (A^s_t)^2)}$$

Finally, in the model we allow for unobserved heterogeneity in the preference parameter β and risk-aversion ν. We use a discrete distribution with two points of support for both parameters. So

$$\Pr(\beta = \beta_1, \nu = \nu_1) = q_1 \qquad \Pr(\beta = \beta_2, \nu = \nu_1) = q_3$$
$$\Pr(\beta = \beta_1, \nu = \nu_2) = q_2 \qquad \Pr(\beta = \beta_2, \nu = \nu_2) = q_4$$

with $q_1 + q_2 + q_3 + q_4 = 1$.

4.4 The data

The data are from the Living in Ireland Survey (LIIS), the Irish contribution to the European Community Household Panel (ECHP) with eight waves of data covering the years 1994-2001. In 1994 a representative sample was drawn from electoral registers. Until 2001, individuals in this sample and all their household members over age 16 were each year asked to complete a questionnaire. In total 4048 households participated in the first wave in 1994, which was 57% of the originally sampled households. In the year 2000 new individuals and their households were added to the panel, as the size of the panel had diminished over time due to attrition. The main cause for attrition after the first wave was the difficulty to trace households that had moved. This problem occurred most often with single young adults, and, therefore, is less of a problem for our purposes (see Watson (2004) and Bolhaar, Lindeboom and Van der Klaauw (2008) for more details on the attrition pattern).

4.4.1 Sample selection and descriptives

From the Living in Ireland Survey all households are selected with a man between age 50 and 75. This reduces the data from 5902 to 2453 households. Furthermore, we select only men, who were married (and whose marital status did not change), which reduces the sample to 1981 couples. Next, we remove men who already left the labor force before age 50, which leaves us with 1739 couples. Since in the model, we consider single-income households, we only keep 1130 couples with a non-working female spouse. The data contain 454 self-employed men and farmers. These types of employment differ from regular employment in the way a pension is provided. Both farmers and the self-employed do not make social security contributions and do not have occupational pensions to supplement the Non-Contributory social security pension. For most farmers and self-employed their business is their 'pension fund': the revenue of selling the business should provide enough capital to live off their own means (Hughes and Watson, 2004). Because this would be difficult to fit in our model, we exclude them from the data. This results in a reduction of the sample to 676 households. Next, we have to exclude households with missing information in relevant variables. This results in a sample of 608 households with 2406 couple-year observations.

The questionnaires cover a wide range of topics, such as (sources of) income, labor market status, health, etc. Table 4.3 gives some descriptives of our sample. The descriptives in the first column are averages over individuals and waves. The descriptives in the second column are taken from the first available observation of the individual in our sample. In this way individuals that have more observations do not have a larger weight in the descriptives than those who entered later or left the survey before the official end in 2001. Of course this will give a low average age and better average health than in the

complete sample used.

Men are on average 58.6 years old when first observed. At the initial observation, slightly one-third has already retired and 60% is still employed. On average they have been in the labor force over 40 years and have been retired for over 2 years when first observed. Most households are either covered by a Medical Card (23%) or supplementary private health insurance (55%).

A relatively large fraction of the retired in the sample receives some second pillar pension. When first observed, 23.8% of the retirees receives a public service pension and 39.9% an occupational pension. Only 10% of the retirees receives a private pension. Of those without a second pillar pension, 52.9% receives a Contributory Pension and 12.9% a Non-Contributory Pension. Most of the people who receive neither a Contributory nor a Non-Contributory Pension do so because they have not yet reached age 65 or 66 to qualify for these schemes.

The (female) spouses are somewhat younger than their husband. They are slightly less often having a health problem, but more often have a high score on the mental health scale, meaning they have worse mental health. On self-assessed health the male and female spouse score (on average) the same.

4.4.2 Variable construction

In our model bad health is an absorbing state. To construct the health variable we use the survey question *Do you have any chronic, physical or mental health problem, illness or disability?* A positive answer to the question above is followed by the request to specify the nature of the health problem. Up to three health problems can be specified. Individuals are also asked since when they have had this health problem. However, this can only be specified for the first health problem that is listed. As a result, the indicated starting age of the health problem increases with age. This can be explained if people with more than one health problem list the most recent health problem they suffer from first. This could either be because this is the health problem they suffer from most at the moment they fill in the questionnaire or because this problem is most fresh in memory. Unfortunately, this question therefore cannot be used to define the health status at age 50, H_0, an initial condition in our model. We will therefore simulate for every individual both situations ($H_0 = 0$ and $H_0 = 1$) and give them weights in the likelihood function according to the average percentage of 50 year-olds with and without a health problem.

For health shocks we use admittance to hospitals. In particular, we directly estimate the parameters describing the risks of health shocks from the fraction of individuals in good and bad health which is admitted to hospital. Table 4.4 shows these probabilities. When being in bad health the probability of experiencing a health shock is 0.27, and this is 0.09 when being in good health. These probabilities are the same for males and females.

The health care costs are represented by the parameters ω_0, ω_1 and ω_2. The value

Table 4.3: Descriptive statistics

	all obs (1)	firstyearonly (2)
age	60.7	58.6
retired	0.412	0.335
employed $\geq$ 15hrs per week	0.528	0.607
years of life † in labor force	41.3	40.1
years of life † retired	2.7	2.1
years education	9.177	8.910
net weekly income in £ 's of 1994	259.40	250.86
savings increased	0.322	0.267
savings fell	0.150	0.156
savings stayed same	0.527	0.577
supplementary private health insurance	0.549	0.550
Medical Card	0.281	0.233
GP visits last 12 months	3.692	3.817
specialist visits last 12 months	0.730	0.703
optician visits last 12 months	0.404	0.394
dentist visits last 12 months	0.571	0.679
hospital stay last 12 months	0.134	0.138
health problem	0.286	0.254
self-assessed health = (very) good	0.760	0.770
GHQ-score $\geq$ 4 (bad mental health)	0.099	0.113
only those already retired		
years of life † in labor force	44.4	44.8
receives no second pillar pension	0.299	0.365
receives public service pension	0.302	0.238
receives occupational pension	0.400	0.399
receives private pension	0.063	0.102
only those already retired and without a second pillar pension		
receives Contributory Pension	0.618	0.529
receives Non-Contributory Pension	0.098	0.129
age spouse	58.0	56.0
GP visits spouse last 12 months	3.878	3.874
specialist visits spouse last 12 months	0.703	0.585
optician visits spouse last 12 months	0.411	0.375
dentist visits spouse last 12 months	0.613	0.635
hospital stay spouse last 12 months	0.115	0.103
health problem spouse	0.263	0.220
self-assessed health = (very) good	0.760	0.779
GHQ-score $\geq$ 4 (bad mental health) spouse	0.123	0.155

† = years of life since the age of 10

Table 4.4: Parameter values of parameters not estimated in Step 2

PARAMETERS TAKEN FROM THE DATA		
Employment opportunities		
$\Pr[E_t = 1 \mid E_{t-1} = 0]$	ζ	0.480
$\Pr[E_t = 1 \mid E_{t-1} = 1]$	ξ	0.955
Health shocks		
$\Pr[\Delta_t = 1 \mid H_t = 0]$	ϕ	0.274
$\Pr[\Delta_t = 1 \mid H_t = 1]$	φ	0.094
Health care costs (in 1000's of £)		
regular costs / health maintainance	ω_0	0.125
costs due to health shock	ω_1	0.900
costs due to bad health	ω_2	0.300
Cost of health insurance (in 1000's of £)		
health insurance premium	q	0.250
PARAMETERS ESTIMATED IN STEP 1		
Transition probability from good to bad health		
constant	γ_0^s	-14.052
age of spouse	γ_1^s	0.265
(age of spouse)^2	γ_2^s	-0.00156
OTHER PARAMETERS		
interest rate	δ	0.01

of all three parameters is estimated by the reported number of visits to a GP, medical specialist, optician or dentist and the number of nights in hospital in the past 12 months. We combine this information with the calculations of Layte and Nolan (2003) of the per unit cost of different types of health care in Ireland.[2] For households with a private supplementary health insurance, we observe their monthly insurance premium. Rates are converted to £ś of 1994 and the median rate is used as an approximation of q. This per person premium for private supplementary health insurance is about £ 250 per year.

The threshold $\bar{Y}$ for getting a Medical Card depends on the household composition and the age of both spouses. As the Medical card income guidelines are increased in accordance with the Consumer Price Index each year, the threshold in real terms stays the same over time. Like the different sources of income, we also use 1994 £ś for the Medical Card threshold. A couple where the man's age is below 66 faces a threshold of £ 118.25 per week. For a couple aged 66 or above, this increases to £ 132.90 per week. For each dependant child below the age of 16 another £ 14.50 is added, for each dependant child above 16 £ 15.00.

For savings our data only contains a measure on a five-point scale: *Increased a lot/Increased a little/Remained the same/Fell a little/Fell a lot.* As might be expected,

[2]The unit costs in Layte and Nolan are in euro's for 1999/2000. We convert the unit costs to 1994 Irish pounds

in the data the most mass is in the category *Remained the same*. Therefore, we reduce the number of categories to 3: *Increased*, *Remained the same* and *Fell*. For 57% of the couples savings stayed the same, 26% said they increased and 17% indicated that savings decreased in the year they entered the sample. If we look at all observations we see a lower percentage for whom savings stayed the same or fell and a higher percentage for whom savings increased. This could indicate that people do not dissave when they get older, but save even more.

Wealth in our model serves two purposes: self-insurance against health care costs and accumulating means to supplement retirement income or retire early on private means. Unfortunately, the data do not contain any information on wealth. Furthermore, even more general information on wealth levels in Ireland is very scarce. We will use the individual's annual wage at age 50 to set an initial wealth level, $W_0 = \varpi \cdot WAGE_0$. We set ϖ to 0.5, as a sensitivity check a change in ϖ can be investigated.

We use observed transitions between employment and unemployment to estimate transition probabilities. In particular, the probability of staying in employment, when being employed (ξ) equals 0.955. The probability of finding work while being unemployed (ζ) is 0.48. Unemployed individuals receive a benefit B_t. The level of the unemployment benefit is equal to that of the Non-Contributory Pension benefits listed in Table 4.1. Finally we set the interest rate at 0.01 (in accordance with French, 2005). Table 4.4 summarizes the values of the structural parameters which we estimated on the raw data.

Recall that in our model wages are predetermined. This implies that we have to impose wage profiles. To approximate the wage an individual receives for employment, the following equation is estimated:

$$WAGE_{i,\tau} = \vartheta_0 + \vartheta_1 X_{i,\tau} + \vartheta_2 J_{i,\tau} + \varepsilon_{i,\tau} \qquad \varepsilon_{i,\tau} \sim N(0, \sigma_\varepsilon) \tag{4.1}$$

where $WAGE_{i,\tau}$ is the wage of individual i observed in wave τ (corrected for inflation). The vector X_τ contains individual characteristics, such as age, gender, years of education, labor market history, etc., while the vector J_τ includes job characteristics, such as hours of work, sector, occupation, etc.

Next, we use that between age 50 and 75, individual wages are very well approximated by

$$\ln\left(WAGE_{i,t}\right) = WAGE_{i,0}\left(1 + \iota_{wage}\right)^t \tag{4.2}$$

where the annual wage growth is estimated to equal 0.0316. Using this approximation we only need to predict the *baseline wage* $WAGE_{i,0}$ of individual i at age 50. For individuals for whom wage is observed in one or more waves, the baseline wage $WAGE_{i,0}$ can be deducted from the observed wage using equation (4.2). Individuals who were already retired when first included in the data, do not have any wage observations. However, the data contain the characteristics of their last job before retirement and we can use equation

(4.1) to get an estimate of the baseline wage.[3] It should be noted that almost 90% of the individuals in our data do not switch employer anymore after age 50. To take into account that the estimated wage approximates the true wage up to the error term $\varepsilon_{i,\tau}$ (equation 4.1), n draws from $N(0, \sigma_\varepsilon)$ are taken to create n reconstructed wages. Each of these n reconstructed wage profiles will have a weight of $\frac{1}{n}$ in the likelihood function.

The pension P_t received at retirement is the sum of social security FP_t (first pillar pensions) and public service, occupational and private pensions SP_t (second pillar pensions). Recall from subsection 4.2.1 that it is common for public service and occupational pensions to take into account the level of social security benefits. Adopting the most common arrangement for each of the pension types, this implies a quite simple rule for calculating the pension profile of individuals with a second pillar pensions. The data provide information on second pillar pensions for retired individuals. For individuals in the labor force we observe if they are eligible for second pillar pensions other than a private pension. We also observe if an individual works in the private or public sector, and more precisely in which occupation. We can thus deduct eligibility for either a public service or an occupational pension. The pension profile for those with a public service pension is

$$P_t = SP_t^{pub}\left(yw_t, WAGE_{A^r-1}, A^r\right) = \frac{1}{80} \cdot \max\left\{yw_t, 40\right\} \cdot WAGE_{A^r-1} \cdot (\iota_{sp})^{A_t - A^r}$$

where yw_t is the number of years the individual has been in the labor force. The profile for occupational pension members is

$$P_t = SP_t^{occ}\left(yw_t, WAGE_{A^r-1}, A^r\right) = \frac{1}{60} \cdot \max\left\{yw_t, 40\right\} \cdot WAGE_{A^r-1} \cdot (\iota_{sp})^{A_t - A^r}$$

Private pensions are not very common and do not follow a specified rule. We will use the same rule as for occupational pensions for private pensions.

For individuals that are only entitled to collecting first pillar pensions (social security), the pension profile depends on whether the individual has made (enough) social security contributions. If no contributions are made wealth has to be taken into account as well (recall that the Non-Contributory Pension is means-tested). First, we estimate the probability that an individual has made social security contributions ($SSC = 1$) on individual and job characteristics. In particular, we use a logit model,

$$\Pr[SSC = 1] = \Lambda\left(X_t, J_t\right)$$

This estimation is based on a sample of retired workers. We use the estimated parameters to approximate the likelihood of making social security contributions for non-retired workers.

[3]Some individuals have missing observations in the characteristics of the last job before retirement. For them we use a second approximation rule, based on the pension rule for second pillar pensions. Using the number of years worked and the pension received, the wage before retirement can be reconstructed. Comparing the reconstructed wage using this approximation method and approximation using equation (4.1) for individuals for whom characteristics of the last job before retirement are available, indicates that the two methods produce wages that are reasonably close.

If sufficient social security contributions are made, an individual is entitled to the Contributory rate. If an individual is not eligible for the Contributory pension, a means test will determine the pension income. Conditional on receiving the Non-Contributory pension, we estimate the amount of the payment that is received by regressing the payment on the level of other possible sources of income and individual characteristics. The estimates are used to predict the amount of Non-Contributory pension payable to those still at work if they would retire without having made (enough) social security contributions. The social security pension that is payable is given by

$$FP_t(A_t, A_t^s, SSC, Y_t^{other}, X_t) = \\ \Pr[SSC = 1] \cdot FP_t^{ssc=1}(A_t, A_t^s) + (1 - \Pr[SSC = 1]) \cdot FP_t^{ssc=0}(A_t, A_t^s, Y_t^{other}, X_t)$$

4.5 Estimation

The first step in our procedure to estimate the parameters from the dynamic programming model specified above is to solve the model backwards using a vector of starting values θ_0 for the parameters we want to estimate θ. For n different values of W_{T-1} and for every possible retirement age $A^r, A^r \in \{50, \ldots, 50+T\}$, last period's value function $V_T = U_T + \rho V_{T+1} = U_T + \rho (W_T)^\kappa$ is optimized over C_T for all relevant (combinations of) values of the state variables at time T, $Q_T = \{W_{T-1}, H_{T-1}, H_{T-1}^s, E_T, R_T, I_T, \Delta_T, \Delta_T^s\}$.

Stepping back one period to period $t = T-1$, the expectation of period T's value function V_T over E_T, Δ_T and Δ_T^s is calculated using the shock and transition probabilities ζ, ξ, ϕ and φ, given H_{T-1}, H_{T-1}^s, E_{T-1} and R_{T-1}. This gives $\mathrm{E}_{E_t,\Delta_t,\Delta_t^s}[\max_{C_t} U_t + \rho V_{t+1}(\ \ )]$ for the n values of W_{T-1} and for all retirement ages A^r. Given H_{T-1}, H_{T-1}^s, E_{T-1} and R_{T-1}, the optimal insurance decision for period T, I_T can be determined. Buying insurance is optimal if the expected value of doing so is larger than the expected value of not doing so, conditional on H_{T-1}, H_{T-1}^s, E_{T-1}, R_{T-1}, W_{T-1} and A^r. The resulting vector contains the maximum value for V_T given H_{T-1}, H_{T-1}^s, E_{T-1}, R_{T-1} and A^r for n different values of W_{T-1}. A xth-order polynomial in W_T can now be fitted to this vector to approximate V_T (given H_{T-1}, H_{T-1}^s, E_{T-1} and R_{T-1}) by a function in W_T (as proposed by Keane and Wolpin, 1994). This reduces the optimization problem from

$$V_t(\ \ ) = \max_{I_t, R_t} \mathrm{E}_{E_t,\Delta_t,\Delta_t^s}\left[\max_{C_t} U_t + \rho \mathrm{E}_{H_t,H_t^s}[V_{t+1}(\ \ )]\right]$$

to

$$V_t(\ \ ) = \max_{I_t, R_t} \mathrm{E}_{E_t,\Delta_t,\Delta_t^s}\left[\max_{C_t} U_t + \rho \mathrm{E}_{H_t,H_t^s}\left[\psi_0 + \psi_1 W_{T-1} + \psi_2 W_{T-1}^2 + \psi_3 W_{T-1}^3\right]\right]$$

The advantage is that it makes evaluation of all combinations of the state variables *of all time periods* no longer necessary. Given H_{T-1}, H_{T-1}^s, E_{T-1}, R_{T-1} and A^r, the ψ's

summarize the utility of optimal choices in the future and reduce the first-order conditions for optimization to an expression that can be solved. The estimated parameter values of the ψ's are stored for later use.

For $H_{T-1} = 0$, with probability 1 $H_T = 0$. For $H_{T-1} = 1$, the probability with which $H_T = 0$ depends on A_{T-1}, E_{T-1} and R_{T-1}. For the spouse this probability only depends on age. For all relevant combinations of E_{T-1} and R_{T-1} the probability that good health will deteriorate to the bad state in period $T-1$ (where $A_{T-1} = 50 + T - 1$) can be computed. Using the obtained transition probabilities for the male and the earlier estimated transition probabilities for the spouse, $\mathrm{E}_{H_t, H_t^s}\left[V_{t+1}(\quad)\right]$ (given E_{T-1} and R_{T-1}) can be computed. With the obtained expected value of future utility the routine described above can be repeated for $t = T-1, T-2, \cdots$ down to $t = 0$.

After having solved the model, we use simulation methods to estimate the parameters. In particular, we adopt the estimation methods of Keane and Sauer (2009). This methods is based on using classification errors. So we simulate the model for a set of parameters and obtain predictions for retirement status, health status, health insurance choice and saving.[4] Estimating the parameters simply yields maximizing the number of correct predictions over the parameters. The criterium function is, however, non-continuous. Therefore, we use the simplex algorithm proposed by Nelder and Mead (1971) to estimate the parameters.[5]

The second step uses the stored values of the ψ's estimated in the first step to solve for optimal choices in each period. Starting at $t = 0$, where initial health of the individual and his spouse H_0, H_0^s and wealth W_0 are known, the ϕ's for each of the retirement ages for period 1 are used to solve the optimization problem and chose the optimal value for R_1 and I_1. For a set of draws for E_1, Δ_1 and Δ_1^s the optimal consumption level C_1 is determined. Subsequently, W_0 can be updated to W_1 as the level of savings S_1 directly follows from the optimal consumption. In addition, a new value for the health variables is drawn using the transition probability resulting from the chosen labor market choices and age. Proceeding in this way, the model can be solved for all period until $t = T$.

The third step of the procedure involves comparing the simulated choices with the observed choices for retirement status, health, health insurance and savings. For each of these outcome variables the fraction of classification errors is calculated. The classification error rates are used to construct the likelihood function as proposed by Keane and Sauer (2009). As savings is a continuous variable in our model, but only a categorized variable in the data, the simulated savings histories have to be categorized in a similar manner as the data to determine the error classification rates. We tried different threshold values to categorize the simulated savings, and a fraction of 0.025 of wealth fitted the data best.

[4] In the data we only observe whether or not household saved or dissaved. In our model savings is continuous. We impose that a household saves if savings were more than 2.5% of the wealth level. We have tried different threshold values.

[5] Also Keane and Wolpin (2001) and French (2005) use this methods to estimate structural models.

In the fourth step, the obtained likelihood is used to update parameter vector θ. With the new parameters θ we go back to step 1. This iterative process continues until the vector of parameters is found that best fits the data. Because of the highly discontinuous nature of the likelihood function, we used the Simplex algorithm proposed by Nelder and Mead (1971) to choose new parameter values.[6] Though computationally intensive, our strategy has two advantages. First, we don't restrict the choice variables by discretizing them (contrary to, for example, French and Jones, 2004). And second, it automatically incorporates a way to address measurement error in the choice variables. Standard errors are obtained with the BHHH-method, or outer product of gradients, using numerical derivatives (in line with Sauer, 2004, and Keane and Wolpin, 2001).

4.6 Results

4.6.1 Parameter estimates

In Table 4.5 the results for the estimated parameters are presented. We find that couples derive positive utility from both employment and retirement of the man, compared to unemployment. The direct effect of health on utility is very small (1.651). The effect of health interacted with retirement is for both spouses much larger. We find that couples derive more utility from retirement if the man is in good health (8.337) and/or his spouse is in good health (15.763). One way to interpret these positive coefficients is that retirement is enjoyed more in good health. The positive coefficients can also be interpreted differently: couples derive more utility from retirement if they are in good health than if they are in bad health because when they are in bad health the lower income that comes with retirement is a larger burden. The couples in our sample also derive some utility of having health insurance beyond the reduction in copayments. Harmon and Nolan (2001) report a survey by the Economic and Social Research Institute (ESRI) in which people were questioned on reasons to buy health insurance. Besides financial reasons also waiting lists were mentioned as an important reason. The positive effect of health insurance, therefore, most likely reflects the utility of health insurance as a way to circumvent waiting lists. In the transition from good to bad health age, as expected, plays an important role. The positive coefficients of γ_1 and γ_5 imply that the probability to move from good to bad health increases with age. This effect is stronger if individuals have not yet retired, suggesting a negative impact on health of being in the labor force at advanced ages. Both γ_2 and γ_6, the effect of age squared, are negative, so the positive effect of age on the probability to transition from good to bad health is diminishing with age. We allowed for heterogeneity in both risk aversion and preferences in our model. The estimated

[6] This is a common choice for this type of models, see for example Keane and Wolpin (2001) and French (2005).

Table 4.5: Estimation results

Utility function			
constant	α_0	79.575**	(35.674)
employment	α_1	85.049***	(3.502)
employment∗age	α_2	0.804***	(0.019)
employment∗age squared	α_3	−0.044***	(0.002)
retirement	α_4	19.806***	(1.433)
health	α_5	1.651	(1.719)
retirement∗health	α_6	8.337	(5.957)
retirement∗health of spouse	α_7	15.763	(13.145)
health insurance	α_8	0.959***	(0.131)
Health transition function			
constant	γ_0	−14.037	(65.197)
age	γ_1	0.247	(0.782)
age squared	γ_2	−0.002	(0.002)
employment	γ_3	−0.003	(1.339)
retirement	γ_4	−0.002	(1.186)
age∗(not retired)	γ_5	−0.00001	(0.013)
age squared∗(not retired)	γ_6	−0.00001	(0.0003)
Behavioural and preference parameters			
value of bequest	κ	0.995***	(0.031)
valuation of future utility	ρ	0.975***	(0.105)
preference for consumption	β_1	0.770	(0.632)
	β_2	0.889	(0.944)
risk aversion	ν_1	0.183***	(0.006)
	ν_2	0.198***	(0.003)
$\Pr(\beta = \beta_1)$		0.127	(0.081)
$\Pr(\nu = \nu_1 \mid \beta = \beta_1)$		0.412***	(0.035)
$\Pr(\nu = \nu_1 \mid \beta = \beta_2)$		0.944***	(0.086)

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

parameters indicate a little heterogeneity in risk aversion (0.183 and 0.198), and more heterogeneity in preferences (0.769 and 0.889). However, the group of individuals that has $\beta = \beta_1$ is quite small, only 12.7% of the population. The by far largest group of individuals has $\beta = \beta_2$ and $\nu = \nu_1$. These results indicate that it is not superfluous to allow for heterogeneity in risk aversion and preferences.

Figure 4.2 shows how the simulated data fit the true data we observe. All panels show the fraction of individuals for which some variable (retirement, health insurance, health, etc.) equals one, ordered by age.[7] The simulated profile for retirement is steeper than in the observed data. In the simulated data most individuals retire at age 60. In reality however, this goes more gradually between 57 and 67. The simulated profiles of having a Medical Card and for health insurance purchase fit the original data better. At lower ages the simulated model predicts lower levels of health insurance purchase, where in the data

[7] As we observe individuals only for a maximum of 8 years, the observations at age 70 are not from the same individuals as the observations at age 55, for example. Hence the irregularities in the profiles, especially for the observed data.

health insurance purchase is quite constant over age. The simulated profile for health fits the data fairly well at lower ages, but health does not decline as much at higher ages as in the true data. The simulated profile for spousal health fits the data quite well. Savings are increasing at lower ages for the majority of the population in the simulations. After age 60, the fraction of the population that has increased savings declines rapidly. The figure for the fraction of the population for whom savings stayed the same is the mirror image of that for increased savings. The simulations show a fraction for whom savings stayed the same that is too low at lower ages, and that increases rapidly after age 60. The fraction for whom savings decreased is low in both the observed and the simulated data. The increased savings at lower ages in the simulated data are thus not used to be dissaved after retirement; after having accumulated wealth, the level of savings stays the same and does not decrease. The discrepancy between the observed and the simulated data for retirement can therefore not (only) be explained by simulated individuals accumulating large amounts of wealth to retire early. A more probable explanation is that some of the assumptions that were made in the construction of the variables are too strong. It was assumed that all the years an individual has been working, count in determining the level of second pillar pensions. If, for example, an individual had employment for some years that did not have a second pillar pension scheme, this will influence the level of his pension. This effect can be especially strong because of the cap on the number of years in employment in the pensionrule (recall from subsection 4.4.2 that years in employment in the pension rule is 40 at maximum). Assuming for all individuals that the full number of years they have been working counts in determining the level of the second pillar pension, implies for most individuals that working beyond age 60 will not increase the level of their pension as they have already worked for 40 years at that age.

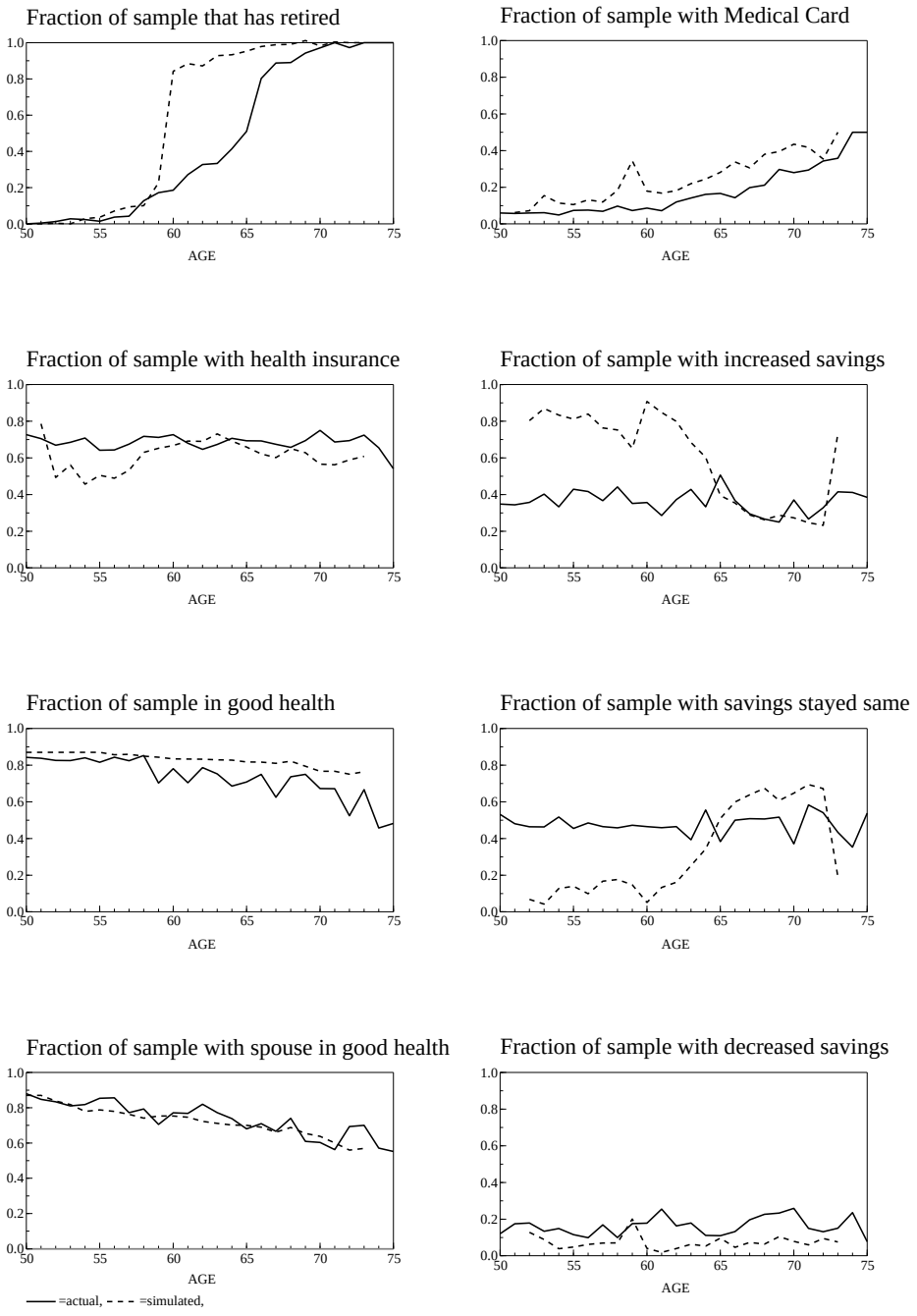
4.6.2 Policy simulations

We use the estimated model to simulate the effects of a number of policy changes.

First, we focus on the Medical Card and simulate the consequences of lowering the income threshold for eligibility for the Medical Card. We lower the income threshold with 20%. In Figure 4.3 we show the effect of lowering the Medical Card threshold on retirement behavior. There is only a very small change in the age of retirement. It seems that some people retire slightly earlier with the lower threshold.

Next, we consider the rising health care costs. Technological advancement results in treatments becoming available for diseases that could not (or not that good) be treated before. These new technologies are often very expensive. Furthermore, they enable people with fragile health to live longer, but with increased health care costs. It is likely that if health care costs rise, the premium of supplementary private health insurance will also increase. This experiment increases both health care costs and the insurance premium by 10%. Figure 4.4 shows that there is no effect on retirement behavior of these changes.

Figure 4.2: Fit of simulated data for retirement, private supplementary health insurance purchase, health, spousal health, Medical Card ownership and savings



Finally, we consider the increase in age at which people become eligible for state pensions. Many countries face an ageing population, which causes financial problems because of a declining ratio of active over inactive individuals. Many countries either recently increased the eligibility age for state pensions or are considering such a policy. Therefore, we simulate the effect of increasing the age for eligibility of the state pension from 65 to 67 and the second pillar pension from 60 to 62. The results are shown in Figure 4.5. We see a shift towards later retirement, but this shift is somewhat smaller than 2 years.

Figure 4.3: Retirement profile lower threshold for Medical Card

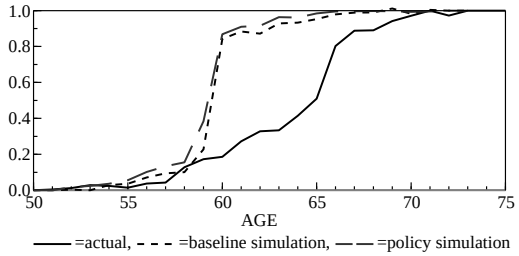


Figure 4.4: Retirement profile increased health care and health insurance costs

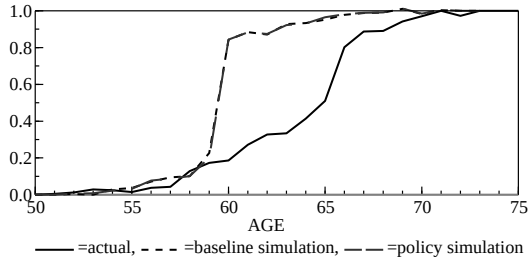
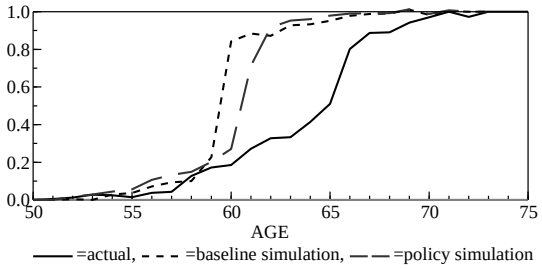


Figure 4.5: Retirement profile increase retirement age with 2 years



4.7 Discussion and conclusion

We developed an estimated a structural model for the behavior around retirement of couples. In particular, we focused on health, health insurance choices and labor market decisions. To estimate the model we used a sample of Irish couples with a single earner in the age between 50 and 75. We have used the estimated model to simulate a number of policy changes.

The key conclusion is that changes in the eligibility for a Medical Card only have a very minor effect on retirement behavior. The same is found for changing health care costs. This might suggest that when deciding to retire, the consequences of individual health risk do not play a very important role. On the other hand, varying the eligibility age for social security and pension affect retirement behavior. In particular, increasing the age of becoming eligible for social security increases the average age of retirement.

Our model allowed for heterogeneity in risk aversion and preferences. The parameter estimates indicate that this is not superfluous: although we find that about 82% individuals belongs to one group with the same preferences and risk aversion, still 18% belongs to one of three smaller groups with different preferences and risk aversion.

Chapter 5

Insurance Search and Switching Behavior

5.1 Introduction

Competitive markets are welfare maximizing, and the law of one price should hold. In many markets there is, however, a substantial degree of price dispersion. This may either be because products are not homogenous, or because consumers face costs to obtain information about prices. Firms can exploit their market power to set prices above marginal costs. Consumer search models are often used to describe such markets. This paper focuses on the Dutch health insurance market, and tests to what degree a simple consumer search model can describe the behavior of consumers in this market. In the empirical analyses, we exploit a major health insurance reform which took place in the Netherlands on January 1, 2006. The reform forced everyone to reassess their health insurance contract.

Before the reform there was a mix of private and public insurance against the costs of health care. In the new system, which is one of *managed competition*, all insurers compete with each other within rules set by the government. The current Dutch system has many similarities with the Swiss health insurance system, and is an inspiration for the health insurance reforms recently suggested by the Obama administration. These ambitions have renewed international interest in incentives of competition within social insurances.

The Dutch regulations oblige everyone to buy a basic insurance package of which the content is determined by the government. Insurance companies are not allowed to refuse applicants for this basic package and to differentiate premiums by any measure of risk (age, health, etc.). A Risk Equalization Fund compensates insurers who have a disproportionate number of high-risk individuals among their insurees. Insurance companies are free to set their own price for the basic insurance package and to compete for insurees. A survey by the Dutch Healthcare Authority indicated that consumers focus on premiums in the decision process (Dutch Healthcare Authority, 2006). If individuals indeed search

sufficiently for the lowest premium, the system should provide incentives to insurers to improve their efficiency and lower their premiums. Consumer search for health insurance, therefore, plays an essential role in this system. However, the monthly premiums for the basic coverage range from €82.50 to €97.75. By switching insurer some people could, therefore, save up to 15% of the insurance premium, which suggests that individuals do not have full information or that search costs are prohibitively high. As a second contribution this paper provides more insight into consumer search behavior in a system of managed competition.

We provide a simple consumer search model, which builds on Stahl (1989), Janssen and Moraga-González (2004) and Janssen, Moraga-González and Wildebeest (2005). Individuals in our model are only heterogeneous in their health, which determines their utility of insurance coverage. Each individual receives an offer for health insurance from their current insurer, and, in addition, may receive an offer for a group contract. These group contracts are mostly offered via employers and give a discount on the premium. After having received the offer(s), individuals decide whether or not to search the market for a lower priced insurance contract.

The model provides a number of testable predictions on insurance choice and search behavior. We use data from the Dutch Health Care Consumer Panel collected by the Netherlands Institute for Health Services Research (NIVEL). Participants in the consumer panel complete questionnaires frequently, and, therefore, the data are extensive on choice and search for insurance contracts. The data confirm the predictions on insurance choice (i.e. there is adverse selection and a lower premium increases coverage). However, the data are not in agreement with predicted search behavior. We argue that the latter is due to heterogenous search costs, and that individuals with low search costs are more likely to obtain an offer for a group contract. This generates a situation of price discrimination which causes that individuals without an offer for a group contract (and most likely higher search costs) pay a higher premium, and also obtain reduced insurance coverage. Stahl (1989) argues that reducing the number of informed consumers (as is the case in the market for individuals without group contracts) leads to more dispersion in premiums. From this observation one may question the usefulness of allowing for group contracts. After all, without group contracts there would be less variation both in premiums and in insurance coverage, which might equalize access to health care within the population.

Our paper contributes to the empirical literature on consumer search models, and particularly to the small literature on search in insurance markets. Pauly, Herring and Song (2002) consider the choice for health insurances and Brown and Goolsbee (2002) focus on the market for life insurances. Both papers use data from the US to investigate the consequences of the introduction of internet search, which should have lowered search costs. Both papers show that empirical predictions are in agreement with consumer search models (e.g. Stahl, 1989). Sorensen (2000, 2001) considers the retail market for prescription drugs. Sorensen (2000) concludes that less than one-third of the price

dispersion can be attributed to pharmacy heterogeneity. All papers use, however, the observed distribution of prices to infer the importance of incomplete information and search. Our data contain direct measures for individual search behavior. Furthermore, we study a well-defined institutional setting in which the rules and timing of actions are highly regulated.

The remainder of the paper is as follows: section 5.2 provides more background and details on the reform of the health insurance system in The Netherlands. Section 5.3 presents the search model. The data used for the empirical part are discussed in section 5.4, and section 5.5 gives results of the empirical analyses. Section 5.6 concludes.

5.2 The Dutch health insurance reform

In The Netherlands, the health insurance system is split into three compartments. The first compartment, the catastrophic insurance, is a public insurance that covers the entire population. It insures individuals again the costs of long-term care (e.g. nursing homes, and mental health institutions). The second compartment includes insurable risk and care that all individuals should have access to. The third and last compartment is supplementary coverage. The Dutch health insurance reform in 2006 only affected the second and third compartment. Total health care expenditures as a percentage of GDP were, both before and after the reform, average for European standards. As shown in Figure 5.1, expenditures (10% in 2007) were well below those of the United States (16%) and also Switzerland (11%), but above the United Kingdom (8.5%).

We will first briefly discuss the old system. Next, we will provide details on the new system and on how the reform, the transition from the old to the new system, was executed.

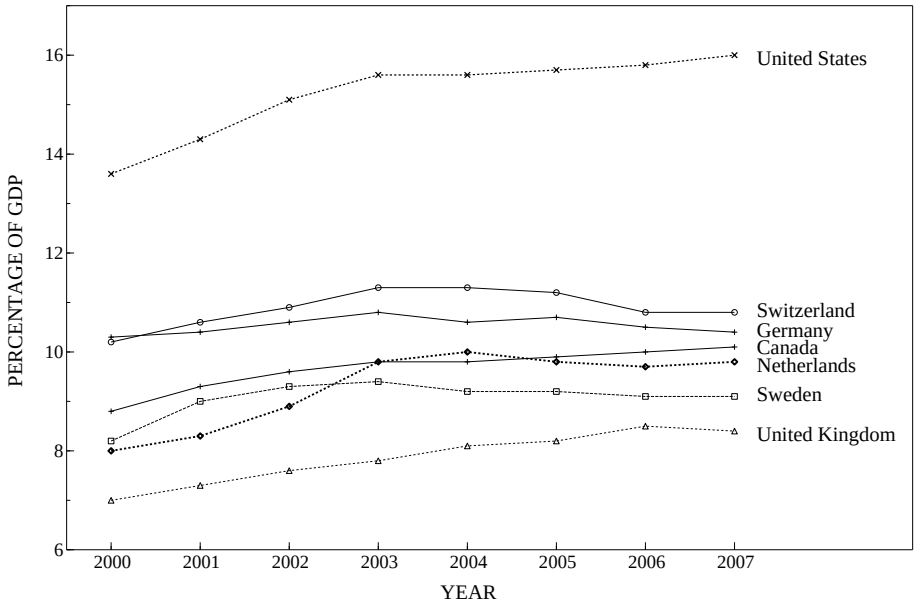
5.2.1 The old system

Before the reform, there was a mix of public and private insurance provision in the second compartment. All breadwinners earning less than some income threshold were compulsory insured, as were their dependents, under the Sickness Fund Act. In 2005 the income threshold was €33,000 for employees and benefit recipients and €21,050 for self-employed. For pensioners eligibility depended on Sickness Fund coverage at age 65. The Sickness Funds covered about 65% of the population.[1] The Sickness Fund Act guaranteed an extensive coverage against a relatively low insurance premium. In 2004, the monthly premium paid directly to the insurer was only €25.[2] Main source of funding were income-

[1]Some civil servants (for example the police force) were covered by a compulsory insurance scheme irrespective of their income. This was about 5% of the total population.

[2]In 2005 a no-claim was introduced to reduce moral hazard. Insurees who did not visit a specialist or hospital or used prescribed medication could receive a cashback up to €225. The introduction of the

Figure 5.1: Total health care expenditures as percentage of GDP (Source: OECD)



related contributions made by those covered by the public insurance and their employers.[3]

Those earning more than the income threshold had to buy health insurance in the private market.[4] Individuals were free to choose their insurer and the extent to which they wished to be covered. In practice, private insurance plans were in coverage and quality of care very similar to Sickness Fund insurance (with the exception of optional deductibles). However, the premium had to fully cover the costs and therefore premiums were diversified by, for example, age and health risks. For a 30-year old without health problems the insurance premium for coverage similar to that of the sickness funds was about €230 per month. The left-hand side of Figure 5.2 summarizes the old system, the right-hand side the new system.

5.2.2 The new system

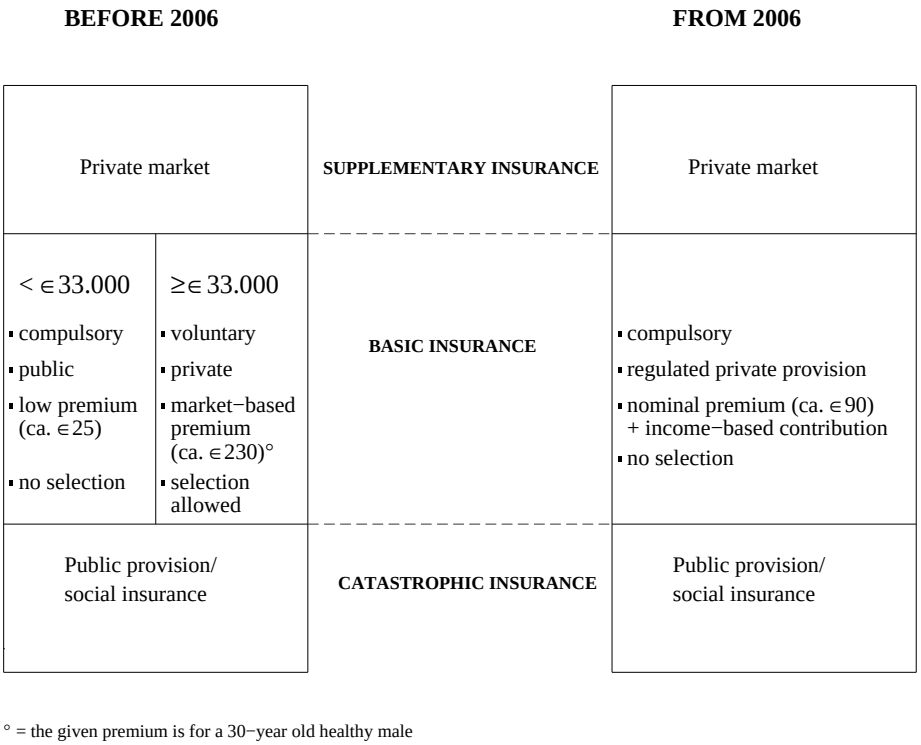
On January 1, 2006 managed competition was introduced in the second compartment. The distinction between Sickness Fund insurance and private insurance disappeared and the former providers of Sickness Fund insurance were transformed into private insurance companies. Within the second-compartment all insurers offer the same *basic* health insurance package of which the content is determined by the government. Coverage of this

no-claim increased insurance premiums with about 24%.

[3]The contribution was 7.95% of income, of which 6.25% was to be paid by the employer.

[4] Chronically ill with a high income, who would be refused by private insurers were covered by a special insurance.

Figure 5.2: The Dutch health insurance reform



basic insurance is less extensive than the coverage under the former Sickness Fund Act. It is compulsory for all inhabitants of The Netherlands to obtain basic insurance from one of the insurers. Insurers are obliged to accept everyone and are not allowed to differentiate premiums (community rating). A Risk Equalization Fund was introduced to compensate insurers for an eventual disproportionate percentage of 'high risk' insurees. Insurers primarily compete on the price of the basic insurance package, as the quality of the delivered care was equal among insurers (they all offer access to all providers).

In 2006, the market consisted of 33 insurance companies. Some of these operated under more than one label, so that in total 43 basic insurance packages were offered.[5] In 2006 the average nominal premium was about €1050 per year.[6] However, there was substantial dispersion in premiums. Figure 5.3 shows that monthly premiums range from €82.50 to €97.75.[7]

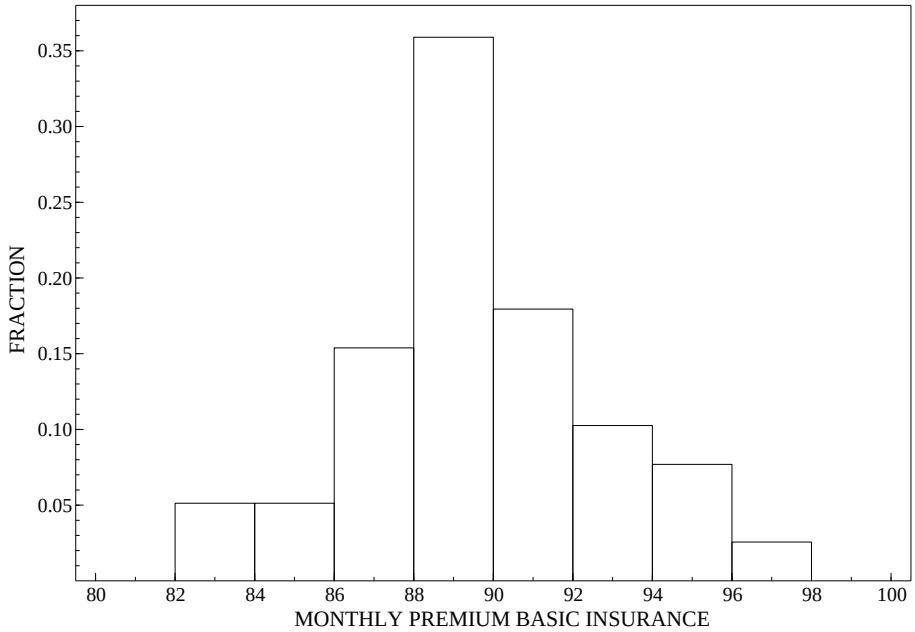
Insurance companies also offer *supplementary* insurance, which includes, for example, dental care, alternative medicine, extension of treatment by physiotherapists, etc. Most insurers offer three or four different supplementary plans, ranging from limited additional

[5]The majority of the insurers (22 insurers) are included in one of six large holdings (see Vektis 2007).

[6]Children under age 18 are covered by their parents' insurance and their premium is paid by the government.

[7]There is no difference in price level between former Sickness Funds and private insurers.

Figure 5.3: Histogram monthly insurance premium



coverage to very extensive coverage. Supplementary insurance is elective, and both the premium and composition is decided by the insurer. Although insurers are allowed to select for the supplementary insurance, most insurers do not. Insurers that do select, only do this for the plan with the most extensive supplementary coverage. There was only one insurer that differentiated premiums for supplementary plans by age. In 2006 in total 137 different supplementary plans were available on the market, with a monthly premium ranging from €5 to €77 (see Dutch Healthcare Authority, 2006). Of these 137 plans, 10 plans require answering questions about the insurees' health (i.e. they select on health risks). Supplementary coverage is very popular, 92.6% of consumers obtained some kind of supplementary insurance.

The basic insurance does not involve copayments, but the system allows individuals to choose for a deductible up to €500. The annual reduction in basic insurance premium was about €36 for every €100 additional deductible. However, this option was not very popular, over 95% of all individuals did not take any voluntary deductible. Insurers are allowed to offer group contracts, and to grant a premium reduction of at most 10% on the basic and supplementary insurance in these group contracts. The majority of the group contracts were offered via employers, but also other groups, such as labor unions, could negotiate group contracts for their members. If an individual received an offer for a group contract, then also the partner was eligible for the discount. In 2006 About 44% of all individuals was participating in a group contract and the average discount was about

7.5% (Vektis, 2007).

5.2.3 The reform

The reform was announced long before January 1, 2006. A large media campaign was set up to inform people about the new health insurance system, and to explain the rules. In October 2005, 98.8% of the respondents in our data knew about the reform. In December 2005 every insurance company had to make an offer to all its insurees.[8] The offer was a combination of the basic insurance and a supplementary insurance plan which was closest to the individual's old insurance plan. This offer was the default option for an individual. Individuals could change insurer or the level of supplementary coverage until May 1, 2006, but the insurance bought provided coverage in retrospect from January 1. In the year of the introduction (2006), insurers were also obliged to accept all their former insurees for *any* level of supplementary coverage until March 1.[9] This implied that almost all changes in insurer or supplementary coverage occurred before March 1.

All health insurance contracts run from January 1 to December 31. Insurers have to post their premiums and conditions for the following year in December, and individuals can only change insurer during the month of January. So, the long period for switching only applied to the year of the introduction of the new system.

5.3 A consumer search model for health insurance

This section discusses a search model for health insurances and derives a number of empirically testable predictions. The model includes the basic characteristics of the Dutch health insurance market. Consumers receive a default option without costs, but can also learn about other insurance plans by making search costs. Insurers post premiums both for basic insurance and one type of supplementary insurance and accept all applicants. We explicitly allow for premium discounts due to group contracts.

5.3.1 Consumer behavior

Each consumer i is characterized by his health h_i, which is in the population distributed according to the distribution function $G(h)$. Each insurer offers the same two types of insurances, a basic insurance and an insurance with higher, supplementary, coverage. All consumers derive the same (expected) utility u_l from basic insurance coverage. The expected utility consumers derive from the insurance with high (supplementary) coverage

[8] Most insurers already announced the premium for the basic insurance in October and November 2005. However, some insurers lowered their premium after learning the premiums of their competitors.

[9] It was also announced that in later years insurers could deny supplemental insurance coverage for new clients.

depends on the consumers' health $u_h(h_i)$. In particular, individuals in good health derive less expected utility from an insurance with high coverage than individuals in bad health, so $u_h'(h_i) < 0$.

At the introduction of the new health insurance system, each consumer received an offer from his current insurer. The offer is characterized by a premium p_0 for basic insurance and $(1+\beta)p_0$ for insurance with high coverage. We impose that each insurer increases the premium with the same fraction β for obtaining supplementary insurance. Obviously, an individual prefers the insurance with high coverage if $u_h(h_i) - u_l > \beta p_0$. The left-hand side of the inequality is decreasing in (good) health, and the right-hand side is increasing in the premium p_0. This implies that individuals are more likely to take insurance with high coverage if they are in bad health (adverse selection), or if the premium p_0 is low.

Hypothesis 1: *Individuals with worse health are more likely to buy health insurance with high coverage (adverse selection).*

Hypothesis 2: *A lower premium induces individuals to take more health insurance coverage.*

Each consumer has a probability δ of also receiving an offer for a group contract. The premiums of group contracts are p_g and $(1+\beta)p_g$, for basic insurance and insurance with high coverage respectively. Individuals prefer the group contract if $p_g < p_0$, which also implies that those individuals who decided to take the group contract are more likely to take insurance with high coverage. Let p_{ns} denote the lowest premium an individual gets offered without having searched the market. So, without an offer for a group contract $p_{\text{ns}} = p_0$, and with an offer for a group contract $p_{\text{ns}} = \min\{p_0, p_g\}$.

After individuals have received the offer from their current insurer and possibly an offer for a group contract, they can decide to search the market for an insurer offering a lower premium. Before searching the market the consumer only knows that the distribution of premiums in the market equals $F(p)$. If the consumer decides to search, he makes costs c and will observe the premiums of all N insurers in the market.[10]

Obviously, the consumer will switch to another insurer if any of the other $N-1$ insurers in the market will offer a lower premium than the current best offer p_{ns}.[11] The

[10] We assume that when consumers search, they observe all premiums in the market, because the government had launched a website where consumers could compare insurance plans between insurers. It explicitly aimed at lowering search costs. Independent consumer organizations followed with their own websites. In our data, over 60% of the individuals who searched for a better offer indicate that they used such websites.

[11] If an individual also received an offer for a group contract, there are in fact only $N-2$ other insurers. Only if the offer for a group contract is with the same insurer the individual was previously insured with, there are still $N-1$ other insurers. For ease of exposition we ignore this, as taking account of this

lowest premium $p_{\min}$ of the other $N-1$ insurers in the market is the first order-statistic of $N-1$ draws from the distribution function $F(p)$, which has expected value

$$\mathrm{E}[p_{\min}] = \int F^{N-1}(p)dp$$

Individuals only search if their expected benefits exceed search costs c. The expected benefits are in terms of finding an insurer with a lower insurance premium. An individual searches if:

$$\max\{u_h(h_i) - (1+\beta)p_{\mathrm{ns}}, u_l - p_{\mathrm{ns}}\} < \max\{u_h(h_i) - (1+\beta)\mathrm{E}[p_{\min}], u_l - \mathrm{E}[p_{\min}]\} - c$$

For individuals who received an offer for a group contract, p_{ns} is the lowest of two offers rather than just the initial offer. This implies that for a consumer with an offer for a group contract the left-hand side will in expectations be smaller (expected gains from continued search are smaller). Such an individual is thus less likely to devote additional efforts to search the market for a better offer.

Hypothesis 3: *Consumers without an offer for a group contract are more likely to search for a lower premium.*

For ease of exposition we assume that the support of $F(p)$ is bounded from $[\underline{p}, \bar{p}]$. We can distinguish three types of individuals. First, individuals in bad health who always choose health insurance with a high coverage. For these individuals health h_i is below $\underline{h}$ for which $u_h(\underline{h}) - u_l = \beta\bar{p}$. Second, there are individuals in such good health that they always only take basic insurance, so h_i exceeds $\bar{h}$ for which $u_h(\bar{h}) - u_l = \beta\underline{p}$. And third, there are individuals with health h_i between $\underline{h}$ and $\bar{h}$ who prefer basic insurance in case of high premium $\bar{p}$ and insurance with high coverage in case of low premium $\underline{p}$.

For individuals in such bad health that they always prefer health insurance with high coverage, the search decision simplifies to

$$(1+\beta)p_{\mathrm{ns}} > (1+\beta)\mathrm{E}[p_{\min}] + c \qquad \text{or} \qquad p_{\mathrm{ns}} > \mathrm{E}[p_{\min}] + \frac{c}{1+\beta}$$

For individuals in good health that always prefer to have only basic insurance, the search decision is

$$p_{\mathrm{ns}} > \mathrm{E}[p_{\min}] + c$$

Since premiums do not depend on the health status, the above implies that individuals in bad health have a lower premium threshold for searching than individuals in good health.

complicates notation without changing our testable predictions.

Hypothesis 4: *Individuals with worse health are more likely to search the market.*

Individuals in the third group only obtain health insurance with high coverage if the premium is sufficiently low. If an individual searches the market (or receives an offer for a group contract) he may find a premium that is lower than the initial offer. For some individuals in the third group this premium will be sufficiently low to make the expected utility of high coverage larger than the expected utility from only basic coverage. Therefore, some individuals who switch insurer to get a lower premium might also switch to a health insurance plan with high coverage.

In the model we made three important assumptions. First, we imposed that there is dispersion of premiums in the market, i.e. $F(p)$ is non-atomic. In the next subsection we sketch the behavior of insurers to argue that in equilibrium there is indeed premium dispersion. However, if there would not be any dispersion of premiums in the market, search would never be beneficial (recall that one starts with an offer and search is costly). In this case, consumer behavior would reduce to only choosing between basic insurance and health insurance with high coverage for which the model predicts adverse selection.

The second key assumption is that we imposed that the premium for insurance with high coverage is proportional to basic health insurance. Alternatively, we could choose an additive specification implying that the premium for health insurance with high coverage equals $p + \beta$. Such a specification implies that consumers choose between basic insurance and insurance with high coverage on comparing $u_h(h_i) - u_l$ and β. Since this is independent of the premium, individuals make their coverage choice already before learning about the initial offer. The individual's health status affects the decision for coverage, but is no longer relevant in the choice for searching. The model thus simplifies to a consumer search model with homogeneous products and homogenous individuals. In this specification, the only possible equilibrium is one where no consumer searches the market because all insurers have the same premium.

The final key assumption is that individuals who search the market observe all premiums in the market. This differs from the usual assumption in consumer search models that when searching, consumers see premiums sequentially, and make search costs for observing each additional premium. Our predictions are robust against changing the search rule. Both search rules generate dispersion of premiums in equilibrium, and similar behavioral predictions for consumers.

5.3.2 Premium dispersion in equilibrium

The testable predictions for consumer behavior depend on existence of premium dispersion. In this subsection, we argue that this should be present in equilibrium. Suppose there are N insurers in the market, which all have the same marginal costs m for insurance

with basic coverage and $(1+\beta)m$ for insurance with high coverage.[12] Insurers only differ in their pre-reform market share θ_j.

Each insurer keeps its clients if these do not get an offer for a group contract with a lower premium, and in addition do not search. Only the insurer with the lowest premium in the market attracts individuals who decide to search. We assume that each insurer has the same market share in group contracts as their overall market share. We furthermore assume that all insurers give the same discount α on the premium when they make an offer for a group contract to a potential client.

From the behavior of consumers we know that there is heterogeneity in search behavior. Individuals in bad health undertake search at a lower expected premium reduction than individuals in good health. Insurers with a high market share can post a relatively high premium, which would imply that they might lose some individuals who get an offer for a group contract from an other insurer, and some individuals with bad health who search the market for better offers. The big insurer would thus lose some market share, but make a relatively high profit per insuree. An insurer with a low market share might post a much lower premium to avoid losing relatively many insurees who get an offer for a group contract from an other insurer, and to induce the clients of other insurers to search the market. This means that the small insurer makes a relatively low profit per insuree, but gains, relative to its market share, many new insurees (if it manages to become the insurer with the lowest premium). Obviously, the degree of price dispersion depends on the size of the search costs c, but also the variation in market shares θ_j and the distribution of health $G(h)$ in the population are important.

Premium dispersion is not only a theoretical prediction. After the Dutch health insurance reform substantial premium dispersion was observed in the market (see again Figure 5.3). Indeed, the lowest premium in the market was posted by a small insurer (named *AnderZorg*). Relating premiums to market shares is difficult, because insurers are very cautious in providing information on market shares. However, in the newspapers one of the five insurers with over one million insurees (*Agis*, which posted the highest premium among them) was considered to be the biggest loser of the reform. The other four insurers with over a million insurees mainly maintained their market share because of writing many group contracts. In particular, using our own data to calculate the fraction of group contracts, there is a substantial, positive correlation (0.40) between the premium posted by insurers and the fraction of insurees covered by a group contract.

[12] Obviously, marginal costs should depend on the health status of the insuree. However, recall that the Risk Equalization Fund compensates insurers for insuring individuals in bad health in such way that the expected costs of all insurees are the same.

5.4 The data

Our data are from the Dutch Health Care Consumer Panel which is collected by the Netherlands Institute for Health Services Research (NIVEL). The panel contains about 1500 individuals and is aimed to be representative for the overall population. For women the age structure in the panel largely coincides with the Dutch population, for men older individuals are somewhat overrepresented in the panel. Individuals in the consumer panel complete questionnaires on health care, health insurance and related issues between two and five times per year. After two to three years panel members are replaced to maintain representativeness. The content varies substantially between questionnaires. In the empirical analyses we use information from the 15 questionnaires send out between 2004 and 2008. This observation period covers the time period around the Dutch health insurance reform (2006). Most questionnaires are not sent to all panel members, in order not to overwhelm them with questionnaires. Usually around 70% of the panel members is randomly selected to receive a particular questionnaire. Combining variables from different questionnaires thus quickly reduces the sample size. Socioeconomic and other background variables are only asked once, at the moment a participant first enters the consumer panel.

In December 2005, a month before the introduction of the new system, participants answered a set of questions about the offer they received from their current insurer. It was also asked whether they were planning to search for better deals offered by other insurers. The April 2006 questionnaire contains information on actual consumer search behavior, the choice of the insurance plan and insurer, as well as information on the total number of offers for a group contract participants had received, and whether they accepted one of these offers for a group contract. We thus know the names of the pre-reform and the post-reform insurer and hence whether the individual has switched insurer. We observe whether an individual participates in a group contract, has a voluntary deductible, and has supplementary insurance coverage. We do not know the extent of the supplemental insurance coverage. However, individuals were asked to report the total amount of premium they pay for health insurance. We combine this information with external information about the premium for basic coverage of each insurer (and the reduced premium for participation in a group contract), which allows us to determine the amount paid for supplemental coverage.

Table 5.1 provides some descriptive statistics. We distinguish between individuals with and without an offer for a group contract. More than 70% of all individuals received an offer for a group contract. Individuals with a group contract are more often employed, and less often retired, so they are also on average younger, have a higher income and are higher educated.[13] Recall that about two-third of the group contracts are with employers,

[13]We do not observe income directly, but rather observe the amount of government compensation an individual receives. Very low income households (less than €17,500 per year) receive the maximum monthly compensation of €33.58 for a single, and €96.25 for a couple. Partial (income dependent)

Table 5.1: Descriptive statistics

	offer for group contract	
	no	yes
fraction	27.62%	72.38%
age (in years)	56.00	51.20
female	59.87%	54.61%
couple	75.88%	80.96%
has children	35.37%	46.71%
low income	38.94%	28.95%
very low income	12.21%	6.33%
years of education	11.84	12.36
employed	35.29%	58.36%
retired	44.12%	27.81%
physical health (1-5 scale; 1=excellent)	2.95	2.77
mental health (1-5 scale; 1=excellent)	2.41	2.39
expected health care use (1-5 scale; 1= very much)	2.76	2.66
changed insurer	10.69%	24.76%
changed plan, same insurer	12.26%	15.43%
has deductible	7.35%	7.14%
has supplementary insurance	95.81%	95.44%
total insurance premium (in €)	108.15	105.89
basic insurance premium (in €)	87.43	83.80
supplementary insurance premium (in €)	20.62	22.09
basic insurance premium before discount (in €)	87.43	87.74
supplementary insurance premium before discounts (in €)	20.62	23.41
health insurance from sickness fund in 2005	65.84%	57.77%
private health insurance in 2005	30.43%	35.59%
civil servant health insurance in 2005	3.73%	6.64%
observations	322	844

and one-third with labor unions, consumer organizations, etc.[14] Group contracts give an average reduction of about 6.5% on the basic insurance, and a 8.5% reduction in premium for supplementary insurance (Dutch Healthcare Authority, 2006). Couples are more likely to receive an offer for a group contract, mainly because such an offer covers all family members. There are, however, no differences in self-assessed physical and mental health between both groups, neither in the average nor in the distribution. Also expected health care use is very similar. Self-assessed health was only asked when individuals first entered the panel, while expected health care use was asked in April 2006, after individuals made their health insurance choice.

Individuals with an offer for a group contract change insurer and insurance plan more often, but have a similar health insurance plan in terms of choice for a deductible and the presence of supplementary coverage. Individuals with a group contract pay in total only 3.1% less on health insurance while they receive about 6.5% discount on the premium for the basic insurance package. Comparing premiums that are paid, individuals with an offer for a group contract spend more on supplementary insurance, both before and after discounts. Table 5.2 compares health insurance decisions in our sample to nationwide behavior. In our sample more individuals have a group contract (72%) than nationwide (44%). In terms of supplementary insurance, voluntary deductibles and insurance premium our sample matches the nationwide statistics fairly well.

The questionnaire of April 2006 contained a question on consumer search behavior. In particular, individuals were asked to answer the question *Did you search for a new health insurance contract?* Table 5.3 displays the fraction of individual searching the market. In total about 46% of the individuals reports to have searched actively for other health insurance plans. Search is less common among individuals who do not have an offer for a group contract. The raw data are, therefore, not in line with the theoretical predictions from the simple consumer search model (Hypothesis 3). We return to this issue in the next section. Only about 30% of all individuals did not receive an offer for a group contract, while 33% of the individuals received multiple offers for a group contract. The table shows that searching is positively related to the number of offers for a group contract received. This remains true after stratifying the sample by labor market status.

Expected health care use was asked in the April 2006 questionnaire. Respondents had 6 options, answers 1 to 5 formed a categorical scale from *very little* to *very much*. The sixth answer was *don't know*. The 9% of individuals that answered *don't know* were removed from the sample for all analyses that involved the use of the variable expected health care use. Furthermore, the categories *much* and *very much* were merged, because only very few individuals expected to use very much health care.

compensation was paid to low income household (below €25,068 for singles and €40,120 for couples).

[14]These are national level figures. In our sample we observe that 85% of the group contracts is obtained via the employer

Table 5.2: Descriptives sample vs. national

	Sample	National*
Percentage with insurance on group contract	72%	44%
Percentage with supplementary insurance	95%	93%
percentage among insured on group contract	96%	94%
percentage among individually insured	94%	92%
Percentage switch insurer	21%	18%
percentage among insured on group contract	25%	28%
percentage among individually insured	11%	10%
Percentage with deductible	7%	5%
percentage of which has deductible of € 100	31%	38%
percentage of which has deductible of € 200	33%	18%
percentage of which has deductible of € 300	11%	10%
percentage of which has deductible of € 400	3%	4%
percentage of which has deductible of € 500	22%	31%
average premium paid for basic insurance (in €)	84.56	85.42
average premium basic insurance before discounts (in €)	87.77	88.33

* Source: Vektis (2007)

Table 5.3: Percentage of searchers by received number of offers for a group contract and labor market status.

	All		Employed		Retired		Other	
no offer for group contract	31.09	(267)	45.26	(95)	17.09	(117)	36.36	(55)
1 offer for group contract	47.21	(377)	50.48	(208)	33.33	(114)	64.81	(54)
2+ offers for group contract	58.25	(309)	65.28	(193)	38.16	(76)	62.50	(40)
average	46.27	(953)	55.24	(496)	28.34	(307)	53.33	(150)

Note: number of observations in parentheses.
Note: *other* contains unemployed, disabled, in full-time education and home duties.

5.5 Empirical results

This section provides insight in how well the consumer search model describes observed behavior at the time of the Dutch health insurance reform. More specifically, we use the data to test the hypotheses derived from the theoretical model.

5.5.1 Testing the hypotheses

Hypothesis 1: *Individuals with worse health are more likely to buy health insurance with high coverage (adverse selection).*

Adverse selection implies that individuals with high expected health care needs (those in bad health) take a higher level of insurance coverage, i.e. buy more supplementary insurance. We test for adverse selection by investigating how the degree of supplementary coverage depends on expected health care use and on self-assessed health. Taking the premium of the supplementary insurance as a measure for coverage is not appealing, because of premium discounts in group contracts and the large variation in insurance premiums between insurers. Alternatively, we construct a measure that relates the additional expenditures on supplementary insurance to the price of the basic package. We define the degree of supplementary coverage as the ratio of the premium for supplementary insurance (before discounts) over the premium for basic insurance (before discounts). This gives the degree of supplemental insurance coverage as a fraction of basic insurance coverage, the latter being the same for all individuals at all insurers.

Table 5.4 presents the results of regressions for supplemental insurance coverage. Column (1) shows the results of a base specification where only expected health care use is included. Individuals who expect very little use of health care (the reference group) have significantly lower supplementary insurance coverage than individuals who expect to use more health care (i.e. little, average or (very) much expected care use). Beyond the reference category 'very little expected care' supplementary insurance coverage is not increasing in expected health care use. This suggests threshold behavior, which is consistent with our consumer search model. Individuals with very little expected health care use prefer a low level of (supplementary) insurance coverage. If the expected health care use is more than very little, it is beneficial to take higher supplementary insurance coverage.

The question on expected health care use was asked in the same questionnaire as the question on the health insurance choice (April 2006). This may cause two problems. First, expected health care use is asked over the full calendar year of 2006, and individuals might already have a partial observation on their health care use. This can potentially weaken the link between expectations and insurance choice. Furthermore, individuals report their expected health care use after having decided about their health insurance plan. The expected health care use may thus reflect adverse selection as well as moral hazard.

Table 5.4: Estimation results from regressing supplementary insurance coverage.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
very little expected care	0.000		0.000		0.000		0.000	
little expected care	0.033**		0.034**		0.032*		0.028*	
	(0.017)		(0.016)		(0.017)		(0.017)	
average expected care	0.035**		0.038**		0.039**		0.038**	
	(0.017)		(0.016)		(0.017)		(0.017)	
(very) much expected care	0.024		0.032*		0.038**		0.035*	
	(0.018)		(0.018)		(0.018)		(0.018)	
physical health		0.011*		0.014**		0.017***		0.016**
		(0.006)		(0.006)		(0.006)		(0.006)
mental health		−0.009		−0.010		−0.008		−0.008
		(0.006)		(0.006)		(0.006)		(0.006)
monthly basic insurance premium (/100)			−0.332***	−0.464***	−0.253*	−0.395***	−0.256*	−0.412***
			(0.128)	(0.132)	(0.130)	(0.138)	(0.133)	(0.139)
female					0.016*	0.018**	0.019*	0.021**
					(0.010)	(0.010)	(0.010)	(0.010)
low income					−0.034***	−0.031***	−0.031***	−0.030***
					(0.010)	(0.010)	(0.011)	(0.011)
very low income					−0.062***	−0.062***	−0.056***	−0.058***
					(0.016)	(0.017)	(0.020)	(0.021)
age							0.0001	0.0002
							(0.0004)	(0.0004)
single							0.001	−0.001
							(0.015)	(0.014)
has children							0.005	0.004
							(0.011)	(0.010)
years of education							0.002	0.001
							(0.002)	(0.002)
intercept	0.233	0.252	0.510	0.637	0.447	0.571	0.421	0.563
	(0.014)	(0.016)	(0.110)	(0.113)	(0.110)	(0.117)	(0.123)	(0.124)
observations	858	933	858	933	823	893	817	888

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

Note: Physical and mental health are measured on a 5-point scale, where 1 is *excellent* and 5 is *poor*

Table 5.5: How did expected health care use affect your insurance choice?

	Expected use of health care			
	very little	little	not much, not little	(very)much
bought extensive supplementary coverage	6.7%	12.0%	16.0%	25.8%
bought very limited or no supplementary coverage	9.2%	11.5%	5.2%	2.5%
observations	120	357	369	198

To get a better idea of the importance of adverse selection, we consider the question *Did you take into account the amount of health care you expect to use this year in deciding upon which health insurance to purchase?* When answering positively, individuals could indicate *I bought extensive supplementary coverage*, or *I bought very limited supplementary coverage* or *I bought no supplementary coverage*. Because this question refers to expected health care use at the time the insurance decision was made, it separates adverse selection from moral hazard. We group very little and no supplementary coverage and show the answers in Table 5.5, broken down by expected health care use. Indeed, the higher the expected health care use, the more likely it is that an individual took more extensive supplementary coverage.

As an alternative to expected health care use, we can also use self-assessed health to investigate adverse selection. Recall that self-assessed health is asked only at the moment an individual first enters the panel. For our sample it is therefore always asked before the reform, and thus before individuals had to decide on their insurance plan. However, for some individuals the information on self-assessed health is already a few years old.[15] Column (2) of Table 5.4 shows the results from regressing supplementary health insurance coverage on self-assessed physical and mental health. Only physical health has a significant impact on the health insurance decision. Recall that a higher value of health indicates worse health. Individuals with a good physical health thus obtain on average less extensive supplementary health insurance coverage. This indicates adverse selection, which, again, confirms the first hypothesis from the consumer search model.

Hypothesis 2: *A lower premium induces individuals to take more health insurance coverage.*

To investigate this second hypothesis we regress the supplementary insurance coverage not only on expected health care use or self-assessed health, but also on the premium for the basic health insurance. Columns (3) and (4) of Table 5.4 report the results. The basic insurance premium has a significant negative impact on supplementary insurance cover-

[15] As panel members are replaced after two to three years, the health information can at maximum be three years old.

age. Individuals who pay a lower premium are more likely to obtain more supplementary insurance coverage (even after controlling for expected health care use or health), which confirms the second hypothesis from the consumer search model.

To investigate the robustness of this conclusion, we add additional control variables. First, in the columns (5) and (6), we include gender and income. Women take, on average, more health insurance coverage, which is consistent with the common belief that women are more risk averse than men. Furthermore, health insurance is a normal good (i.e. health insurance coverage increases significantly with the income of individuals). But more important, the effect of the premium on supplementary health insurance coverage remains negative and significant. This remains when adding age, household composition and years of education to the regression (see columns (7) and (8)). None of these covariates has a significant effect on supplementary health insurance coverage, and other covariate effects do not change after including these additional variables.

Hypothesis 3: *Consumers without an offer for a group contract are more likely to search for a lower premium.*

Individuals who received an offer for a group contract, can choose (without having searched) between two offers. Their best offer has in expectation a lower premium than individuals who did not receive an offer for a group contract. This implies that the expected gains from search are lower for individuals with an offer for a group contract and that they, therefore, are less likely to engage in search.

Recall from the previous section that individuals with an offer for a group contract indicate to search on average more often for *a new health insurance contract* (see Table 5.3). A potential problem is that individuals might consider the offer for a group contract as a new health insurance contract. They may then classify themselves as searchers after having compared the initial offer with the offer for a group contract, which is not considered as searching in our model. Therefore, we also consider the follow-up question: *What sources did you use when searching for a health insurance contract?* Multiple answers were allowed. Individuals most often report having used the internet (73%), especially websites that compare insurance contracts from all insurers (84% of those having used the internet) and websites of insurers (80% of those having used internet). Other answers included advice from a family member (23%), contact with a health insurer via e-mail or telephone (21%) and advertisements (19%).

We consider as a stricter definition for search only using (independent) websites that compare insurance contracts of all insurers. According to this definition, 32% of those with an offer for a group contract, and only 19% of those without an offer for a group contract, have searched. Table 5.6 shows the results of a probit model for the effect of an offer for a group contract on search behavior, using the strict definition for searching.

Table 5.6: Probit model for searching

	(1)	(2)	(3)	(4)
offer for group contract	0.417***	0.342***	−14.612***	−13.949**
	(0.093)	(0.098)	(5.417)	(5.729)
employed		−0.047	−0.053	−0.237*
		(0.122)	(0.124)	(0.140)
retired		−0.692***	−0.687***	−0.493***
		(0.139)	(0.142)	(0.183)
monthly basic insurance premium offered			−0.097*	−0.097*
∗no offer for group contract			(0.055)	(0.058)
monthly basic insurance premium offered			0.073***	0.065**
∗offer for group contract			(0.028)	(0.029)
female				0.056
				(0.104)
years of education				0.054**
				(0.021)
age				−0.014***
				(0.005)
low income				−0.090
				(0.116)
very low income				0.015
				(0.220)
single				−0.064
				(0.136)
children				−0.064
				(0.108)
intercept	−0.890	−0.617	7.943	8.120
	(0.082)	(0.122)	(4.820)	(5.130)
observations	1143	1143	948	893

***=significant at 1% level, **= significant at 5% level, *=significant at 10% level.
Note: the strict definition for search, i.e. search via comparison websites, is used here.
Note: column (2)-(4) applies the Conniffe and O'Neill (2008) correction for missing covariates.

Table 5.7: Percentage of switchers by offer receival for group contract and search behavior

	offer for group contract		no offer for group contract	
	search	no search	search	no search
switched insurer	34.3%	14.9%	28.3%	3.2%
not switched insurer	65.7%	85.1%	71.7%	96.8%
observations	417	410	92	220

Note: the strict definition for search, i.e. search via comparison websites, is used here.

Column (1) shows that receiving an offer for a group contract significantly increases the propensity to search. Column (2) shows that this effect remains after controlling for labor market status. In column (3) we also add the premium p_0 of the initial offer. This column shows that individuals with an offer for a group contract are significantly more likely to search if the initial offer was high. The opposite is true for individuals without an offer for a group contract. This result remains after controlling for additional observed characteristics (see column (4)). In the next subsection, we investigate further why the data are not consistent with the third hypothesis from our consumer search model. Table 5.7 shows the percentage of individuals that switches insurer at the moment of the reform. We distinguish between those with and without an offer for a group contract, and those who did and did not search the market for better offers. As one might expect individuals who have searched the market, and those who received an offer for a group contract, are much more likely to switch insurer than their counterparts. In the table we used the strict definition of searching, which explains why some individuals who did not receive an offer for a group contract, and who did not search, still switch insurer. This table shows that searching actually increases the likelihood of switching insurer, and thus measures relevant individual behavior.

Hypothesis 4: *Individuals with worse health are more likely to search the market.*

The model predicts that individuals in bad health derive more expected utility from a health insurance with extensive supplementary coverage. Recall from the first hypothesis that this adverse selection was present in the data. Individuals in bad health should thus be more likely to benefit from searching the market. Since we imposed that all individuals have the same search costs, and the premiums do not depend on health, individuals in worse health should search more often.

In Table 5.8 we show again estimation results for a probit model for the search decision, but we include health as an explanatory variable. Again, we use expected health care utilization and self-assessed health as measures for individual health. Columns (1) and (2) indicate that both expected health care use and self-assessed health do not have a significant impact on search behavior (although the coefficients have the expected signs).

Table 5.8: Probit model for searching

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
very little expected care	0.000		0.000		0.000		0.000	
little expected use	−0.178		−0.268		−0.261		−0.219	
	(0.138)		(0.169)		(0.172)		(0.176)	
average expected use	−0.084		−0.187		−0.175		−0.069	
	(0.136)		(0.167)		(0.170)		(0.176)	
(very) much expected use	−0.247		−0.083		−0.054		0.084	
	(0.152)		(0.185)		(0.190)		(0.197)	
physical health		−0.061		0.002		0.037		0.096
		(0.050)		(0.062)		(0.064)		(0.066)
mental health		−0.012		−0.073		−0.082		−0.070
		(0.048)		(0.061)		(0.063)		(0.064)
offered monthly premium			0.033	0.031	0.028	0.024	0.029	0.029
basic insurance			(0.023)	(0.022)	(0.023)	(0.023)	(0.024)	(0.024)
female					0.130	0.145	0.065	0.057
					(0.107)	(0.103)	(0.118)	(0.113)
low income					−0.280**	−0.317***	−0.081	−0.106
					(0.118)	(0.113)	(0.130)	(0.125)
very low income					−0.402*	−0.425**	0.094	0.036
					(0.215)	(0.205)	(0.253)	(0.241)
age							−0.014***	−0.017***
							(0.005)	(0.004)
single							−0.221	−0.166
							(0.158)	(0.154)
children							−0.049	−0.025
							(0.123)	(0.120)
years of education							0.078***	0.071***
							(0.024)	(0.023)
intercept	−0.408	−0.382	−3.208	−3.126	−2.781	−2.529	−3.148	−3.086
	(0.118)	(0.137)	(2.005)	(1.995)	(2.087)	(2.081)	(2.133)	(2.125)
observations	1040	1128	649	711	620	678	617	675

***=significant at 1% level, **= significant at 5% level, *=significant at 10% level.
Note: the strict definition for search, i.e. search via comparison websites, is used here.

In columns (3) and (4) we add the premium of the initial offer, but this does not change the effect of health on search behavior. Finally, in columns (5)-(8), we add individual characteristics. This does not change the effect of health on search behavior. Columns (5) and (6) point out an effect of income on search behavior. If we include age and education, in columns (7) and (8), the effect of income is absorbed in these variables. All results show positive, but insignificant effects, of bad health and high expected health care use on searching. This implies that we cannot reject the fourth hypothesis of the model. However, the effects of health on searching are at most very small (if at all present).

5.5.2 Explaining search behavior

The consumer search model fails in explaining the search behavior of individuals, and, in particular, the difference in search behavior between individuals with and without an offer for a group contract. In this subsection, we further investigate search behavior.

In our theoretical model, we made a number of simplifying assumptions. First, we imposed that individuals are only heterogeneous in health, but have the same search costs. However, if there is heterogeneity in search costs, and high search costs are related to bad health, the model predictions in hypothesis 4 change. Second, we assumed that individuals know the distribution of premiums in the market. If individuals, however, do not know this distribution, receiving an offer for a group contract may be informative on the variation in premiums in the market. Individuals can use this information to update their beliefs. Receiving an offer for a group contract could then stimulate search, which alters hypothesis 3. Third, we imposed that each individual has the same probability of receiving an offer for a group contract. In 2006, the larger part of the group contracts was with employers. This suggests that not every individual has the same probability of receiving such an offer. In particular, if the probability to receive an offer for a group contract is negatively correlated to the size of the search costs, this will affect hypothesis 3. Below we provide some empirical evidence on these three possible violations of the model assumptions.

There are a number of reasons why the size of search costs could be related to individual health. First, older people, who on average have worse health than younger people, may have more problems collecting information. For example, older people may have more problems finding information on the internet, which is the most used and probably cheapest search method. Indeed, only 50% of the people above age 65 have access to internet at home compared to about 90% of the individuals below age 65. However, even after controlling for age and other observed differences, receiving an offer for a group contract still has a positive and significant effect on search (see Table 5.9). Another, second, explanation why the size of search costs may be related to health is that individuals in bad health could be afraid that insurers will reject them.

Table 5.9: Probit model for searching

	(1)	(2)	(3)
offer for group contract	0.523***	0.329***	0.489***
	(0.096)	(0.102)	(0.097)
one employed partner		0.494***	
		(0.123)	
two employed partners		0.531***	
		(0.126)	
older than 65			−0.411***
			(0.112)
couple			0.202*
			(0.113)
female	0.206**	0.140	0.147*
	(0.084)	(0.088)	(0.087)
years of education	0.060***	0.045**	0.064***
	(0.018)	(0.019)	(0.018)
low income	−0.060	−0.041	−0.007
	(0.097)	(0.106)	(0.099)
very low income	−0.272	0.128	−0.034
	(0.172)	(0.180)	(0.187)
expected health care use	0.117	0.002	0.147
	(0.141)	(0.123)	(0.140)
expected health care use	0.075	0.189	0.115
	(0.141)	(0.122)	(0.140)
expected health care use	0.025	0.075	0.107
	(0.156)	(0.143)	(0.155)
intercept	−1.365	−1.841	−1.511
	(0.293)	(0.292)	(0.318)
observations	973	854	973

***=significant at 1% level, **= significant at 5% level, *=significant at 10% level.
Note: the strict definition for search, i.e. search via comparison websites, is used here.
Note: column (2) applies the Conniffe and O'Neill (2008) correction for missing covariates.

Before the reform it was common practice in the private market that insurers declined applicants (recall section 5.2, and in particular footnote 4). After the reform, insurers are by law not allowed to decline applicants for the basic insurance package, but they can deny clients supplementary insurance. Although all insurers announced beforehand that they would accept everyone even for supplementary insurance (which also happened in practice), individuals in bad health may still worry about being rejected either at this stage or later. The survey contains a question about about why people did not change insurer. Less than 1% indicates that they did not switch because they were afraid of being denied by another insurer. Buchmueller, Feldstein and Strombom (2002) show that in the US less healthy individuals experience higher costs of switching to another insurer as this (often) also implies switching medical provider. For this reason, the less healthy are the least price sensitive with regard to insurance premiums. In The Netherlands the cost of switching provider does not play a role as all insurers reimburse care from all providers.

The second simplifying assumption we made and might be violated is that individuals know the distribution of premiums $F(p)$ in the market. Individuals believing that the variation in premiums is low, are likely to decide not to search. Individuals who received an offer for a group contract may realize that the variation in premiums is larger than assumed, which may induce them to search actively. Although we do not have any direct evidence on individual beliefs, it is relevant to note that before the reform the government announced that the average annual premium would be about €1106. The actual premiums were between €990 and €1120, so almost all insurers had a lower premium. This may imply that after learning their premium, most individuals believed that they received a good offer. If individuals are unaware of the distribution of premiums, then those with a high premium offer (close to that announced by the government) might have believed that the variation in premiums was very low and thus would not have searched further. While those with a low premium offer may have overestimated the variation in premiums, and thus searched for an even lower premium.

The third simplifying assumption that could possibly be violated is that all individuals have the same probability of receiving an offer for a group contract. If this probability is not the same for everyone and, in addition, negatively correlated with search costs, it will change the model prediction in hypothesis 3. There are a number of ways through which the probability to receive a group offer can be related to search costs. First, as employers are the most important channel via which an offer for a group contract can be received, elderly are less likely receive such an offer as they are often no longer employed. On the other hand elderly might have higher search costs due to unfamiliarity with the internet, the least costly way to search. Second, offers for group contract include spousal coverage against the same premium. This implies that couples of which both spouses are employed, have double chances to receive an offer for a group contract. Furthermore, in most couples (85%) both partners have the same insurer, and they may therefore have economies of scale when searching.

Table 5.10: Probit model for receiving an offer for a group contract

	(1)	(2)	(3)	(4)
employed	0.550***	0.536***	0.298**	0.364**
	(0.129)	(0.134)	(0.150)	(0.156)
retired	−0.036	−0.022	−0.068	−0.041
	(0.129)	(0.134)	(0.180)	(0.187)
physical health	−0.090	−0.120**	−0.115*	
	(0.058)	(0.060)	(0.062)	
mental health	0.075	0.101*	0.133**	
	(0.055)	(0.057)	(0.059)	
little expected use				0.015
				(0.178)
average expected use				0.179
				(0.179)
(very) much expected use				0.124
				(0.195)
knowledge reform		0.033**	0.027*	0.038**
		(0.015)	(0.016)	(0.017)
female			−0.143	−0.142
			(0.108)	(0.114)
low income			−0.271**	−0.260**
			(0.115)	(0.120)
very low income			−0.402**	−0.386*
			(0.203)	(0.215)
age			−0.003	−0.003
			(0.005)	(0.006)
single			−0.065	0.012
			(0.136)	(0.141)
has children			0.047	0.053
			(0.117)	(0.120)
years education			0.020	0.026
			(0.021)	(0.023)
intercept	0.426	0.309	0.498	0.188
	(0.205)	(0.225)	(0.476)	(0.477)
observations	942	879	829	755

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

A third way in which search costs and group offers could be correlated is that the offer for a group contract in itself generates lower search costs. Individuals that receive a group offer compare this group offer with the offer from their current insurer and therefore increase their knowledge of the system, which reduces the costs of comparing further offers.

However, even among employed workers there is substantial heterogeneity. Table 5.10 presents estimates of a probit model for receiving an offer for a group contract. Column (1) shows that employed individuals are, indeed, more likely to receive such an offer. Health does not have a significant impact on the probability of receiving an offer for a group contract. Next, we include as regressor a variable which measures the knowledge of individuals about the health insurance reform. This variable is based on 15 statements, included in the questionnaire of October 2005 (so before premiums were announced, and offers for a group contract were made), to which individuals had to answer true or false (or they could answer don't know). The knowledge variable equals the number of correct answers minus the number of wrong answers. This guarantees that someone who doesn't know an answer, gets the same expected score when guessing as when answering don't know. The average score in our population equals 4.2 (with a maximum of 13 and a minimum of -7). In column (2) we add this as an additional regressor, and find that individuals with more knowledge about the health insurance reform were significantly more likely to receive an offer for a group contract. Column (3) shows that this effect remains large and significant after controlling for other individual characteristics. The only important individual characteristic is income, offers for a group contract are associated with high incomes.

Obviously, not all employed workers have the same probability of receiving an offer for a group contract. Insurers mainly write group contracts for firms with higher paid employees, and with more knowledge about the health insurance reform. Of course, it might be that this is mainly driven by the firms, because higher-income workers or workers with more knowledge about the reform may push their firm harder to establish a group contract. Or larger firms (with many previously privately insured employees) already had a group contract with a private insurer before the reform. Knowledge about the health insurance reform is also positively correlated with searching (a correlation of 0.167, significant at the 1% level).

Offers for a group contract are more often made to individuals who were more likely to compare insurers, i.e. individuals with low search costs. For most insurers the premium of a group contract is below the regular premiums of the other insurers. Insurers can thus set higher regular premiums, because average search costs in the market for individual contracts (i.e. without an offer for a group contract) are relatively high. This argument follows Stahl (1989), who shows within a consumer search model that if the number of informed (low costs) individuals is reduced (as is the case in the market for individual contracts), price dispersion increases.

The possibility of offering a group contract facilitates insurers to apply third degree

price discrimination, which may be welfare reducing. The main reason for the government to allow for group contracts was that it created the possibility for insurers to insure most employees of a firm and at the same time also insure the firm for the costs of for example sickness absenteeism. The government hoped that such combinations of insurances would induce insurers to put more effort in prevention of health problems.

Our consumer search model should be modified such that it allows for heterogeneity in search costs and the probability of receiving an offer for a group contract should be negatively related to search costs. If this is the case, then the model is, of course, capable of explaining the fact that individuals with an offer for a group contract are more engaged in search. We simulated the model with both homogeneous and heterogeneous search costs (see Table 5.11 for the parameter values that were used). Results are listed in Table 5.12, and show that heterogeneity in search costs can generate that individuals with an offer for a group contract more often search and obtain insurances with a lower premium for basic coverage. Because of the lower premium, they obtain more supplementary coverage, and pay a higher overall premium (which is also what the data show). However, heterogeneity in search costs between individuals with and without an offer for a group contract cannot explain that among individuals without an offer for a group contract search is negatively related to the offer from the current insurer. Also choosing for the default in case of a decision overload as discussed by Frank and Lamiraud (2008) cannot explain this. It can only be explained if insurers base their premium on the estimated search costs among their insurees (recall that individuals are not randomly distributed over insurers, but that this is the consequence of the old combined public and private system). The earlier discussed alternative explanation is that individuals do not have correct beliefs about the distribution of premiums.

Table 5.11: Parameters used in simulation

premium offered by previous insurer	p_0	$\sim N(1080, 45)$
utility from high coverage	u_h	$\sim U(2680; 3080)$
discount offered by group contract		6.5%
markup for supplementary insurance	β	0.40
search costs	c	150
search costs without group offer	c_0	150
search costs with group offer	c_1	25
utility from only basic coverage	u_l	2400
number of firms in the market	N	20
probability receive offer for group contract		0.56

Table 5.12: Simulation results

Search costs equal c, both with and without offer for group contract		
	no offer for group contract	offer for group contract
percentage choose high coverage	64.8%	69.4%
percentage choose to search	22.2%	0.2%
average price best offer before search	1080.0	1006.2
average price paid for basic insurance	1049.2	1006.0
Search costs equal c_0 without offer for group contract and c_1 with offer for group contract		
	no offer for group contract	offer for group contract
percentage choose high coverage	64.8%	71.1%
percentage choose to search	22.2%	40.4%
average price best offer before search	1080.0	1006.2
average price paid for basic insurance	1049.2	988.2

Note: parameters used in the simulations are shown in Table 5.11.

5.6 Discussion and conclusion

We presented a simple consumer search model for individual health insurance decisions at the moment of the Dutch health insurance reform. The model provided four hypotheses, which we could test empirically. Our data confirm both hypotheses on the choice for insurance plan. In particular, there is adverse selection in the market and health insurance coverage is decreasing in the premium.

The simple consumer search model had more problems explaining both hypotheses on individual search behavior. In particular, the data rejected the hypothesis that consumers without an offer for a group contract are more likely to search. Our preferred explanation is that group offers are targeted towards individuals who are better informed about the health insurance system. We provided some empirical evidence that supports this explanation.

For public policy it might be a serious concern that better informed individuals, i.e. those with lower search costs, are more likely to receive an offer for a group contract. This might suggest that insurers use group contracts for cream-skimming, for example, by setting high premiums, but offering maximum discounts on group contracts to low health-risks employees. Furthermore, the group contracts take better informed individuals out of the regular market, which allows insurers to exploit the higher search costs of the remaining individuals in this segment. This will lead to lower competition, and more price dispersion. Since we saw that the choice of health insurance coverage is strongly related to the premium, it may also affect equity and access to health care within the population.

In recent years, the use of group contracts became even more popular. Insurers also started to offer premium reductions to associations of individuals with a particular illness. Offering premium reductions to very specific high-risk groups seems counterintuitive, but

is the consequence of the existence of the Risk Equalization Fund. The Risk Equalization Fund itself is useful in the current system of managed competition, as it stimulates competition by equalizing the expected health care costs of all individuals for insurers. However, insurers started exploiting small flaws in the system by targeting group contracts towards groups of individuals with an illness for which the compensation might have been set to high.

The system of managed competition seems to be successful in keeping premiums for health insurance low. In the year of the introduction insurers incurred substantial losses, mainly because of their attempts to attract as many insurees as possible. At that time experts feared that premiums would increase sharply to compensate for these losses. However, the rise in premiums was low in 2007 and 2008 and even negative in 2009. One might argue that the willingness of individuals to switch created enough competition to withhold insurers to increase premiums.

Chapter 6

Conclusion

This thesis included four studies on health insurance. Each of the studies analyzed a different aspect of the behavior of individuals in relation to health insurance.

In the second chapter, we addressed the effect of information asymmetries on the purchase of private supplementary health insurance, and the use of health care services. The empirical focus was on Ireland, which has a mixed system of public and private health insurance. This system is ideal for studying moral hazard and selection. Data from the Living in Ireland Survey are used for the analysis. This 8-wave panel dataset allows us to distinguish between fixed effects and dynamic effects in insurance choice and health care utilization. No evidence was found for the presence of moral hazard. This implies that the presence of copayments does not influence health care utilization. There was, however, evidence for the presence of advantageous selection: those who have low levels of health care utilization, are most likely to insure themselves. We find that education is an important determinant of advantageous selection. Other determinants include income, health and healthy behaviors. Possible pathways via which these determinants drive advantageous selection include risk attitude, time discount rates and other measures of time preference, and preferences for health. Finally, we showed the importance of both persistence and unobserved fixed effects in health insurance decisions and health care utilization.

The third chapter provides a theoretical motivation for the presence of advantageous selection in dynamic models. Model simulations show how advantageous selection can occur, and that only limited variation between individuals is needed to change patterns of strong adverse selection into patterns of strong advantageous selection.

How copayment-free health insurance for low-income households affects retirement behavior was investigated in the fourth chapter. In particular, we investigated for Ireland whether the sharp income limit on the provision of copayment-free public health insurance induced older workers around this income limit to retire earlier. A structural model is built that incorporates the institutional details of the health insurance and retirement schemes in Ireland and the incentives created by these schemes. It describes the insurance

choice and retirement decisions of married men between the ages 50 and 75. Individuals differ in the wage they receive if employed, their (retirement)age specific pension profile, preferences, risk aversion and the sequence of health shocks and shocks in employment opportunities. The model is solved with dynamic programming and estimated using simulation techniques. With the obtained parameters policy simulations could be performed. Simulating the effect of abolishing the copayment-free health insurance for low-income households shows that this will have very little effect on the retirement age. We therefore conclude that the Medical Card scheme does not induce earlier retirement.

The fifth chapter, exploits the Dutch health insurance reform of 2006. It investigates how individuals choose a health insurance, using a simple consumer search model. From this model we derived four hypotheses: two on insurance plan choice and two on search behavior. The hypotheses on insurance plan choice were confirmed by the data. The hypotheses on search behavior, however, were rejected by the data. In particular, according to the model individuals with an offer for a group contract should search less, while the data show higher search levels. We discussed the role of three simplifying assumptions that were made in the search model: homogeneity in search costs, knowledge about the distribution of prices and homogeneity in the probability to receive an offer for a group contract. There was evidence in the data that individuals differ in search costs, and that this is correlated with health. Furthermore, it was found that offers for a group contract are not randomly distributed in the population. Those with the best knowledge about the health insurance system have the highest probability of receiving an offer for a group contract. The price dispersion that results, is highly undesirable from a social welfare point of view: as health insurance coverage is highly related to the premium, it may affect equity and access to health care.

The main conclusion from this thesis is that selection effects are very important. Incentive effects, such as moral hazard and labor supply effects, are found to be much smaller or even absent. This should be taken into account by governments when (re)designing their health insurance system to keep it affordable in the future. From chapter 2 we know that the individuals selecting themselves into insurance need not be those with the highest risks. This implies that health insurance need not be disappearing in a private market. On the other hand, chapter 5 showed how, even in a highly regulated setting, insurers may have indirect ways to select their insurees and how this may lead to inequality in access to care. This is not only important in (re)designing health insurance systems, but also important for regulators of existing health insurance systems to pay special attention to.

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Samenvatting in het Nederlands (Summary in Dutch)

In onze vergrijzende samenleving vormen de stijgende kosten van de gezondheidszorg een steeds groter probleem. Publieke zorgverzekeringsstelsels komen onder druk te staan, omdat de kosten per verzekerde stijgen en het aantal werkenden, die het grootste deel van deze kosten moeten opbrengen, afneemt. Aangezien de vergrijzing van de samenleving en de verhouding niet-werkenden per werkende hun piek nog niet hebben bereikt, ligt het in de lijn der verwachtingen dat de druk op publieke zorgverzekeringsstelsels in de (nabije) toekomst verder zal toenemen. Veel landen, waaronder de Verenigde Staten, overwegen daarom het publieke zorgverzekeringsstelsel te herzien. Andere landen hebben deze herziening reeds doorgevoerd, zoals Nederland en Zwitserland.

Dit proefschrift bestaat uit vier studies op het gebied van zorgverzekeringen, alle vanuit een microeconometrisch perspectief. In hoofdstuk 2 staat de vraag centraal of er sprake is van moral hazard en risico selectie in de markt voor zorgverzekeringen. Van moral hazard is sprake als een individu meer gebruik maakt van gezondheidszorg (en dus meer kosten maakt) als hij verzekerd is dan hij zou hebben gedaan als hij niet verzekerd was. Selectie doet zich voor wanneer individuen met een bepaald risicoprofiel meer geneigd zijn zich te verzekeren. Een klassiek voorbeeld van selectie is negatieve risicoselectie, een situatie waarin degenen met het hoogste risico (en dientengevolge ook de hoogste verwachte kosten) het meest geneigd zijn zich te verzekeren. Recent is er echter door verschillende wetenschappers ook een andere vorm van risicoselectie onder de aandacht gebracht, positieve risicoselectie. Deze vorm van selectie beschrijft een effect dat tegenovergesteld is aan negatieve risicoselectie: niet degenen die de hoogste kosten verwachten te maken, maar juist degenen die de laagste kosten verwachten te maken (de zogenoemde 'goede' risico's) zijn het meest geneigd zich te verzekeren. Een mogelijke verklaring voor dit op het eerste oog contrantuitieve effect is dat individuen verschillen in hun aversie van risico's en dat individuen met een sterke afkeer van risico's zowel sneller geneigd zijn een verzekering af te sluiten, als meer moeite doen om de risico's die zij lopen zoveel mogelijk in te perken. Zij zullen bijvoorbeeld gezonder leven om gezondheidsrisico's te verkleinen. Het effect van deze gezondere levensstijl is echter ook dat zij, gemiddeld gezien, gezonder zullen zijn, waardoor een positief verband tussen gezondheid en het hebben van een verzekering

ontstaat. Recente studies die positieve risicoselectie empirisch aantonen, focussen vrijwel allemaal op de markt voor zorgverzekeringen voor ouderen in de Verenigde Staten, zoals Medigap (een aanvullende verzekering bovenop de publieke zorgverzekering voor ouderen, Medicare) en verzekeringen die de kosten van langdurige zorg dekken. In Europa beperken publieke zorgverzekeringen zich, in tegenstelling tot de Verenigde Staten, niet tot ouderen, maar bieden dekking voor de gehele bevolking. Omdat het waarschijnlijk is dat ouderen verschillen van de algehele bevolking in preferenties en in gezondheidsrisico's, kunnen de resultaten die gevonden zijn voor ouderen, niet zomaar n-op-n vertaald worden naar de algehele bevolking.

De data die gebruikt worden voor de analyses in hoofdstuk 2 gebruiken zijn afkomstig uit Ierland. De vormgeving van het Ierse zorgverzekeringsstelsel maakt Ierland een bijzonder interessante casus om te bestuderen. Ierland kent een publieke zorgverzekering voor de gehele bevolking. Binnen deze publieke zorgverzekering is er echter een belangrijke rol weggelegd voor de eigen bijdrage. Deze eigen bijdrage is aanzienlijk en geldt voor, onder andere, bezoeken aan zorgverleners, medicatie, ziekenhuisopname, etc. Voor het een derde deel van de bevolking met de laagste inkomens geldt een vrijstelling van de eigen bijdrage, middels een *Medical Card*. Naast de publieke zorgverzekering bestaat er de mogelijkheid om op de private markt een aanvullende zorgverzekering af te sluiten. Een aanvullende zorgverzekering biedt een reductie van de eigen bijdrage (meestal 50%). Zo ontstaan er dus drie aparte groepen met ieder een andere hoogte van de eigen bijdrage: geen eigen bijdrage (de lage inkomens), gereduceerde eigen bijdrage (aanvullend verzekerden) en volledige eigen bijdrage. Deze variatie in de hoogte van de eigen bijdrage creëert een ideale setting voor het bestuderen van moral hazard. Daarnaast zorgen het verbod op premiedifferentiatie (iedereen betaalt dezelfde premie, ongeacht leeftijd, risicoprofiel of gezondheid) en de verplichting voor verzekeraars om iedereen die zich aanvullend wil verzekeren te accepteren voor een dergelijke verzekering, een ideale setting voor onderzoek naar (positieve dan wel negatieve) selectie. Het uit elkaar trekken van moral hazard en selectie is niet voor de hand liggend. Omdat gezondheid de keuze zich wel of niet aanvullend te verzekeren zal beïnvloeden en verzekeringsstatus op zijn beurt invloed kan hebben op de gezondheid, is er een ernstig endogeniteitsprobleem. Door gebruik te maken van panel data (data waarbij dezelfde individuen over meerdere jaren gevolgd worden) kunnen we deze endogeniteitsproblemen verhelpen. De dynamische panel data modellen die we gebruiken verschaffen daarnaast meer inzicht in de onderliggende factoren.

Er blijkt geen bewijs te zijn voor de aanwezigheid van moral hazard. De hoogte van de eigen bijdrage heeft dus geen invloed op de hoeveelheid gezondheidszorg die gebruikt wordt. Bij dit resultaat moet de kanttekening gemaakt worden dat aangezien identificatie van het effect geschiedt op basis van individuen die wisselen van het niveau van eigen bijdrage dat ze moeten betalen, de groep individuen aan de onderkant van de inkomensverdeling, voor wie het erg onwaarschijnlijk is dat ze wisselen van niveau van de eigen bijdrage, in de schatting genegeerd wordt. Voor de aanwezigheid van positieve

risico selectie is wel bewijs gevonden: de individuen in onze steekproef die zich het meest verzekeren zijn degenen die een lage hoeveelheid zorg verwachten te gebruiken. Opleiding lijkt een belangrijke onderliggende factor van positieve risico selectie te zijn, ook als na correctie voor de invloed van inkomen.

Hoofdstuk 3 onderzoekt hoe positieve dynamische selectie kan ontstaan in een model dat zich over meerdere perioden uitstrekt (een dynamisch model). Selectie mechanismen werken in een dynamisch model niet noodzakelijkerwijs op dezelfde manier als in een statisch model. Daarnaast kunnen ook de benodigde veronderstellingen uiteen lopen.

In tegenstelling tot een statisch model, kunnen individuen in een dynamisch model investeren in hun gezondheid. Preferenties en risico aversiteit hebben daardoor niet alleen een *direct* effect op de keuzes die een individu maakt. Omdat de keuzes die een individu nu maakt ook een effect hebben op gezondheid in de toekomst, en gezondheid in de toekomst op zijn beurt weer van invloed is op toekomstige beslissingen over het afsluiten van een verzekering, hebben preferenties en risico aversiteit ook een *indirect* effect op de keuzen die een individu maakt. Door dit soort dynamische effecten, ontstaat de correlatie tussen gezondheid en preferenties (of risico aversiteit) in een dynamisch model *automatisch*. Dit in tegenstelling tot een statisch model waarin deze correlatie als aanname gemaakt moet worden om positieve risicoselectie te genereren.

Daarnaast is ook de aanname dat individuen in goede gezondheid een kleinere kans hebben te worden getroffen door een schok in hun gezondheid dan individuen in slechte(re) gezondheid niet noodzakelijk. Zelfs als de kans op een schok hetzelfde is voor iedereen, ongeacht gezondheid, ontstaat de correlatie tussen gezondheid en preferenties (of risico aversiteit) automatisch. En daarmee ook positieve risicoselectie.

Simulaties van het dynamische model toonden aan dat heterogeniteit in ofwel preferenties ofwel voldoende is om patronen van sterke negatieve risicoselectie om te buigen naar sterke positieve risico selectie.

Selectie en moral hazard zijn beide effecten die directe verband houden met de manier waarop het zorgstelsel is vormgegeven. Maar er kunnen ook meer onverwachte effecten zijn van de vormgeving van het zorgstelsel. In hoofdstuk 4 staan dergelijke effecten centraal: we bestuderen opnieuw Ierland en onderzoeken of de scherpe inkomenslimiet voor vrijstelling van de eigen bijdrage voor gezondheidszorg er toe leidt dat oudere werknemers met een inkomen in de buurt van de inkomenslimiet eerder met pensioen gaan.

Het is bekend dat met het toenemen van de leeftijd de uitgaven aan gezondheidszorg snel toenemen omdat de gezondheid achteruit gaat en schokken in de gezondheid vaker plaatsvinden. Voor iedereen zonder Medical Card zullen daardoor de kosten voor gezondheidszorg snel toenemen bij het ouder worden. Het kan daardoor voordelig zijn voor individuen met een inkomen boven de limiet voor een Medical Card om de arbeidsmarkt te verlaten door met pensioen te gaan, als het lagere inkomen na de (vervroegde) pensionering recht op een Medical Card, en dus gezondheidszorg zonder eigen bijdrage, geeft.

Voor het onderzoeken van deze hypothese ontwikkelen we een structureel model voor verzekeringskeuze en participatie op de arbeidsmarkt tussen het 50^e en 75^e levensjaar, waarin individuen onzeker zijn over de hun gezondheid, schokken in die gezondheid en de arbeidsmarkt in de toekomst. Het opgezette structurele model bevat de (belangrijkste) prikkels die het systeem van de Medical Card creert en maakt gebruik van individu en leeftijd specifieke loon en pensioen profielen. Individuen in het model kunnen onderling verschillen in preferenties en in de mate waarin ze risico avers zijn. Uit hoofdstuk 2 en 3 weten we dat deze heterogeniteit belangrijk kan zijn in het verklaren van de geobserveerde patronen in de data. De empirische analyse richt zich op echtparen waarvan slechts n van beide partners actief is/was op de arbeidsmarkt na het 50e levensjaar. Bij de keuzes die het echtpaar maakt omtrent verzekeren en participatie op de arbeidsmarkt houdt het rekening met de gezondheid, en de kans op schokken in de gezondheid, van zowel de werkende als de niet-werkende partner.

Om het model op te lossen zijn dynamisch programmeren en numerieke methoden gebruikt, waarna de parameters geschat konden worden met behulp van simulatie technieken. Een groot voordeel van het gebruik van structurele modellen is de mogelijkheid die het biedt om met de gevonden parameter schattingen mogelijke beleidsveranderingen doorgerekend kunnen worden. Om de invloed van het Medical Card programma op arbeidsmarkt participatie van ouderen te bepalen, wordt het model doorgerekend voor het geheel opheffen van de Medical Card. Hieruit blijkt dat het Medical Card programma niet heeft geleid tot vervroegde uittreding.

Het nieuwe zorgverzekeringsstelsel dat in Nederland werd geïntroduceerd op 1 januari 2006 is onderwerp van hoofdstuk 5. Voor de herziening kende Nederland een gemend publiek-privaat zorgverzekeringsstelsel. Mensen met een laag inkomen waren verplicht verzekerd bij publieke zorgverzekeraars, de ziekenfondsen, tegen een lage premie. Iedereen met een inkomen boven de ziekenfondsgrens kon terecht bij private zorgverzekeraars voor een zorgverzekering, maar was niet verplicht een verzekering af te sluiten. Met de herziening werd een systeem geïntroduceerd van *managed competition*, waarin verzekeraars met elkaar concurreren binnen door de overheid gestelde spelregels. Iedereen is verplicht zich te verzekeren in het nieuwe stelsel voor tenminste de basisverzekering. De dekking van deze basisverzekering wordt vastgesteld door de overheid, en verzekeraars zijn verplicht iedereen te accepteren voor de basisverzekering. Een vereveningsfonds zorgt ervoor dat verzekeraars gecompenseerd worden indien er een disproportionele concentratie van hoogrisico individuen zich bij hen aanmeldt voor een verzekering.

Voor een goede werking van een dergelijk systeem van managed competition is het cruciaal dat consumenten zoeken naar de verzekering met de beste combinatie van prijs, dekking en kwaliteit. Alleen als consumenten zoeken, is er een prikkel voor verzekeraars om verzekeringen tegen een zo laag mogelijke premie aan te bieden en zo efficint mogelijk te werken om ondanks de lage premie toch winst te kunnen maken.

Dit hoofdstuk richt zich daarom op het zoekgedrag van consumenten op de markt voor

zorgverzekeringen. Door de ingrijpende herziening van het stelsel ontstond er een situatie eind 2005, begin 2006 waarin iedereen opnieuw de afweging moest maken bij welke verzekeraar en met welke dekking zich te verzekeren. Het simpelweg hernieuwen van de huidige polis, normaliter een voor de hand liggende keuze, was door de ingrijpende veranderingen op dat moment niet meer zo voor de hand liggend. Voor de analyse gebruiken we een zoekmodel, waarin de belangrijkste kenmerken van het nieuwe zorgverzekeringsstelsel zijn verwerkt. Dit type zoekmodellen, voor het beschrijven van zoekgedrag van consumenten op productmarkten, wordt veelvuldig gebruikt voor het beschrijven van allerlei verschillende productmarkten. In het vakgebied van de gezondheidseconomie zijn deze modellen echter nog maar weinig toegepast.

Uit dit model zijn vier hypothesen af te leiden die getoetst kunnen worden op de data. Twee van de vier hypothesen hebben betrekking op de verzekerings- of dekkingskeuze: individuen met een slechtere gezondheid kopen een verzekering met een uitgebreidere dekking, en lagere premies leiden ertoe dat individuen kiezen voor een uitgebreidere dekking. Beide hypothesen werden bevestigd door de data. De andere twee hypothesen hebben betrekking op het zoekgedrag van individuen: individuen zonder aanbod voor een collectief contract zoeken meer dan individuen mét zo'n aanbod, en individuen met een slechtere gezondheid zoeken meer dan individuen met een goede gezondheid. Deze twee hypothesen werden echter beide niet bevestigd door de data. Waar het model voorspelde dat individuen met een aanbod voor een collectief contract minder zullen zoeken, zien we in de data dat zij juist méér zoeken.

Drie aannames die aan het model ten grondslag liggen kunnen een rol spelen in deze discrepantie: homogeniteit in zoekkosten, kennis omtrent de verdeling van de prijzen en homogeniteit in de kans om een aanbod voor een collectieve verzekering te ontvangen. Individuen blijken inderdaad te verschillen in de hoogte van kosten die zoeken met zich meebrengt, en deze verschillen zijn gecorreleerd met gezondheid. Simulaties van een aangepast model waarin heterogeniteit in zoekkosten geïncorporeerd is laten zien dat hiermee inderdaad de in de data geobserveerde patronen gegenereerd kunnen worden. Daarnaast blijken sommige individuen een grotere kans hebben een aanbod voor een collectiecve verzekering te ontvangen dan anderen. Dit kan het resultaat zijn van *afromen van de markt* door zorgverzekeraars, hetgeen vanuit oogpunt van gelijkheid zeer ongewenst is.

De algehele conclusie die getrokken kan worden uit dit proefschrift is dat selectie effecten veel belangrijker lijken te zijn op de zorgverzekeringsmarkt dan effecten van (onjuiste) prikkels, zoals moral hazard en, in het geval van Ierland, arbeidsparticipatie effecten. Overheden zouden hiermee rekening moeten houden wanneer zij het zorgverzekeringsstelsel wijzigen of hervormen. Daarnaast is het belangrijk dat toezichthouders aandacht besteden aan mogelijkheden voor verzekeraars om op indirecte wijze hun verzekerden te selecteren, omdat dit kan leiden tot ongelijkheid in de toegankelijkheid van de gezondheidszorg.

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