PhD thesis

Private health insurance in a universal tax-financed health care system – an empirical investigation

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Preface

This thesis is the result of three years work at the Health Economics Research Unit at the Institute of Public Health, University of Southern Denmark. The PhD project was internally funded from the University of Southern Denmark, and the data collection was supported by the Danish Health Insurance Foundation.

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Table of contents

CHAPTER 1

Thesis introduction

Table of contents:

1 Introduction

The present thesis is concerned with private health insurance that exists alongside a universal tax-financed or social insurance health care system and is taken out on a voluntary basis. This type of private health insurance exists in some form in most universal health care systems, and it has increased in importance in several European countries over the past decades (Maarse 2006). The private health insurance schemes have largely developed around the universal health care systems, and as a consequence, they are rather heterogeneous across countries. While some private health insurance schemes have as their primary purpose to cover private copayment, other schemes cover treatments that are also available free of charge within the borders of the universal health care system.

The literature on private health insurance that co-exists with universal health care systems has yet to establish a clear consensus on definitions. Similar schemes are often referred to with different terms and vice versa. For now, the term 'voluntary private health insurance' (VPHI) is used to denote the various types of private health insurance that may exist alongside a universal health care system and are taken out on a voluntary basis.[1] Section 1.1 accounts for the different classifications which have been used in the literature to distinguish between the alternative functions that VPHI may have in relation to a universal health care system and presents a classification to be used throughout the thesis.

In most countries with universal health care systems, VPHI comprises only a small part of the total health care funding (OECD 2010; White 2009). However, given that significant shares of the populations are covered in several countries, the phenomenon is not negligible due to the large numbers of insurance takers.

The overall objective of this thesis is to analyse empirically the determinants of VPHI coverage and its effect on the use of health care services. Individually purchased and employment-based contracts are analysed separately, given that the decision processes leading to these two types of insurance coverage and the theoretical underpinnings can reasonably be expected to differ markedly. In addition, the contracts and the regulatory framework differ on various dimensions in the Danish market.

The thesis consists of this introductory *chapter 1*, which is intended to provide the background for the empirical analyses by accounting for the institutional and theoretical framework for the analyses as well as the dataset to be used. Moreover, *chapter 2* reviews the empirical literature on what characterizes the privately insured in universal health care systems in order to guide the selection of covariates in

[1] Voluntary in this case implies that the insurance schemes are not mandatory by law, but purchased by individuals on a voluntary basis or by employers on behalf of their employees, either voluntarily or in consequence of collective agreements (Mossialos and Thomson 2002; OECD 2004).

subsequent analyses. However, it is emphasised that the main focus of the thesis is empirical, and so are its contributions to the literature. Specific objectives of the empirical chapters are to:

a) Estimate the determinants of employment-based VPHI and explore whether these differ for employees who receive the insurance free of charge and those who pay the premium out of their pre-tax income *(chapter 3)*.

b) Estimate the causal effect of employment-based VPHI on the use of health care services *(chapter 4)*.

c) Estimate the causal effect of individually purchased VPHI on the use of health care services with a specific focus on how the effect varies with identifying assumptions *(chapter 5)*.

Economic theory predicts that the probability of having VPHI coverage is most likely not randomly distributed within the population, but depends on individual characteristics such as risk preferences and health (Cutler and Zeckhauser 2000), and for employment-based contracts also on characteristics related to the workplace (Currie and Madrian 1999). As evident from the review in *chapter 2* of the empirical literature on what characterises the privately insured in universal health care systems, the determinants of individually purchased VPHI have been studied extensively. In contrast, the evidence on what characterises the group of individuals with employment-based VPHI is confined to a few studies (Aarbu (2010), Besley et al. (1999), Grepperud and Iversen (2011), King and Mossialos (2005), Kjellberg et al. (2010), and Seim et al. (2007)). The present thesis thus addresses a sparsely analysed area, also internationally, by estimating the determinants of employment-based VPHI in Denmark.

The other key issue addressed in the thesis is to what extent VPHI increases the use of health care services. This is a crucial question both from the perspective of understanding the behavioural mechanisms that lead to the purchase of VPHI and the responses that insurance itself causes in terms of health care use. The overall maintained hypothesis deduced from economic theory is that VPHI increases the use of covered health care services through various channels; most importantly by lowering the price or waiting time that patients are facing at the point of use, thereby generating ex post moral hazard in the use of services for which the demand is price or time elastic (Arrow 1963; Pauly 1968). Institutional barriers such as the use of gatekeepers and restrictions in the coverage provided by the private insurers may, however, moderate this effect.

Empirically, it is not straight forward to identify the causal effect VPHI on the use of health care services, as both the decision to take out VPHI and the use of health care are determined by several correlated and often unobserved factors, which may cause insurance status to be endogenous in models of health care use (Cameron et al. 1988). A large empirical literature has sought to identify the effect of private health insurance on health care use in various institutional settings, using a wide range of econometric methods (see e.g. Manning et al. 1987; Schellhorn 2001; Buchmueller et al. 2004; Vera-Hernández 1999; Holly et al. 1998; Jones et al. 2006;Barros et al. 2008; Anderson et al. 2011). The present thesis thus builds on an extensive literature in this regard.

In 2008, when the work on the thesis started, individually purchased VPHI had been subject to some investigation within the framework of the Danish health care system (Christiansen et al. 2002; Pedersen 2005), while a rapidly growing group of individuals with employment-based VPHI was largely unexplored territory. Since then, the research area of VPHI has received increasing attention, and today new knowledge emerges on a regular basis. To mention a few recent contributions, Kjellberg et al. (2010) have outlined the development in employment-based VPHI and assessed its consequences. Borchsenius and Hansen (2010) and Pedersen (2011) have estimated the effect of employment-based VPHI on sickness absence, the former in the form of a research report published by the Danish Insurance Association. Holstein (2010) has calculated the effect of employment-based VPHI on the public finances under various assumptions in a memorandum prepared for Cepos, and Søgaard et al. (2011) have estimated its effect on the use of tax-financed health care services. While these studies have all generated valuable knowledge on various aspects of VPHI in Denmark, the results of the present thesis add knowledge on important, yet unexplored, dimensions.

Overall, the thesis contributes to the literature by basing the empirical analyses on a comprehensive dataset from Denmark collected specifically for the purpose, which contains exceptionally detailed information on VPHI coverage and whether contracts are purchased on an individual basis or provided through the workplace, as well as a wide range of other variables that are relevant in relation to the analysis of VPHI. The specific research contributions of the empirical analyses are accounted for in detail in each of the empirical chapters and summarised in *chapter 6*.

1.1 Concepts and definitions

The concept of private health insurance includes a large number of rather diverse insurance arrangements. Systematic use of concepts and definitions is thus highly desirable for international comparisons as well as general analysis.

In health care systems where private health insurance provides the primary source of coverage for all health care (i.e. both acute and elective) for the entire population or part of the population, it may be classified as either principal or substitute, respectively (OECD 2004). While neither of these two types of private health insurance are analysed in this thesis, they are briefly defined in the following in order to place the present thesis in a broader context.

Substitute private health insurance substitutes for coverage that would or could otherwise be available through the statutory health care system. This type of private health insurance is essentially only found in social insurance health care systems, and it is usually only available to clearly defined population groups, who are either not eligible for coverage through the social insurance system or allowed to opt out on a voluntary basis.[2] People with substitutive private health insurance do not make the normal contributions to the statutory health care system (Mossialos and Thomson 2002). Principal private health insurance (PHI) is found in health care systems where private health insurance provides the main source of funding for the entire or the majority of the population.[3]

1.1.1 Functional classification of private health insurance in universal health care systems

This section introduces a functional classification of the various types of private health insurance that may be purchased on a voluntary basis in addition to the coverage provided by a universal tax-financed or social insurance health care system. As previously mentioned, voluntary is taken to imply that the insurance schemes are not mandatory by law, but purchased by individuals on a voluntary basis or by employers on behalf of their employees, either voluntarily or in consequence of collective agreements (Mossialos and Thomson 2002; OECD 2004). The focus of the classification is to distinguish the alternative functions that VPHI may have in relation to a universal health care system. Hence, it is a useful tool to structure the analysis of various types of VPHI and their impact on universal health care systems.

Table 1 summarizes the existing classifications of VPHI that co-exists with a universal tax-financed or social insurance health care system, distinguishing between the alternative functions that VPHI may have in relation to the universal system. It is evident from Table 1 that there is no general agreement on definitions in the literature – adding some confusion to the literature.

This thesis adopts the functional classification proposed by Colombo and Tapay (2004) and OECD (2004). According to this classification, VPHI coverage may be classified as complementary, supplementary or duplicate in relation to the tax-financed health care system. Complementary VPHI

[2] For example, the upper income groups in the Netherlands are excluded from the social insurance system and requested to purchase substitutive private health insurance on a voluntary basis, while the upper income groups in Germany are allowed to opt out of the social insurance system on a voluntary basis, provided that they take out private health insurance.

[3] The distinction between highly regulated principal private health insurance and a social insurance health care system is not clear-cut in the literature (White 2009). This thesis takes the approach of Colombo and Tapay (2004) and defines legally compulsory private health insurance in any form as social insurance, while private health insurance that provides the main source of coverage, but is not legally compulsory, is referred to as principal private health insurance. Following this approach, the United States is the only industrialized country with principal private health insurance (usually provided as part of the employment contract), while the insurance arrangements found in e.g. Switzerland and the Netherlands are classified as social insurance health care systems. It is, however, acknowledged that the distinction may also be based on the source of financing, such that principal private health insurance refers to insurance schemes that are financed through private premiums (which are often, but not always, voluntary), while social insurance is financed mainly through social security contributions akin to taxes (OECD 2004). Following this approach, the Swiss health care system may be classified as highly regulated principal private health insurance.

covers private copayment for treatments that are only partly financed by but delivered within the universal health care system.[4] Supplementary VPHI covers treatments that are excluded from the universal health care system. The scope for complementary and supplementary coverage thus depends on the coverage provided by the universal health care system. Duplicate VPHI covers health care services that are also available free of charge within the universal health care system. More specifically, duplicate VPHI is frequently used to cover diagnostics and elective surgery at private hospitals for procedures that are subject to some waiting time when provided through the universal health care system. Another option is for duplicate VPHI to cover access to specialist care without prior referral from a general practitioner when this is required within the universal health care system. Hence, the main benefits of duplicate coverage are generally perceived to be faster access to treatment, greater freedom of choice, and in some cases also better amenities (Colombo and Tapay 2004; OECD 2004).

Table 1 Existing classifications of VPHI in universal health care systems

Coverage	Co-payment for treatments that are partly covered by the universal system	Treatments that are excluded from the universal system	Treatments at private facilities for treatments that are also available within the universal system
White (2009)	Gap		Parallel
Colombo and Tapay (2004)	Complementary	Supplementary	Duplicate
OECD (2004)	Complementary	Supplementary	Duplicate
Henke and Schreyögg (2005)	Supplementary		Complementary
Mossialos and Thomson (2002)	Complementary		Supplementary

The classification by Colombo and Tapay (2004) is preferred over the alternatives in this thesis because it is slightly more detailed, while at the same time sufficiently broad to capture changes over time in the design of private health insurance schemes. It is, however, acknowledged that a large number of studies use the alternative definitions. Hence, these are considered equally valid.

A crucial difference between the insurance types outlined in Table 1 and substitute private health insurance is that while individuals with the latter are completely excluded from the tax-financed health care system, those with VPHI that is taken out in addition to the coverage provided by a tax-financed or social insurance health care system do not lose their entitlement to use the tax-financed system and are still obliged to contribute towards it.

[4] This type of private health insurance is commonly referred to as supplemental health insurance or Medigap insurance in the context of the US health care system (Atherly 2001).

In practice, most insurance policies that co-exist with a tax-financed or social insurance system are difficult to classify accurately because they bundle several types of coverage. The possible overlaps in coverage complicate the use of a functional classification for practical purposes such as data collection and empirical analysis. Moreover, insurance contracts may differ on other important characteristics than coverage, such as whether they are purchased on an individual basis or taken out by employers on behalf of their employees, and the method of premium calculation (OECD 2004). However, the functional classification of VPHI outlined in this section still provides a useful conceptual framework, provided one recalls the various caveats and ambiguities.

1.2 Outline of the introductory chapter

The remaining part of this introductory chapter is organised as follows. Section 2 describes the institutional setting in which the research questions and the results of the thesis should be interpreted. Section 3 goes more into depth with the economic theory on the individuals who have taken out VPHI and how this may affect their use of health care services. Section 4 outlines the pros and cons of VPHI in universal health care systems and discusses the extent to which the various arguments are supported by empirical evidence. Section 5 describes and discusses the data on which the empirical chapters are based. Finally, section 6 provides a reader's guide to the empirical chapters, accounting for the specific contributions of each of the chapters and their interrelationships.

The introductory chapter does not contain a review of the empirical literature on the determinants of VPHI and its effect on the use of health care services, because this is carefully reviewed in the empirical chapters. Likewise, given that the main focus of the thesis is empirical, detailed descriptions of the various econometric techniques applied throughout the thesis are also postponed to the empirical chapters.

2 Institutional setting

Institutional setting may matter for the selection of relevant research questions as well as the subsequent interpretation of results. This section therefore describes the institutional setting in which the empirical research questions and the results of this thesis should be interpreted. Section 2.1 describes the overall features of the Danish health care system, and section 2.2 accounts for the evolution of VPHI in Denmark and its role in relation to the tax-financed health care system.

2.1 The Danish health care system

From a broad institutional perspective, Denmark is a classical Scandinavian welfare state, in which the state provides several universal services ranging from childcare to education, elderly care, and health care.

2.1.1 Organisation and funding

The Danish health care system is a universal tax-financed health care system. The fully tax-financed universal health care system of today formally came into place in 1973, when the sickness funds were abolished. The tax financing is based on revenue from all types of taxes. The tax contributions are independent of the use of health care services. The system is organised in three levels: 1) The state, 2) five regions, and 3) 98 municipalities (Strandberg-Larsen et al. 2007; Vrangbæk and Christiansen 2005). All levels have directly elected political bodies. The state is responsible for preparing legislation, regulatory issues, and providing overall guidelines for the health sector. The regions own and run hospitals, and they finance general practitioners, specialists, physiotherapists, dentists, and pharmaceuticals through risk adjusted block grants from central government, i.e. the regions cannot levy taxes or raise revenues from other sources. In 2011 there are on average 1.1 million inhabitants per region (Statistics Denmark 2011). The municipalities have full responsibility for primary prevention, health promotion, rehabilitation outside of hospitals, and institutions for people with special needs, i.e. disabilities or addictions. The activities of the municipalities are financed by municipal income taxes and block grants from the state. The Danish health care system is thus a decentralised public system, like what one sees in the other Scandinavian countries.

While tax revenue is the main source of funding, the Danish health care system is also characterised by private copayment for services such as adult dental care, medication, medical aids, physical therapy, and chiropractic care. Particularly for pharmaceuticals and adult dental care, copayment makes up a considerable share of the total funding (Strandberg-Larsen et al. 2007). According to OECD (2010) numbers, private copayment made up approximately 14 percent of the total health expenditure in 2007.[5]

[5] Not counting expenditures related to elderly care as health expenditure, private copayment made up close to 19 percent of total health expenditures (Pedersen et al. 2005).

Historically the use of private copayment to finance health care has been increasing over time, but since 2006 the level of copayment has been stable (The Ministry of Interior and Health 2010). Finally, cosmetic surgery and alternative treatments such as zone therapy and homeopathy are excluded from the tax-financed health care system and are thus exclusively paid by the patients, as is usually also fertility treatment (as of January 1, 2011).

2.1.2 Objectives

The goals of the Danish health care system are stated in the Danish Health Act from 2005 (Retsinformation 2005) and in government documents (The Ministry of Health 1999;The Ministry of Interior and Health 2002). In the Danish Health Act it is stated that the objective of the health care sector is to improve public health and to prevent and treat disease, suffering, and physical limitation. Moreover, the health care sector must ensure respect for the individual and the right to self-determination, and to fulfil the requirements of 1) easy and equal access to the health care sector, 2) high quality treatment, 3) coherent treatment pathways, 4) freedom of choice, 5) easy access to information, 6) transparency, and 7) short waiting time for treatment. With reference to these statements, the objective of the Danish health care system can be interpreted as a mix of efficiency, autonomy, and equity in the sense of procedural justice (Gundgaard 2008). However, the list of objectives in the Danish Health Act is by no means exhaustive. Equity considerations are also an integrated part of the Danish culture. Government programmes (developed by different governments) on public health and health promotion from 1999 and 2002 both stressed the concern for social inequalities in health and increased life expectancy (The Ministry of Health 1999; The Ministry of Interior and Health 2002). Finally, it has been argued that other objectives are present too, such as geographical equality, high quality care, and cost containment, although these are not necessarily explicitly stated (Pedersen et al. 2005).

2.1.3 Access

For the predominant majority of the population, i.e. 99.3 percent (Danish Medical Association 2008), hospitalisation and treatment by specialists and general practitioners (GPs) are free at the point of use, and GPs act as gatekeepers.[6] Hence, the GPs play a crucial role in relation to following the principle of keeping treatment at the lowest effective care-level (i.e. the so-called LEON-principle). This principle implies that while patients should always be offered treatment at the lowest effective care level that is professionally justifiable, they should not receive treatment at a more specialised level than necessary. Patients who seek specialist care without a referral from their GP are generally liable to pay the full fee, with the exception of ophthalmologists and ear, nose, and throat specialists, who are also paid from the public coffers when contacted directly.

[6] The remaining 0.7 percent of the population have opted for an arrangement where they are free to visit any health care provider without referral from a GP against paying a small copayment for all services except hospital treatment (www.borger.dk 2011).

2.1.3.1 Copayment

In addition to being a means of raising funding, copayment it is also expected to restrict the access to and the use of affected health care services (Donaldson et al. 2004). As previously mentioned, residents face copayments for the use of health care services such as adult dental care, medication, medical aids, physical therapy, and chiropractic care in the Danish health care sector. For some services, e.g. medication and physiotherapy, patients need a prescription or a referral from their GP in order to qualify for the public subsidy, while the access to dental and chiropractic care is only restricted by copayment, i.e. patiens can access these services without consulting their GP.

2.1.3.2 Waiting time

For some types of non-emergency treatments, mainly elective surgery, there is some waiting time for treatment at public hospitals. From an economic point of view the presence of waiting lists can be seen as a method to ration and allocate available resources as well as an expression of excess demand (Lindsay and Feigenbaum 1984). Over time the presence of waiting times has attracted a considerable amount of public and political attention and given rise to a series of policy initiatives (Madsen 2010).

In 1993, the government introduced an initiative allowing patients to freely choose between public hospitals and clinics for some non-emergency treatments, thereby encouraging patients to ‘vote with their feet’ and ideally increasing the flexibility of the public hospital system (www.borger.dk 2010). The free choice of hospital is basically a move towards a more demand-driven system in the sense that patients’ preferences decide which hospital to use. It was though that in combination with information about waiting times and other quality indicators, the free choice of hospital would initiate patient flows from hospitals with long waiting times to hospitals with shorter waiting times (Pedersen et al. 2005). The free choice of hospital was extended in 2002 and renamed ‘extended free choice of hospital’. This implied that after waiting two months for treatments like elective surgery at public hospitals, citizens can choose either private hospitals or go abroad with treatment being paid by the public coffers. In October 2007, the waiting time before the extended free choice of hospital becomes effective was reduced to one month. In practice the initiative serves as a waiting time guarantee for elective surgery, and it is a move to strengthen the rights of patients. Recently several important players in the Danish health care system, such as the Danish Medical Association and Danish Regions, have argued in favour of differentiating the waiting time guarantee with respect to severity (Steenberger 2009).[7] However, the extended free choice of hospital remains in its original form at the time of writing.

2.1.4 Private hospitals and clinics

The number of private hospitals and clinics has been increasing steadily since the first commercial private hospital was established in 1989/90 (Pedersen 2007; The Ministry of Interior and Health 2010). One reason for this being that duplicate private health insurance can only be used at private hospitals facilities

[7] None of the parties have, however, argued in favour of allowing waiting times of more than two months.

in Denmark, where the public hospitals are not allowed to accept paying patients. The majority of the private operators that have entered the market in recent years are smaller specialised clinics. Private and public hospitals in Denmark are not comparable, given that emergency and acute care, cancer treatment, prenatal care, and deliveries are only available at public hospitals (The Ministry of Interior and Health 2010). The overriding part of the treatments taking place at private hospitals and clinics are planned operations/elective surgery. The private hospitals are dependent on the public hospital sector for their primary human resource, the consultant physicians, who are trained and have their full time jobs in the public hospitals and 'moonlight' at the private hospitals.

In total, the private hospitals and clinics account for approximately 2 percent of the public hospital costs. Considering only costs for treatments that are comparable between the private and the public sector, the private hospitals account for approximately 5 percent of the hospital costs (Danish Regions 2010).

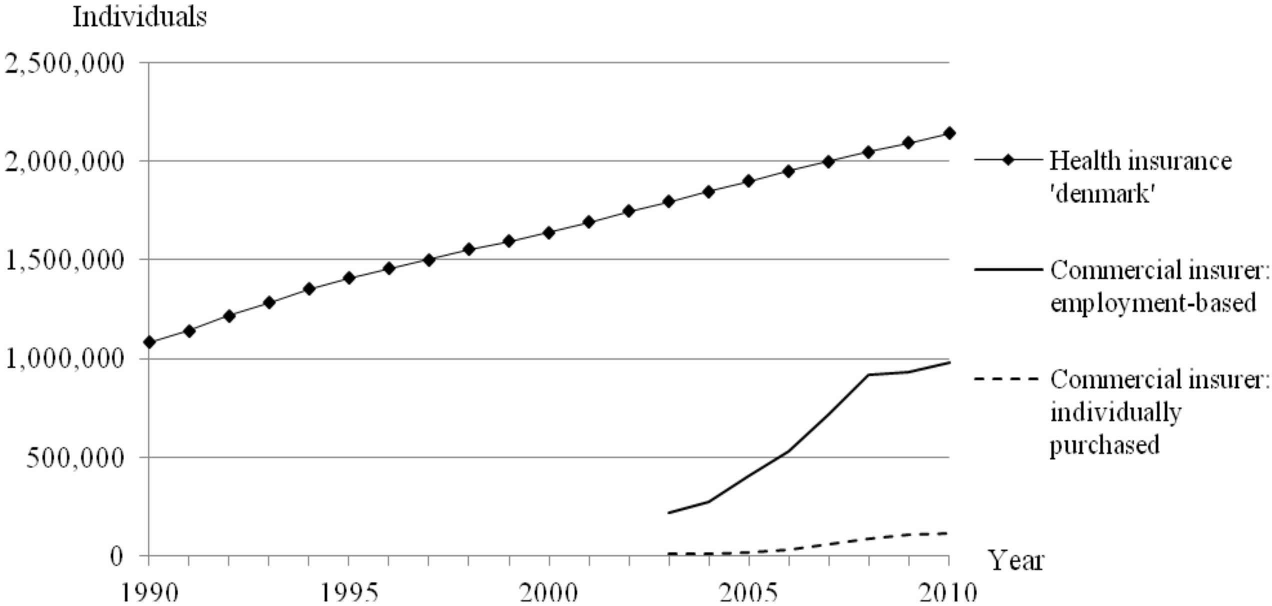
Up until 2002/2003 the economic profits of the private hospitals and clinics were either negative or just balancing. Subsequently, the private sector has experienced an increasing turnover and positive profits until 2009, but today is facing hard economic conditions with several bankruptcies (Pedersen 2010). The improved position of the private hospitals is mainly due to regions contracting out treatments to private hospitals and an increasing number of patients using the extended free hospital choice, which allowed patients to go private if the waiting time for treatment at the public hospitals exceeded one month. In addition, although to a lesser extent, an increasing number of patients with private health insurance have also helped to create a foundation for a private treatment sector. Some of the insurance companies that offer duplicate private health insurance have been shareholders in the private hospitals in order to affect the establishment and maintenance of private treatment facilities through this channel (Pedersen 2007). Geographically the private hospitals are mainly concentrated around the bigger cities, especially the capital of Copenhagen.

2.2 Private health insurance in Denmark

The presence of copayment for some health care services and waiting time for others within the tax-financed health care system provides the basis for a market for VPHI. There are two suppliers of VPHI in Denmark: 1) The non-profit mutual insurance company Health Insurance 'denmark' and 2) commercial insurance companies. The policies supplied by 'denmark' and the commercial insurers, respectively, differ with regard to benefits, premium setting, eligibility, and the tax-treatment of premiums. An important common characteristic of the different types of VPHI is, however, that none of them cover acute and emergency treatment. Moreover, the privately insured do not lose their entitlement to use the universal health care system, and they are still obliged to contribute towards it by paying taxes in any case.

Figure 2.1 shows the development in the number of privately insured from 1990 to 2010. The number of individuals covered by the different types of VPHI should be seen in relation to a Danish population of approximately 5.5 million people, i.e. more than 50 percent of the population carry some kind of VPHI.

Figure 2.1 Number of individuals covered by VPHI in Danmark, 1990-2010



Sources: The Danish Insurance Association (2010) and Health Insurance denmark (2009).
Note: The number of individuals covered through 'denmark' includes children under the age of 16, who are covered for free through their parents.

It is seen from Figure 2.1 that the group of individuals with VPHI through 'denmark' has increased steadily in size over the recent decades and includes around 40 percent of the population in 2010. The increase in the prevalence of employment-based VPHI is noted to coincide with the introduction of preferential tax treatment for this type of VPHI, as accounted for in section 2.2.2.4. While the increased prevalence of employment-based VPHI has attracted a considerable degree of attention, the growth in 'denmark' has not met any popular or political resistance.[8]

The group of individuals with commercial VPHI purchased on an individual basis is rather small and not analysed empirically in the present thesis. Hence, apart from noting that the benefits of these policies are largely the same as for the employment-based insurances, while the premiums are not subject to special tax treatment and are risk rated based on age, this type of individually purchased VPHI is not considered further here.

Despite the fact that a substantial part of the Danish population is covered by VPHI, it plays only a minor role in the overall financing of health care. According to OECD figures, only 1.6 percent of the total health expenditure was accounted for by private health insurance in 2007 (OECD 2010). However, when looking at particular health care services, such as adult dental care and prescription medication, VPHI

[8] The reason for this probably being that the premium for membership of 'denmark' is not tax-exempted, combined with the scope of the benefits. In particular, 'denmark' mainly covers copayments for services that are partly financed by and provided within the universal health care system, while the employment-based contracts primarily cover elective surgery at private hospitals for procedures that are subject to some waiting time within the universal health care system, as will be accounted for in sections 2.2.1.1 and 2.2.2.1.

purchased through ‘denmark’ provides substantial financing. More precisely, the payouts by ’denmark’ equal about 50 percent of the public expenditures for dental care and about 14 percent of the public expenditures for prescription medication (Pedersen 2005).

2.2.1 Health Insurance ‘denmark’

The non-profit mutual insurance company Health Insurance ‘denmark’ was established in 1973 as a remnant of the former system of sickness funds. The mutual aspect means that the members are responsible for the liabilities of the company, but only in the form of the ordinary premium (Pedersen 1994). Membership of ‘denmark’ may only be purchased on an individual basis.

2.2.1.1 Benefits and premium setting

The principal function of ‘denmark’ is to provide partial coverage of copayments for health care services which are only partly covered by the universal health care system, such as adult dental care, medication, physical therapy, chiropractic care, psychological counselling and the like. Partial coverage of elective surgery at private hospitals was introduced around 1990, when the first commercial private hospital opened. In 2009, around 25 percent of the members of ‘denmark’ held such coverage (Health Insurance denmark 2009). Hence, the coverage provided by ‘denmark’ may be classified as mainly complementary to the universal health care system according to the functional classification outlined in section 1.1.1, although duplicate coverage is also provided for some members. The coverage provided by ‘denmark’ always leaves a small copayment to be paid out-of-pocket. Most likely in order to counter moral hazard.

The members of ‘denmark’ can choose between four insurance groups that differ with respect to benefits and premiums (Health insurance denmark 2010a).[9] In all groups, children are covered for free through the parental membership until the age of 16. There is a common premium structure for all members in a given group regardless of health status and other personal characteristics such as age and gender, i.e. the premiums are not risk rated. Finally, it is possible to switch insurance group after having been enrolled in the same group for 12 months or more without having to re-qualify for membership.

Group 5 provides partial coverage of copayments related to medication, vaccinations, dental care, and glasses or contact lenses. Copayment for physiotherapy and chiropractic care is also partly covered, as is copayment for psychological counselling. In addition to the basic benefits, members of group 5 may take out an additional policy that partly covers expenditures related to elective surgery at private hospitals in Denmark and abroad. In 2010, the annual premium for a membership of group 5 amounted to DKK

[9] In addition to membership of one of the four insurance groups, it is also possible to purchase travel insurance and additional insurance which pays out a fixed amount of money in the event of critical illness through ‘denmark’. However, given that these types of insurance differ fundamentally from VPHI, they are not considered further in this thesis.

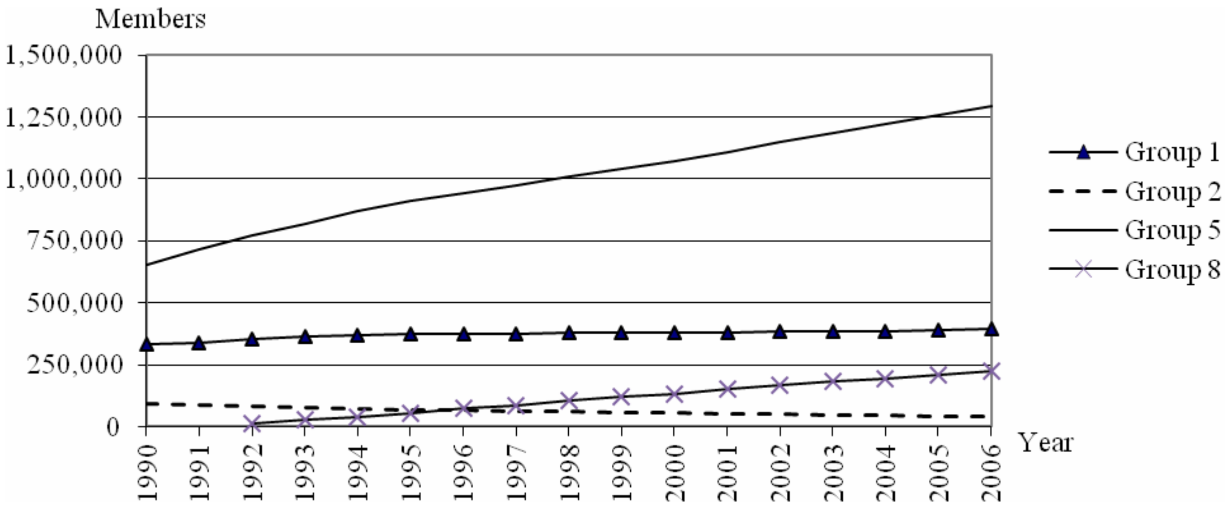
1312/EUR 176 per adult. Additional coverage of elective surgery costs DKK 480-1200/EUR 64-161 per year.[10]

Group 1 provides more extensive coverage of the same types of health care services as covered by group 5. In particular, the reimbursement rate for copayments related to medication is higher especially, and expenditures related to elective surgery at private hospitals are partly covered after 12 months' membership by default. Members of group 1 paid an annual premium of DKK 2968/EUR 398 per adult in 2010.

Group 2 is designed specifically for the approximately 0.7 percent of the population that has opted for an arrangement within the universal health care system where they are free to visit any health care provider without referral from a GP against paying a small copayment for all services except hospital treatment.[11] In addition to the services covered by group 1, specialist care and diagnostic tests are also reimbursed for members of group 2. Hence, this group provides the most extensive coverage available within 'denmark'. Members of group 2 paid an annual premium of DKK 3832/EUR 514 per adult in 2010.

Group 8 is passive coverage in the sense that membership of this group does not provide any actual benefits, but allows members to switch to one of the other groups without having to re-qualify for membership. Hence, this group is aimed at people who fulfil the eligibility requirements at the time of enrolment and expect that they want active coverage a later point in time. Members of group 8 paid an annual premium of DKK 396/EUR 53 per adult in 2010.

Figure 2.2 Distribution of members on the four insurance groups in 'denmark', 1990-2006



Source: Internal material from Health Insurance 'denmark'.

[10] Conversions from DKK to EUR are undertaken using the March 2011 average exchange rate of 745.74 (Danske Bank 2011).

[11] It is noted that the 0.7 percent stated by www.borger.dk (2011) corresponds reasonable well with the share of the population with a membership of 'denmark's *group 2* calculated as 42,000·100/5,500,000 = 0.77.

Figure 2.2 shows the distribution of members on the four insurance groups in 'denmark' in the period from 1990 to 2006. While the size of group 1 has remained relatively constant, group 5 has experienced a considerable growth over time and is by far the largest insurance group in 2006. Group 8 has also experienced accession of new members since it was introduced in 1992, although the size of this group is still smaller than groups 1 and 5. Group 2 is the smallest groups within 'denmark', and as the only group it has decreased in size over time.

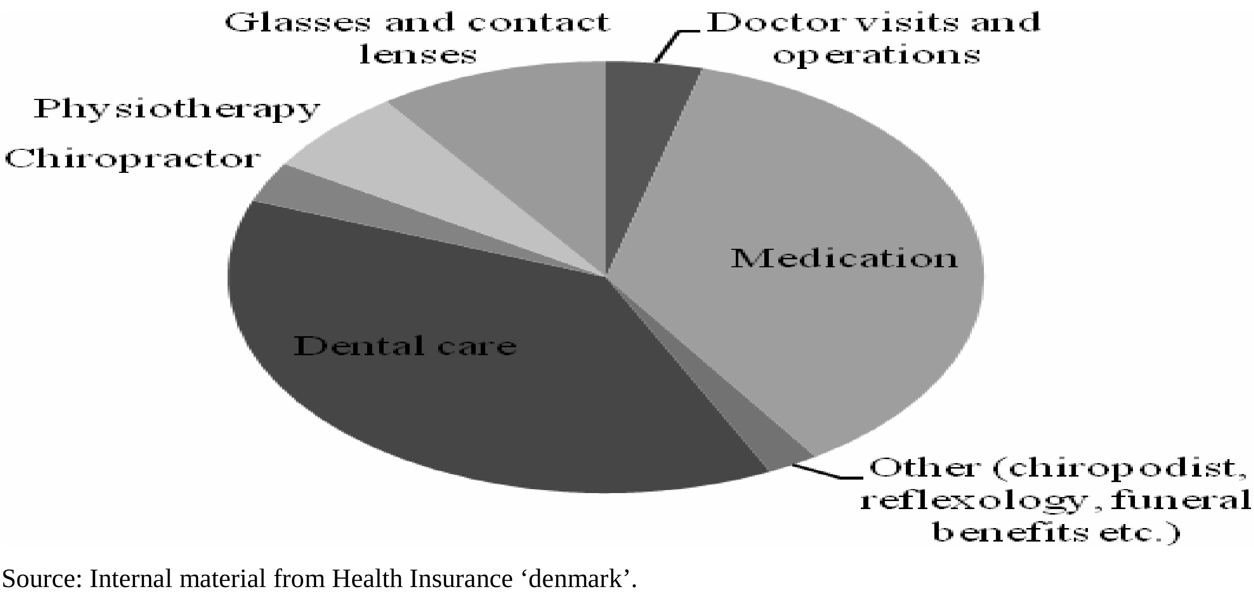
2.2.1.2 Eligibility

Several requirements must be met in order to be eligible for a membership of 'denmark' (Health Insurance denmark 2010b). At the time of enrolment individuals must be physically and mentally healthy, and they must not have received medication or treatment from a physiotherapist, chiropractor or a resembling provider within the recent 12 months. Children who were already born when their parents joined 'denmark' must meet the health requirements in order to qualify for free membership, whereas children born after their parents joined 'denmark' are automatically eligible for free coverage. Moreover, individuals must be less than 60 years old when joining 'denmark', and only people with permanent address in Denmark, who are covered by the tax-financed health care system, are eligible for coverage. However, once a member, it is possible to stay insured as long as one may wish.

2.2.1.3 Compensations

Figure 2.3 shows the distribution of the compensations paid out by 'denmark' on different groups of health care services in 2010.

Figure 2.3 Distribution of compensations paid out by 'denmark', 2010



Source: Internal material from Health Insurance 'denmark'.

It is seen from Figure 2.3 that the larger share of the compensations paid out by 'denmark' cover copayments for adult dental care and prescription medication. Moreover, the shares of compensations allocated towards physiotherapy and glasses and contact lenses are also considerable, while the share of compensations allocated towards doctor visits and operations is smaller.

2.2.2 Commercial insurance companies

The VPHI policies supplied by the commercial insurance companies are mainly purchased by employers on behalf of their employees, as evident from Figure 2.1. Most of the commercial insurance companies in the Danish market offer some kind of VPHI, and the policies are often bundled with other insurance products and pension schemes which are provided through the workplace.

In addition to VPHI, some employers also have company health schemes in place, which provide prevention and treatment of work-induced injuries, typically with physical therapy, chiropractic care, massage, and reflexology. Other schemes cover general health check-ups. The health schemes differ fundamentally from employment-based VPHI in the sense that they do not provide any type of elective surgery at private facilities, and that they treat work-induced injuries only (The Danish Insurance Association 2010). Hence, apart from being included as covariates in some analyses, the health schemes are not considered further in this thesis.

2.2.2.1 Benefits and premium setting

The benefits and premiums of the VPHI policies supplied by the commercial insurance companies differ somewhat between insurance companies, and may be tailored to specific firms. However, the literature has identified a number of common characteristics and tendencies (Borchsenius and Hansen 2010; Kjellberg et al. 2010; Pedersen et al. 2011), which are accounted for in this section.

The employment-based VPHI policies generally require that there is a medically documented need for treatment, given that this is a condition for obtaining the preferential tax treatment of the insurance premiums as accounted for in section 2.2.2.4. For hospital treatment, need is typically documented by obtaining a referral from a general practitioner, while need for chiropractic care and psychological counselling may be documented by the relevant provider.

The overall purpose of the VPHI policies sold by the commercial insurers in Denmark is to cover diagnostics and elective surgery at private hospitals for treatments that are also available within the universal health care system, but often with some waiting time. Hence, they may be classified as mainly duplicate in relation to the universal health care system according to the functional classification outlined in section 1.1.1. Moreover specifically, the policies cover expenditures related to examinations, including laboratory tests and scans, ambulatory treatments, and operations at private hospitals and clinics. Most policies to some extent also cover rehabilitation after covered operations, as well as re-examinations and -treatments. In addition, the commercial insurers increasingly cover health care services for which copayment is common in the universal health care system, such as physiotherapy, chiropractic care, and psychological counselling; however, often with a limitation on the annual number of consultations. Most insurance companies offer a basic package of benefits, typically narrowly defined around treatment at private hospitals and clinics, and various supplementary modules. Some companies include physiotherapy, chiropractic care, and psychological counselling in the basic coverage, while others include it in the supplementary modules. Examples of other services that may be included in the supplementary modules are alcohol rehabilitation, home nurse visits, and transportation between home and treatment facilities. Finally, some companies offer to extend the coverage to the spouse and children of the covered employee (Kjellberg et al. 2010).

The VPHI policies sold by the commercial insurers usually do not cover alternative treatment, cosmetic surgery, preventive care, gastric bypass surgery, fertility treatment, conditions caused by pregnancy and birth, injuries sustained during professional sports, glasses and contact lenses, and adult dental care.

While risk rating of premiums is unlikely within companies due to the conditions of the tax-exemption; it is, however, likely to occur between companies. Moreover, larger companies generally pay a smaller premium per employee because their bargaining power is stronger and the scope for risk pooling increases with company size (Kjellberg et al. 2010). Table 2.1 shows the development in the average annual premiums per person for VPHI purchased through commercial insurers in the period from 2003 to 2010. For lack of more detailed data, the average premium per person is calculated as total premium income for the commercial insurance companies divided by the number of insured.

Table 2.1 Average annual premiums for VPHI purchased through commercial insurers, 2003-2010

		2003	2004	2005	2006	2007	2008	2009	2010
Average premium per person covered	DKK	1157	1233	1033	990	997	1114	1369	1471
	EUR	155	165	139	133	134	149	184	197

Source: The Danish Insurance Association (2010).
Note: Conversions from DKK to EUR are undertaken using the March 2011 average exchange rate of 745.74 (Danske Bank 2011).

According to Table 2.1 the average premium per person was constant around DKK 1000 for several years, but increased from this level in 2008 and onwards. The premiums are either fully paid by the employers or (for about one third of the insured based on the data used in this paper) deducted from the pre-tax income of the employees.

2.2.2.2 Eligibility

The decision to offer employment-based VPHI is that of the employer. Hence, the main eligibility criterion is that individuals work for a company that offers VPHI. In Denmark, employment-based VPHI is by far most widespread in the private sector. Moreover, two unions have included employment-based VPHI in their collective agreements (Financial Services Union Denmark 2010; National Insurance Workers' Association 2007).

While it is possible that screening of firms occurs, insurance eligibility within the firm is usually not restricted by health requirements due to the conditions on of the tax-exemption described in section 2.2.2.4. However, there may be a deferred period for coverage of existing conditions, just like chronic conditions may be excluded from coverage.

2.2.2.3 Compensations

Table 2.2 shows the percentage-wise distribution of the gross compensations paid out by the commercial insurers on different groups of health care services in the period from 2003 to 2010.

Table 2.2 Distribution of compensations paid out by commercial insurers, 2003-2010

	2003	2004	2005	2006	2007	2008	2009	2010
Operations	68.4%	53.5%	58.3%	55.8%	65.6%	68.4%	66.3%	60.8%
Psychologist, psychiatrist, etc.	1.8%	3.5%	4.2%	6.2%	8.1%	8.4%	9.3%	9.8%
Physiotherapy, chiropractor, etc.	6.8%	7.4%	12.0%	18.0%	17.8%	17.4%	18.4%	21.0%
Other (home care, recreation, escort etc.)	23.1%	35.6%	25.5%	20.0%	8.6%	5.8%	6.0%	8.4%

Source: The Danish Insurance Association (2010).

It is seen from Table 2.2 that the larger share of the compensations paid out by the commercial insurers is allocated towards elective operations at private hospitals and clinics. Moreover, Table 2.2 reveals that over the time period in question, there is a trend towards VPHI increasingly being used to finance health care services like physiotherapy, chiropractic care, and psychological counselling, which are subject to copayment when delivered through the universal health care system.

2.2.2.4 Tax treatment of the insurance premiums

Legislation was enacted in 2002 that tax-exempted employees for the value of employment-based VPHI subject to some conditions (The Danish Parliament 2002). This is contrary to the common practice of taxing fringe benefits like labour income. The conditions for the tax-exemption are that the insurance is offered to all employees in the company, and that there is a medically documented need for treatment. However, the legislative framework allows companies to differentiate somewhat in the health benefits offered to their employees based on seniority and number of working hours and maintain the tax exemption (Danish Tax and Customs Association 2005). Depending on the taxable income of the employee, the tax exemption implies an indirect tax subsidy of about 40-60 percent of the VPHI premium.

The purpose of the tax-exemption was to make it more attractive for employers to assume a social responsibility and to improve the overall welfare by reducing waiting times for treatment at public facilities and decreasing sickness absence.[12] In addition, it was hoped that making the tax-exemption

[12] However, the evidence base for these expectations to how VPHI may affect social welfare was and is not strong.

contingent on the insurance being offered to all employees in the company would induce a more equal distribution of EPHI within the companies (The Danish parliament 2002). The condition that the insurance should be offered to all employees in a company in order to qualify for the tax-exemption was not included in the initial bill, but added during the readings of the bill.

Finally, it is noted that the employers may deduct their annual expenditures on VPHI as an operating cost, thereby reducing taxable profits. However, given that this has long been possible and does not differ from the tax treatment of other expenditures related to employee health and most fringe benefits, the preferential tax treatment of employment-based VPHI relates exclusively to the employees (Pedersen et al. 2011).

3 Theoretical framework

This section accounts for the economic literature on the demand for private health insurance and its effect on the use of health care services in order to establish the theoretical framework for the analyses undertaken in the empirical chapters of the thesis. In reality, the decision to take out private health insurance as well as the use of health care services are most likely based on dynamic optimization by individuals. However, given that the main focus of the thesis is empirical, it is judged that static models will meet the case.

The predominant share of the theoretical literature on private health insurance applies directly to settings where private health insurance provides the primary source of coverage and the choice is between purchasing private health insurance and going uninsured. This type of private health insurance may be classified as principal private health insurance (PHI) in accordance with the definitions outlined in section 1.1. Although the institutional setting of PHI differs considerably from that of voluntary private health insurance (VPHI) in universal health care systems, the theoretical framework developed to model the decision to purchase insurance and its effect on the use of health care services may reasonably be argued to be applicable to VPHI in universal health care systems, although to varying degrees. Moreover, given that no independent theoretical framework has yet been developed specifically for VPHI in universal health care systems, the various models developed in the context of PHI appear to be the best possible alternative.

The section is organised as follows. Section 3.1 accounts for some general models the individual demand for PHI, and accounts for their implications in terms of the demand for the various types of VPHI that may exist in universal health care systems. Section 3.2 summarises and compares the different angles of approaches taken in the theoretical literature on the employers' decision to offer PHI, which is seen to differ fundamentally from the individual demand. Finally, section 3.3 accounts for the various channels through which PHI may affect the use of health care services, and discusses their relevance in relation to VPHI in universal health care systems.

3.1 The individual demand for private health insurance

The individual demand for health care is highly variable and unpredictable given that illness strikes at random, which necessitates some sort of insurance mechanism in the financing of health care services (Arrow 1963). This section lays out various models of the individual demand for PHI. The models accounted for in this section are all based on expected utility theory, which is the framework most frequently used to model choice under uncertainty in the literature (Machina 2008).[13] Sections 3.1.1-3.1.3 account for the original models of the individual demand for PHI under different informational assumptions. Section 3.1.4 discusses the implications of the models in terms of the demand for the different types of VPHI that may exist in universal health care systems, and accounts for a theoretical contribution that explicitly models the demand for duplicate VPHI.

3.1.1 Model with symmetric information

The classical one-period model of PHI demand with symmetric information between the insurer and the insurance taker was developed by Friedman and Savage (1948). Subsequently, some variation of the model has been included in popular health economics textbooks such as Zweifel and Breyer (1997), Santerre and Neun (2010), and Cutler and Zeckhauser (2000). The presentation in this section follows the exposition in Cutler and Zeckhauser (2000).

Individuals are assumed to fall ill with the probability $0 \leq p \leq 1$ and remain in good health with the probability $1 - p$. The probability p is known by both the individuals and the insurer, i.e. there is symmetric information. The cost of medical care if ill is m, and treatment is assumed to restore ill individuals to perfect health (i.e. the non-financial consequences of illness are ignored). Insurance contracts are assumed to provide the fixed amount of money m in the event of illness, which is also known as indemnity insurance. The independence between the actual use of medical care and m implies that ex post moral hazard is assumed away. Moreover, the contracts are characterized by the risk rated actuarially fair insurance premium $\pi = p \cdot m$. All individuals are assumed to have a stable utility function which is additively separable in the arguments wealth y and final health $H[.]$. In other words, the marginal utility of income does not depend on the health state, and the utility function does not change as health or income change. The utility function is assumed to satisfy the properties $U' > 0$ and $U'' < 0$, which is equivalent to the definition of risk aversion under uncertainty. Finally, individuals without insurance are assumed to have sufficient income to pay for care at the point of demand when ill.

The assumption that treatment restores the individual to perfect health is modelled by letting final health be a function initial health and medical care, where $d = 0$ indicates a healthy individual and $d = 1$ indicates an ill individual, so that $H[1,m] = H[0,0]$. The expected utility functions for individuals with and without PHI may then be written as:

$$V_I = (1-p)U(y-\pi, H[0,0]) + pU(y-\pi, H[1,M]) = U(y-\pi) \tag{3.1}$$

$$V_N = (1-p)U(y, H[0,0]) + pU(y-m, H[1,M]) = (1-p)U(y) + pU(y-m) \tag{3.2}$$

where the subscripts I and N denote insured and not insured, respectively.

[13] It is, however, acknowledged that the demand for private health insurance may also be modelled based on alternative models of choice under uncertainty, such as prospect and regret theory (Marquis 1996).

The expected utility of an individual without PHI may be approximated by Taylor series expansion taken about the level of income net of the insurance premium:[14]

$$V_N \approx U(y-\pi)+U'(U''/2U')\pi(m-\pi) \tag{3.3}$$

whereafter the value of PHI can be calculated as:

$$(V_I - V_N)/U' \approx (1/2)(-U''/U')\pi(m-\pi) \tag{3.4}$$

The expression to the left of the equal sign in equation (3.4) is the difference between being uninsured and insured scaled by the marginal utility of payment for risk removal, while the expression to the right is the benefit of risk removal. Evaluating the expression stated in equation (3.4), it is seen that the benefit of PHI is determined by the coefficient of absolute risk aversion ($-U''/U'$) and the variance in the cost of care if uninsured. Since both of these terms are positive under the given assumptions, the expected utility with fair insurance is greater than the expected utility without insurance in this model. Moreover, the value of PHI and hence the demand is seen to increase with the degree of risk aversion and the variance of the cost of medical care. This implies that the demand for PHI covering catastrophic losses should be greater than the demand for PHI covering low variance losses.

The intuition behind this result is that having access to fair insurance, risk averse individuals prefer to smooth the marginal utility of income by transferring income from the healthy state, where the marginal utility of income is relatively low, to the ill state, where the marginal utility of income is relatively high. In this way, the demand for PHI has traditionally been interpreted as a demand for certainty, and the purchase of PHI is equivalent to accepting a small certain loss, i.e. the insurance premium, in order to avoid the risk of incurring a larger loss with the same expected utility (Friedman and Savage 1948).

Nyman (2003) suggested an alternative approach to modelling the demand for PHI. Following this approach, the decision to purchase PHI is made by comparing the expected utility gain from the income transfer in the ill state to the expected utility loss from paying the insurance premium in the healthy state rather than comparing the expected utility with and without PHI, respectively.[15] Given that uncertainty occurs both with and without insurance, risk aversion is only expected to play a minor role in the demand for PHI according to the approach. The essence of PHI thus becomes a redistribution of income rather than elimination of risk (Nyman and Maude-Griffin 2001; Nyman 2003). A central part of this alternative

[14] Taylor series expansion about the level of income net of the insurance premium, from eq. (3.2) $V_N \approx (1 - p)\ [U(y - \pi) + U'\pi + (1/2)U''\pi^2] + p[U(y - \pi) - U'(m - \pi) + (1/2)U''(m - \pi)^2]$. Collecting terms, this simplifies to $V_N \approx U(y - \pi) + U'\{(1 - p)\pi - p(m - \pi)\} + (1/2)U''\{(1 - p)\pi^2 + p(m - \pi)^2\}$. The term $(1 - p)\pi - p(m - \pi)$ is zero. The term $(1 - p)\pi^2 + p(m - \pi)^2$ can be expanded as $(1 - p)\pi^2 + pm^2 - 2pm\pi + p\pi^2$. Since $pm = \pi$, this simplifies to $pm^2 - \pi^2 = \pi(m - \pi)$ (Cutler and Zeckhauser 2000).

[15] The alternative approach of Nyman (2003) may be shown to be mathematically equivalent to the classical model of PHI demand when individuals use the same amount of medical care regardless of their health status.

theory concerns a decomposition of increased use of health care services induced by PHI into inefficient ex post moral hazard and use that is due to an efficient transfer of income from the healthy to the ill, as will be accounted for in section 3.3.4.

3.1.1.1 Access value

The assumption that individuals without PHI have sufficient income to pay for health care at the point of demand when ill implies that the income elasticity of the demand for health care is zero. This is a rather strong assumption, which is at best questionable. De Meza (1983) has developed an alternative model based on the assumption that health care is a normal good, which implies that more of it will be demanded when PHI is available. This model takes into account that individuals without PHI are not always able to pay for health care at the point of use when ill, and that some health care costs may in fact not occur without insurance.[16] The implications of individuals with and without PHI not necessarily using the same amount of health care when ill for the demand for PHI were further developed by Nyman (1999b). More specifically, Nyman (1996b) argued that in addition to providing protecting against financial risk, PHI is then also valued for giving access to health care that would otherwise be unaffordable, i.e. it has ‘access value’. The access value is greater for individuals with limited financial resources, since for these individuals, the alternative to purchasing PHI may well be to go without treatment in the ill state, which implies that the financial loss associated with illness is limited. In addition, PHI that covers expensive procedures may reasonably be expected to have greater access value than PHI covering smaller losses.

3.1.2 Model with one-dimensional private information and adverse selection

The notion that one-dimensional private information may cause adverse selection in various markets was introduced by Akerlof (1970), and the classical model of adverse selection into insurance based on risk was subsequently developed by Rothschild and Stiglitz (1976) and (Wilson 1977).

The presence of one-dimensional private information may be incorporated into the framework of the model developed in section 3.1.1 by replacing the assumption of symmetric information with an assumption that individuals know their probability of falling ill, and hence their expected health care costs, while insurers do not have this information (or alternatively that insurers are not allowed to use this information when setting their premiums). The population is assumed to consist of two different risk types. High-risk individuals who fall ill with the probability $0 \leq p^H \leq 1$ and remain in good health with the probability $1 - p^H$, and low-risk individuals who fall ill with the probability $0 \leq p^L \leq 1$ and remain in good health with the probability $1 - p^L$, where $p^H > p^L$. The cost of medical care remains the fixed amount of money *m*, but now PHI contracts allow individuals to choose between different coverage levels denoted by *c(m)* rather than dictate full reimbursement. Each individual can only buy one PHI contract, i.e. there is price and quantity competition.

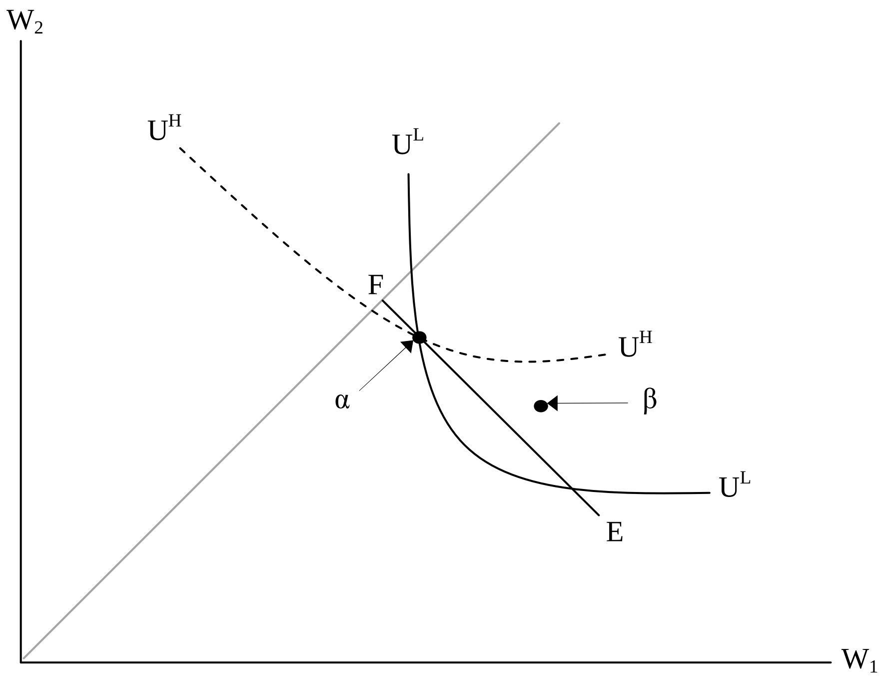
[16] The main point of de Meza (1983) was to show that PHI may have non-trivial effects on the use of health care even in the absence of moral hazard.

If there was symmetric information, i.e. the probabilities of falling ill were known by both individuals and insurers, both risk types would be offered to purchase PHI at the risk rated actuarially fair premiums $\pi^H = p^H \cdot c(m)$ and $\pi^L = p^L \cdot c(m)$, and both risk types would chose to purchase full coverage in equilibrium. However, when the insurers cannot discriminate among the individuals based on their probability of falling ill, all individuals would be offered to purchase private health insurance at the premium $\pi = \bar{p} \cdot c(m)$, where $\bar{p} = \lambda \cdot p^H + (1 - \lambda)p^L$ is the average probability of falling ill in the population. Other things equal, high-risk individuals are willing to pay more than low-risk individuals for additional coverage, and they will therefore choose to purchase PHI contracts that provide more extensive coverage. In this way, the presence of asymmetric information leads to adverse selection in a competitive insurance market.

Defining an equilibrium as a situation where, when individuals chose contracts so as to maximize their expected utility, no contract makes negative expected profits and no contract outside the equilibrium set of contracts would make a non-negative profit if offered, it is relatively straight forward to establish that if there is an equilibrium in a competitive insurance market with private information, it must be a separating equilibrium where the low-risk individuals purchase more comprehensive coverage than the high-risks.

Figure 3.1 shows that a pooling equilibrium where both risk types purchase the same insurance contract is not feasible. The horizontal axis represents net income in the ill state, W_1, and the vertical axis represents net income in the healthy state, W_2. The indifference curves of the high- and low-risk individuals are denoted by U^H and U^L, respectively, and EF is the fair-odds line where insurance contracts break even.

Figure 3.1 Pooling equilibrium in market with one-dimensional private information

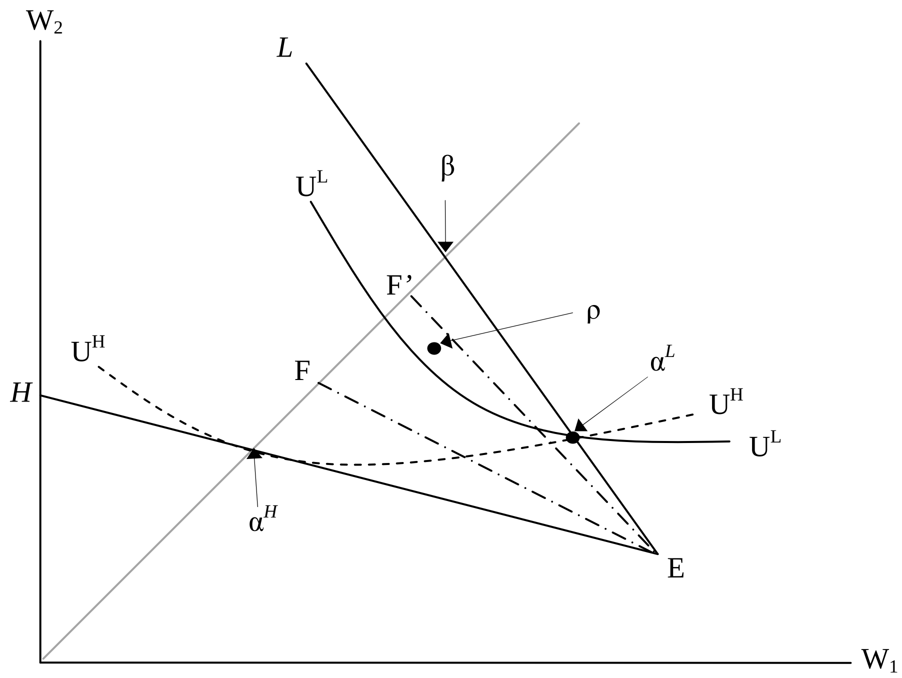


Source: Rothschild and Stiglitz (1976), p. 635.

Suppose that the contract *α*, which is located where the indifference curves of the high- and low-risk individuals intersect the fair-odds line, is a pooling equilibrium. In this case, the conditions that no contract makes negative expected profits, and no contract outside the equilibrium set of contracts would make a non-negative profit if offered must hold. However, it is seen from Figure 3.1 that the second equilibrium condition does not hold, because there is a contract, *β*, which is preferred to *α* by the low-risk individuals and makes a positive profit when purchased only by the low-risk individuals. Hence, there cannot be a pooling equilibrium in a competitive insurance market with one-dimensional private information.

Figure 3.2 shows a separating equilibrium where the different risk types purchase different contracts.

Figure 3.2 Separating equilibrium in market with one-dimensional private information



Source: Rothschild and Stiglitz (1976), p. 636.

The fair-odds line *EF* is replaced by *EH* (with slope $(1 - p^H)/p^H$) and *EL* (with slope $(1 - p^L)/p^L$), which are the fair-odds lines for high- and low-risk individuals respectively. In this model, the high-risk individuals prefer the contract α^H and the low-risk individuals prefer the contract *β*, both of which provide full insurance. However, high-risk individuals will also purchase the contract *β* if it is offered, which would cause the profit of this contract to be negative, and it is therefore not an equilibrium. Instead, the contract α^L is the most preferred contract for the low-risk individuals that does not attract the high-risk individuals. Hence, the set of separating contracts (α^H,α^L) makes up the only possible equilibrium in the competitive insurance market with asymmetric information.[17] In this equilibrium, the high-risk individuals end up in

[17] This point is formalised in Wilson (1977).

their preferred plans with complete insurance coverage, while the low-risks purchase less than complete coverage.

It may also be the case that there is no equilibrium in the competitive insurance market with private information. This may be seen by considering the insurance contract ρ in Figure 3.2. This contract is above the U^L indifference curve through α^L and also above U^H and would hence be purchased in preference to either α^H or α^L if offered. If ρ makes a profit when purchased by both groups, it will upset the potential equilibrium of (α^H,α^L). The profitability of ρ can be shown to depend on the composition of the market. If there are sufficiently many high-risk individuals for *EF* to represent the market odds, then ρ will not make a profit and the separating equilibrium (α^H,α^L) remains. If there are relatively few high-risks so that the market odds are represented by *EF'*, then ρ will make a positive profit. Given that (α^H,α^L) is the only feasible equilibrium, the competitive insurance market will not have any equilibrium in this case.

In general, an equilibrium is less likely to exist when the costs to the low-risk individuals of pooling are low because there are relatively few high-risks in the population and/or the difference in the probability of falling ill between high- and low-risks is small, or the costs of separating are high because the low-risks are very risk averse (Rothschild and Stiglitz 1976).

The predictions of the simple one-period model developed by Rothschild and Stiglitz (1976) have been shown to extend to more general frameworks in a number of studies. Among others, Chiappori and Salanié (2000) conjecture that the basic intuition of the model remains valid in a dynamic setting, and Chiappori et al. (2006) show that the prediction of adverse selection in competitive insurance markets with one-dimensional private information is robust to removing the restriction on the number of risk types and their distribution, and introducing multiple levels of losses. However, other studies have shown that some of the predictions may change in slightly different settings. Feldman and Dowd (1991) and Cutler and Reber (1998) have developed models with a continuous distribution of risk in the population rather than two risk types and shown that adverse selection may cause the market for generous insurance policies to break down as a consequence of a dynamic process. In this case, the low-risk individuals will end up in their preferred plans, while the high-risk individuals end up in less generous plans than is optimal (i.e. the opposite sorting of adverse selection).

3.1.2.1 Supply-side restrictions

Insurers and regulators can impose various measures in order to counter adverse selection into PHI (Cutler and Zeckhauser 2000). A common countermeasure to adverse selection is screening, where the insurance company seeks to uncover whether a potential applicant is a high- or low-risk individual in order to risk rate the premium based on the acquired information or enforce eligibility requirements. Likewise, low-risk individuals may signal their risk type to the insurers in various ways, such as agreeing to take on coinsurance or deductible clauses. Another potential supply side response to adverse selection is to exclude existing conditions from coverage, which may make the insurance contract less attractive for individuals who are generally in bad health. Along a similar line, insurance companies may also attempt to make their contracts more attractive to low-risk individuals, e.g. by including discounts on fitness clubs, thereby indirectly discouraging adverse selection into PHI.

In either case, it must be kept in mind that a necessary condition for adverse selection to occur is that premiums are set based on the average probability of illness within the population. If premiums are risk rated or there are eligibility requirements in place preventing high-risk individuals from entering the market, then the relationship between the probability of falling ill and the demand for PHI is ambiguous.

3.1.3 Model with multi-dimensional private information and advantageous selection

There is general agreement that when individuals have private information on multiple dimensions, the relationship between risk type and the chosen level of insurance coverage can be of any sign (Chiappori et al. 2006; Hemenway 1990; de Meza and Webb 2001; Jullien et al. 2007; Fang et al. 2006; Fang et al. 2008). While the literature on multi-dimensional dimensional private information in insurance markets is still at a developmental stage, several promising contributions within the recent decade implies that it is on the edge of becoming a well-established part of the economic literature on PHI. The model presented in this section follows the simple conceptual framework of Fang et al. (2006; 2008). It is noted to be a partial equilibrium model in the sense that it analyses the purchase decision of the individual assuming a particular equilibrium (i.e. a set menu of insurance contracts) and not a full equilibrium model in which insurers compete by offering different contracts. This is sufficient to capture the idea of advantageous selection into PHI when individuals have private information on multiple dimensions.[18]

Like in the classical model of PHI demand introduced in section 3.1.1, individuals fall ill with the probability $0 \leq p \leq 1$ and remain in good health with the probability $1 - p$. In addition, they are assumed to differ on some other vector, γ, that may also affect their probability of purchasing PHI.[19] The individuals know their probability of falling ill as well as their γ, while the insurers do not have any of this information. Hence, the individuals have private information on multiple dimensions.

The literature generally considers risk preferences to be the main source of advantageous selection into PHI (de Meza and Webb 2001; Finkelstein and McGarry 2006; Hemenway 1990; Jullien et al. 2007). This section therefore starts out by interpreting γ as risk aversion and showing that the probability of insurance purchase $Q(p,\gamma)$ is increasing in p and γ in this case. In order to derive $Q(p,\gamma)$ when γ equals risk aversion, consider an individual with a constant relative risk aversion utility function:

[18] Moreover, a full equilibrium model of an insurance market with multi-dimensional private information does not yet exist (Fang et al. 2008).

[19] In the model with one-dimensional private information presented in section 3.1.2, the risk type p is the only dimension of heterogeneity and γ is implicitly assumed to be constant in the population.

$$U(y) = \frac{y^{1-\gamma}}{1-\gamma} \tag{3.5}$$

where y denotes wealth and γ is the parameter of relative risk aversion. Like in the model introduced in section 3.1.1, the cost of medical care restoring ill individuals to perfect health amounts to m, and private health insurance covering the fixed amount of money m in the event of illness may be purchased at the price of π.

The expected utility functions for individuals with and without insurance may be written as:

$$V_I(p,\gamma) = U(y-\pi) + e \tag{3.6}$$

$$V_N(p,\gamma) = (1-p)U(y) + pU(y-m) \tag{3.7}$$

where subscripts I and N denote insured and not insured, respectively, and e is a fixed cost of taking out insurance (e.g. search and administrative costs), which is logistically distributed in the population and independent of p and γ. Fang et al. (2006) showed that the probability that the individual purchases PHI may then be given by the logistic expression:

$$Q(p,\gamma) = \frac{\exp[V_I(p,\gamma)]}{\exp[V_I(p,\gamma)] + \exp[V_N(p,\gamma)]} \tag{3.8}$$

where $Q(p,\gamma)$ is increasing in p and γ.[20] Hence, individuals with a higher probability of falling ill and the more risk averse are more likely to purchase PHI when individuals have private information on these two dimensions. If the degree of risk aversion is negatively correlated with the probability of falling ill, the prediction of the model with one-dimensional private information that the high-risk individuals purchase relatively more comprehensive insurance coverage is thus reversed.

The model is generalised to take into account that advantageous selection into private health insurance may in principle occur on any private information that is positively correlated with insurance coverage and at the same time negatively correlated with risk by modelling the probability of insurance purchase $Q(p,\gamma)$ as a reduced form function of p and γ.[21] One such potential source of advantageous selection is cognitive ability (Fang et al. 2006; Fang et al. 2008; Bolhaar et al. 2008). Assume that (p,γ) is distributed according to a joint cumulative distribution function F in the population, and let $F_{\gamma|p}(\cdot|\cdot)$ denote the CDF of risk aversion γ conditional on risk type p. The marginal probability of purchasing PHI for a given risk type p (after integrating out γ) is given by:

[20] It may be seen that $Q(p,\gamma)$ is increasing in p by noting that the sign of $\delta Q/\delta p$ is the same of $\delta(V^I - V^N)/\delta p$, which is given by $\delta(V^I - V^N)/\delta p = U(y) - U(y - m) > 0$. To see that $Q(p,\gamma)$ is increasing in γ, use the fact that for any $\gamma' > \gamma$ there is a strictly concave and increasing utility function $v(\cdot)$ so that $u(y; \gamma') \equiv v(u(y; \gamma))$.

[21] The dependence of Q on c and π is suppressed for simplicity in what follows.

$$\tilde{Q}(p) = \int Q(p,\gamma) dF_{\gamma|p}(\gamma|p) \tag{3.9}$$

Fang et al. (2008) have shown that (3.9) cannot be monotonic in *p* if at least one element in γ satisfies the following two propositions:

(i) γ is positively correlated with insurance coverage, i.e. $Q(p,\gamma)$ is increasing in γ.

(ii) γ is negatively correlated with risk *p*.

The model outlined in this section is general in the sense that the assumed negative correlation between γ and *p* may arise either exogenously or endogenously; this does not matter for the results. Cutler et al. (2008) have developed an alternative model where the more risk averse individuals are assumed to take actions to reduce their risk, thereby endogenously generating a negative correlation between γ and *p*.

3.1.4 Application to voluntary private health insurance in universal health care systems

It is relatively straight forward to adapt the models accounted for in sections 3.1.1 to 3.1.3 to the demand for complementary and supplementary VPHI in universal health care systems, assuming that the coverage of the universal health care system is fixed and exogenously determined. This assumption may be argued to be plausible in the shorter run, given that it usually requires lengthy political processes to change the coverage of the universal system. However, for duplicate VPHI the situation is more complicated.

More precisely, the various models may be adapted to supplementary VPHI by letting *p* denote the probability of contracting an illness for which the treatment is excluded from the universal health care system but covered by supplementary VPHI. For complementary VPHI, it is done by letting *p* denote the probability of needing medical care which is subject to copayment in the universal health care system and *m* denote copayment rather than the total cost of medical care. Following this line of reasoning, economic theory predicts that the demand for supplementary as well as complementary VPHI is increasing in the degree of risk aversion and the variance of payments and copayments, respectively. For complementary VPHI to have access value, the copayments in the universal health system would have to be greater than the financial resources of the individual. Although this could happen in countries where copayment makes up a large share of the total health expenditures, such as Switzerland, it is most likely not the case very often. Considering the scope for health-based selection, Olivella and Vera-Hernández (2006) have extended the model presented in section 3.1.2 to consider the demand for complementary VPHI and found that individuals adversely select themselves into complementary VPHI when they have one-dimensional private information on *p*. Along a similar line, common sense implies that the relationship between *p* and the chosen level of supplementary and complementary VPHI coverage may be of any sign if individuals have private information on multiple dimensions. However, the type of model with multi-dimensional private information and advantageous selection has not yet been formally adapted to model VPHI in universal health care systems.

The demand for duplicate VPHI is less straight forward to model, given that this type of VPHI does not cover forced financial losses in the same sense as PHI, but rather treatments at private facilities which are also available free of charge within the universal health care system. Hence, it may reasonably be expected that the demand for duplicate VPHI is somehow related to the quality of the (typically) publicly provided health care or strong preferences for private provision. Section 3.1.4.1 accounts for a theoretical contribution by Besley et al. (1999) and Propper et al. (2001) that explicitly models the demand for duplicate VPHI under symmetric information, emphasizing the link between the quality of the universal health care system and the decision to purchase duplicate VPHI. Considering the scope for health-based selection into duplicate VPHI, Olivella and Vera-Hernández (2006) extended the model presented in section 3.1.2 and found that one-dimensional private information on health leads to a separating equilibrium where the healthy individuals choose to rely exclusively on the universal health care system while the individuals in bad health purchase duplicate VPHI.[22]

In terms of access value, it may be argued that some individuals assign access value to duplicate VPHI, interpreted in the sense of access to private sector treatment, given that they are eligible to receive treatment in the universal health care system free of charge (Jones et al. 2007). This would be the case for individuals who would not have the financial resources to pay at the point of demand for treatment at private hospitals in the ill state.

Finally, Propper (1993) has argued that some individuals may not consider duplicate VPHI to be within their choice set for political or ideological reasons. These individuals, who may increase their expected utility by taking out duplicate VPHI for medical or other reasons, but do not consider the option for attitudinal reasons, are said to have preferences that are captive to the universal health care system.[23] The idea that some individuals may be captive to the universal health care system has been extended further by Costa-Font and García-Villar (2009), who argued that the more risk averse individuals are also more likely to be captive to the universal system.

3.1.4.1 Model of the individual demand for duplicate VPHI with symmetric information

Besley et al. (1999) and Propper et al. (2001) have modelled the demand for duplicate VPHI under symmetric information, emphasizing the link between the quality of the universal health care system which is accessible free of charge at the point of demand and the decision to purchase duplicate VPHI.

[22] The model developed by Olivella and Vera-Hernández (2006) considers duplicate VPHI as providing more complete coverage than the universal health care system. In this way, it does not differ conceptually from the model with one-dimensional private information and adverse selection presented in section 3.1.2, and is thus not accounted for in detail in this section.

[23] Although the scenario is less likely, captivity may, however, also occur the other way around, so that individuals holding beliefs that are critical of the universal health care system are inclined to go private.

While the quality of the universal health care system is thus of central importance in relation to duplicate VPHI, the exact definition of quality within the realm of medical care is not straight forward. One possible and generally accepted approach is to assess quality along the dimensions of organisational structure, process, and the medical results (Donabedian 2005). Another option is to define quality as the waiting time for non-urgent medical care, i.e. in reality quick access, given that this is often mentioned as a chief concern in universal care systems, or as amenities, such as better food and private rooms (Besley et al. 1999). There is no need to be specific about this in the current model.

Like in section 3.1.1, individuals are assumed to contract an illness which can be treated in the private health care sector with the probability $p \in [0,1]$, which is known both by the individuals and the insurer. Medical care is available in varying qualities, denoted by $q \in [\underline{q}, \bar{q}]$. Ill individuals may receive one unit of medical care of quality Q from the universal health care system or alternatively purchase one unit of their preferred quality of medical care in the private sector. Assuming that quality of care is a normal good, the quality of private sector care must be at least as high as that of the care available in the universal health care system, otherwise there would not be a market for it.

The utility function of a healthy individual with income y is denoted by $U(y)$, and the utility function of an ill individual with income y who receives medical care of quality q is denoted by $u(q,y)$. Both are assumed to be concave in income. Moreover, $u_{qy}(\cdot)$ is assumed to be equal to or greater than zero, which implies that quality of care is a normal good. Income is assumed to be continuously distributed with finite support between $[\underline{y}, \bar{y}]$.

The individuals may purchase duplicate VPHI that reimburses the cost of private sector care in the event of illness. Given that the privately insured have already paid the premium before falling ill and thus face a zero-cost of treatment at the margin, it is evident that they will choose to receive medical care of the quality $q = \bar{q}$ in case of illness.[24] The duplicate VPHI contracts are priced according to a risk rated actuarially fair insurance premium, including a multiplicative loading factor β.

The expected utility functions for individuals with and without duplicate VPHI may then be written as:

$$V_I(p, \bar{q}, y, \beta) = (1-p)U(y - \beta p \bar{q}) + pu(\bar{q}, y - \beta p \bar{q}) \tag{3.10}$$

$$V_N(p, Q, y) = (1-p)U(y) + pu(Q, y) \tag{3.11}$$

where the subscripts I and N denote insured and not insured, respectively. Individuals purchase duplicate VPHI if and only if:

[24] In this regard, the model differs fundamentally from the classical model of principal private health insurance demand outlined in section 3.1.1, which assumed away moral hazard by modelling the expenditure level m as independent of insurance status.

$$V_I\left(p,\bar{q},y,\beta\right) \geq V_N\left(p,Q,y\right). \tag{3.12}$$

Assuming that there is an income level, $\hat{y} \in \left[\underline{y},\bar{y}\right]$, where individuals are indifferent between taking out duplicate VPHI and relying exclusively on the universal health care system, Besley et al. (1999) have shown that:

(i) All individuals with income above $\hat{y}$ will demand duplicate VPHI.

(ii) $\hat{y}$ is non-decreasing in β and Q.

Where the cut-off income level $\hat{y}$ is defined by:

$$(1-p)U\left(\hat{y}-\beta p\bar{q}\right)+pu\left(\bar{q},\hat{y}-\beta p\bar{q}\right)=(1-p)U\left(\hat{y}\right)+pu\left(Q,\hat{y}\right) \tag{3.13}$$

In order for the result in (i) to hold, it must be the case that the left side of equation (3.13) increases faster than the right side as a function of $\hat{y}$ for a given p. Differentiating each side of (3.13), this is found to be true if:

$$(1-p)U_y\left(\hat{y}-\beta p\bar{q}\right)+pu_y\left(\bar{q},\hat{y}-\beta p\bar{q}\right)>(1-p)U_y\left(\hat{y}\right)+pu_y\left(Q,\hat{y}\right) \tag{3.14}$$

That this inequality holds follows from the assumptions that $U(\cdot)$ and $u(\cdot)$ are concave in income and that $u(\cdot)$ has a positive cross-derivative. Hence, individuals select themselves into duplicate VPHI based on their incomes because the universal health care system limits the quality of health care available, with the latter being a normal good. The result in (ii) follows by totally differentiating (3.13) and solving for the relevant variables. These results imply that the cut-off income level for individuals to purchase duplicate VPHI may increase with the quality of care available within the universal health care system and the loading factor β. Tax subsidies may be modelled as $\beta < 1$, whereas $\beta > 1$ is the more standard case of administrative costs. Like in the model of the demand for PHI outlined in section 3.1.1, the effect of p on the probability of purchasing duplicate VPHI is ambiguous when symmetric information implies that each individual's probability of falling ill is reflected in their insurance premium.

Finally, it is noted that in reality it is usually also possible to purchase medical care in the private sector at the point of demand if uninsured, which should thus be included in the expected utility without insurance (Propper 1993). However, given that this issue has not yet been addressed in the theoretical literature, and that it is questionable how many individuals actually choose pay out-of-pocket for private care, it is not considered further here.

3.2 The employers' decision to offer private health insurance

Employer behaviour as regards the provision of private health insurance is surprisingly little explored in economics, and the existing literature is characterised by several different angles of approaches rather than a unified approach (Currie and Madrian 1999). In consequence, this section summarises and compares the different angles of approaches taken in the literature rather than presents each theoretical model in detail. Regardless of which approach is taken, the employers' decision to offer private health insurance differs fundamentally from the individual demand in that, among other things, the one making the decision is not necessarily the one covered by the insurance.

The theoretical literature on the employers' decision to offer private health insurance is developed exclusively within the setting of principal private health insurance (PHI) providing the primary source of coverage, i.e. in the US. However, it may be argued that the reasoning behind the various approaches to thinking about the employers' decision is also applicable to VPHI in universal health care systems, although to varying degrees, given that the tradeoff between wages and PHI and the employers' cost advantage in the provision of VPHI are universal.

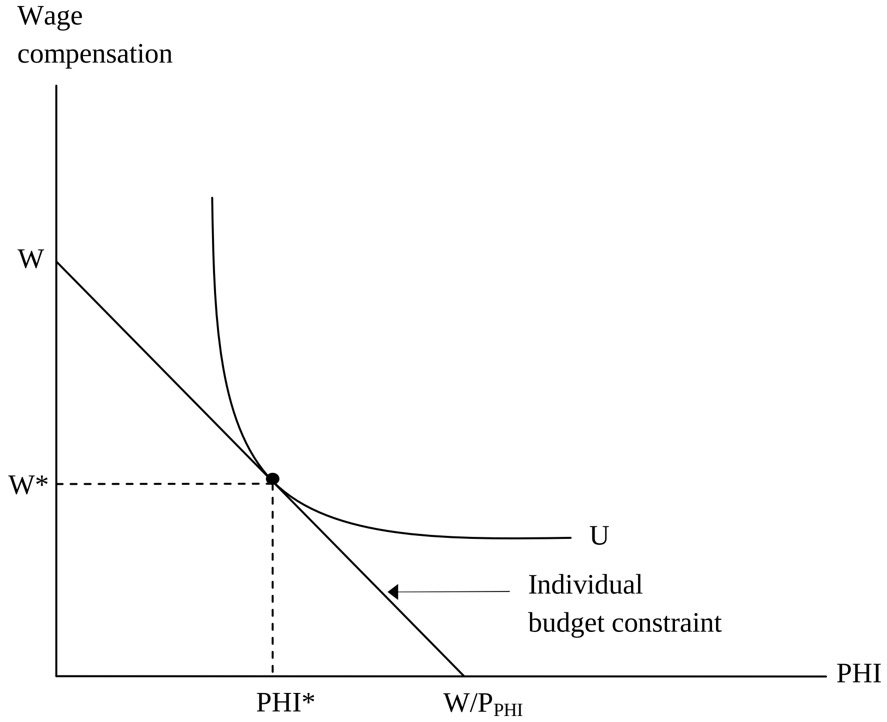
The remainder of the section is organised as follows. Section 3.2.1 accounts for the reasoning behind the frequently stated argument that one of the main reasons for employers to offer PHI as part of the compensation package is that they may have a cost advantage over employees in the provision of private health insurance. Section 3.2.2 considers employer provision of PHI within the framework of compensating wage differentials, assuming that the provision of PHI is determined by employers with a view toward minimising their total labour costs subject to maintaining the employees' utility at the level required to keep the firm competitive in the labour market. Section 3.2.3 discusses how the employers' decision to offer PHI may be modelled by aggregating the preferences of the employees through union bargaining, and accounts for how this approach differs from the theoretical framework of compensating wage differentials. Section 3.2.4 discusses how employer provision of PHI may also be considered within the health capital framework. Finally, section 3.2.5 accounts for potential effects of PHI on various labour market outcomes, such as turnover and absenteeism, which may cause employers to include PHI in the compensation package even in the absence of employees' demanding it.

3.2.1 Employers' cost advantage in the provision of private health insurance

This section follows the exposition of Currie and Madrian (1999) in accounting for how employers having a cost advantage over employees in the provision of PHI may encourage employer provision of PHI. Employers may have a cost advantage in the provision of PHI either because they have a cost advantage over employees in the market for PHI or because employment-based contracts are subject to preferential tax treatment.

Employee preferences for employment-based rather than individually purchased PHI may be analysed within the framework of Figure 3.3, which shows the individual choice of how to allocate the after-tax compensation between PHI and wages when employees and employers face the same price of PHI, denoted by P_{PHI}, and there is no special tax-treatment of employment-based contracts. The shape of the indifference curve reflects the employee's preferences for the tradeoff between wages and PHI. The optimal allocation for the employee depicted in Figure 3.3 is (W*, PHI*), where the indifference curve is tangent to the budget restriction.

Figure 3.3 Allocation of after-tax compensation between PHI and wages when employees and employers face the same price of PHI



Source: Currie and Madrian (1999), p. 3364.

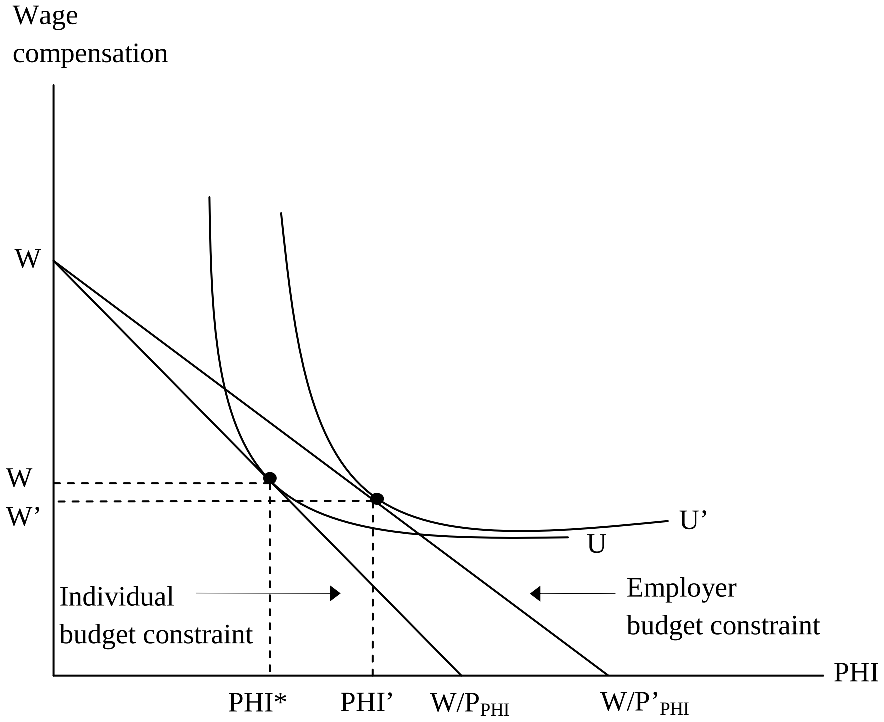
If employees can purchase PHI at the same price as employers, they will be indifferent between receiving (W*, PHI*) and an alternative compensation of W and PHI = 0, because they can replicate their preferred compensation by buying PHI = PHI* at the price of (W-W*)/P_{PHI} in the private market.[25] Hence, a possible reason for employees to prefer that their employers take out PHI on their behalf rather than having to buy it on an individual basis is that the employers have a cost advantage in the provision of PHI. This situation is shown in Figure 3.4.

In figure 3.4, the employees can use their wage compensation to purchase any combination of PHI and other consumption goods along the individual budget constraint. Given that employers can purchase PHI at the price of $P'_{PHI} < P_{PHI}$, the combinations of insurance and other consumption goods available to the employees expand to those along the employer budget constraint if employers purchase PHI on behalf of

[25] On the other hand, if the employer provides the wrong level of PHI coverage (this could happen if employers do not know the preferences of their employees, or if non-discrimination laws prohibit employers from taking into account that employees have heterogeneous preferences) and the employee cannot 'sell' excess insurance coverage (B > B*), or if the employee cannot incrementally supplement deficient insurance coverage (B < B*), employer provision of PHI makes the individual worse off.

their employees. The consumption bundles along the employer budget constraint are only available to employees with employment-based PHI and cannot be replicated by the employees in the private market. Hence, employees may reach a higher level of utility by receiving PHI as part of their compensation package. Moreover, depending on the magnitude of the difference between P_{PHI} and P'_{PHI}, employers have some leeway for choosing other combinations of wages and PHI than the one which is preferred by an employee and still make that employee better off than had he received the wage compensation W and purchased PHI in the private market.

Figure 3.4 Allocation of after-tax compensation between PHI and wages when employees face a higher price of PHI than employers



Source: Currie and Madrian (1999), p. 3364.

The literature has provided several reasons as to why employers may have a cost advantage over individuals in the provision of PHI (Gruber 2000). For one thing, the preferential tax treatment of employment-based PHI found in some countries may affect composition of the compensation package in favour of PHI by expanding the consumption possibility set disproportionately in this direction, as shown in figure 3.4. Moreover, employers may have a cost advantage in the market for PHI for several reasons. First, some individuals who would increase the average cost of PHI in the market for individually purchased policies when premiums are not risk rated (such as pensioners and long-term ill), are excluded from the risk pool when insurance is offered through the workplace. This may be reflected in lower premiums in the market for employment-based group contracts. Second, group purchase of PHI has the potential to reduce adverse selection and lower administrative costs through pooling. The benefit from risk pooling implies that larger firms are expected to be more likely to insure their employees than smaller firms. Third, employers have more negotiation power than single individuals due to bulk purchasing.

In the context of VPHI that co-exists with a universal health care system, the insurance premiums make up a negligible share of the total compensation package[26], and the employees may reasonably be expected to value this type of insurance less than PHI that provides the primary source of coverage. These differences may be expressed within the framework of figures 3.3 and 3.4 by drawing the budget constraint and the indifference curves flatter, in which case the employees prefer to spend less on VPHI. However, the argument that employees may prefer their employers to purchase insurance on their behalf because the employers have a cost advantage in this respect applies equally well to VPHI in universal health care systems.

3.2.2 Compensating wage differentials

The employers' decision to offer PHI as part of the compensation package may also be analysed within the theoretical framework of compensating wage differentials for fringe benefit provision (Goldstein and Pauly 1976; Feldman et al. 1997; Currie and Madrian 1999). This framework considers PHI as part of a compensation package which may be used by employers to attract and retain labour, and considers explicitly the tradeoff between wages and PHI.

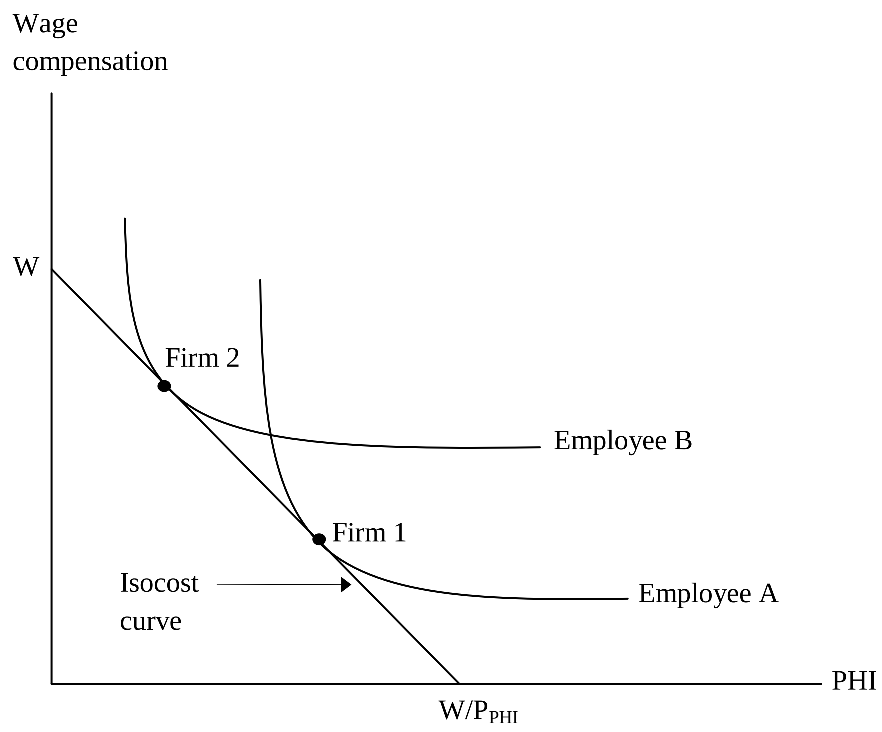
In a competitive product market, economic theory predicts that firms minimise their total labour costs, subject to maintaining the employees' utility at the level required to keep the firm competitive in the labour market. Firms that offer too little compensation will not be able to attract the desired amount and quality of labour inputs, while firms that offer too much will be driven out of business by other companies with lower labour costs. Hence, employers will offer a combination of PHI and wages which is commensurate to that offered by other firms drawing workers from the same labor pool. In order to stay in business, employers reduce wages with one unit for each one unit increase in PHI costs, i.e. PHI is paid for with foregone wages and explicit employee contributions.

Figure 3.5 shows how employees will sort themselves into firms offering different combinations of wages and PHI based on their preferences within this framework, assuming that the total compensation for employees A and B is the same and that all employers face the same tradeoff between wages and PHI. The shape of the indifference curves reflects the employees' preferences for PHI, which are seen to vary across employees in figure 3.5. The employees' preferences for employment-based PHI may vary across individuals depending on a variety of factors, including risk preferences, health status, and the availability of alternative sources of PHI (discussed in sections 3.1.1-3.1.3).

[26] For example, the value of employment-based VPHI makes up less than 0.5 percent of the average money wages for the permanently employed in Denmark (Statistics Denmark 2009c; The Danish Insurance Association 2010).

The combinations of wages and PHI offered in the market thus reflect a sorting of employees across companies based on their preferences for PHI. The employers' condition for providing PHI is that the price of a given level of PHI coverage is less than their reservation price for this level. Hence, the employers' decision of whether to offer PHI and how much to offer thus depends on the price at which they can purchase it in the market as well as the preferences of current as well as potential employees (Feldman et al. 1997).

Figure 3.5 Sorting of employees across firms offering different combinations of PHI and wages



Source: Currie and Madrian (1999), p. 3374.

Finally, it is noted that the budget constraint and the indifference curves are likely to be flatter when considering VPHI that co-exists with a universal health care system for reasons discussed in section 3.2.1. This implies that the employees prefer to allocate a smaller share of their wages toward this type of private health insurance. Hence, offering VPHI as part of the compensation package most likely does not have the same ability to attract and retain labour as offering PHI in the setting where the choice is between having PHI and going uninsured.

3.2.3 Union choice model

Goldstein and Pauly (1976) were the first to explicitly link employee preferences for employer provision of PHI and the employers' decision to offer PHI as part of the compensation package. The union choice model developed by Goldstein and Pauly (1976) considers the employers' provision of PHI as determined by aggregating the preferences of employees through union bargaining.

Assuming that the level of PHI coverage is decided upon by majority vote within unions, this model predicts that employees are divided into groups with homogeneous preferences for the level of PHI coverage in equilibrium.[27] In such homogeneous groups, the optimum for the employee with median preferences is also the optimum for all other group members. Hence, no employee will be motivated to change union group. It may be seen that any equilibrium in which the members of the union groups are heterogeneous in their preferences for PHI is unstable as follows. Assume that there are two types of employees who differ with respect to their preferences for PHI and that the optimal number of union groups is two. If the employees are evenly divided between the groups, the median preferences in both groups will be the same, and so will the level of PHI provided by employers. However, if one of the groups were to provide a slightly higher level of PHI benefits than the other, it would attract one type of employees and reject the other type. This process will continue until a stable equilibrium is established, in which the groups are homogeneous.

Unions as well as employers may benefit from aggregating preferences into single purchasing groups rather than offering multiple plans each enrolling a smaller number of employees for several reasons (Bundorf 2002). For one thing, offering multiple plans lowers the benefits from risk pooling, and it implies that unions may forego economies of scale in administrative costs and incur additional costs from contracting with multiple suppliers and collecting employee premium contributions. Moreover, favourable tax treatment of PHI is often contingent upon satisfying rules intended to guard against discrimination in favour of highly compensated employees.

The framework of the union choice model is applicable to employer provision of VPHI in universal health care systems, although this generalisation of the model is subject to the reservation that the employees' preferences for including VPHI in the compensation package, and thus also the focus of the unions, are most likely less pronounced in such a setting.

The union choice model differs from the framework of compensating wage differential in that unions are assumed to aggregate the preferences of the actual staff of employees only, while the compensating wage differential framework assumes that firms minimize their total labour costs subject to keeping the firm competitive in the labour market, i.e. taking the preferences of potential future employees into account also. Another difference is that the insurance premiums are not passed on to the employees in the form of lower wages in the type of models that consider the employers' provision of PHI as determined as an

[27] The preferences of some types of employees will be weighted more heavily than others depending on which voting rule is applied. Majority voting implies that the preferences of the median employee determine the provision of PHI. Given that the distribution of wages is bounded below (either by zero or by the minimum wage), the median wage is virtually always below the average wage. Hence, in general, a model that uses majority voting will weight the preferences of lower income employees more heavily than a model that determines on the provision of PHI based on the preferences of the average employee (Glied and Zivin 2004).

aggregate of employee preferences (Glied and Zivin 2004). Hence, the two approaches to firm decision making do not necessarily lead to the same outcome. Finally, the union choice model fundamentally differs from decision making based on compensating wage differentials in that the decision of providing PHI as part of the compensation package is assumed to be made by unions rather than employers. In this regard, it is noted that a common critique of the union choice model is that it is debatable how closely the mechanism used to determine the employers' provision of PHI resembles actual decision making processes within companies. In particular, the assumption that unions arbitrarily decide on the employers' provision of PHI has been argued to be unrealistic (Goldman and Pauly 1976).

3.2.4 The health capital approach

The employers' decision to purchase PHI may also be considered within the framework of the model developed by Bolin et al. (2002). Bolin et al. (2002) extended the health capital approach of Grossman (1972) to include employers and found that they may also have substantial interest in investing in the health of their employees, given that employees who are off work sick are costly in terms of sickness benefits and lost labour. The channels through which employers are expected to invest in the health of their employees were not explicitly considered by Bolin et al. (2002). However, it may reasonably be argued that one option is for employers to purchase PHI on behalf of their employees. The model developed by Bolin et al. (2002) assumes that the employer invests in the health capital of the employee up to the point where the marginal gain in profit from doing so equals the net marginal cost to the employer. The marginal benefit of an investment in health is shown to depend on the technology used in the employer's production, i.e. whether it is labour or capital intensive, as well as government regulation. Hence, governments can encourage employers to invest in the health of their employees e.g. by making this subject to preferential tax-treatment. Moreover, in an uncertain world, risk averse employers are predicted to make larger investments in the health of their employees (e.g. by taking out PHI) than they would in a perfectly certain world (Bolin et al. 2002).

3.2.5 Effects of employer provision of private health insurance on labour market outcomes

Finally, employers may include PHI in the compensation package even in the absence of employee demand for it, if potential labour market effects of PHI imply that doing so is more profitable than offering wages alone. An important labour market outcome which may be affected by employer provision of PHI is job turnover. In the standard model of job turnover, individuals change job when the value of an alternative job exceeds that of the current job. When PHI is attached to the job, however, turnover involves not only changing jobs, but also changing insurance. Hence, the relative levels of benefits and costs of the PHI available from different employers may reasonably be expected to impact the job choices of employees and to reduce the overall turnover of staff if there are transaction costs associated with shifting insurer (Currie and Madrian 1999). The effect on job choices, and thus also on the turnover of staff, is likely to be much smaller (or even non-existing) for VPHI that co-exists with universal health care systems than for PHI that provides the primary source of coverage. Another reason that it may be profitable for employers to include PHI in the compensation package regardless of whether employees demand it or not is in order to protect themselves against the cost and uncertainty imposed by sickness absence, assuming that people get back to work quicker with PHI coverage. This argument is central in the employers' decision to offer duplicate VPHI in settings where the main benefit this is quicker access to some elective procedures than is available within the universal health care systems (Borchsenius et al. 2010; Pedersen 2011). Following this line of thinking, Grepperud and Iversen (2011) have argued that companies with a large share of employees in bad health and those operating in industries exposed to considerable health risks may be relatively more inclined to purchase duplicate PHI, i.e. adverse selection at the company level. The argument was put forward in the context of duplicate VPHI. As for adverse selection at the individual level, this relationship is based on an assumption of asymmetric information implying that the price at which insurance is offered to a company does not increase proportionally with its expected use of the insurance. Another implication is the possibility that companies using specialised labour, which is usually highly paid and hard to replace in the case of illness, are more likely to invest in the health of their employees by taking out PHI, again assuming that PHI reduces sickness absence. These potential effects of PHI on labour market outcomes are not explicitly taken into account in the framework of compensating wage differentials or the union choice model.

Finally, employers may use PHI to encourage self-selection of attractive employees into the company, if the preferences for employment-based PHI are correlated with other desirable characteristics (Currie and Madrian 1999). For example, it may be the case that employees with children have stronger preferences for PHI and are also less mobile. Thus, employers can attract employees who seek to establish a long-term employment relationship by offering PHI. However, employer provision of generous PHI may also lead to adverse selection of employees in bad health into the company, if the employees who have the strongest preferences for PHI are the ones who need it the most. In this case, it may be worthwhile for employers to provide less extensive PHI coverage than the amount that would minimise labour costs, in order to avoid attracting an extraordinary high share of unhealthy employees.

3.3 Effects of private health insurance on health care use

This section accounts for how a number of novel theoretical contributions in economics predict that private health insurance may change preventive behaviour and increase the use of covered health care services through various channels.[28] Like most of the literature on private health insurance, the theoretical framework for analysing how private health insurance affects the use of health care services was

[28] In this regard, it is noted that while the standard theoretical approach to modelling the demand for health care services is the Grossman (1972) model, in which individuals are assumed to invest in health capital and demand health care services in a similar way as they invest in human capital, a shortcoming of this approach is that the risk aspect of the demand is not included. Hence, this branch of the theoretical literature is not pursued further hear.

developed exclusively within the setting of PHI, but is applicable to VPHI in universal health care systems to varying degrees.

The section is organised as follows. Section 3.3.1 assumes that individuals can affect their probability of falling ill and discusses how PHI may lead to a reduction in preventive efforts in this case through ex ante moral hazard. Section 3.3.2 accounts for how PHI may induce ex post moral hazard in the use of health care services for which the demand is price elastic by lowering the price patients are facing at the point of use, which is probably the most cited reason for PHI to lead to higher utilization levels. While ex ante moral hazard refers to the effect of PHI on actions the individual takes before his state of health is known, ex post moral hazard refers to the behaviour of individuals once the health state is known (Zweifel and Breyer 1997). Section 3.3.3 describes for how PHI may increase the use of health care services through financial risk reductions, i.e. because the desired level of utilization is greater under the financial certainty created by insurance than under uncertainty. Along a similar line, section 3.3.4 accounts for how PHI that provides a fixed amount of money in the event of illness may also increase the use of health care services by transferring income from the healthy to the ill. An important distinction between ex post moral hazard and the effects described in sections 3.3.3 and 3.3.4 is that while moral hazard occurs only for PHI that covers actual medical expenditures, thereby reducing the price that patients are facing at the point of use, the latter are shown to also occur for PHI that provides a fixed amount of money in the event of illness, i.e. indemnity insurance. While the emphasis of the section is on consumer incentives, section 3.3.5 accounts for how PHI has the potential to affect the use of health care services by affecting the behaviour of doctors acting on behalf of their patients, i.e. supplier-induced demand. Finally, section 3.3.6 discusses the relevance of the various mechanisms through which private health insurance may affect the use of health care services in relation to VPHI that co-exists with a universal health care system. This section also accounts for how institutional barriers and various restrictions in the coverage provided by the private insurers may moderate the effect of VPHI.

Empirically, it is not straight forward to distinguish between the various mechanisms that may cause PHI to affect the use of health care services. Hence, the stringent categorisation of the various effects expressed in this section may reasonably be regarded as a theoretical construction, which is nevertheless interesting, given that the welfare consequences of additional use differ for some of the mechanisms. Which of the effects dominate in practice depends on the particular setting.

3.3.1 Ex ante moral hazard

Assuming that individuals can influence their probability of falling ill by undertaking various preventive and self-protective efforts, ex ante moral hazard entails the possibility that PHI reduces the incentives for prevention (Pauly 1986). The scope for ex ante moral hazard may be shown to depend crucially on whether insurance premiums reflect preventive activities (Ehrlich and Becker 1972; Zweifel and Breyer 1997). If insurance premiums reflect the effort devoted to prevention and self-protection, the privately insured have the correct incentives to devote resources to prevention, because this reduces the price of insurance. In contrast, if insurance premiums do not reflect the efforts devoted to prevention, the presence of PHI may reduce the extent of prevention undertaken, thereby creating ex ante moral hazard. Hence, ex ante moral hazard stems from an informational asymmetry that occurs because the insurers cannot observe the actions undertaken by their customers, or are not allowed to use this information in setting their premiums.

In general, it is debatable how well the theoretical prediction of ex ante moral hazard applies to PHI covering adverse events with severe non-monetary consequences (Kenkel 2000). The line of reasoning goes as follows. Even if the individual has full coverage for the monetary components of the loss related to illness (i.e. medical expenditures and foregone earnings), there will most likely still be an uninsurable utility loss in the case of illness. One reason for this is the pain and suffering that is usually associated with illness, which cannot be insured against. Another reason is that medical care cannot always restore an ill individual to perfect health. The presence of these non-monetary consequences of illness, which cannot be insured against, suggest that the scope for ex post moral hazard, where PHI disturbs the incentives to invest in prevention, is most likely small. Nevertheless, some individuals might still be at the margin where having PHI matters to their prevention decisions.

Ex ante moral hazard may be interpreted as an externality in the sense that the single insurance taker does not take into account the effect of his or hers preventive efforts on the premiums paid by the other members of the insurance pool (Gravelle 1986).[29] Given that the monetary benefits of prevention are external to the single individuals but impose a negative externality on the insurance company, a market solution to the presence of ex ante moral hazard is for insurance companies to invest directly in prevention. This insight may be used to explain why some employers offer health schemes and insurance policies covering preventive health care. To the extent that employers take on the risk of productivity losses caused by health problems and sickness absence, this provides an incentive to invest in the preventive and self-protective efforts of their employees (Kenkel 2000).

Moreover, if the individuals differ on multiple dimensions that jointly determine the purchase of PHI and preventive efforts, the privately insured may exhibit more prevention. As discussed in section 3.1.3, one possible source of such advantageous selection into VPHI is risk aversion, with the hypothesis being that the more risk averse individuals are both more likely to purchase PHI and to undertake prevention. In addition, extending the framework to allow for the purchase of PHI that covers preventive health care services, it may reasonably be expected that PHI increases the amount of prevention as a result of the substitution effect described in section 3.3.2 (Zweifel and Manning 2000). The theoretical prediction of the relationship between prevention and PHI coverage is thus ambiguous.

[29] While most analyses implicitly assume that PHI reduces the efforts devoted to prevention below what is socially optimal, the externality caused by ex ante moral hazard could in theory be both positive and negative (Kenkel 2000).

Hence, ex ante moral hazard is considered a theoretical option that cannot be ruled out for PHI as well as VPHI in universal health care systems, although not subject to considerable concern, given the severe non-monetary consequences associated with illness, which cannot be insured against.

3.3.2 Ex post moral hazard

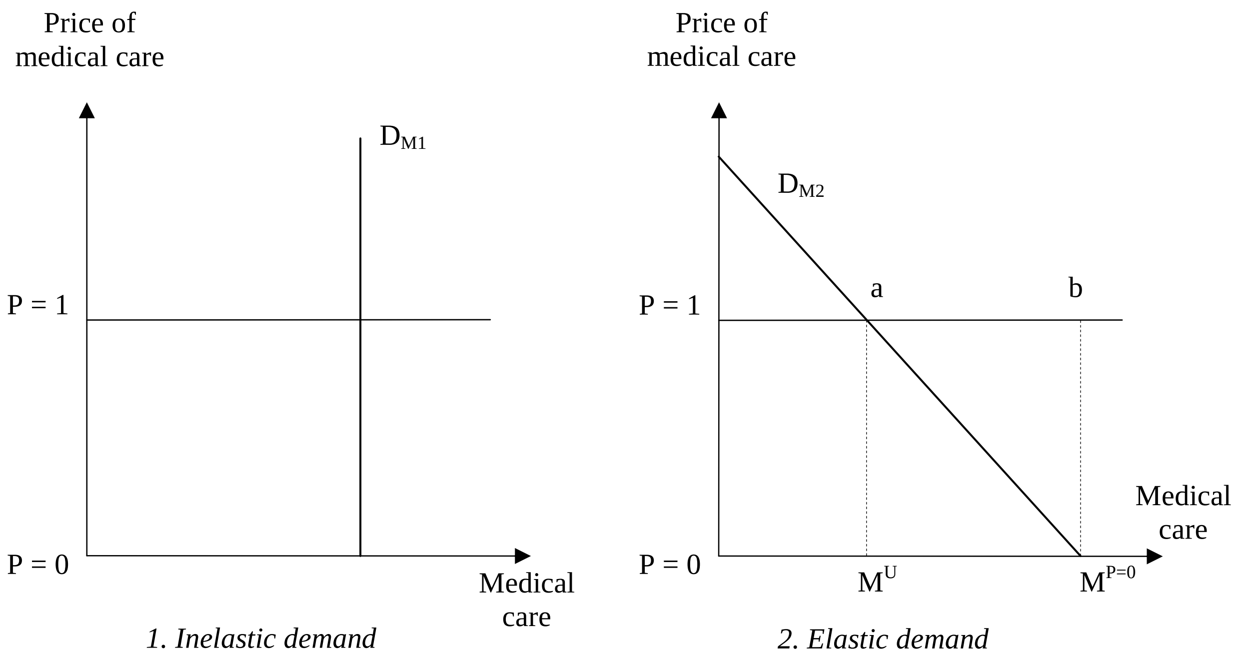
In many cases insurance contracts that provide a fixed amount of money in the event of illness, i.e. indemnity insurance, are not practically feasible. The reason for this is that medical needs are not fully monitorable, and that different individuals with the same illness may have different optimal medical expenditures, at least as far as the insurance company can tell. Instead of indemnity insurance, insurance companies thus tend to offer PHI contracts that cover the actual medical expenditures fully or partly, thereby using medical expenditures as a signal of the true medical needs (Cutler and Zeckhauser 2000). This implies that individuals are not facing the full cost of their use at the point of demand.

Within this setting, economic theory predicts that private health insurance induces ex post moral hazard in the use of health care services for which the demand is price elastic by lowering the price that patients are facing at the point of use, thereby leading to higher utilization levels (Arrow 1963; Pauly 1974). In the terminology of economic demand theory, ex post moral hazard may thus be classified as the substitution effect of people spending more money on health care when its price is reduced by PHI. Hence, despite the somewhat unfortunate terminology, ex post moral hazard is not some sort of moral failure, but rather a rational response to an economic incentive.

Along a similar line, it may be argued that the presence of PHI may also affect the type or quality of medical care that individuals choose to receive, assuming that the demand for quality is price elastic. This effect of PHI on the use of health care services is termed ‘qualitative’ moral hazard (Pauly 1983).

Figure 3.6 shows the effect of the price change caused by PHI on the use of health care services for different price elasticities of the demand. In the left side of Figure 3.6, the demand for medical care is assumed to be perfectly inelastic. This is reflected by a vertical Marshallian demand curve denoted by D_{M1}. In this case, the individual is seen to use M^U medical care regardless of the price, i.e. there is no moral hazard. Examples of health care services for which the demand may reasonably be expected to be price inelastic are bypass operations, chemotherapy, and other major treatments that are necessary in order to survive but constitute considerable health risks themselves. In the right side of Figure 3.6, the demand for medical care is elastic; that is, the quantity demanded varies inversely with price. This is reflected by a vertical Marshallian demand curve denoted by D_{M2}. With elastic demand and PHI that reduces the price of medical care to P = 0, the individual uses additional ($M^{P=0}$- M^U) medical care because the marginal price to the individual is zero. This additional use is ex post moral hazard. Hence, the price elasticity of the demand may be used as an indicator of the potential for moral hazard.

Figure 3.6 Demand for health care services and ex post moral hazard



Source: Folland et al. (2007), p. 165.

Moreover, it is seen from Figure 3.6 that the marginal cost of producing the care exceeds the willingness to pay for all units of care above M^U. Hence, ex post moral hazard may also be defined as additional use which is valued less by the individual than the cost of producing it (Pauly 1983). Considering the welfare consequence of additional health care use that is due to moral hazard by comparing the gain from receiving the care $M^U aM^{P=0}$ to the cost of producing the care $M^U abM^{P=0}$, it is clear that this will always be negative. It may thus be argued that PHI gives rise to a tradeoff between the benefits of risk spreading, as accounted for in section 3.1.1, and the costs of moral hazard.

However, despite the fact that moral hazard inserts a ’wedge’ between the costs associated with medical care and its price, the presence of moral hazard in itself does not necessarily mean that there is some correctable inefficiency. It may well be optimal to have PHI cover the incurred medical costs rather than some exogenous indicator of health in the cases where health is difficult to monitor correctly, and the effect of treatment is uncertain (Pauly 1983). Hence, ex post moral hazard may be regarded as something that reduces real income but cannot always be corrected. In addition, another issue related to the evaluation of the welfare loss caused by ex post moral hazard is that given market solutions are not always considered optimal within the health area, it is not clear that this situation should necessarily be used as a benchmark for efficiency. In particular, the presence of altruism, equity considerations, and fiscal externalities may well imply that the optimal use of health care services for the individual is not necessarily where demand intersects with marginal costs.

3.3.3 Financial risk reduction

Besides ex post moral hazard, PHI may also be shown to increases the use of health care services through risk reductions, i.e. because the desired level of health care use is greater under the financial certainty created by PHI than under uncertainty (de Meza 1983; Vera-Hernández 1999). This effect has been shown to occur for indemnity insurance that provides a fixed amount of money in the event of illness, i.e. it differs fundamentally from the ex post moral hazard effect of people spending more on health care when its price is reduced.

The intuition behind the mechanism that causes PHI to increase the use of health care services through risk reductions may also be thought of as follows. Consider an uninsured individual. He could be suffering from an illness, but chooses not to seek medical care today in order to avoid feeling worse tomorrow and already having used his income endowment. With PHI, however, the individual would have sought medical care today (Vera-Hernández 1999).

De Meza (1983) formalised the effect of risk reductions in a simple two-period model where individuals have access to a perfect capital market which may provide a substitute, althout imperfect, for PHI. The probability of falling ill is assumed to be exogensouly given and uncorrelated across the two periods. Solving this model for the two periods and comparing the use of medical care with and without PHI, respectively, de Meza (1983) found that in most cases the use of medical care in the ill state was higher with PHI, assuming that medical care is a normal good. However, it is possible to find cases where the expected demand for medical is higher without PHI when the probability of falling ill exceeds 50 percent in the two-period model. To see this, consider an individual who is healthy in the first period. When the probability of falling ill exceeds 50 percent, such an individual is guaranteed to suffer less than an average amount of illness over a lifetime. Hence, if illness strikes in the second period, savings allows for higher health care costs than would be possible if the individual had paid a fair insurance premium in both periods.

Finally, it is noted that Pauly (1983) has showed that assuming a constant propensity to devote income to health care services regardless of health within the population; it is possible that PHI does not have any risk reduction effects on the use of health care services at all on the aggregate level. However, with no empirical evidence suggesting that the demand for health care services takes this form, and knowing that other demand functions (e.g. constant income elasticity) lead to a positive income effect, this argument as to why risk reduction is not important does not appear to be very strong.

3.3.4 Income transfer

PHI has also be shown to increase the use of health care services by creating an ex post transfer of income from the healthy to the ill (Pauly 1968; Nyman and Maude-Griffin 2001; Nyman 2003). This income transfer is what causes PHI to have access value, as discussed in section 3.1.1.1.

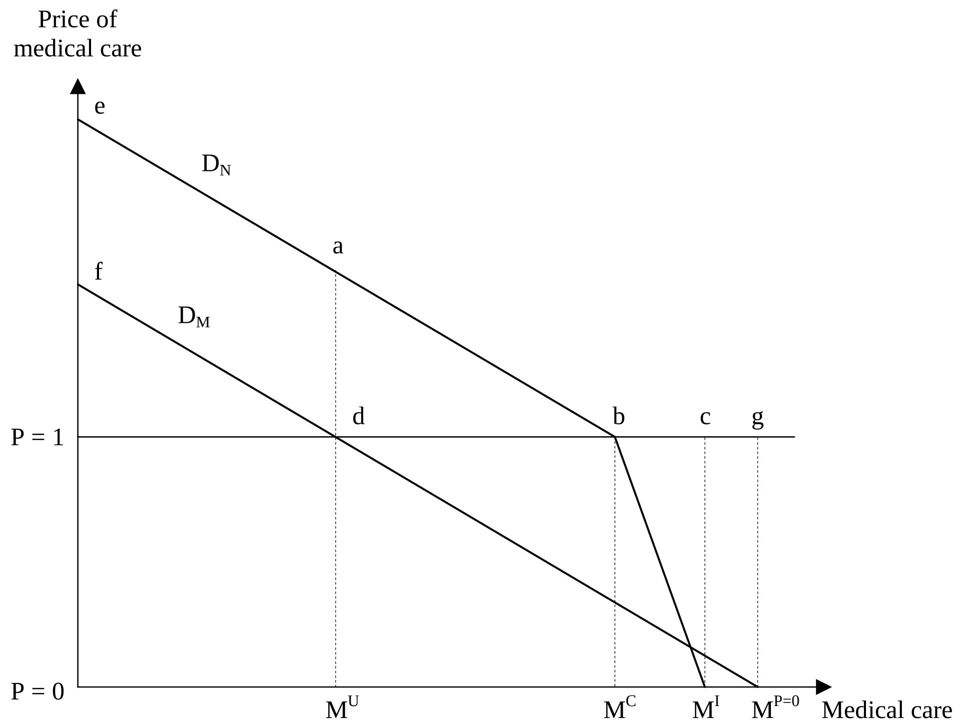
The framework used to illustrate ex post moral hazard in section 3.3.2 assumed that individuals change their use of health care services by moving along the Marshallian demand curve. No distinction was made between individuals who fell ill and those who remained healthy. The framework outlined in this section assumes that some individuals pay the insurance premium, remain healthy, and do not use any additional health care services.[30] For example, if the probability of falling ill within a given period is 0.25, then for every four individuals with PHI, three would transfer income to the one who fell ill. Assuming that the use of health care services increases with income, which seems plausible, part of the use of medical care among the ill individuals is attributable to the transfer of income from those who pay the insurance premium but do not have any claims.

The conceptual difference between ex post moral hazard and the increase in use due to an income transfer may be through of as follows. The thought experiment is whether an individual would pay the expected cost of a treatment before knowing his health state. For example, assume that an individual has an income of $25,000 and faces a one percent risk of falling ill. If it was possible to contract for a specific amount of treatment in advance of falling ill, the individual would choose to receive $50,000 worth treatment when ill in return for paying an insurance premium of $500. With PHI that reduces the cost of treatment to zero the same individual would, however, use medical care worth $60,000. The ex post moral hazard in this example is $10,000, which is the additional use over the optimal amount of treatment that the individual would contract for in advance of falling ill. The remaining overuse is due to the income transfer.

Figure 3.7 shows the effect of the income transfer on the use of health care services. D_M is the Marshallian demand curve for an uninsured ill individual, who is seen to use M^U medical care. D_N is the demand curve for an ill individual with PHI that pays off by reducing the price of health care services to zero. For a wide range of health care services, it may reasonably be argued that the willingness to pay when healthy provides an inappropriate measure of their true value, while the willingness to pay when ill and insured most likely provides a better estimate (Nyman 2003). Hence, PHI causes the demand curve to shift out, assuming that the individual has a greater willingness to pay for medical care when ill, and that PHI enables him to pay for it due to the income transfer, as discussed above.

[30] Or more realistically, there is a distribution of health care use where individuals in the upper end of the distribution receive a net transfer and individuals in the lower end of the distribution make a net payment.

Figure 3.7 Demand for health care services and the income transfer



Source: Nyman (2002), p. 117.

It is seen from Figure 3.7 that the income transfer causes the individual to use additional (M^C - M^U) medical care. Moreover, because the insurance contract pays off by reducing the price of PHI, the individual demands additional (M^I - M^C) medical care, but the willingness to pay for this additional care reflects the reduced income from paying the premium. Hence, the new demand curve D_N is kinked at the point b, where the willingness to pay after the income transfer equals the price for medical care without PHI. If the price of medical care had dropped exogenously to zero, it is seen from Figure 3.7 that the individual would demand $M^{P=0}$ medical care. This is more than the individual with PHI, because the payment of the insurance premium which is required to reduce the price to zero reduces the income that is leftover to use on medical care.

It is seen from Figure 3.7 that the willingness to pay when insured exceeds the marginal cost of producing the care for all units of care up until M^C induced by the income transfer, but are less than the marginal cost for the additional (M^I - M^C) units of care that are due to the price effect, i.e. ex post moral hazard. The total welfare effect of the additional use of medical care induced by PHI is assessed by comparing the gain from receiving the care $M^U abM^I$ to the cost of producing the care $M^U dcM^I$. Which of the two areas is the larger one depends various factors, among others the price and income elasticity of the demand. Hence, while it may be argued that the income transfer is merely a reinterpretation of the increase in use due to ex post moral hazard, it is clear that the welfare consequences of the income transfer are not captured by Figure 3.6.

Finally, it is noted that the analysis of the income transfer in this section takes its point of departure in an ill individual, i.e. there is no uncertainty, expected utility theory, or contingent claims. Hence, the size of the income transfer also depends on the probability of falling ill. In particular, illnesses that occur with a small probability give rise to large income transfers, while illnesses that occur on a more frequent basis are associated with smaller income transfers. There is no income transfer if the probability of falling ill equals one (Nyman 2003). Hence, for health care services which are used on a frequent basis and primarily associated with minor illness, such as medical check-ups, prescriptions, dental care and the like, the effect of the income transfer may reasonably be argued to be small or even negative (Pauly 1983).

3.3.5 Supplier induced demand

The individual demand for medical care is assumed to be determined by both supply and demand side factors. The effects of PHI on the demand side were considered in sections 3.3.2 to 3.3.4. This section considers the supply side, where doctors have the opportunity to induce demand because, as in other markets for credence goods, i.e. goods whose utility impact is difficult or impossible for the buyer to ascertain, there are most likely considerably information asymmetries (Jürges 2007). In particular, doctors are better informed about necessary and appropriate diagnoses and treatments than their patients, which is why the patients come to see them in the first place. In health economic terms, supplier induced demand does not include doctors inducing appropriate tests and treatments, but only tests and treatments that are not medically indicated (including flat-of-the curve medicine) and are only suggested in order to increase profits (Jürges 2007).

Supplier-induced demand is most likely to arise in a payment system with fee-for-service, where doctors can generate additional income by inducing demand (Evans 1974). Inducement may occur after the patients have contacted the doctors, when the doctors inform the patients about their health status and suggest a treatment. At this stage, doctors have the opportunity to generate additional income from inducing demand, although usually at some price in terms of disutility from doing so. In fee-for-service systems where the fees are higher at private hospitals or when treating privately insured patients, doctors are given an additional incentive to induce demand among the privately insured patients (Jürges 2007). Moreover, the scope for inducing demand may be argued to be better among the privately insured patients. The reason for this is that at the next stage, where the patients decide on their compliance with the recommendations of the doctor (also known as the frequency decision), the privately insured patients may have lower opportunity costs because of preferential treatment. Hence, it is possible that part of an observed increase in the use of health care services is attributable to supplier induced demand for PHI as well as VPHI in universal health care systems.

3.3.6 Application to voluntary private health insurance in universal health care systems

It is relatively straight forward to generalise the various ex ante demand side mechanisms accounted for in sections 3.3.2 to 3.3.4 to model the effect of complementary and supplementary VPHI on the use of covered health care service, while the effect of duplicate VPHI are more complicated.

3.3.6.1 Complementary and supplementary VPHI

Along the lines of section 3.3.2, complementary and supplementary VPHI may be shown to induce ex post moral hazard in the use of covered health care services by lowering the marginal price that patients are facing at the point of use. The extent to which this occurs depends on the price elasticity of demand. Moreover, the presence of institutional barriers such as gatekeepers and various restrictions in the coverage provided by the private insurers may moderate the effect of VPHI. However, potential for complementary and supplementary VPHI to increase the use of health care services through financial risk reductions and income transfers as described in section 3.3.3 and 3.3.4, respectively, is most likely of minor importance. Firstly, for complementary and supplementary VPHI to increase the use of covered health care through an ex post transfer of income from the healthy to the ill, the copayments or the costs of the services excluded from the universal health care system would have to be greater than the financial resources of the individual. Although this could happen in countries where copayments make up a large share of the total health expenditures or the coverage provided by the universal health care system is sparse, it is most likely not the case very often. Secondly, it is noted that the scope for the risk reduction discussed in section 3.3.3 to increase the use of health care services is decreasing with the probability of contracting an illness for which the treatment is covered by VPHI. Hence, to the extent that complementary and supplementary VPHI covers routine services that are used on a frequent basis and primarily associated with minor illness, such as medical check-ups, prescriptions, dental care and the like, ex post moral hazard may reasonably be expected to be the dominant effect on the demand side.

3.3.6.2 Duplicate VPHI

Assessing the effect of duplicate VPHI on the use of health care services is less straight forward, given that this type of VPHI does not cover forced financial losses in the same sense as PHI, but rather treatments at private facilities which are also available free of charge within the universal health care system.

Considering first the effect of duplicate VPHI that covers diagnostics and elective surgery at private hospitals for procedures that are subject to some waiting time when provided through the universal health care system, this may be argued to depend on among other things the institutional setting and the conditions of coverage. When the indications for treatment are the same whether treatment is financed through the universal health care system or by duplicate VPHI and the demand for care is time inelastic, i.e. demand for a given treatment does not depend on the waiting time, there is no reason as to why duplicate should VPHI increase the use of health care services. Instead, it is possible that duplicate VPHI causes substitution by shifting use from the universal health care system to privately paid contacts, while the total use of health care services stays the same. On the contrary, it is clear that duplicate VPHI has the potential to induce moral hazard in the use of health care services if the indications for treatment differ for private insurance patients or the demand for care is time elastic, which is possible for some elective procedures. Like for complementary and supplementary VPHI, institutional barriers and various restrictions in the coverage provided by the private insurers may, however, moderate this effect.

Next, considering duplicate VPHI that covers access to specialist care without prior referral from a general practitioner, its effect on the use of health care services is argued to be ambiguous due to two opposing effects (Vera-Hernández 1999). On the one side, this type of duplicate VPHI may reasonably be expected to increase the use of health care services mainly through ex post moral hazard as described in section 3.3.2. On the other side, it is also possible to think of situations where the heterogeneity in visits between different types of providers implies that duplicate VPHI reduces the use of health care services as measured by the number of visits. For example, consider the case of a patient without duplicate VPHI who has visited a medical specialist within the universal health care system. If this patient is disappointed about the received treatment, he may decide to also visit a private specialist and pay the full price for this out-of-pocket. On the contrary, patients with duplicate VPHI are more likely to choose their preferred provider the first time around, which implies that they use less health care services as measured by the number of visits in this particular example. It should, however, be emphasised that such behaviour is only possible for health care services for which it makes sense to receive the same service repeatedly. Hence, for elective surgery at private hospitals, heterogeneity in the services provided at public and private hospitals, respectively, is thus not expected to reduce the use of health care services among the privately insured.

In addition to generating moral hazard in the use of the covered health care services, VPHI, duplicate as well as supplementary and complementary, may also increase the use of health care services within the universal health care system for reasons discussed in section 4.2.2.5. This effect of VPHI is referred to as public moral hazard in the literature (Folland et al. 2007; Stabile 2001).

The welfare consequences of VPHI in universal health care systems are thus considerably more complex than those of PHI that provides the primary source of coverage due to to the various mechanisms discussed in this section. Moreover, additional complexity is added in section 4, which surveys the various pros and cons associated with VPHI in universal health care systems.

4 Pros and cons of voluntary private health insurance in universal health care systems

This section outlines the pros and cons of private health insurance that is purchased on a voluntary basis in addition to the coverage provided by a universal health care system (VPHI) and discusses the extent to which the various arguments and theoretical predictions are supported by empirical evidence. The section is not intended to constitute an exhaustive review of the literature, but rather to provide a background for placing the findings of the present thesis into a broader perspective. As noted in section 3, the theoretical literature on VPHI is limited compared to that on PHI that provides the primary source of coverage.

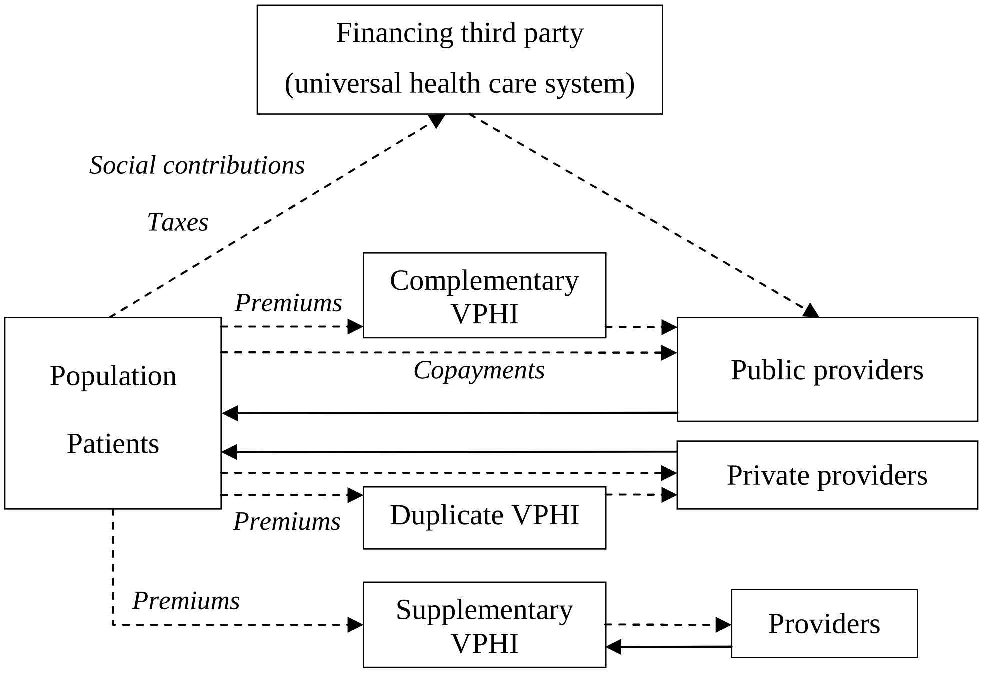
In accordance with the functional classification outlined in section 1.1.1, VPHI is classified as complementary, supplementary or duplicate in relation to the coverage provided by the universal health care system in this section. Duplicate VPHI covers treatments at private hospitals for treatments that are also available through the universal health care system. Given that duplicate VPHI is most frequently used to cover elective surgery at private hospitals, this is considered as default in the following. Complementary VPHI covers copayments for treatments that are only partly financed by but delivered within the universal health care system. Supplementary VPHI covers treatments that are excluded from the universal health care system. The exact nature of the types of health care services covered by supplementary VPHI varies considerably across countries.[31]

The alternative functions that VPHI may have in relation to a universal health care system are illustrated within the framework of the medical triad in Figure 1.1. Compared to the original medical triad, Figure 1.1 is extended to include both public and private health care providers, as well as private insurers offering complementary, supplementary, and duplicate VPHI, respectively. Figure 1.1 shows that patients contribute to the tax-financed health care system through taxes or social contributions. The universal health care system reimburses a set of public providers for treating the patients when ill. In this regard, it is noted that the distinction between public and private providers is based on the source of financing in Figure 1.1. The public providers are defined by being paid by the universal health care system, complementary VPHI, and private copayments in returns for medical care. The private providers are paid by duplicate VPHI and private payments, and they are parallel to the universal health care system in the

[31] Supplementary VPHI is used to cover an extraordinarily wide range of rather different health care services across countries, including dental care, pharmaceuticals, rehabilitation, long-term care, amenity hospital services (where the medical part of the treatment is covered by the universal health care system), alternative medicine, and fertility treatment (OECD 2004).

sense that they offer treatments which are covered by the universal system when delivered by public providers.

Figure 1.1 The medical triad modified to account for VPHI



Source: Modified version of Cutler and Zeckhauser (2000), p. 566.
Note: Dashed lines represent money flows; solid lines represent service flows.

Like any other conceptual framework, Figure 1.1 simplifies the reality in some respects, the main difference between Figure 1.1 and actual health care systems being that there is usually some extent of overlap between the different groups of health care providers. Publicly paid patients may be treated by private providers under various circumstances, and duplicate VPHI patients may be treated at private wards in public hospitals in several countries (Mossialos and Thomson 2002). Moreover, the set of providers delivering the care financed by supplementary VPHI are difficult to define accurately due to the large variations in the types of health care services covered by supplementary VPHI across countries. These complications are deliberately excluded from Figure 1.1 and subsequent discussions, given that their inclusion is not expected to provide additional insight in relation to the purpose of this thesis. Finally, the facts that VPHI premiums are often paid for by employers and may be subject to preferential tax treatment are omitted in Figure 1.1. The issues that this may give rise to are, however, discussed continuously throughout the section. Within the framework of Figure 1.1, it is noted that the focus of the present thesis is on complementary and duplicate VPHI, and on the flows of health care services than runs from public and private providers to the patients.

In the following, the various arguments and theoretical predictions found in the literature on private health care financing, including both copayment and VPHI, as well as the literature that specifically addresses VPHI, are identified. In addition, theoretical contributions considering the welfare effects of combining a universal health care system with a parallel private health care sector which may be accessed either by direct payment or duplicate VPHI are also discussed.

The section is structured as follows. Section 4.1 lays out the arguments in favour of the different types of VPHI and reviews the theoretical literature on combining universal financing with a parallel private sector. Section 4.2 accounts for the arguments against VPHI, including various channels through which VPHI may be argued to adversely affect the performance of universal health care systems. Section 4.3 accounts for some equity considerations related to VPHI. Finally, the various pros and cons of VPHI are summarised and discussed in section 4.4.

4.1 Advantages of voluntary private health insurance

It is evident that VPHI places the privately insured in a better position in terms of access to medical care. Complementary and supplementary VPHI shields the insurance takers from unwanted financial risk and possibly also allows for greater use of health care. Duplicate VPHI covering treatments at private providers increases the freedom of choice relative to what would be possible within the framework of a universal health care system and provides quicker access to treatment for some. In addition, duplicate VPHI has also been argued to benefit the individuals who remain to be treated within the universal health care system for various reasons, which are discussed in sections 4.1.1-4.1.3.

4.1.1 Public hospital waiting times

From a societal perspective, one of the main arguments in favour of duplicate VPHI is that it has the potential to reduce the waiting time for treatment at public hospitals by shifting the insured to private hospitals. More precisely, common sense prompts that if the indications for operation at public and private hospitals are the same, then one hip replacement performed at a private hospital will inevitably reduce the waiting list correspondingly at a public hospital. In this way, VPHI may be argued to benefit the privately insured as well as those who remain to be treated within the universal health care system. Moreover, duplicate VPHI may be argued to increase the total capacity of the health care system by bringing additional resources into the system.

The empirical evidence on whether duplicate VPHI actually relieves the pressure on universal health care systems is sparse and plagued by methodological problems, in particular with regards to identifying VPHI as the main cause of an observed change.[32] However, a recent study based on register data from Denmark

[32] Examples of factors that may affect the waiting time for treatment at public hospitals are changes in the demand for health care services following demographic changes, movements in the expectations and the indications for treatment, supply side changes induced by the introduction of new technologies, general efficiency improvements, strikes, and various regulatory initiatives (see Hurst and Siciliani (2003) for a thorough review).

and using propensity score matching found that employment-based duplicate VPHI policies reduce the use of selected tax-financed hospital services, both overall and at the operation level (Søgaard et al. 2011). All else equal, this may be equated with a negative effect on the waiting time for treatment at public hospitals.

4.1.2 Redistributional effects

Besley and Coate (1991) have shown theoretically that universal provision of a private good combined with a parallel private sector primarily used by the better off can redistribute income from the rich to the poor. The ‘price’ of the redistribution is that the quality of the public providers cannot exceed that of the private providers. Assuming that the quality of the public providers is lower than that of the private providers, some individuals will choose to opt out of the universal system by paying for obtaining a higher quality in the private sector. However, these individuals continue to contribute to the financing of the universal system by paying taxes or social insurance contributions. Assuming that quality is a normal good, the individuals who opt out of the universal system will be those with higher incomes. In this way, the presence of a parallel private sector implies that the benefits of the universal system are enjoyed exclusively by the low-income individuals but paid by all. The Besley and Coate (1991) model does not take into account that the parallel private sector may generate inequity in the access to the private good in question as discussed in section 4.3.

Along a similar line, Hoel and Sæther (2003) developed a theoretical model specific to the health care system where the quality dimension of the good is defined as waiting time for treatment. Assuming that the presence of waiting time within the universal health care system induces patients with high waiting costs to seek private care, Hoel and Sæther (2003) found that the patients who remain to be treated in the universal health care system are better off with some waiting time for treatment and a parallel private sector than they would have been in a purely universal system. The critical assumption is that the individuals who are treated at private hospitals use less public hospital treatment, i.e. that the privately provided services substitute the publicly provided, thereby reducing the cost of the universal health care system. If this condition holds, even if it was possible to eliminate the waiting time for treatment within the universal health care system at no cost, the redistribution of income facilitated by the better off opting for treatment at private providers means that it may still be socially optimal to maintain some waiting time for treatment in the universal health care system and allow for a parallel private sector (Hoel and Sæther 2003).

To the best knowledge of the author, there is no empirical evidence on the magnitude of the redistributional effects discussed above. Moreover, it is questionable whether such can be produced.

4.1.3 General welfare effects

Another branch of the theoretical literature has considered the theoretical welfare effects of a universal health care system combined with a parallel private health care sector which may be accessed either by direct payment or duplicate VPHI.

Epple and Romano (1996) developed a public choice based model of public provision of private goods and found that universal provision with no restrictions on parallel private provision was preferred by a majority of voters over either only universal provision or market provision. The intuition behind this result is that combining universal provision with private provision, the higher income voters will prefer a lower level of spending on the universal health care system than otherwise and top up with private purchase. Permitting parallel private provision thus moves the median voter down the distribution of health care service demand. The individuals with a low willingness to pay for health care in general will also benefit from this, as universal provision is reduced and either taxes fall or the spending is diverted to other areas they value more highly. In this way, the increase in total spending and reduction in the spending on universal provision generally increases the overall social welfare of universal provision with no restrictions on parallel private provision in voting models.

Along a similar line, Gouveia (1997) developed a theoretical model of voter preferences over alternative health care systems and found that a universal health care system combined with a parallel private health care sector used by the better off was preferred over a purely universal system by a majority of voters. Within this framework, Gouveia (1997) argued that the hypothetical movement from a purely universal system to one that combines universal health care with a parallel private sector constitutes a Pareto improvement. Assuming that one can choose the same consumption bundle as before, nobody is worse off, and those who voluntarily chose to use the private sector when this is allowed must be better off. The critical assumption here is that everybody can choose the same consumption bundle when universal health care is combined with a parallel private sector as they would have used in a purely universal health care system. The plausibility of this assumption hinges on whether any of the potential adverse effects of VPHI on universal health care systems which will be accounted for in section 4.2 are present, and to what extent.

Iversen (1997) modelled the effect of a parallel private sector on the waiting time for treatment within the universal health care system theoretically in order to shed light on how the group of patients who remain to be treated within the universal health care system is affected by the presence of a private sector. The theoretical prediction of this study is that when the access to waiting lists is not rationed in the universal health care system (i.e. all patients who accept the prevailing waiting times are admitted to the waiting list), the effect of a parallel private sector on the waiting time for treatment within the universal health care system is generally undetermined. Assuming that doctors ration the access to waiting lists so that some of the patients who would have preferred to be admitted to a given waiting list are referred to other treatments, Iversen (1997) found the waiting times to increase if the doctors employed at public hospitals are allowed to work in the private sector in their spare time, but remain constant when doctors work exclusively in the public hospital sector.[33] Hence, the theoretical predictions of Iversen (1997) do not confirm the frequently stated argument that duplicate VPHI reduces the waiting time for treatment in the

[33] This is related to the literature on dual practice, which is discussed in section 4.2.2.2.

universal health care system. Moreover, the finding of Iversen (1997) calls into question the assumption of Gouveia (1997) that the individuals who rely exclusively on the universal health care system can choose the same consumption bundle when universal health care is combined with a parallel private sector as they would have used in a purely universal system. It must, however, be kept in mind that the predictions of Iversen (1997) rest on the assumptions that doctors either work exclusively in the public sector or work in the public sector as their primary employment and in the private sector in their spare time. In reality, it is also possible for doctors to work exclusively in the private sector, as discussed in section 4.2.2.1.

There is no empirical evidence on the general welfare effects discussed in this section.

4.2 Adverse effects of voluntary private health insurance

Besides the evident advantages for the privately insured, VPHI may be argued to induce ex post moral hazard in the use of health care services by lowering the price or waiting time that patients are facing at the point of demand, thereby possible leading to potentially inefficient use of resources, as discussed in section 3.3.6. In addition, VPHI may also be argued to adversely affect the performance of universal health care systems through several channels. These adverse effects imply, among other things, that VPHI does not necessarily reduce waiting time for treatment at public hospitals and benefit the society as a whole, as argued in section 4.1.

4.2.1 Support for the universal health care system

For one thing, it may be argued that the budgets of universal health care systems are determined by dynamic processes rather than given, in which case increased emphasis on private solutions in general and duplicate VPHI in particular may reduce the political support for the universal health care system and over time reduce it to 'poor service for the poor' (Besley et al. 1998; Propper 2000). The mechanism argued to bring about this outcome is as follows: If the better off and privately insured receive less treatment within the universal health care system, over time, their commitment to maintain this system may fall because their personal benefit from the system is reduced. This may lead to lobbying for lower taxes and cuts in the health care budget, which may in turn cause more people to purchase duplicate VPHI, and so on (Propper and Green 2001).[34] In addition, duplicate VPHI may also reduce the pressure to devote additional resources to the universal health care system to the extent that it generates an alternative source of income

[34] The example of the United States, in which the public share of total health spending is relatively low and various attempts to mobilise support for establishing a universal health care system over the past three decades have failed, is typically adduced in this regard (Tuohy et al. 2004). However, the United States is not necessarily a very good example when it comes to analysing the consequences of duplicate VPHI in universal health care systems. For one thing, a shift from principal private health insurance to a universal health care system is not necessarily comparable to the preservation of a well-functioning universal health care system. Moreover, the role of private health insurance in the United State differs markedly from that of VPHI as briefly discussed in section 1.1. Hence, the example of the United States is disregarded in the following.

for doctors, and usually at better rates than within the universal health care system (Mossialos and Thomson 2002). In this way, dynamic effects initiated by the mere presence of duplicate VPHI may cause the universal health care system to eventually become 'poor service for the poor'.

The argument that duplicate VPHI will lead to a downward spiral in the capacity of the universal health care system depends on the premises that 1) the support for the universal health care system is negatively associated with the prevalence of duplicate VPHI and 2) the demand for duplicate VPHI is negatively affected by the quality of the universal health care system. There are, however, several other plausible relationships between the level of support for the universal health care system, the take up of duplicate VPHI, and the quality of the universal health care system (Propper and Green 2001).

For one thing, it is equally plausible to think that the privately insured would be less supportive of the universal health care system on ideological grounds regardless of their insurance status. Yet another possibility is that individuals may be frustrated with the quality of care available in the universal health care system and purchase duplicate VPHI as a reaction to this, even though they would prefer a higher level of tax-financing or social insurance contributions in order to obtain a higher quality of care for everybody from an ideological point of view. Along a similar line, it is perfectly possible for individuals to support the universal health care system and at the same time purchase duplicate VPHI; the two things are not necessarily contradictory in a welfare state (Pedersen 2007). Finally, duplicate VPHI usually only covers a limited range of elective procedures. In this case, the privately insured still rely on the universal health care system for emergency and acute care, which means that duplicate VPHI only reduces their personal benefit from the universal health care system marginally.

Considering the empirical evidence on how VPHI affects the quality of the universal health care system, the take up of duplicate VPHI has been shown to be negatively affected by various quality indicators of the universal health care system in the United Kingdom and Spain.[35] More precisely, Besley et al. (1999) and King and Mossialos (2005) found a positive association between regional waiting times and VPHI holdings for both individually purchased and employment-based policies in the United Kingdom. Wallis (2003) found regional waiting times and lagged health expenditure within the tax-financed health care system to be significant determinants of the individual demand for VPHI, while Propper et al. (2001) examined several measures of universal and private sector quality and found that all quality indicators except for waiting list length had a significant impact on the probability of VPHI ownership. Within the context of the Spanish health care system, Jofre-Bonet (2000) found the probability of having VPHI to be increasing with waiting list length, and Costa and Garcia (2003) and Costa-Font and Jofre-Bonet (2006) found indices and perceptions of universal health care sector quality to be important determinants of VPHI demand.

[35] This finding is also noted to be in accordance with the assumption of the models discussed in section 4.1.2 that the presence of waiting time within the universal health care system induces patients seek private sector care.

Regarding the support for the universal health care system, the empirical literature provides some evidence that this is negatively affected by duplicate VPHI ownership. Studies from the United Kingdom indicates that the users of private health care are slightly less supportive of universalist principles (Burchardt et al. 1999) and that the privately insured are less likely to favour increased spending on the tax-financed health care system and to see health spending as a priority (Besley et al. 1996; Hall and Preston 1998).[36] Hence, the preconditions for a downward spiral are present. There is, however, no direct empirical evidence, neither in favour of nor against, the argument that duplicate VPHI leads, in and by itself, to a downward spiral of changes in attitudes and budget cuts, ultimately reducing the capacity of the universal health care system. Moreover, while the privately insured in the United Kingdom express less support for spending on the universal health care system, the development in their attitude does not necessarily differ from that of the individuals who rely exclusively on the universal system.

4.2.2 The efficiency of the universal health care system

In addition to the argument that duplicate VPHI may reduce the capacity of the universal health care system over time, another class of arguments against VPHI are concerned with that it may generate inefficiencies in the sense of a less than optimal use of the resources within in universal health care systems through several more specific dynamic mechanisms. The mechanisms outlined in sections 4.2.2.1-4.2.2.4 were formulated in terms of a parallel private sector, which may be accessed either by direct payment or duplicate VPHI, while the prevalence of public moral hazard as discussed in section 4.2.2.5 is linked specifically to VPHI.

4.2.2.1 Factor input prices

A frequently stated argument against allowing a parallel private sector is that this may erode the monopsonistic purchasing power of the universal health care system, thereby leading to higher factor input prices (Propper and Green 2001). While some of the lower factor input prices in universal health care systems may reflect genuine lower costs of public sector capital (Globerman and Vining 1998), this is most likely not the case for labour inputs. Assuming a fixed labour force, the underlying mechanism is that staff may be drawn from public to private providers to the extent that private sector employment is more profitable. This may in turn raise the labour input prices for both public and private providers, given that the share of employed in the private sector is substantial and that the private sector offers full-time employment. The consequences for labour input prices are, however, unclear when the private sector mainly offers part-time weekend and evening employment to publicly employed doctors cf. the discussion of dual practice in section 4.2.2.2, and in general when the private sector is small.

[36] Descriptive evidence from Denmark likewise indicates that while the predominant majority of the population supports the universal tax-financed health care system regardless of VPHI status, the individuals with employment-based duplicate VPHI differ from the remaining population by being less supportive (Pedersen et al. 2011).

The interpretation of the rupture with monopsonistic purchasing power as something negative is, however, subject to the reservation that monopsony in the health care sector is not necessarily welfare increasing (Pauly 1998). In particular, the elimination of monopsony power and the corresponding increase in expenditures may be welfare improving, given that the providers' gains are also included in the calculations of social welfare. However, this issue is complicated somewhat if monopsony power is used to reduce the cost of achieving some level of redistribution, which may reasonably be assumed to be the case for universal provision of health care, as discussed in section 4.1.2. In this case, a decline in monopsony power also implies that a greater level of distortionary taxes is necessary to achieve the same level of redistribution (Glied 2008). Over time, the consequences of a universal health care system using its monopsonistic power to keep down the price of labour may also be that it ends up with a lower quality staff, or that employment contracts allowing dual practice are made use of on a large scale.

Various searches in the electronic database EconLit did not reveal any empirical literature on how VPHI affects factor input prices in universal health care system.

4.2.2.2 Dual practice and incentives for health care providers

Dual practice has been argued to reduce the incentives for staff to perform well in the public hospital sector for several reasons. First, extensive 'moonlighting' may imply that doctors work more hours than they are actually capable of and so the quality of the care they provide falls. Second, if doctors are salaried in the public hospital sector and paid on a commission basis at private hospitals, dual practitioners have a financial incentive to shirk within the public system and transfer their effort to the private sector. Third, it may create an unfortunate incentive structure if some providers are able to benefit from maintaining lengthy waits for elective surgery at public hospitals by shifting patients to their private, and often more profitable clinics (Propper and Green 2001;Tuohy et al. 2004). Morga and Xavier (2001) developed a theoretical model of the effects of dual practice on the waiting time for elective surgery at public hospitals, taking into account the various conflicting interests of public hospital doctors when these are allowed to practice privately. Not surprisingly, the model found the waiting time for elective surgery at public hospitals to be decreasing in altruism and increasing in the impact of foregone income on doctors' utility and the population's preferences for private sector treatment.

The practical importance of dual practice depends largely on the incentive structures embedded in the universal health care system as well as the opportunities outside of this. For example, the scope for working excessively long hours or shirking within the universal system may be reduced considerably by imposing upper limits on the number of hours that publicly employed doctors are permitted to work in the private sector, while strategic shifting of patients may be eliminated by prohibiting doctors within the universal health care system from referring patients to their own private clinics.

While the phenomenon of physicians' dual practice is generally short on evidence (Socha and Bech 2010), recent empirical evidence on the relationship between physicians' dual practice and their work inputs in

Denmark does not reveal any systematic relationship between dual practice and public hospital work hours, participation in voluntary tasks or activities that might conflict with the private-practice hours, and preferences for part-time employment (Socha and Bech 2011). Hence, it appears that the physicians engaged in dual practice perform at least as good in the public hospitals as their counterparts who do not hold a second job.

4.2.2.3 Cream skimming

Another channel through which duplicate VPHI have been argued to adversely affect the efficiency of the universal health care system is by creaming off the simpler cases, leaving the universal system with a more complex and, thus, burdensome caseload (White 2009). Cream skimming does, however, not burden the universal health care system in absolute terms, given that the more complex patients would have had to be treated in any case.

An empirical investigation of variations in inpatient length of stay within the universal health care system in Australia found the level of local private inpatient facilities to be positively associated with the costs of the universal health care system (Martin and Smith 1996). This may be taken to mean that parallel private systems attract healthier patients and perform relatively less complicated procedures, thereby increasing the average complexity and dependency of the patients continuing to use the public system (Tuohy et al. 2004). Empirical analysis in Duckett and Jackson (2000) likewise suggests that the average complexity of cases, within case-mix groups, is higher in public than in private Australian hospitals.

4.2.2.4 Change in expectations

Another channel through which duplicate VPHI may be argued to place strain on the universal health care system is by changing the expectations of what constitutes appropriate care (Glied 2008). For example, the perceptions of what constitutes a reasonable amount of waiting time for elective surgery are likely to depend on the typical practice. If the individuals with duplicate VPHI are able to obtain services quicker from private providers, the individuals who are treated at public hospitals may begin to view the delivery patterns within the universal health care system as unreasonable. Assuming that the expectations to appropriate waiting times are established by observed average, bringing down the average will increase expectations. For one thing, this may affect the welfare of the individuals who remain to be treated within the universal health care system. Moreover, the increase in expectations induces a demand for increased spending within the universal health care system if the median voter does not have duplicate VPHI. Hence, duplicate VPHI may impose a fiscal externality on the universal health care system through changing the expectations of what constitutes appropriate care.

4.2.2.5 Public moral hazard

In addition to generating moral hazard in the use of covered health care services as discussed in section 3.3.2, VPHI may also be argued to induce moral hazard in the use of health care services within the universal health care system. In the case of complementary VPHI, the universal health care system pays for part of any additional use induced by the complementary insurer (Folland et al. 2007).[37] Along a similar line, VPHI that duplicates the coverage provided by the universal health care system may place additional strain on general practice to the extent that reimbursement by private insurers is contingent on having a documented need for treatment, usually in the form of a referral or prescription from a general practitioner. These channels through which VPHI may increase the use of health care services within the universal system are referred to as public moral hazard in the literature (Folland et al. 2007; Stabile 2001).

Empirical research on the practical importance of public moral hazard is sparse, and the results point in different directions. In the context of the Canadian health care system, where doctor visits are covered under public insurance, while prescription drugs are subject to considerable copayment for most people, Stabile (2001) found some evidence of public moral hazard in the form of a positive effect of VPHI covering prescription drugs on doctor visits. Considering the effect of VPHI covering semi-private or private hospital rooms, this was found to affect neither the probability of spending at least one night nor the number of nights in the hospital (Stabile 2001).

4.2.3 Cost control

Finally, private financing of health care services made up by copayment and VPHI has frequently been argued to be less able to control costs than universal health care systems (Propper and Green 2001). Considering the two sources of private financing separately, it is noted that while VPHI is expected to increase the use of health care services due to moral hazard effects, copayment may reasonably be expected to restrict the access to and the use of affected health care services (Donaldson et al. 2004). Hence, the theoretical mechanisms behind the argument that private financing of health care is generally less able to control costs are not clear cut, especially when taking into account that VPHI comprises only a small share of the total health care funding in most countries (OECD 2010).

Empirically, it may be assessed whether private financing is inferior regarding cost control by considering macro level evidence on whether higher shares of private financing leads to higher expenditure levels and, more importantly, higher growth in expenditures. In this regard, Gerdtham et al. (1992) examined the determinants of aggregate health care expenditures across 19 OECD member states and found that countries with larger shares of universal financing were generally characterised by lower levels of health care expenditure. This finding was reproduced by Globerman and Vining (1998), who found a negative relationship between the share of universal financing and cost inflation. However, once other influencing factors (such as the number of doctors and the use of inpatient beds) were controlled for, financing mix

[37] If for example the universal health care system covers 60 percent of a physiotherapy treatment worth EUR 50 and the remaining 40 percent is financed by a copayment which may or may not be covered by complementary VPHI, and complementary VPHI induces three additional visits at EUR 50 over and above what would have been used in its absence, the presence of complementary VPHI leaves the universal health care system with an additional expenditure of EUR 0.6·1,500 = 90.

was found to be less important in determining expenditure growth. In addition, Globerman and Vining (1998) found the negative association to be sensitive to the inclusion of the United States in the model. When the United States was excluded, the share of universal financing and the growth in health expenditures were not significantly related. Globerman and Vining (1998) therefore argues that the inclusion of the United States leads to misleading conclusions if the higher quality of care (including quicker access) which may be argued to be available in the United States is not adjusted for. Based on more recent data, Tuohy et al. (2004) found that on aggregate, an increase in the private share of total health expenditures is associated with a subsequent decline in universal health spending as a proportion of total public expenditures (and vice versa) across several OECD countries. However, national analyses indicated that the overall relationship could be the result of different dynamics in different nations, and that the effect depends on the form of private financing. Finally, Gerdtham and Jonsson (2000) surveyed the existing cross country evidence and found that a higher share of universal financing alone does not guarantee lower health expenditures (holding constant other features of the health care system). However, some of the features which are commonly used in universal health care systems, such as gatekeepers, appear to keep down expenditures. It may thus appear as if private financing (including both copayment and VPHI) leads to higher expenditure levels, although this is most likely not the entire story. For one thing, the link between the financing mix and the level of health care expenditure also depends on the mechanisms embedded in different types of health care systems. Moreover, the negative associations between the share of universal funding and the level of or growth in health expenditures found in the literature seem to be largely driven by the United States, which may reasonably be considered an outlier when it comes to the financing of health care.[38]

Finally, the importance of cost control may reasonably be argued to be less central when considering private sources of financing alone than for universal health care systems financed by taxes or social contributions. Keeping in mind that private financing consists in individuals are spending their own money on health care at their own free will, if the additional costs imposed by private financing reflect patients getting more or a higher quality of care, there is not the same need to focus on cost control as there would be in a universal system. However, there may still be good reasons to control the growth in the private health care costs. Moreover, when copayments or VPHI premiums are subject to preferential tax treatment, any additional costs induced by private financing are not only paid for by the affected individuals with their own money, but also indirectly by the tax-payers.

[38] As previously mentioned, the share of expenditures coming from private health insurance is substantially larger in the United States than in other countries, given that principal private health insurance (i.e. both acute and elective) provides the primary source of coverage for the working age population (Currie and Madrian 1999).

4.3 Equity considerations

Equity may reasonably be considered a fundamental value in societies with a universal health care system in place (Glied 2008). The preference for equity may be modelled within an externality framework, by assuming that the health of one person enters the utility of another. Moreover, it may be argued that equity plays a particularly important role in the health care sector because health is a vital precondition for succeeding in other aspects of life (Culyer and Wagstaff 1993; Daniels 1985).

An equitable health care system is generally perceived to be one where individuals contribute according to their ability to pay and receive treatment according to their need.[39] The equity consequences of VPHI are thus assessed along the dimensions of both financing and delivery. Analytically, a distinction may be made between horizontal and vertical equity (Culyer and Wagstaff 1993). Horizontal equity implies that equal individuals are treated equally, that is, individuals with the same income contribute the same, and individuals with the same need receive the same amount of health care. Vertical equity implies that individuals with higher incomes contribute more than those with lower incomes. Likewise, according to the rule, individuals with a greater need should receive more health care services. In neither case does the principle of vertical equity state how much more. Thus, while there is no universal norm for fulfillment of vertical equity, differences in the degree of equity can be compared.

4.3.1 Health care financing

The financing of health care may be described as proportional, progressive, or regressive for equity purposes (Wagstaff and Van Doorslaer 1992). Proportional financing implies that everybody contributes to the health care system with the same share of their income. Progressive financing implies that wealthier individuals contribute proportionally more to the health care system, while regressive financing implies the opposite, namely that those in the lower end of the income distribution contribute proportionally more.

Assuming that the demand for VPHI is income elastic, duplicate VPHI covering treatment at private hospitals without exempting individuals from their obligations towards the universal health care system may reasonably be expected to increase the level of progressivity in the overall financing of a health care system, given that the privately insured to some extent pay twice for their health care. The financing of VPHI which is complementary or supplementary in relation to the universal health care system may likewise be argued to be progressive, assuming that this is also mainly purchased by the better off.

The degree of equity in the financing of health care may be investigated empirically by calculating various concentration indices showing the extent to which financing departs from proportionality. Wagstaff et al. (1999) compared the progressivity of health care financing systems and their constituent parts across

[39] The health economics literature does not agree on the meaning of 'need' and whether equity concerns should relate to health status, the amount of health care received, or the access to health care (Gravelle et al. 2006). This disagreement is considered to be outside the scope of the present thesis.

countries. Regarding the financing of VPHI, this was found to be regressive in countries where copayment rates are high and complementary VPHI is relied upon by the majority of the population (i.e. France and Ireland) but otherwise typically progressive, reflecting the higher demand for VPHI by the better off. Along a similar line, Van Doorslaer et al. (1999) estimated how health financing systems affect income distributions across countries by examining how progressivity interacts with the average proportion of income spent on health care, the extent to which households with similar incomes are treated unequally (i.e. horizontal inequity), and the extent of any re-ranking in the move from the pre-payment income distribution to the post-payment income distribution. Van Doorslaer et al. (1999) found that while private sources of financing generally had large pro-rich redistributive effects, the redistributive effect of VPHI varied between countries, being pro-rich in France, Ireland, and Switzerland, and pro-poor elsewhere (including Denmark, Germany, Italy, the Netherlands, Portugal, and the United Kingdom). Decomposition showed that the major source of the income redistribution associated with VPHI comes through progressivity in the payment of insurance premiums.

Finally, White (2009) has argued that while VPHI may make the overall financing of a health care system appear more progressive, this analysis seems beside the point for two reasons. First, VPHI is frequently subject to preferential tax treatment and/or subsidised by employers, in which case the individual insurance holders only feel part or none of its cost. Second, VPHI is purchased on a voluntary basis, which implies that the purchasers may obviously think it is worth its while.

4.3.2 Access to and use of health care services

The importance of equity issues in relation to the effect of VPHI on the delivery of health care services may reasonably be argued to rest largely on the existence of some meaningful connection between the use of health care services and well-being (Glied 2008). Equity may be modelled as an externality where the access to and use of health care services by one person enters the utility of another. An equity externality implies that people place some value on the degree of equality in the delivery of health care services.[40] In this relation, it is noted that a preference for equity is more than a just belief that everyone should have access to some health care, it implies that the difference in access to or use of health care services between the higher and the lower income groups should not exceed some maximum (Glied 2008).

As previously mentioned, the extent of equity in the delivery of health care services may be assessed based on the principle of horizontal equity, which implies that individuals in equal need have the same access to or use of health care services (Van Doorslaer and Wagstaff 1992). Considering horizontal

[40] Differences in the access to and the use of health care services caused by VPHI may also enter utility functions in other ways than through an equity externality, although these are less likely. For one thing, it is possible that the uninsured are envious of the VPHI purchase of others and that this reduces their welfare. Moreover, VPHI may also generate welfare for the privately insured due to pretentiousness or snob effects if they value their VPHI more simply because others cannot afford it (Dowd 1999).

inequity as any differences, it may be argued that VPHI generates horizontal inequity in the access to health care between the privately insured and those not holding VPHI by definition, by allowing individuals with the same need for health care to differ in their access to treatment depending on insurance status. However, a more frequently used approach is to consider horizontal inequity as differences in access or use that vary systematically with sociodemographic determinants.

Empirical studies of the take-up of VPHI have consistently found this to increase with income and education level (see e.g. Besley et al. (1999), Grepperud and Iversen (2011), King and Mossialos (2005), Rodríguez and Stoyanova (2008), and Ellis and Savage (2008)). Partly because the better off and higher educated are more likely to purchase VPHI on an individual basis, and partly because they are more likely to have employers who purchase it on their behalf. The empirical evidence thus indicates that horizontal inequity in the access to health care services caused by VPHI is a real issue of concern.

The empirical evidence on whether VPHI generates horizontal inequity in the use of health care services is closely related to the literature on ex post moral hazard. As accounted for in section 3.3.2, ex post moral hazard is a question of whether VPHI causes individuals to use additional health care services for which the marginal cost exceeds the marginal benefit, i.e. inefficient overuse, whereas inequity focuses on overuse relative to the medical need for care. However, due to problems in measuring marginal benefits and costs, the empirical literature on inequity in use is largely identical with than on ex post moral hazard. In either case, the results of this literature are not clear-cut. While some studies have found that VPHI does not affect the overall use of health care services (e.g. Höfter (2006), Riphahn et al. (2003), and Schokkaert et al. (2010)), others found a positive and significant effect (e.g. Cameron et al. (1988), Harmon and Nolan (2001), and Savage and Wright (2003)). In addition, Mossialos and Thomson (2002) summarised the empirical evidence on VPHI in the European Union and found indications that patients with duplicate VPHI were treated favourably by physicians in Finland, Spain, and Portugal, and had shorter waiting times for treatment in Austria, Ireland, Italy, Portugal, Spain, Sweden, and the United Kingdom. Combined with the fact that the privately insured are generally better off, this points in the direction of duplicate VPHI generating some extent of horizontal inequity in the use of health care services.

Finally, it has been argued that VPHI does not give rise to particular equity issues for two different reasons. Firstly, it may be argued that high-income individuals can afford to use more of the health care services that are only partly covered by or excluded from the universal health care system than low-income individuals even in the absence of VPHI, and that they may also be able to purchase treatment at private hospitals or preferential treatment at public hospitals (White 2009). Hence, easier access for people with higher incomes would still exist in the absence of VPHI, assuming that there is a private market. Secondly, it may be argued that what matters is not equity but adequacy. According to this view, if the universal health care system is adequate, it is unproblematic that some individuals, i.e. the privately insured, have preferential access to health care and possibly also use more or a higher quality of some types of health care services, as long as they do not make anybody else worse off (Rodríguez and Stoyanova 2004). In most cases matters are, however, not quite so simple. For one thing, the ability to use the benefits of the universal health care system may be affected by whether individuals hold VPHI cf. the public moral hazard effects discussed in section 4.2.2.5. Second, duplicate VPHI may be argued to adversely affect the universal health care system in various ways, as discussed in section 4.2. Hence, the condition that nobody is made worse off by VPHI may not hold. Finally, it is noted that it adds an additional dimension to the equity discussion when VPHI premiums are subject to preferential tax treatment.

4.4 Summary and discussion of the pros and cons: The jury is still out

The review of the pros and cons of VPHI in universal health care systems provided in this section shows that there are several plausible arguments both for and against VPHI and only limited empirical evidence to support them. Moreover, it is clear that the different types of VPHI differ in their implications for the universal health care system, thus giving rise to different challenges.

On the pro side VPHI, duplicate as well as complementary and supplementary, inevitably provide the privately insured with better access to medical care. Moreover, the theoretical literature on combining a universal health care system with a parallel private sector has shown that a parallel private sector used by the better off can redistribute income from the rich to the poor (Besley and Coate 1991), and for this reason, the patients who remain to be treated in the universal health care system are better off with some waiting time for treatment and a parallel private sector than they would have been in a purely universal system (Hoel and Sæther 2003). Along a similar line, economic theory has shown that a universal health care system combined with a parallel private sector used by the better off is both preferred by a majority of voters (Epple and Romano 1996; Gouveia 1997). However, it must be kept in mind that the theoretical models on which these predictions are based leave potential adverse effects of VPHI on universal systems as well as equity considerations out of account, along with some more or less realistic assumptions to arrive at the conclusions. Moreover, the empirical importance of the theoretical merits of VPHI discussed above has yet to be assessed – which will not be an easy task.

In addition to benefitting the privately insured, it has also been argued that duplicate VPHI has the potential to reduce the waiting time for treatment at public hospitals by shifting the insured to be diagnosed and treated at private hospitals. While this argument is difficult to test directly, Søgaard et al. (2011) have provided empirical evidence that duplicate VPHI reduces the use of selected public hospital services in Denmark. Ceteris paribus, this may be equated with a reduction of the waiting time for treatment within the universal health care system brought about by VPHI. The critical assumption here is ‘ceteris paribus’. This may or may not be the case, given that the dynamics of a universal health care system combined with duplicate VPHI are likely to be complex.

Duplicate VPHI may also be argued to adversely affect the performance of universal health care systems in various ways. However, the empirical evidence is scant. For one thing, there is no direct empirical evidence, neither in favour of nor against, the frequently stated argument that dynamic effects initiated by the mere presence of duplicate VPHI will reduce the universal health care system to 'poor service for the poor' over time, and several plausible counterarguments suggest that this is not necessarily the case. However, given some, but not overwhelming empirical evidence from the United Kingdom and Spain suggesting that the preconditions for a downward spiral are present at least in these countries, it remains important to pay attention to whether the capacity of the universal health care system deteriorates over time as a consequence of duplicate VPHI, especially if this is becoming more widespread in the sense of making up a substantial part of health expenditures. Another frequently stated argument is that duplicate VPHI and a parallel private sector may lead to higher labour input prices at public hospitals by introducing competition in the labour market, the consequences being either a lower quality of staff in the public sector or widespread use of dual practice, which is not unproblematic. Firstly, dual practice has been argued to reduce the incentives for staff to perform well in the public hospital sector. While empirical evidence from Denmark indicates that physicians who engage in dual practice perform at least as good in the public hospitals as their counterparts who do not hold a second job, the literature is generally short on empirical evidence on this issue. Secondly, the existence of a parallel private hospital sector has been shown theoretically to increase the waiting time for treatment at public hospitals if the doctors in the public sector are allowed to work in the private sector in their spare time (Iversen 1997). This result, however, rests on the assumptions that doctors work either exclusively in the public hospital sector or work in the public sector as their primary employment and in the private sector in their spare time. In reality, it is also possible for doctors to work exclusively in the private hospital sector, which is what was argued to put upward pressure on the labour input prices at the public hospitals in the first place. When doctors work at public hospitals as their primary employment and in the private sector in their spare time, the consequence of VPHI for labour input prices is unclear.

Duplicate VPHI has also been argued to adversely affect the performance of the universal health care system by affecting factor input prices, expectations of what constitutes appropriate care, the average complexity of the cases within the universal health care system, and the incentives of health care providers. The empirical evidence on the practical importance of these issues is at best based on single or relatively few studies from a limited selection of countries. Moreover, economic theory and several empirical studies indicate that VPHI may induce moral hazard in the use of covered health care services and sometimes also in the use of health care services which are finance by the universal health care system. However, it is important to note that additional use of health care services due to VPHI is not necessarily inefficient, according to the discussion provided in section 3.3.6.

Hence, while it is evident that VPHI places the privately insured in a better position in terms of access to medical care, it is less clear whether it relieves the pressure on universal health care systems in the longer run, thereby also benefitting those who remain to be treated within the universal health care system and society as a whole. In this connection, it is also worth noting that to the extent that the privately insured continue to use the universal health care system for some types of care, the adverse effects of VPHI on the universal health care system may also affect the privately insured. In addition, given that the presence of a universal health care system in itself indicates some extent of preference for equity in the society, it may be considered problematic that some people, namely those covered by VHI, have better access to and possibly also use more health care services than others, assuming that the adverse effects of VPHI on the universal health care system will materialise.

5 Data material

The empirical chapters of the thesis are based on data from a cross-sectional survey of the Danish population. The survey was conducted in 2009 by Professor Kjeld Møller Pedersen, Associate professor Jacob Nielsen Arendt, and PhD student Astrid Kiil from the University of Southern Denmark. The collection of data was supported financially by the Danish Health Insurance Foundation, and YouGov Zapera Ltd. handled the practical aspects.

The use of primary data has certain advantages and disadvantages compared with the use of secondary data collected by others. For one thing, primary data usually contain all the necessary information on the relevant variables, because they are collected specifically for the purpose of the research project. Secondary data are more likely to omit some relevant information. Another advantage of using primary data is that the researcher has first-hand knowledge of how the data were collected and subsequently prepared for analysis, while this information might be sparse or imprecise for secondary data. On the other hand, secondary data usually come at a lower price than primary data, and they are more likely to allow for comparisons across time and between countries. However, to the best knowledge of the author, there are no secondary datasets which would have been superior to the primary data described in this section for the purpose of the present thesis.[41]

The remainder of this section accounts for the dataset used in the thesis as follows. Section 5.1 accounts for the data collection, including the decision to use an internet-based questionnaire, the development and pretesting of the questionnaire, and the practical aspects. Section 5.2 discusses the quality of the survey, including potential sources of error and the representativity of the data. Finally, descriptive statistics for

[41] One possible source of secondary data is the Danish Health Interview Survey (Ekholm et al. 2006), which contains some information on private health insurance coverage and health care use within the Danish population. However, the detail level of the information on private health insurance coverage is considerably lower than that available in the primary dataset used in this thesis. Another possible secondary data source is information from the customer registers of the commercial insurance companies linked with various registers. Such data have been collected by the Danish Insurance Association and analysed in Borchsenius and Hansen (2010) and Søgaard et al. (2011). One obvious limitation of the dataset collected by the Danish Insurance Association is that it only contains information on about 65 percent of the private health insurance holders (i.e. 35 percent of the privately insured appear to be uninsured). Moreover, it does not contain information on whether insurance policies are purchased from the commercial insurers on an individual basis or provided through the workplace, and on membership of Health Insurance 'denmark'. More importantly, the data were released shortly before the present PhD thesis was to be handed in, and they are not readily available to anybody who may wish to analyse them.

the main variables are provided in section 5.3. Parts of the section have previously been published in Kiil and Pedersen (2009).

5.1 Data collection

5.1.1 Method of data collection

It was decided to collect the data using an internet-based questionnaire due to the relative speed and cost-effectiveness of this survey mode. Moreover, the opportunity of incorporating automatic skip patterns in the questionnaire in order to prevent that respondents are asked unnecessary questions was considered a major strength in this particular survey.

The internet-based questionnaire was distributed via YouGov Zapera's Denmark panel, which is an actively managed internet-based panel containing 38.600 members in Denmark as of July 2009 (YouGov Zapera Ltd. 2009b). This panel may be classified as a discontinuous online panel in the sense that respondents are asked to participate in surveys on different topics across time (Nancarrow and Cartwright 2007). The YouGov Zapera Denmark panel meets the Esomar international code on marketing and social research practice. This implies among other things that its members are recruited through a wide selection of channels in order to ensure an appropriate demographic balance, and that panel members must log on with a password when participating in surveys in order to ensure that the intended person completes the survey.

The respondents received an e-mail inviting them to participate in the survey, which included a link to the questionnaire. Follow up e-mails reminding non-respondents to fill in the questionnaire were sent out after the initial invitation. The invitation and follow up e-mails are enclosed in Appendix A.

Panel members received small incentives for participating in surveys in order to ensure representativity of the sample and to avoid an overweight of respondents with a strong interest in the subject of the survey. After completion of the questionnaire, respondents entered a draw for a gift voucher to a travel agency worth DKK 5000/EUR 670 and 25 gift vouchers to a supermarket chain worth DKK 1000/EUR 134 each.[42] It is noted that the use of a draw could potentially bias the sample by attracting an overweight of respondents who like to gamble.

5.1.2 Questionnaire development and pretesting

The Internet-based questionnaire was developed in the time period from November 2008 to May 2009 by the responsible researchers. The contents of the questionnaire were selected based on theoretical considerations and adjusted to accommodate the structural conditions in Denmark. Comparability with existing empirical studies was taken into consideration.

[42] Conversions from DKK to EUR are undertaken using the March 2011 average exchange rate of 745.74 (Danske Bank 2011).

The questionnaire was set up by the author using the software SurveyXact. In this early version of the questionnaire, respondents could navigate back and forward, and a colored bar showed the number of questions left. Respondents were allowed to leave questions blank and still proceed answering the questionnaire in the various pilot surveys. This option was, however, removed from the final questionnaire in order to avoid that respondents could enter into the draw without actually having answered any questions.

5.1.2.1 Preliminary pilot survey

An early version of the questionnaire was tested on friends and family of the responsible researchers in December 2008. The main purpose of this preliminary pilot survey was to make sure that the questionnaire was comprehensible by people with no particular interest in private health insurance. After answering the questionnaire, the test subjects were briefly interviewed about their understanding of selected questions, and they were also asked to describe any difficulties experienced. Subsequently, several revisions were made.

5.1.2.2 Expert reviews

In April 2009 the revised version of the questionnaire was tested and reviewed by researcher colleagues with extensive experience in questionnaire design and econometric analysis from the Department of Health Economics and the Centre for Applied Health Services Research and Technology Assessment at the University of Southern Denmark. The project manager from YouGov Zapera also provided a number of valuable comments, and all these expert reviews resulted in a number of revisions in the questionnaire and some rephrasing.

5.1.2.3 Final pilot survey

Before deciding on the final version of the questionnaire, a pilot survey was performed on the revised version of the questionnaire in May 2009. The final pilot survey included 106 respondents drawn from the same population as the main survey by YouGov Zapera. It revealed that a few response categories were missing for some questions in order for the response categories to be exhaustive. In addition, it was confirmed that the automatic skip patterns were set up correctly and no questions stood out due to extraordinary high non-response rates. Thus, the final pilot survey only led to a few minor revisions of the questionnaire.

5.1.3 Questionnaire length

The final questionnaire had an estimated answering time of 10 to 20 minutes. Deciding on the optimal length of a questionnaire is a matter of extracting as much information from the respondents as possible without overburdening them. While some studies have found evidence of a negative association between questionnaire length and response rate, the larger share of the literature on internet-based surveys points in the direction of response rates not being significantly affected by questionnaire length. Moreover, there is evidence that other elements, such as respondent contacts and topic salience, may be more important than questionnaire length in determining response rates (Cook et al. 2000; Sheehan 2006). Hence, the expected answering time of 10 to 20 minutes for the total questionnaire is not expected to cause major problems for the response rate in this survey. An English version of the final questionnaire, including marginal response distributions, is enclosed in Appendix A. The Danish version of the questionnaire is available in Kiil and Pedersen (2009).

5.1.4 The data collection process

The collection of data was undertaken by YouGov Zapera Ltd. In order to ensure that the data were roughly representative of the Danish population, YouGov Zapera used their experience with response rates within different population groups to select the sample. A total of 13,246 individuals aged 18-75 were sampled and 5,447 participated in the survey, corresponding to a response rate of 41 percent. Although not impressive, this response rate is in line with what is commonly seen in internet-based surveys (Cook et al. 2000; Sheehan 2006).

5.1.4.1 Time schedule

The data were collected during the time period from June 10 to June 28, 2009. The time schedule for the distribution of invitations and follow up e-mails is outlined in Table 5.1.

Table 5.1 Time schedule for the data collection

Date	Number of e-mail invitations sent out	Number of follow up e-mails sent out	Corresponding responses
June 10, 2009	1003		371
June 15, 2009	4990		1745
June 17, 2009	3940		1268
June 19, 2009		3875	547
June 19, 2009	3044		945
June 22, 2009		4565	395
June 25, 2009	567		280
Total	13544	8440	5551

Source: YouGov Zapera Ltd. (2009a).
Note: The number of invitations sent out included 298 respondents aged 76+ and the corresponding responses included 104 respondents. These respondents are excluded from subsequent analyses.

The first four batches of e-mail invitations sent out from June 10 to June 22 were restricted to individuals aged 18-70, while the last batch of e-mail invitations sent out on June 25 was restricted to individuals aged 70+. This somewhat unfortunate procedure was due to a misunderstanding between YouGov Zapera Ltd. and the responsible researchers regarding the age-wise delimitation of the survey population. Subsequently, it was decided to restrict the survey population to individuals aged 18-75 since the use of an internet-based questionnaire to collect data from individuals aged 76+ is likely to lead to selection bias.

5.1.4.2 Preparation of the data

The raw data were stored electronically by YouGov Zapera. After completion of the data collection, the data were prepared for statistical analysis as follows. The data were loaded into Stata and compressed in order to reduce the amount of memory used by the data. Several logical tests and other quality assessments were used to identify errors in the data, which were then corrected.[43] Finally, labels were added. The resulting data-file included 83 variables labeled v1-v86, referring directly to the questionnaire.

A log book accounting for the various steps from raw data to the final dataset as well as a codebook accounting for the precise content and scale of the variables can be found in Kiil and Pedersen (2009). The various do-files used to clean-up and prepare the data are stored on a mainframe computer at the Faculty of Social Sciences, University of Southern Denmark. The files are available from the author upon request. An electronic copy of the data and the documentation to match will be stored in the Danish Data Archive after completion of the project.

5.1.4.3 Comments

Several respondents commented on the questionnaire. Some of these comments may be valuable when developing questionnaires on similar issues in the future, and they may also be useful when interpreting results based on the resulting dataset. Table 5.2 shows the comments grouped by content and their frequency within the sample.

Table 5.2 Frequency of comments

Content of comment	**Frequency**
Experienced technical problems while answering the questionnaire	6
There should not be a tax deduction for employer paid health insurance	7
The risk questions in the last part of the questionnaire are difficult to answer	18
There should be lower or no copayment for adult dental care	23
The questionnaire is very long	35
Experienced problems with the automatic skip patterns	44
Interesting, relevant, and thought provoking survey	57
Negative attitude towards private health insurance and privatisation of the health care sector in general	85
Comment on other issue	220
Total	495

Note: The number of comments does not reflect the number of respondents who have commented on the survey. The reason for this is that each comment is registered according to its content, which implies that comments regarding

[43] Errors were identified and corrected as follows: 1) Respondents indicating to have subordinates but subsequently stating the number of subordinates to be zero were re-coded as having no subordinates, 2) individuals with an alcohol consumption outside of the feasible range (i.e. -3, 900, 4050, and 11111 units of alcohol per week) were dropped, and 3) one respondent who stated to have had 99 contacts to all health care providers within the 12 months prior to the interview was dropped.

more than one issue are registered more than once. 41 respondents chose to comment that they did not have any comments. These comments are not included in the table.

It is clear from Table 5.2 that only a few respondents experienced technical problems while answering the questionnaire (n=6), while some respondents thought they have been asked unnecessary questions (n=44). Further investigation showed that these respondents were mainly disability pensioners, who had been asked a number of work-related questions. This is obviously a mistake in the set-up of the skip patterns on behalf of the researchers.

Moreover, some respondents thought that the questionnaire was very long (n=35), and that the risk questions in the last part of the questionnaire were difficult to answer (n=18). On the other hand, a large number of respondents found the survey interesting, relevant, and thought provoking (n=57). Some respondents have also stated their opinion on issues related to the survey, like copayment for adult dental care (n=23), tax deduction for employment-based health insurance (n=7), and private health insurance and privatisation of the health care sector in general (n=85).

Finally, a large number of comments on other issues were also made (n=220). These comments concerned among other things elaborations on specific questions, general reflections, and comments on missing response categories as perceived by the respondents.

5.2 Survey quality

5.2.1 Sources of error

The quality of survey data may be hampered by various types of error. Given that some error will almost inevitably be present in survey data, the discussion provided in this section is intended to shed light on some potential problems to be aware of. Moreover, it is noted that survey quality is not an absolute concept, but should be considered relative to other features of the data, such as accuracy, costs, and timeliness, and alternative data sources.

The major sources of error in surveys are generally agreed to include issues related to coverage, sampling, non-response, and measurement (Couper 2000; Frankfort-Nachmias and Nachmias 1996; Särndal et al. 1992). Following the terminology of Couper (2000), the dimensions of survey quality are defined in the following using the concepts of a target population, i.e. the population to which one wants to make inference, and the frame population including individuals who can be reached prior to the selection of the sample. In addition to the traditional sources of survey error, it has recently been pointed out that the mere act of participating in an ongoing panel may change respondent behaviour and attitudes, which in turn will affect survey quality. This phenomenon, which is unique to data collected using an internet-based panel, is referred to as panel conditioning.

5.2.1.1 Coverage

Coverage is defined by the degree of correspondence between the target population and the frame population. The most common cause of coverage error is that some members of the target population are missing from the frame population.[44] The severity of coverage error is a function of both the degree of mismatch between the target population and the frame population and the extent to which the individuals who are included in the survey frame differ from those who are not on the variables of interest.

An essential reason why some members of the target population are missing from the frame population is the use of an internet-based questionnaire for the data collection. However, the use of an internet-based questionnaire is not expected to imply a particularly large mismatch between the target population of Danes aged 18-75 and the frame population, given that 86 percent of the Danish adult population had internet access in their homes in 2009 and almost all of these used it to send and receive e-mails (Statistics Denmark 2009a).

For obvious reasons, it is not possible to assess with certainty the extent to which the individuals who are included in the survey frame differ from those who are not.

5.2.1.2 Sampling

Another dimension of survey quality is sampling, which refers to the selection of respondents from the frame population. The established principles of statistical inference are in theory only applicable to probability based samples, where all members of the population have known and positive probabilities of selection (Couper 2000). The identification of respondents through YouGov Zapera's Denmark panel, in which it is possible to enroll on a voluntary basis, thus implies that the established principles of statistical inference are in theory not applicable to the resulting dataset. However, the practical importance of some extent of voluntary enrolment in internet-based panels has yet to be assessed. Moreover, statistical inference is frequently based on various types of non-probability based samples (e.g. because all members of the frame population could not be identified) within the social sciences. It is thus not believed that the issues as regards sampling outweigh the benefits of using YouGov Zapera's Denmark panel to identify respondents.

5.2.1.3 Non-response

Non-response error arises due to the fact that not all people included in the sample are willing or able to complete the survey. As with coverage, the severity of non-response error is a function of the rate of non-response as well as differences between respondents and non-respondents on the variables of interest. Non-response may occur at various stages of the data collection process. Some respondents may not respond to being approached during the initial recruitment of respondents, other respondents may be open

[44] The opposite scenario, i.e. that the survey frame includes some individuals who are not part of the target population, is, however, also possible.

to contact but refuse to have internet access or provide a false e-mail address, and finally some respondents may choose not to respond when sent the survey invitation.

Information is only available on the latter type of non-response in this survey. Of the 13,246 sampled individuals aged 18-75, 5,447 participated in the survey while 7,799 did not respond, corresponding to an overall non-response rate of 59 percent. The distribution of non-response is described in Table 5.3, where the non-response rates are reported separately by region and gender and age combined.[45]

Table 5.3 Non-response by region and gender and age combined

		Invited sample	Non-response	
		n	**n**	**%**
Region	Capital area	4,238	2,487	58.68
	Zealand	1,942	1,125	57.93
	Central Jutland	2,833	1,653	58.35
	Northern Jutland	1,327	807	60.81
	South Denmark	2,906	1,727	59.43
Male	18-25	839	620	73.90
	26-35	1,335	921	68.99
	36-45	1,461	982	67.21
	46-55	1,323	788	59.56
	56-65	1,199	595	49.62
	66-75	604	256	42.38
Female	18-25	811	498	61.41
	26-35	1,341	832	62.04
	36-45	1,423	855	60.08
	46-55	1,291	699	54.14
	56-65	1,198	590	49.25
	66-75	421	163	38.72
Total		13,246	7,809	

The non-response rate is seen to be similar across the five regions of Denmark, but decreasing with age for both genders and higher for males compared to females across all age groups. The variation in non-response rates by age and gender may reflect a varying degree of interest in the subject of the survey, as well as a general tendency for males, especially the younger ones, to be less inclined than females to participate in surveys. The extent of bias entailed by a low response rate is a function of the response rate itself as well as differences between respondents and non-respondents on the variables of interest. In the present study, it is possible that the respondents differ from those who did not answer the questionnaire by having a greater interest in the subject of the survey, i.e. VPHI. Such an interest could be spurred by being strongly for or against VPHI, and it may be positively or negatively related to health. Moreover, it is uncertain how this relates to the remaining variables used in this study. Hence, while caution should

[45] These are the only characteristics which are known for both respondents and non-respondents.

always be exercised when generalising results based on survey data to populations, there are no obvious reasons to believe that results based on the present survey will be systematically biased by non-response.

5.2.1.4 Measurement error

Measurement error is defined as the difference between the true value of a variable and the corresponding observed value (Särndal et al. 1992). The causes of measurement error can be classified into three broad categories as follows. First, an inaccurate measurement instrument may be interpreted in different ways by different people, e.g. due to the use of a poorly specified questionnaire or simple misunderstandings. Another factor that may cause measurement error is response error. Response error may arise due to e.g. memory error on part of the respondent, lack of motivation, comprehension problems, differences in perceptions, or inability to allocate an event to the right time period. Moreover, respondents may be unwilling to provide information about some issues or choose to provide false information deliberately due to sensitivity issues and concerns about confidentiality. Third, for data collected by personal interviewing, differences between interviewers with respect to skills and personal characteristics may also induce measurement error.[46]

The extent and cause of measurement error depends on among other factors the method of data collection. In the present survey, where the data were collected using an internet-based questionnaire, the design of the questionnaire is of crucial importance. Given the amount of effort put into developing the questionnaire and the extensive pilot testing, it is reasonable to assume that the extent of measurement error which is attributable to a poorly specified questionnaire is minimised. Moreover, respondents were explicitly reassured about the confidentiality of their responses in the invitation to the survey.

Another factor which may affect the extent of measurement error is the nature of the variables on which data are collected. For some types of variables, it is possible to observe the values essentially without error, while it is very hard to identify a suitable measuring instrument for other types of variables. This is discussed in the following.

The demographic variables age and gender are examples of variables which are relatively unproblematic to measure, implying that the extent of measurement error is expected to be limited for these and similar variables. On the contrary, some extent of measurement error is likely to occur when measuring the economic resources of an individual by self-reported pre-tax income. One reason for this is that the true economic resources may differ from the pre-tax income if savings and investment income is not included, just like the measure does not take into account geographical differences in the cost of living. Another reason is that response error might occur due to memory error on part of the respondent. Moreover, respondents may be unwilling to provide information about income, or choose to provide false information deliberately due to sensitivity issues and concerns about confidentiality. A similar type of

[46] This type of measurement error is also known as interviewer bias.

response error may also occur for the variables measuring health-related lifestyle, where it is possible that respondents report false information deliberately in order to appear to have a healthier behaviour. The variables measuring satisfaction with the tax-financed health care system and self-assessed health status may also suffer from some extent of measurement error due to difficulties in finding a suitable measuring instrument. For both variables, the perception of a given level of satisfaction or health may differ between individuals. For example, some symptom free individuals with diabetes might consider their health as being poor or bad due to the diabetes, while others in the same situation might consider their health as being good or excellent due to the absence of symptoms when medicated appropriately.

Considering the variables measuring ownership of different types of VPHI, the non-negligible shares of respondents stating that they do not know their insurance status may be taken to indicate that these variables suffer from some extent of measurement error due to memory error on part of the respondent. In addition, it is possible that some individuals are not aware that they are covered by VPHI, e.g. because they have it as a fringe benefit without knowing, or because the premium for membership of ‘denmark’ is paid by their parents or a spouse. However, there is no reason to believe that the extent of measurement error in the variables measuring VPHI status in this survey is any larger than in other similar surveys. The increased focus on private health insurance in the Danish media in recent years may even be expected to reduce the extent of measurement error that is due to respondents not knowing their own status.

Finally, it is possible that the count variables measuring self-reported use of various health care services are subject to some response error if respondents are unable to recall or allocate past use to the right time period. Determining the length of the recall period when collecting data on self-reported use of health care services involves a tradeoff. While longer recall periods may invariably introduce recall errors, shorter recall periods come at a cost in terms of less information (Clarke et al. 2008). In general, rare events call for longer recall periods than more frequent events. Clarke et al. (2008) have argued in favour of using longer recall periods when the interest of the study lies in the use over the longer period by comparing the errors incurred by respondents in recalling health care use over the target period with the errors induced by the imputation process used to expand the responses obtained for a shorter recall period to the longer period. Kjellsson et al. (2011) used experimental data to study how the length of the recall period affected recall error and found that overall a recall window of one year is preferable to scaling up recall windows of one, three, or six months. However, Kjellsson et al. (2011) also found several individual characteristics to be associated with recall errors. This implies that a shorter recall window may be preferable if the objective of the survey is analysis on the individual level. Bhandari and Wagner (2006) reviewed 42 studies that evaluated the accuracy of self-reported health care use data and found among other things that the inaccuracy of self-reporting increases with longer recall periods, that underreporting is a substantially more frequent problem at 12 months than over-reporting, and that there is a positive association between visit frequency and underreporting. Moreover, the accuracy of reported outpatient visits, such as physiotherapist and chiropractor visits, is consistently found to be lower than that of inpatient visits. The optimal recall period thus depends on among other things the objective of the data collection, the prevalence of the event in question, and the type of health care on which information is collected. This survey measures self-reported use of various health care services using a recall period of 12 months prior to the interview. This is in line with the recommendation of Clarke et al. (2008). It was decided to use the same recall period for all services despite differences in prevalence and type, in order not to cause unnecessary confusion. Hence, some extent of response error is expected to be present, especially for the variables measuring outpatient visits.

Summing up, while most of the variables included in the dataset are expected to be measured with reasonable accuracy, some variables may be subject to varying degrees of measurement error. This must be taken into account when interpreting the empirical findings of the thesis. There is, however, no reason to expect that the dataset used in this thesis is subject to a larger extent of measurement error than other surveys on similar issues.

5.2.1.5 Panel conditioning

Panel conditioning refers to a tendency for respondents to answer survey questions differently solely due to participation in previous surveys. On the one hand, respondents may put a greater effort into answering a given survey if they found previous surveys administered through the panel interesting. Moreover, respondents may become familiar with the research format, which enables them to answer more accurately and make fewer mistakes. On the other hand, if previous participation was disappointing, respondents may exert less effort and develop techniques to avoid follow-up questions and strategically shorten the response time. Hence, the effect of panel conditioning on survey quality is ambiguous.

Empirical evidence on the importance of panel conditioning, although sparse and at an early stage, indicates that panel conditioning is probably not a major issue in internet-based panels. Toepel et al. (2008) investigated whether there are differences in the effect of questionnaire design between trained and fresh respondents and found little evidence that survey experience influenced the question-answering process. Trained respondents did, however, seem to be somewhat more likely to take shortcuts in the response process and study the questions less carefully. Along a similar line, Christensen and Ladenburg (2010) investigated issues of panel conditioning in a survey of parents' satisfaction with daycare arrangements in Denmark and found no significant evidence of panel conditioning. Hence, there is no reason to believe that the quality of the survey data used in this thesis is severely hampered by negative effects of panel conditioning.

5.2.2 Representativity

Representativity of the sample is important in order to be able to generalise results based on the survey to the entire population. In this section the representativity of the sample is described by comparing the respondents in the sample to the population they are intended to represent, i.e. the Danish population aged

18-75. Population figures covering the year 2009 and including individuals aged 18-75 (unless otherwise noted) are obtained from Statistics Denmark.

One may argue that the data should be adjusted to provide an accurate picture of the Danish population by applying probability weights.[47] However, when stratification is not exogenous, which is the case when experience with response rates is used to select the sample, it is not appropriate to apply probability weights (Cameron and Trivedi 2005).

Table 5.4 shows the distribution of the population and the sample on the region of residence and reports the results of several two-sided tests for equality of sample and population proportions. It is seen from Table 5.4 that individuals from the capital region are slightly overrepresented in the sample, while individuals from Northern Jutland are slightly underrepresented.

Table 5.4 Representativity by region

	Population (%)	Sample (%)	Two-sided test for equality (z-value)
Capital area	30.83	32.15	2.104**
Zealand	14.79	15.00	0.435
South Denmark	21.46	21.64	0.333
Central Jutland	22.46	21.66	-1.409
Northern Jutland	10.46	9.55	-2.203**
Number of obs.	3,772,966	5,447	

Source: Statistics Denmark (2009b).
Note: * significance at 10 percent level; ** significance at 5 percent level; *** significance at 1 percent level.

Table 5.5 shows the distribution of the population and the sample by age and gender combined. For males, there is a clear pattern where the younger age groups 18-55 are underrepresented and the older age groups 56-75 are overrepresented. For females, the age groups 18-35 and 46-65 are overrepresented, while the age groups 36-45 and 65-75 are underrepresented, i.e. the pattern is more mixed.

The differences between the sample and the population are small in magnitude, although statistically significant for many groups. This may be taken to mean that the sample selection strategy employed by YouGov Zapera (and described in section 5.1.4) has been reasonably successful. The sample selection strategy is, however, based on the assumption that non-response is uncorrelated with other characteristics than those observed. If non-respondents differ with respect to other characteristics than age and gender,

[47] Probability weights are defined as the inverse of the probability that the individual under consideration was sampled from the population, i.e. they denote the number of individuals in the population that each sampled respondent represents.

inviting more respondents from the demographic groups with low response rates does not necessarily improve the representativity of the sample in general.

Table 5.5 Representativity by age and gender combined

		Population (%)	Sample (%)	Two-sided test for equality (z-value)
Male	18-25	4.18	4.02	-0.588
	26-35	9.22	7.60	-4.131***
	36-45	10.99	8.79	-5.182***
	46-55	9.89	9.82	-0.168
	56-65	9.54	11.09	3.891***
	66-75	5.81	6.39	1.826*
Female	18-25	4.78	5.75	3.343***
	26-35	9.15	9.34	0.498
	36-45	10.68	10.43	-0.603
	46-55	9.73	10.87	2.835***
	56-65	9.62	11.16	3.860***
	66-75	6.39	4.74	-4.990***
Number of obs.		3,772,966	5,447	

Source: Statistics Denmark (2009b).
Note: * significance at 10 percent level; ** significance at 5 percent level; *** significance at 1 percent level.

The representativity of the sample is also assessed for the number of people in the household, education level, occupation, and health care use. These characteristics were not used by YouGov Zapera to select the sample. Table 5.6 shows the distribution of the population and the sample by number of people in the household. It is seen from Table 5.6 that smaller households with 1-2 individuals are somewhat overrepresented in the sample, while households with four individuals or more are significantly underrepresented.

Table 5.6 Representativity by number of people in the household

	Population (%)	Sample (%)	Two-sided test for equality (z-value)
1	20.78	22.86	3.777***
2	38.89	44.19	8.023***
3	15.27	14.61	-1.347
4	15.89	13.05	-5.727***
5	5.91	4.26	-5.167***
6 or more	3.27	1.03	-9.303***
Number of obs.	3,772,966	5,447	

Source: Statistics Denmark (2009b).

Note: * significance at 10 percent level; ** significance at 5 percent level; *** significance at 1 percent level.

In Table 5.7, the education level of the sample is compared to the education level of the population. It is seen that individuals with 7-11 years of school education or a vocational education are significantly underrepresented in the sample, while all other groups are overrepresented. The differences between the sample and the population with regards to education level are large in magnitude.

Table 5.7 Representativity by education level

	Population (%)	Sample (%)	Two-sided test for equality (z-value)
7-11 years of school education	32.35	0.77	-35.165***
High school	8.57	20.73	7.560***
Vocational education	33.30	24.49	-13.796***
Academy profession degree	5.03	10.50	18.475***
Bachelor's degree	14.26	26.25	25.314***
Postgraduate qualifications	6.49	15.02	25.547***
Other	0.00	2.24	-
Number of obs.	3,756,572	5,447	

Source: Statistics Denmark (2009b).

Note: * significance at 10 percent level; ** significance at 5 percent level; *** significance at 1 percent level. Population figures are from 2008 and include individuals aged 15-69.

Even though some of the differences between the population and the sample with regards to education level may be caused by differences in the definitions used by Statistics Denmark and the perceptions of the respondents, Table 5.7 indicates that the underrepresentation of individuals with a low education level is a problem in this survey.

Table 5.8 assesses the representativity of the sample with respect to occupation. The most substantial differences between the sample and the population are that pensioners are significantly underrepresented in the sample, while students are significantly overrepresented. Employed and unemployed are also underrepresented in the sample, and self-employed and assisting spouses are overrepresented, although the deviations are much smaller than those found for students and pensioners.

Finally, Table 5.9 shows the average number of contacts to various health care providers for the population and the sample. The average number of contacts to general practitioners and specialists is lower for the sample than for the general population, while the opposite relationship exists for visits to dentists, chiropractors, and physiotherapists. Thus, the sample is not exactly similar to the population it is intended to represent with respect to health care use. It may explain some of the difference that visits to chiropractors and physiotherapists that are paid for privately are not registered by Statistics Denmark. Moreover, memory problems on part of the respondents may also have contributed to the differences.

Based on Table 5.9 one might speculate that it is easier to remember visits for which a co-payment was made, sometimes even more visits than actually took place.

Table 5.8 Representativity by occupation

	Population (%)	Sample (%)	Two-sided test for equality (z-value)
Self-employed	4.41	5.05	2.296**
Assisting spouse	0.16	0.29	2.470**
Employed	60.07	58.66	-2.131**
Unemployed	4.53	3.75	-2.785***
Pensioner	23.06	17.83	-9.170***
Early retirement pensioner	3.25	3.36	0.456
Student	1.83	8.65	37.537***
Other	2.70	2.42	-1.260
Number of obs.	4,255,156	5,447	

Source: Statistics Denmark (2009b).
Note: * significance at 10 percent level; ** significance at 5 percent level; *** significance at 1 percent level. Figures for the population are from 2008 and includes individuals aged 18 and up.

Table 5.9 Representativity by health care use

	Population average # of contacts within the previous 12 months	Sample average # of contacts within the previous 12 months	Two-sided test for equality (z-value)
General practitioner	7.76	3.58	-58.382***
Specialist doctor	0.94	0.74	-7.894***
Dentist	1.10	1.69	29.383***
Chiropractor	0.48	0.59	3.434***
Physiotherapy	1.31	1.92	5.822***
Number of obs.	3,772,966	5,447	

Source: Statistics Denmark (2009b).
Note: * significance at 10 percent level; ** significance at 5 percent level; *** significance at 1 percent level. Figures for the population are from 2008.

To sum up, the representativity of the Danish Survey on Voluntary Health Insurance 2009 is hampered by several statistically significant deviations between the sample and the population. Most of the deviations are relatively small in magnitude, which implies that the overall representativity seems reasonable in spite. However, the severe underrepresentation of individuals with a low education level is problematic. The underrepresentation of this particular group could be due to the chosen method of data collection. Given that underrepresentation of individuals with a low education level is a general problem in questionnaire surveys based on questionnaires (see e.g. Christensen et al. (2009)), it is, however, uncertain how much an alternative method of data collection, like paper-based questionnaires sent out in the mail, would have improved upon the representativity.

5.3 Descriptive statistics for key variables

This section reports descriptive statistics for the key variables measuring VPHI coverage and the use of health care services. Additional descriptive statistics are reported in the empirical chapters where this is relevant. Moreover, the marginal response distributions for the remaining variables included in the dataset can be found in Appendix A.

Table 5.10 shows descriptive statistics for the variables measuring VPHI coverage along the dimensions of VPHI supplied by commercial insurers and membership of 'denmark', thus allowing for an assessment of double coverage. The individuals who do not know their exact insurance status are dropped.[48]

Table 5.10 Types of voluntary private health insurance schemes held

VPHI supplied by commercial insurer	Member of 'denmark'					
	Yes		No		Total	
Through own employer						
- Employer pays all	9.93%	(n = 492)	8.03%	(n = 398)	17.95%	(n = 890)
- Employee contributes	4.38%	(n = 217)	3.03%	(n = 150)	7.40%	(n = 367)
Through partner's employer	2.02%	(n = 100)	1.51%	(n = 75)	3.53%	(n = 175)
Individually purchased	2.28%	(n = 113)	1.27%	(n = 63)	3.55%	(n = 176)
No	35.26%	(n = 1,748)	32.30%	(n = 1,601)	67.56%	(n = 3,349)
Total	53.86%	(n = 2,670)	46.14%	(n = 2,287)	100.00%	(n = 4,957)

It is seen from Table 5.10 that while 32 percent of the sample do not hold VPHI, the individuals in the remaining part of the sample all hold some type of VPHI coverage. More than half of the respondents are members of 'denmark'. Among the members of 'denmark', a considerable share also holds employment-based VPHI. While the far majority of the individuals with employment-based VPHI are insured through their own employer, some individuals have VPHI through their partner's employer. The employers are seen to pay the entire premium for the majority of the individuals who are insured through their own employer. However, a notable share contributes to the premium out of the pre-tax income. Finally, it is

[48] The dropped individuals are distributed as follows: 51 did not know whether they were members of 'denmark', 221 did not know whether they were insured through their own employer, 60 were insured through their employer but did not know whether the premium was fully paid by the employer; 100 did not know whether they were insured through their partner's employer; 58 did not know whether they had purchased VPHI from a commercial insurance company on an individual basis.

seen from Table 5.10 that some of the members of ‘denmark’ have taken out VPHI from a commercial insurance company on an individual basis. While this is perfectly possible, it cannot be ruled out that some of these individuals have confused VPHI with other types of insurance sold by commercial insurers, such as insurance that pays out a fixed amount of money in the event of a critical illness.

Table 5.11 shows descriptive statistics for the variables measuring the use of the types of health care services analysed in the empirical chapters for the full sample and broken down by insurance status. Health care use is measured by self-reported number of visits within the previous 12 months, as discussed in section 5.2.1.4. It is seen from Table 5.11 that the distribution in the use of health care services within the previous 12 months is right-skewed with a high concentration of zeros for all services except for contacts to GPs and dentists and the use of prescription medication, where more than half of the sample reports a positive use. Comparing the health care use of the uninsured to the sample average, it is seen that the percentage with a positive use is lower among the uninsured for contacts to GPs, physiotherapists, chiropractors, psychologists, specialists, dentists, and hospitalisations and higher for ambulatory contacts and regular use of prescription medication. Considering average use, the pattern differs somewhat in that the uninsured have less contacts to physiotherapists, chiropractors, and dentists than the sample average but more contacts to GPs, psychologists, ambulatory providers, and hospitalisations. Hence, the descriptive evidence on differences in use between the individuals with and without VPHI, respectively, does not reveal any clear patterns.

Within the group of privately insured, the average number of contacts to GPs, physiotherapists, specialists, and dentists as well as ambulatory contacts and hospitalisations during the 12 month period is above the average of the full sample for members of ‘denmark’ and below the average for individuals with employment-based VPHI. Except for physiotherapist contacts, this trend is confirmed by considering the distribution of visits, where the percentage of individuals with positive use is above the average of the full sample for members of ‘denmark’, and below the average for individuals with employment-based VPHI. Likewise, the percentage with a regular use of prescription medication is above the sample average for members of ‘denmark’ and below the sample average for individuals with employment-based VPHI. These differences support the strategy outlined in section 1 of analysing membership of ‘denmark’ and employment-based VPHI separately. The descriptive statistics provided in Table 5.11 do not reveal any clear-cut patters regarding how the use of physiotherapy, chiropractic care, and psychological counselling differs between insurance groups. The use for the individuals with combinations of ‘denmark’, employment-based VPHI, and VPHI purchased through a commercial insurer on an individual basis generally lies in the interval between members of ‘denmark’ and employment-based VPHI, although with some deviations. Finally, the group of individuals who are only covered by VPHI purchased on an individual basis through a commercial insurer is rather small and thus not considered further here.

Table 5.11 Health care use broken down by insurance status

Visits to:	Insured ’denmark’ (n = 1,748)	Employment-based (n = 623)	Commercial (n = 63)	Combi-nations (n = 922)	Uninsured (n = 1,601)	Total (n = 4,957)
GPs						
0	16.30%	20.39%	14.29%	17.68%	18.11%	17.63%
1	16.99%	23.43%	26.98%	21.15%	18.49%	19.18%
2 or more	66.70%	56.18%	58.73%	61.17%	63.40%	63.18%
Mean (std. err.)	3.75 (0.12)	2.87 (0.16)	4.14 (1.45)	2.90 (0.11)	4.15 (0.16)	3.62 (0.08)
Physiotherapists						
0	81.86%	80.10%	82.54%	77.22%	83.95%	81.46%
1	2.80%	5.46%	4.76%	3.58%	3.25%	3.45%
2 or more	15.33%	14.45%	12.70%	19.20%	12.80%	15.09%
Mean (std. err.)	2.13 (0.20)	1.61 (0.23)	2.41 (1.59)	1.94 (0.19)	1.94 (0.22)	1.97 (0.11)
Chiropractors						
0	88.04%	88.28%	84.13%	83.30%	91.76%	88.34%
1	2.40%	1.77%	4.76%	4.34%	1.31%	2.36%
2 or more	9.55%	9.95%	11.11%	12.36%	6.93%	9.30%
Mean (std. err.)	0.60 (0.06)	0.61 (0.09)	0.40 (0.13)	0.84 (0.09)	0.45 (0.05)	0.59 (0.03)
Psychologists						
0	93.48%	94.86%	93.65%	93.49%	94.25%	93.91%
1	1.03%	0.64%	0.00%	1.30%	0.69%	0.91%
2 or more	5.49%	4.49%	6.35%	5.21%	5.06%	5.18%
Mean (std. err.)	0.44 (0.06)	0.37 (0.08)	0.78 (0.50)	0.44 (0.08)	0.45 (0.07)	0.44 (0.04)
Specialists						
0	62.64%	74.64%	69.84%	66.92%	67.65%	66.65%
1	19.97%	13.64%	19.05%	18.44%	16.43%	17.73%
2 or more	17.39%	11.72%	11.11%	14.64%	15.93%	15.61%
Mean (std. err.)	0.85 (0.05)	0.59 (0.07)	0.52 (0.13)	0.67 (0.05)	0.75 (0.05)	0.75 (0.03)
Dentists						
0	13.10%	18.78%	26.98%	11.82%	26.11%	17.95%
1	25.46%	35.79%	31.75%	29.61%	26.86%	28.06%
2 or more	61.44%	45.43%	41.27%	58.57%	47.03%	53.98%
Mean (std. err.)	1.91 (0.04)	1.48 (0.05)	1.33 (0.15)	1.76 (0.04)	1.56 (0.04)	1.71 (0.02)
Ambulatory						
0	69.57%	77.21%	74.60%	76.03%	69.96%	71.92%
1	13.90%	10.27%	4.76%	11.06%	10.99%	11.86%
2 or more	16.53%	12.52%	20.63%	12.91%	19.05%	16.22%
Mean (std. err.)	1.00 (0.08)	0.87 (0.14)	0.73 (0.18)	0.63 (0.06)	1.09 (0.08)	0.94 (0.04)
Hospitalisations						
0	86.84%	89.25%	88.89%	91.21%	88.69%	88.58%
1	8.92%	7.54%	6.35%	6.72%	7.62%	7.89%
2 or more	4.23%	3.21%	4.76%	2.06%	3.69%	3.53%
Mean (std. err.)	0.24 (0.03)	0.16 (0.02)	0.22 (0.10)	0.12 (0.02)	0.21 (0.02)	0.20 (0.01)
Medicine use						
Yes	51.77%	33.23%	38.10%	36.98%	52.28%	46.68%

No	48.23%	66.77%	61.90%	63.02%	47.72%	53.32%

6 A reader's guide to the thesis

The main part of the thesis is made up by one review paper (chapter 2) and three empirical papers with original research (chapters 3-5). Chapter 6 discusses and concludes. Finally, a Danish summary is included at the end of the thesis.

The empirical chapters are all based on data from the cross-sectional sample of the Danish population described in detail in section 5. Given the intention that each chapter can be read independently and in an arbitrary order, there will be some repetition of general issues. Moreover, the chapters are written with an eye to publication in different academic journal. Hence, the style of writing and reference differs somewhat between the chapters. The reader is asked to bear with these inconveniences.

Chapter 2 reviews the empirical literature on what characterises the privately insured in universal health care systems and assesses how well the empirical evidence corresponds with the theoretical predictions. This information is useful in itself, as well as in order to guide the selection of covariates in subsequent empirical chapters. The review is restricted to consider individually purchased policies, given that the theoretical frameworks for analysing individually purchased and employment-based VPHI differ markedly. Empirical studies were identified by performing searches in electronic databases and examining weekly reports on new health economics research. The literature search identified a total of 24 articles and 15 working papers, the majority of which were published within the recent decade. Socioeconomic characteristics, including income, are generally found to be important determinants of having private health insurance. Likewise, the empirical evidence generally supports the theoretical prediction of individuals selecting themselves into duplicate VPHI based on the quality of care available within the universal health care system, just like the demand for VPHI is consistently fund to be negatively affected by the effective insurance premium. On the contrary, the empirical evidence on the importance of risk preferences is sparse and points in different directions. Finally, with few exceptions, the privately insured are generally found to be in better health, thus rejecting the standard theory of adverse selection. The literature provides several possible explanations for the absence of adverse selection.

While the determinants of individually purchased VPHI have been studied extensively in the literature as evident from chapter 2, empirical evidence on what characterises the group of individuals with employment-based VPHI in universal health care systems is restricted to a few studies.

Chapter 3 estimates the determinants of employment-based VPHI ownership within the Danish workforce and explores whether these differ for employees who receive the insurance free of charge and those who pay the premium out of their pre-tax income. It was found that the probability of having employment-based VPHI is positively affected by private sector employment, size of the workplace, whether the workplace has a health scheme, income, being employed as a white-collar worker, and age until the age of 49, while the presence of subordinates, gender, education level, membership of 'denmark' and living in the capital region are not significantly associated with insurance coverage. As expected, the characteristics related to the workplace are by far the quantitatively most important determinants. The association between employment-based VPHI and self-assessed health is found to be quadratic such that individuals in good self-assessed health are more likely to be insured than those in excellent and fair, poor or very poor self-assessed health, respectively. Finally, the probability of having employment-based VPHI is found to be negatively related to the level of satisfaction with the tax-financed health care system. The results are not affected notably by applying a bivariate probit model with sample selection in order to distinguish empirically between employees who receive the insurance free of charge and those who pay the premium out of their pre-tax income. Hence, these two groups may reasonably be combined in future analyses of employment-based VPHI in Denmark, even though the underlying decision processes leading to insurance coverage differ somewhat.

Another key issue in the economic literature on private health insurance is one of identification; more precisely how to separate the causal effect of VPHI on the use of health care services from differences in use that are attributable unobserved factors affecting both the probability of having VPHI and the use of health care services. This issue is the focal point of chapters 4 and 5.

Chapter 4 estimates the effect of employment-based VPHI on the use of covered health care services using the method of propensity score matching. This method is based on an assumption of selection on observables, which is argued to be plausible given the institutional setting of employment-based VPHI in Denmark and the wide set of relevant covariates available in the data. The chapter seeks to comply with the common critique of matching estimators that they require the researcher to make a large number of choices in the estimation process by assessing the sensitivity of the results with respect to several possible specifications of the propensity score and matching algorithms. For the total sample of occupationally active, the estimates of how employment-based VPHI affects the probability of having had one or more hospitalisations, physiotherapist, chiropractor, psychologist, specialist, and ambulatory contacts within the previous 12 months are positive for all health care services except for psychologist visits, but do not differ significantly from zero. Restricting the sample to private sector employees, it is found that employment-based VPHI increases the probability of having had any ambulatory contacts (such as examinations, scans, same-day surgery, and control visits) by 6-7 percentage points in addition to the baseline probability of 22.4 percent.

Chapter 5 investigates how the estimated effects of individually purchased VPHI varies with different untestable assumptions by discussing and comparing the results obtained by four fundamentally different identification strategies: 1) Joint parametric modelling relying on functional form and an instrumental variable, 2) propensity score matching relying on selection on observables, 3) a standard univariate parametric estimator relying on functional form and selection on observables and finally 4) non-parametric bounds using weaker assumptions. The results show evidence of a positive and significant effect of VPHI on the use of dental care, physiotherapy, and chiropractic care, irrespective of the method applied. The effect of VPHI on the use of ambulatory care is insignificant, while the results differ across methods for general practice and prescription drug use. The joint parametric model allowing for selection on unobservables generally produces higher estimates than the identification strategies relying on selection on observables. It is shown by means of bounding that the exclusion restriction does not have much identifying power on its own, which implies that the results from the joint parametric model mainly rely on functional form. Moreover, it is clear from the various bounds that while strong assumptions of selection do not rule out incentive effects, only one set of bounds identify a positive sign of the effect of VPHI for all outcomes.

Chapter 6 summarises and discusses the findings, policy implications, and limitations of the empirical chapters and concludes.

6.1 Status of the empirical chapters

The empirical chapters are at somewhat different stages in the process of preparation and publication:

Chapter 2

Kiil A. 2011. What characterises the privately insured in universal health care systems? A review of the empirical evidence

- ➔ Submitted to Health Policy

Chapter 3

Kiil A. 2011. Determinants of employment-based private health insurance in Denmark
Earlier versions of the paper were presented 1) at the 15th meeting in the Danish Forum for Health Economics, the Danish Institute for Health Services Research, Copenhagen, April 14 2010 and 2) at the 16th meeting in the Danish Forum for Health Economics, MarselisborgCentret, Århus, April 13 2011.

- ➔ Accepted for publication in the Nordic Journal of Health Economics

Chapter 4

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Chapter 5

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APPENDIX A Questionnaire with marginal response distributions

A.1 Invitation e-mail

Subject: Survey from YouGov Zapera

Dear <name>,

You are hereby invited to answer a questionnaire from YouGov Zapera, which takes between 10 and 20 minutes to fill out. The questionnaire is about voluntary health insurance, and it is part of a research project at the University of Southern Denmark. The questionnaire is open until June <date> 2009 or until we have received a sufficient number of responses.

To thank you for your help, everybody who completes the survey participates in a draw for 1 gift voucher worth 5000 DKK to a travel agency and 25 gift vouchers worth 1000 DKK each to Coop.

Participation in the survey is completely optional and we would appreciate that you answer all questions. In case you cannot answer a question or find it irrelevant please tick or write “Don’t know”, where this is possible.

Click on this link to start the survey: http://www.yougov.dk/survey?login=<pw>

The results from the questionnaire survey will be published in such a way that no private individuals can be recognised. All information is handled with strict confidentiality, and only the researchers responsible for the survey will have access to
data from the questionnaire survey.

Thank you in advance for your help.

YouGov Zapera Ltd.

A.2 Follow up e-mail

Subject: Survey from YouGov Zapera

Dear <name>,

A few days ago we sent you an invitation to participate in a survey. We would just like to make you aware that it is not too late to participate yet. It takes about 20 minutes to fill out the questionnaire.

The questionnaire is about voluntary health insurance, and it is part of a research project at the University of Southern Denmark. The questionnaire is open until June <date> 2009 or until we have received a sufficient number of responses.

PLEASE NOTE
To thank you for your help, everybody who completes the survey participates in a draw for 1 gift voucher worth 5000 DKK to a travel agency and 25 gift vouchers worth 1000 DKK each to Coop.

Participation in the survey is completely optional and we would appreciate that you answer all questions. In case you cannot answer a question or find it irrelevant please tick or write “Don’t know”, where this is possible.

Click on this link to start the survey: http://www.yougov.dk/survey?login=<pw>

The results from the questionnaire survey will be published in such a way that no private individuals can be recognised. All information is handled with strict confidentiality, and only the researchers responsible for the survey will have access to data from the questionnaire survey.

Thank you in advance for your help.

YouGov Zapera Ltd.

A.3 English questionnaire with marginal response distributions

single

Q1 What is your gender? *(n=5447)*

1. Male *(47.71%)*
2. Female *(52.29%)*

numeric

Q2 What is your age? *(n=5447)*

Write number of years: ____________________ *(mean 46.76)*

numeric

Q3 What is your postcode?

Write postcode: ____________________

numeric

Q4 How many adults aged 16 years or above lives in your household? *(n=5447)*
(Including yourself)

Write number of adults: _____________________ *(mean 1.92)*

numeric

Q5 How many children aged 15 years or below lives in your household? *(n=5447)*

Write number of children: _______________________ *(mean 0.45)*

single

Q6 What is your current marital status? *(n=5447)*

1. Married *(52.52%)*
2. Civil partnership *(0.81%)*
3. Unmarried, cohabiting *(18.05%)*
4. Unmarried, live alone/with parents *(12.87%)*
5. Divorced *(7.62%)*
6. Separated *(1.41%)*
7. Widow/widower *(3.23%)*
8. Other *(3.49%)*

single

Q7 Which type of housing do you live in? *(n=5447)*

1. Owner-occupied *(61.37%)*
2. Housing co-operative *(7.42%)*
3. Rented *(30.20%)*
4. Service tenancy *(0.33%)*
5. Other *(0.68%)*

text

The next questions are about your education and occupation.

single

Q8 What is the highest level of school education you have completed? *(n=5447)*

1. 7 years of schooling *(3.69%)*
2. 8-9 years of schooling *(10.04%)*
3. 10-11 years of schooling *(27.45%)*
4. General Certificate of Secondary Education *(58.82%)*

single

Q9 Have you completed a vocational or higher education? *(E.g. carpenter, nurse, lawyer)* *(n=5447)*

1. Yes, I have completed a vocational or higher education *(78.48%)*
2. No, but I am currently enrolled in a vocational or higher education *(6.59%)*
3. No *(14.93%)*

single – if Q.9=1

Q10 Which vocational or higher education have you completed? *(State the highest education you have completed)* *(n=4276)*

1. Semi-skilled worker education (e.g. hospital porter, truck driver, process operator, driver) *(1.05%)*
2. Basic vocational course *(4.16%)*
3. Trainee or apprentice education (e.g. hairdresser, gardener, office clerk, carpenter) *(17.66%)*
4. Other vocational education (e.g. medical secretary, draughtsman, home carer, bachelor of commerce) *(8.33%)*
5. Academy Profession degree, less than 3 years (e.g. pharmacologist, police officer, computer scientist) *(13.38%)*
6. Bachelor’s degree or Professional Bachelor’s degree, 3-4 years (e.g. school teacher, nurse, occupational therapist) *(33.44%)*
7. Postgraduate qualifications, more than 4 years (e.g. doctor, architect, upper secondary school teacher) *(19.13%)*
8. Other *(2.85%)*

single

Q11 What is your main occupational position? *(n=5447)*
(Please tick only one box)

Employed

1. Self-employed *(5.05%)*
2. Assisting spouse *(0.29%)*
3. Worker, skilled (e.g. craftsman, gardener, mechanic, butcher) *(4.63%)*
4. Worker, unskilled/semi-skilled (e.g. driver, truck driver, process operator, machine operator, bricklayer’s labourer) *(4.70%)*
5. White-collar worker (e.g. office or shop assistant, manager, teacher, auditor, nurse, home carer, day nurse, consultant) or public servant *(45.93%)*
6. Other employment *(3.40%)*

Unemployed

7. Unemployer or re-training *(3.34%)*

Enrolled in education

8. Apprentice or trainee *(0.90%)*
9. Student, higher education *(7.73%)*

10. Student, basic school *(0.02%)*

Pensioner

11. Old-age pensioner *(10.91%)*
12. Disability pensioner *(6.02%)*
13. Other pensioner *(0.90%)*
14. Early retirement pensioner *(3.36%)*

Other

15. Housewife/house husband *(0.39%)*
16. On long term sick leave (3 months or more) *(1.08%)*
17. Military service *(0.00%)*
18. On social security/unemployment benefit *(0.40%)*
19. Rehabilitee *(0.22%)*
20. Other *(0.73%)*

single – if Q.11=1-6,20
Q12 Do you have any subordinates/employees? *(n=3527)*

1. Yes *(21.18%)*
2. No *(78.82%)*

numeric – if Q.12=1
Q13 How many subordinates/employees do you have? *(n=747)*

Write number of subordinates/employees: __________________ *(mean 17.32)*

single – if Q.11=1-6,8,19,20
Q14 Is your workplace a public or private company? *(n=3634)*

1. Private *(56.52%)*
2. Public (state, regions, municipalities, offentligt ejede institutioner med egne bestyrelser) *(36.63%)*
3. Independent public company (national and other public joint-stock companies, e.g. DONG, DSB, Post Denmark, and TV2) *(3.63%)*
4. Other *(2.15%)*
5. Don’t know *(1.07%)*

single – if Q.11=1-6,8,19,20
Q15 How many people are employed at your workplace? *(n=3634)*
(If you are employed by a large concern, consider only your local workplace)

1. 1-4 employees *(10.32%)*
2. 5-9 employees *(7.04%)*
3. 10-19 employees *(10.40%)*
4. 20-49 employees *(17.03%)*
5. 50-99 employees *(12.19%)*
6. 100-249 employees *(13.29%)*
7. 250-499 employees *(6.96%)*
8. 500 employees or more *(18.71%)*
9. Don’t know *(4.05%)*

text
The next questions are about health insurance.

single

Q16 Are you a member of ‘Health Insurance denmark’? *(n=5447)*

1. Yes, group 8 (basis membership/passive membership) *(4.52%)*
2. Yes, group 5 (covers medication, dentist visits, glasses and physiotherapy among other things, but no operation coverage) *(30.84%)*
3. Yes, group 1 (more comprehensive coverage than group 5 incl. operation coverage) *(11.38%)*
4. Yes, group 2 (most comprehensive coverage, more than group 1) *(3.16%)*
5. Yes, but don’t remember which group *(3.27%)*
6. No *(45.90%)*
7. Don’t know *(0.94%)*

single – if Q.16=2

Q17 Have you taken out operation coverage in addition to your membership of group 5? *(n=1680)*

1. Yes *(8.39%)*
2. No *(85.89%)*
3. Don’t know *(5.71%)*

prioritisation – if Q.16=1-5

Q18 Prioritise the two most important reasons for you being a member of ‘Health Insurance denmark’. *(n=2896)*

(Prioritise 1 in the box next to the most important reason and 2 in the box next to the second most important reason)

1. Dissatisfaction with the public healthcare system *(1. 3.14% | 2. 4.56%)*
2. Pressure from family *(1. 1.76% | 2. 2.69%)*
3. To insure my children *(1. 8.39% | 2. 14.33%)*
4. Co-payments in the public healthcare system/good contributions from ’denmark’ *(1. 60.53% | 2. 14.16%)*
5. Waiting times in the public healthcare system *(1. 1.45% | 2. 5.25%)*
6. Have seen the consequences of not being a member of ‘Health Insurance denmark’ in the near family *(1. 6.63% | 2. 19.06%)*
7. Other *(1. 7.80% | 2. 24.76%)*
8. None of these reasons *(1. 10.29% | 2. 10.29)*

single – if Q.16=2-5

Q19 Have you used your membership of ’Health Insurance denmark’ within the last 12 months? *(n=2650)*

1. Yes *(90.98%)*
2. No *(8.38%)*
3. Don’t know *(0.64%)*

text

An increasing number of companies offer their employees <u>health insurance</u>.

A <u>health insurance</u> covers expenses to operations at private hospitals among other things, and usually also counselling and treatment by physiotherapists and chiropractors. The main rule is that the employer pays the insurance premium.

single – if Q.11=1-6,8,9,16,19,20

Q20 Do you have a health insurance through your employer? *(n=4055)*

1. Yes *(33.61%)*
2. No *(60.52%)*
3. Don't know *(5.87%)*

single – if Q.6=1-3

Q21 Do you have a health insurance through your spouse's employer? *(n=3888)*

1. Yes *(7.05%)*
2. No *(88.45%)*
3. Don't know *(4.50%)*

single – if Q.20=1

Q22 Does your employer pay the entire premium for the health insurance? *(n=1363)*

1. Yes *(67.87%)*
2. No, part of the premium is deducted from my wage *(27.73%)*
3. Don't know *(4.40%)*

prioritisation – if Q.20=1 eller Q.21=1

Q23 What is in your opinion the two most important reasons for the increasing popularity of employer paid health insurance? *(n=1546)*

(Prioritise 1 in the box next to the most important reason and 2 in the box next to the second most important reason)

1. Dissatisfaction with the public healthcare system *(1. 9.38% | 2. 4.40%)*
2. It is a tax free fringe benefit which is free for the employee
   (1. 18.50% | 2. 15.33%)
3. It gives access to treatment at private hospitals *(1. 17.40% | 2. 19.40%)*
4. Less sickness absence due to quicker treatment *(1. 38.16% | 2. 26.97%)*
5. Waiting times in the public healthcare system *(1. 13.71% | 2. 29.17%)*
6. Co-payments in the public healthcare system *(1. 0.39% | 2. 0.52%)*
7. Other *(1. 1.23% | 2. 2.20%)*
8. None of these reasons *(1. 1.23% | 2. 1.23%)*

single

Q24 Have you taken out a private health insurance independent of your employer and other than 'Health Insurance denmark', for which you pay the entire premium? *(n=5447)*

(Consider only private health insurance covering yourself – not children or spouses)

1. Yes *(6.02%)*
2. No *(91.79%)*
3. Don't know *(2.18%)*

single – if Q.20=1 eller Q.21=1 eller Q.24=1

Q25 Have you used your health insurance within the last 12 months? *(n=1745)*

1. Yes *(20.46%)*
2. No *(79.37%)*
3. Don't know *(0.17%)*

text
An increasing number of companies likewise offer their employees a company healthcare scheme at the workplace.

A company healthcare scheme is not the same as an employer paid health insurance. A company healthcare scheme is paid by the company and gives access to different facilities at the workplace, like physiotherapy, or referrals to e.g. a Falck Health Centre.

A fruit basket or healthy food in the canteen are not considered company healthcare schemes in this survey.

single – if Q.11=1-6,8,9,16,19,20
Q26 Do you have a company healthcare scheme at your workplace? *(n=4055)*
1. Yes *(25.65%)*
2. No *(67.77%)*
3. Don’t know *(6.58%)*

single – if Q.26=1
Q27 Have you used the company healthcare scheme at your workplace within the last 12 months? *(n=1040)*
1. Yes *(45.87%)*
2. No *(53.85%)*
3. Don’t know *(0.29%)*

text
The next questions are about your health.

single
Q28 How would you describe your general state of health? *(n=5447)*
1. Excellent *(15.57%)*
2. Good *(52.01%)*
3. Fair *(24.78%)*
4. Poor *(6.63%)*
5. Very poor *(1.01%)*

text
By placing a tick in one box in each group below, please indicate which statements best describe your own health state today.

single
Q29 Mobility *(n=5447)*
1. I have no problems in walking about *(86.25%)*
2. I have some problems in walking about *(13.62%)*
3. I am confined to bed *(0.13%)*

single
Q30 Self-care *(n=5447)*

1. I have no problems with self-care *(97.74%)*
2. I have some problems with washing or dressing myself *(1.96%)*
3. I am unable to wash or dress myself *(0.29%)*

single

Q31 Usual activities (e.g. work, study, housework, family or leisure activities) *(n=5447)*

1. I have no problems with performing my usual activities *(81.97%)*
2. I have some problems with performing my usual activities *(15.72%)*
3. I am unable to perform my usual activities *(2.31%)*

single

Q32 Pain/discomfort *(n=5447)*

1. I have no pain or discomfort *(56.93%)*
2. I have moderate pain or discomfort *(39.69%)*
3. I have extreme pain or discomfort *(3.38%)*

single

Q33 Anxiety/depression *(n=5447)*

1. I am not anxious or depressed *(84.58%)*
2. I am moderately anxious or depressed *(14.08%)*
3. I am extremely anxious or depressed *(1.34%)*

single

Q34 Do you have any long-term illness, injury, handicap or other long-term condition? *(n=5447)*
(With long-term is meant more than 6 months)

1. Yes *(34.20%)*
2. No *(64.27%)*
3. Don't know *(1.52%)*

battery single

Q35 Below is a list of various health conditions and illnesses. Please mark for each illness if you have had it now or previously. *(n=5447)*

Statement:

1. Asthma *(1. 6.72% | 2. 5.73% | 3. 86.47% | 4. 1.08%)*
2. Allergies (not asthma) *(1. 23.57% | 2. 6.76% | 3. 67.67% | 4. 2.00%)*
3. Diabetes *(1. 5.56% | 2. 0.53% | 3. 92.64% | 4. 1.27%)*
4. Hypertension *(1. 16.83% | 2. 6.43% | 3. 73.21% | 4. 3.52%)*
5. Chronic bronchitis, emphysema *(1. 3.25% | 2. 1.21% | 3. 93.70% | 4. 1.84%)*
6. Osteoarthritis, rheumatoid arthritis *(1. 18.78% | 2. 1.17% | 3. 76.13% | 4. 3.91%)*
7. Osteoporosis *(1. 2.04% | 2. 0.20% | 3. 94.91% | 4. 2.85%)*
8. Cancer, including leukemia *(1. 0.83% | 2. 2.97% | 3. 94.49% | 4. 1.71%)*
9. Migraine or frequent headaches *(1. 10.46% | 2. 11.03% | 3. 77.84% | 4. 0.66%)*
10. Chronic anxiety or depression *(1. 4.77% | 2. 6.21% | 3. 87.83% | 4. 1.19%)*
11. Other mental health disorder *(1. 2.59% | 2. 2.74% | 3. 93.52% | 4. 1.16%)*
12. Back condition *(1. 12.89% | 2. 7.62% | 3. 78.02% | 4. 1.47%)*
13. Incontinence *(1. 4.79% | 2. 1.32% | 3. 93.17% | 4. 0.72%)*
14. Tinnitus *(1. 9.86% | 2. 1.85% | 3. 87.09% | 4. 1.19%)*

Scale:

1. Yes, have now
2. Yes, have had previously
3. No
4. Don’t know

numeric
Q36 How many days within the last 12 months have you been absent at your work because of illness? *(n=5445)*

Write number of days: ________________ *(mean 19.01)*

single
Q37 Do you use glasses or contact lenses? *(n=5447)*

1. Yes *(69.85%)*
2. No *(30.15%)*

single
Q38 Many adults have had some teeth extracted. How many of your own teeth do you have left? *(n=5447)*
(Adults have 28 teeth + the four wisdom teeth, which are not counted in. The response category “all teeth left” is thus used even if one or more wisdom teeth are extracted)

1. No teeth left *(1.60%)*
2. 1-9 teeth left *(2.46%)*
3. 10-19 teeth left *(6.88%)*
4. 20-27 teeth left *(33.67%)*
5. All teeth left *(53.92%)*
6. Don’t know *(1.47%)*

single – if Q.38=2-6
Q39 If you were to assess your teeth, how would you describe them? *(n=5280)*

1. Very good *(19.53%)*
2. Rather good *(41.31%)*
3. Neither good nor poor *(29.41%)*
4. Rather poor *(8.58%)*
5. Very poor *(1.17%)*

single
Q40 If you think of the last 5 years, what would you say provides the best description of your dentist visits? *(n=5447)*

1. Visit the dentist for regular check-ups once or twice per year *(72.65%)*
2. Visit the dentist for check-ups, but it happens less frequently than once a year *(11.84%)*
3. Only visit the dentist if there are problems *(11.97%)*
4. Never visit the dentist *(3.54%)*

text
The next questions are about your contact with the health care system.

battery numeric

Q41How many times within the last 12 months have you been in contact with the healthcare system due to discomfort, illness or injury? *(n=5447)*
(Include only contacts due to own illness – not children's illness)
Statement:

1. General practitioner (incl. telephone consultation) *(mean 3.58)*
2. Doctor from the emergency service (incl. telephone consultation) *(mean 0.30)*
3. Specialist doctor, e.g. eye doctor *(mean 0.74)*
4. Emergency room *(mean 0.17)*
5. Ambulant treatment (treatment at a hospital without hospitalisation, e.g. examinations, operations, and control visits) *(mean 0.93)*
6. Hospitalisation *(mean 0.20)*

Scale:

Write number of contacts: ___________

single – if Q.41_3=minimum 1 contact
Q42 Who paid for your course of treatment the last time you visited a specialist doctor? *(n=1782)*

1. The public sector *(84.40%)*
2. I paid everything myself *(3.31%)*
3. I paid myself and got a contribution from 'Health Insurance denmark' *(5.05%)*
4. My employer paid health insurance covered the expenses *(3.09%)*
5. My privately paid health insurance covered the expenses *(0.84%)*
6. Other *(1.23%)*
7. Don't know *(2.08%)*

single – if Q.41_5=minimum 1 contact
Q43 The last time you received ambulant treatment, was it at a public hospital or a private hospital? *(n=1510)*

1. Public hospital *(88.54%)*
2. Private hospital *(10.07%)*
3. Don't know *(1.39%)*

single – if Q.43=2
Q44 Who paid for your outpatient care at the private hospital? *(n=152)*

1. The public sector *(48.68%)*
2. I paid everything myself *(6.58%)*
3. I paid myself and got a contribution from 'Health Insurance denmark' *(1.97%)*
4. My employer paid health insurance *(36.18%)*
5. My privately paid health insurance *(5.92%)*
6. Other *(0.00%)*
7. Don't know *(0.66%)*

single – if Q.41_6=minimum 1 contact
Q45 The last time you were hospitalised, was it at a public hospital or a private hospital? *(n=619)*

1. Public hospital *(90.31%)*
2. Private hospital *(9.21%)*
3. Don't know *(0.48%)*

single – if Q.45=2

Q46 Who paid for your inpatient care at the private hospital? *(n=57)*
1. The public sector *(45.61%)*
2. I paid everything myself *(7.02%)*
3. I paid myself and got a contribution from 'Health Insurance denmark' *(0.00%)*
4. My employer paid health insurance *(42.11%)*
5. My privately paid health insurance *(5.26%)*
6. Other *(0.00%)*
7. Don't know *(0.00%)*

battery numeric
Q47 How many times within the last 12 months have you used the following treatment providers? *(n=5446)*
Statement:
1. Dentist *(1.69%)*
2. Physiotherapist *(1.92%)*
3. Chiropractor *(0.59%)*
4. Psychologist *(0.43%)*
5. Reflexologist *(0.26%)*

Scale:
Write number of contacts: ___________

single – if Q.47_1=minimum 1 contact
Q48 Did any of the below-mentioned pay wholly or partly for 1 or more of your dentist treatments? *(n=4443)*
1. Yes, 'Health Insurance denmark' *(50.24%)*
2. Yes, my employer paid health insurance *(0.81%)*
3. Yes, my privately paid health insurance *(0.38%)*
4. No *(47.51%)*
5. Don't know *(1.06%)*

multiple – if Q.47_2=minimum 1 contact
Q49 Did any of the below-mentioned pay wholly or partly for your course of treatment at the physiotherapist? *(n=998)*
1. Yes, I paid wholly or partly myself *(32.16%)*
2. Yes, 'Health Insurance denmark' *(34.57%)*
3. Yes, my employer paid health insurance *(12.63%)*
4. Yes, my company healthcare scheme *(11.02%)*
5. Yes, my privately paid health insurance *(2.40%)*
6. No, none of the above-mentioned paid anything *(21.34%)*
7. Don't know *(1.90%)*

multiple – if Q.47_3=minimum 1 contact
Q50 Did any of the below-mentioned pay wholly or partly for your course of treatment at the chiropractor? *(n=624)*
1. Yes, I paid wholly or partly myself *(33.97%)*
2. Yes, 'Health Insurance denmark' *(45.19%)*
3. Yes, my employer paid health insurance *(13.78%)*
4. Yes, my company healthcare scheme *(10.10%)*

5. Yes, my privately paid health insurance *(2.08%)*
6. No, none of the above-mentioned paid anything *(12.82%)*
7. Don't know *(0.96%)*

multiple – if Q.47_4=minimum 1 contact

Q51 Did any of the below-mentioned pay wholly or partly for your course of treatment at the <u>psychologist</u>? *(n=337)*

1. Yes, I paid wholly or partly myself *(27.89%)*
2. Yes, 'Health Insurance denmark' *(15.13%)*
3. Yes, my employer paid health insurance *(12.76%)*
4. Yes, my company healthcare scheme *(7.72%)*
5. Yes, my privately paid health insurance *(2.08%)*
6. No, none of the above-mentioned paid anything *(39.17%)*
7. Don't know *(3.56%)*

single – if Q.47_5=minimum 1 contact

Q52 Did any of the below-mentioned pay wholly or partly for your course of treatment at the <u>reflexologist</u>? *(n=241)*

1. Yes, 'Health Insurance denmark' *(9.96%)*
2. Yes, my employer paid health insurance *(2.90%)*
3. Yes, my company healthcare scheme *(12.03%)*
4. Yes, my privately paid health insurance *(1.24%)*
5. No *(72.20%)*
6. Don't know *(1.66%)*

single

Q53 Do you take prescription medication on a regular basis (i.e. at least once a week)? *(n=5447)* ***(Excluding contraceptive pills).***

1. Yes *(45.27%)*
2. No *(54.73%)*

text

The next questions are about your health habits.

single

Q54 Do you think it is possible to make an effort in order to maintain good health? *(n=5447)*

1. Yes, I think that own effort is very important *(69.36%)*
2. Yes, I think that own effort is important *(25.41%)*
3. Yes, I think own effort is of some importance *(4.87%)*
4. No, I don't think own effort matters *(0.37%)*

single

Q55 Do you do anything to maintain or improve your health? *(n=5447)*

1. No, I don't do anything *(8.89%)*
2. No, I have tried but given up *(8.00%)*
3. Yes, I do something *(83.11%)*

multiple – if Q.55=3 – random (2-10)

Q56 What do you do to maintain or improve your health? *(n=4527)*

1. Nothing particular *(0.62%)*
2. Exercise *(73.65%)*
3. Eat a healthy diet *(77.42%)*
4. Usually make sure not to eat too much *(51.87%)*
5. Try to stop smoking/smoke less *(11.80%)*
6. Do not drink alcohol *(13.70%)*
7. Limit my alcohol intake *(36.20%)*
8. Make sure to lead a less stressful life *(42.79%)*
9. Make sure to get enough sleep *(57.01%)*
10. Stay in touch with family and friends *(59.86%)*
11. Other *(5.81%)*

single
Q57 How many days in a typical week are you usually physically active for at least 30 minutes per day? *(n=5447)*
Include moderate or hard physical activity where your breathing is increased; e.g. exercising and competitive sports, gardening, brisk walking, bicycling at moderate or fast pace or strenuous work. Include both work and leisure.

1. 0 days per week *(7.84%)*
2. 1-2 days per week *(33.21%)*
3. 3-5 days per week *(39.80%)*
4. 6-7 days per week *(19.15%)*

single
Q58 How often do you ride a bicycle? *(n=5447)*

1. Almost daily or daily *(29.28%)*
2. At least once a week *(18.65%)*
3. At least once a month *(11.36%)*
4. Less than once a month *(19.39%)*
5. Never *(21.31%)*

single – if Q.58=1-3
Q59 When you ride a bicycle, how often do you wear a bicycle helmet? *(n=3230)*

1. Always *(18.08%)*
2. Often *(7.83%)*
3. Occasionally *(4.71%)*
4. Rarely *(4.92%)*
5. Never *(64.46%)*

single
Q60 When you are the driver of a car, van or truck, how often do you wear a seatbelt? *(n=5445)*

1. Always *(85.79%)*
2. Often *(2.35%)*
3. Occasionally *(0.44%)*
4. Rarely *(0.48%)*
5. Never *(0.55%)*
6. I am never the driver of a car, van or truck *(10.39%)*

single

Q61 When you are a passenger of a car, van or truck, how often do you wear a seatbelt? *(n=5445)*

1. Always *(92.87%)*
2. Often *(4.59%)*
3. Occasionally *(0.68%)*
4. Rarely *(0.66%)*
5. Never *(0.48%)*
6. I am never a passenger of a car, van or truck *(0.72%)*

single

Q62 How often do you smoke? *(n=5447)*

1. Almost daily or daily *(24.42%)*
2. At least once a week *(1.73%)*
3. At least once a month *(1.43%)*
4. Less than once a month *(3.38%)*
5. Never *(69.05%)*

numeric

Q63 How many units of alcohol do you usually drink per week? *(n=5443)*

Write number of units: ___________ *(mean 6.59)*

1 bottle of beer = 1 unit
1 bottle of strong beer = 1,5 unit
1 bottle of alcopop = 1 unit
1 glass of fortified wine (e.g. port wine) = 1 unit
4 cl. liqueur = 1 unit
1 bottle of wine = 6 unit
1 glass of wine = 1 unit

single

Q64 How often do you drink more than 5 units of alcohol on the same occasion? *(n=5447)*

1. Almost daily or daily *(1.67%)*
2. At least once a week *(9.20%)*
3. At least once a month *(17.79%)*
4. Less than once a month *(50.41%)*
5. Never *(20.93%)*

numeric

Q65 How tall are you? *(n=5447)*

Write height measured in cm: ______ *(mean 174.06)*

numeric

Q66 How much do you weigh? *(n=5376)*

Write weight measured in kg: __________ *(mean 80.55)*

battery single

Q67 When was the last time you:

Statement:

1. Had a preventive health check by a doctor *(n=5447)*

(1. 42.65% | 2. 13.05% | 3. 39.78% | 4. 4.52%)
2. Had an influenza vaccination *(n=5447)*
   (1. 20.10% | 2. 10.48% | 3. 66.18% | 4. 3.23%)
3. Had a preventive screening for breast cancer *(if Q.1=2) (n=2848)*
   (1. 32.90% | 2. 13.73% | 3. 52.18% | 4. 1.19%)
4. Had a preventive screening for cervical cancer *(if Q.1=2) (n=2848)*
   (1. 59.55% | 2. 23.31% | 3. 15.55% | 4. 1.58%)
5. Did a self examination of your breast *(if Q.1=2) (n=2848)*
   (1. 67.87% | 2. 5.06% | 3. 20.47% | 4. 6.60%)

Scale:
1. Within the last 3 years
2. More than 3 years ago
3. Never
4. Don't know

text
The next questions are about your attitudes towards the public healthcare sector in Denmark.

single
Q68 How satisfied or unsatisfied are you overall with the public healthcare sector in Denmark? *(n=5447)*
1. Very unsatisfied *(5.23%)*
2. Predominantly unsatisfied *(20.29%)*
3. Neither satisfied nor unsatisfied *(27.61%)*
4. Predominantly satisfied *(41.22%)*
5. Very satisfied *(5.65%)*

battery single
Q69 Below is a range of statements about the public healthcare sector in Denmark.
Please indicate how much you agree or disagree with each statement. *(n=5447)*
Statement:
1. The waiting times for treatment are in general reasonable
   (1. 15.11% | 2. 31.74% | 3. 17.40% | 4. 22.78% | 5. 6.79% | 6. 6.17%)
2. The treatment you get is in general of a lower quality than in the private healthcare sector
   (1. 16.67% | 2. 19.92% | 3. 23.24% | 4. 14.65% | 5. 5.62% | 6. 19.90%)
3. I am convinced that in the future I will receive fully satisfactory treatment in the public healthcare sector if I become ill
   (1. 7.12% | 2. 17.51% | 3. 21.57% | 4. 30.97% | 5. 17.81% | 6. 5.01%)
4. In the future it will become necessary to take out a private insurance in order to get the best possible treatment if you become ill
   (1. 18.01% | 2. 17.92% | 3. 23.00% | 4. 21.35% | 5. 9.31% | 6. 10.41%)

Scale:
1. Disagree completely
2. Disagree partly
3. Neither agree nor disagree
4. Agree partly
5. Agree completely

6. Don’t know

battery single

Q70 Below is a range of statements about the <u>organisation</u> of the healthcare sector. Please indicate how much you agree or disagree with each statement. *(n=5447)*

Statement:

1. It is important that everybody in Denmark has equal access to healthcare
   (1. 1.76% | 2. 2.66% | 3. 5.03% | 4. 11.91% | 5. 77.44% | 6. 1.19%)
2. If there is waiting time in the healthcare sector it is ok that employed are treated before unemployed
   (1. 28.18% | 2. 18.36% | 3. 15.13% | 4. 24.82% | 5. 10.13% | 6. 3.38%)
3. The healthcare system should mainly be tax financed
   (1. 2.39% | 2. 3.12% | 3. 9.93% | 4. 19.50% | 5. 60.60% | 6. 4.46%)
4. It is ok that some patients are treated before others with the same need if they can afford to pay for it or have insurance
   (1. 41.84% | 2. 17.04% | 3. 13.11% | 4. 14.71% | 5. 9.53% | 6. 3.78%)

Scale:

1. Disagree completely
2. Disagree partly
3. Neither agree nor disagree
4. Agree partly
5. Agree completely
6. Don’t know

text

The employer paid health insurance policies are much debated. It is noted among other things that unlike insurance policies purchased from ’Health Insurance denmark’ a tax subsidy is given to employer paid health insurance.

This tax subsidy consists of two parts:
A) The employer is allowed to deduct the insurance premium as a regular operating cost in his accounts thereby reducing the taxable profit (corresponding to the rules for other fringe benefits).
B) The employee covered by health insurance is not taxed from the value of the insurance (unlike the rules for other fringe benefits, e.g. newspaper and telephone subscriptions).

single

Q71 Do you think it is ok that employers are allowed to deduct the insurance premium as a regular operating cost in his accounts? *(n=5447)*

1. Yes *(46.01%)*
2. No *(30.90%)*
3. I have no opinion on that issue *(23.10%)*

single

Q72 Do you think it is ok that employees getting an employer paid health insurance are not taxed from this fringe benefit? *(n=5447)*

1. Yes *(52.18%)*
2. No *(30.40%)*
3. I have no opinion on that issue *(17.42%)*

text

The next questions are about your personal facts and economic conditions.

single

Q73 Are you a member of a trade union? *(n=5447)*

1. Yes *(67.08%)*
2. No *(32.46%)*
3. Don't know *(0.46%)*

single – if Q.105=1

Q74 Which trade union are you a member of? *(n=3654)*

1. Blik- og Rørarbejderforbundet *(0.03%)*
2. C3 ledelse og økonomi *(1.18%)*
3. Danmarks Lærerforening *(6.05%)*
4. Dansk El-Forbund *(0.71%)*
5. Dansk Funktionærforbund – Serviceforbundet *(0.82%)*
6. Dansk Journalistforbund (DJ) *(1.56%)*
7. Dansk Jurist- og Økonomforbund (DJØF) *(3.75%)*
8. Dansk Magisterforening (DM) *(2.05%)*
9. Dansk Metal *(2.82%)*
10. Dansk Postforbund *(0.22%)*
11. Dansk Sygeplejeråd *(2.41%)*
12. Den Almindelige Danske Lægeforening *(1.23%)*
13. Fag og Arbejde (FOA) *Previously Forbundet af Offentligt Ansatte og Pædagogisk Medhjælper Forbund (6.29%)*
14. Fagligt Fælles Forbund (3F) *(7.06%)*
15. Finansforbundet *(3.48%)*
16. Forbundet af It-professionelle (Prosa) *(0.63%)*
17. Forbundet for pædagoger og klubfolk (BUPL) *(1.86%)*
18. Frie Funktionærer (SFF) *(0.38%)*
19. Gymnasieskolernes Lærerforening (GL) *(16.53%)*
20. Handels- og Kontorfunktionærernes Forbund (HK) *(3.80%)*
21. Ingeniørforeningen i Danmark (IDA) *(4.54%)*
22. Kristelig Fagforening (Krifa) *(4.16%)*
23. Ledernes Hovedorganisation *(0.49%)*
24. Malerforbundet *(0.49%)*
25. Nærings- og Nydelsesmiddelarbejder Forbundet (NNF) *(2.08%)*
26. Politiforbundet i Danmark *(1.45%)*
27. Socialpædagogernes Landsforbund *(0.74%)*
28. Teknisk Landsforbund (TL) *(20.83%)*
29. Træ-Industri-Byg i Danmark (TIB) *(0.66%)*
30. Other trade union *(1.53%)*
31. Don't know *(0.14%)*

single – if Q.11=1-8,12-20

Q75 Are you a member of an unemployment fund? *(n=5447)*

1. Yes *(60.95%)*
2. No *(38.08%)*
3. Don't know *(0.97%)*

single

Q76 Which political party did you vote for at the last general election, November 13, 2007? *(n=5447)*

1. A. Social Democrats *(19.22%)*
2. B. Social Liberals *(5.67%)*
3. C. Conservatives *(10.70%)*
4. F. Socialist People's Party *(17.06%)*
5. K. Christian Democrats *(0.79%)*
6. O. Danish People's Party *(9.27%)*
7. V. Liberals *(22.36%)*
8. Y. Liberal Alliance *(2.86%)*
9. Ø. Unity List – Red-Green Alliance *(2.42%)*
10. Voted blank *(0.70%)*
11. Did not vote *(3.82%)*
12. Don't know/Do not wish to disclose this information *(5.12%)*

single

Q77 What is your <u>personal</u> income before tax on an annual basis? *(n=5447)*

1. Less than 100000 DKK *(6.11%)*
2. 100000-199999 DKK *(16.17%)*
3. 200000-299999 DKK *(19.15%)*
4. 300000-399999 DKK *(22.86%)*
5. 400000-499999 DKK *(12.47%)*
6. 500000-599999 DKK *(5.16%)*
7. 600000-699999 DKK *(2.83%)*
8. 700000-799999 DKK *(1.47%)*
9. 800000-899999 DKK *(0.75%)*
10. 900000-999999 DKK *(0.33%)*
11. 1000000 DKK or more *(1.08%)*
12. Don't know *(1.34%)*
13. Do not wish to disclose this information *(10.32%)*

single

Q78 What is your <u>household</u> income before tax on an annual basis? *(n=5447)*

1. Less than 100000 DKK *(2.02%)*
2. 100000-199999 DKK *(8.08%)*
3. 200000-299999 DKK *(9.69%)*
4. 300000-399999 DKK *(11.80%)*
5. 400000-499999 DKK *(9.99%)*
6. 500000-599999 DKK *(10.59%)*
7. 600000-699999 DKK *(10.68%)*
8. 700000-799999 DKK *(7.91%)*
9. 800000-899999 DKK *(5.64%)*
10. 900000-999999 DKK *(4.08%)*
11. 1000000 DKK or more *(6.37%)*

12. Don't know *(2.59%)*
13. Do not wish to disclose this information *(10.56%)*

text

The final questions are about your attitudes towards risk and insurance in general.

multiple

Q79 Which of the following insurance types are you covered by? *(n=5447)*

1. Accident insurance (compensation is paid out at disablement or death) *(83.13%)*
2. Patient transport insurance *(19.02%)*
3. Home contents insurance *(94.02%)*
4. None of the insurances types mentioned *(2.59%)*
5. Don't know *(1.21%)*

single

Q80 How would you describe your personal attitude towards economic risk on a scale from 0 to 10? *(n=5447)*

0 indicates that you prefer to avoid economic risk, while 10 in the other end of the scale indicates that you gladly take an economic risk.

1. I focus mainly on the opportunity of *economic loss* and *prefer to avoid risk* (0) *(13.46%)*
2. (1) *(9.23%)*
3. (2) *(15.64%)*
4. (3) *(14.82%)*
5. (4) *(8.92%)*
6. (5) *(20.56%)*
7. (6) *(7.07%)*
8. (7) *(6.02%)*
9. (8) *(2.88%)*
10. (9) *(0.51%)*
11. I focus mainly on the opportunity of *economic gain* and *like to take a risk* (10) *(0.88%)*

single

Q81 All things considered how would you describe your personal attitude towards health and risk on a scale from 0 to 10? *(n=5447)*

0 indicates that you usually pay regard to health in your daily activities, while 10 in the other end of the scale indicates that it does not play an important role.

1. I focus on having a healthy and safe behaviour and *prefer to avoid risk* (0) *(9.97%)*
2. (1) *(10.02%)*
3. (2) *(18.98%)*
4. (3) *(17.70%)*
5. (4) *(10.94%)*
6. (5) *(18.87%)*
7. (6) *(5.36%)*
8. (7) *(4.28%)*
9. (8) *(2.40%)*
10. (9) *(0.55%)*

11. I do not focus on having a healthy and safe behaviour and *do not worry about risk* (10) *(0.92%)*

single

Q82 Imagine that you unexpected have inherited 1000000 DKK from a distant relative. Subsequently you receive an investment offer from an established bank with the following conditions: There is a chance that the invested amount will *double* during the next two years. But it is equally likely that you *lose half* of the invested amount. If you e.g. choose to invest 400000 DKK there is a chance that this amount grows to 800000 DKK during the next two years. But it is equally likely that the amount drops to 200000 DKK.

How large a share of the 1000000 DKK would you choose to invest? *(n=5447)*

1. 0 DKK *(41.31%)*
2. 100000 DKK *(10.63%)*
3. 200000 DKK *(14.28%)*
4. 300000 DKK *(9.58%)*
5. 400000 DKK *(4.13%)*
6. 500000 DKK *(8.63%)*
7. 600000 DKK *(1.16%)*
8. 700000 DKK *(0.70%)*
9. 800000 DKK *(0.84%)*
10. 900000 DKK *(0.15%)*
11. 1000000 DKK *(0.88%)*
12. Don’t know *(7.71%)*

Open

Q83 There are no more questions – but if you feel like elaborating on some of your answers or have any comments on the survey, please write it here:

____

CHAPTER 2

What characterises the privately insured in universal health care systems? A review of the empirical evidence

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Abstract:

Objectives: This paper reviews the empirical literature on what characterises the individuals with voluntary private health insurance (VPHI) in universal health care systems and assesses how well the empirical evidence corresponds with the theoretical predictions. *Methods:* Empirical studies were identified by performing searches in electronic databases and examining weekly reports on new health economics research. *Results:* The literature search identified a total of 24 articles and 15 working papers, the majority of which were published within the recent decade. Socioeconomic characteristics, including income, are generally found to be important determinants of having private health insurance. Likewise, the empirical evidence generally supports the theoretical prediction of individuals selecting themselves into duplicate VPHI based on the quality of care available within the universal health care system, just like the demand for VPHI is consistently fund to be negatively affected by the effective insurance premium. On the contrary, the empirical evidence on the importance of risk preferences is sparse and points in different directions. Finally, with few exceptions, the privately insured are generally found to be in better health, thus rejecting the standard theory of adverse selection. The literature provides several possible explanations for this.

Keywords: private health insurance; universal health care systems; determinants; review

Table of contents:

1 Introduction

In one third of all OECD countries, 30 percent of the population or more are covered by some sort of voluntary private health insurance (VPHI) in addition to the coverage provided by the universal health care system [1]. Hence, knowledge on this type of private health insurance is of widespread relevance.

The VPHI schemes have largely developed around the universal health care systems and as a consequence, they are rather heterogeneous across countries. In settings where the privately insured remain to be covered by and contribute towards the financing of the universal health care system, the coverage provided by VPHI may be classified as complementary, supplementary or duplicate in relation to the universal health care system [1;2]. Complementary and supplementary VPHI cover copayments for health care services that are only partly financed by or excluded from the universal health care system, respectively. Duplicate VPHI provides preferential access to treatments that are also available free of charge within the universal health care system, although often with some waiting time. VPHI is purchased directly by individuals or by employers on behalf of their employees, either at the employers' initiative or in consequence of collective agreements [3].

This paper reviews the empirical literature on what characterises the privately insured in universal health care systems and assesses how well the empirical evidence corresponds with the theoretical predictions. This information is useful in itself, as well as in order to guide the selection of covariates in subsequent empirical analyses. The review is restricted to consider individually purchased policies, given that the theoretical frameworks for analysing individually purchased and employment-based VPHI differ markedly, and that the latter has only been sparsely analysed in a non-US context.[1] Particular attention is paid to the role of risk preferences, and to whether there is evidence of selection into VPHI based on health risk and risk preferences, as predicted by economic theory. Along a similar line, the theoretical predictions of individuals selecting themselves into duplicate VPHI based on income and the quality of care available within the universal health care system are assessed.

The paper is structured as follows. Section 1.1 accounts for the theoretical predictions of what characterises the privately insured in general and in universal health care systems in particular. Section 2 describes the search strategy used to identify the empirical literature to be included in the review and the criteria for inclusion. Section 3 summarises the characteristics of the identified studies and accounts for their empirical results by topic. Section 4 assesses how the empirical evidence corresponds with the

[1] The reader is referred to [4] for an account of the theoretical framework of employer provision of VPHI and a review of the empirical literature on the determinants of having employment-based VPHI coverage.

theoretical framework and discusses the methodological challenges of the literature. Finally, section 5 concludes.

1.1 Brief outline of the theoretical framework

The individual demand for private health insurance is usually modelled within the framework of expected utility theory. More precisely, individuals are assumed to decide whether to insure by comparing the scenarios with and without private health insurance, respectively, and choosing the option that yields the higher expected utility subject to a budget constraint. Within this framework, the demand for private health insurance has been shown to increase with the degree of risk aversion, assuming symmetric information between the insurer and the insurance taker [5;6]. Moreover, individuals have been shown theoretically to adversely select themselves into private health insurance based on their risk of falling ill when they know more about this than the insurers or the insurers are not allowed to use this information in setting the premiums, assuming individuals are risk averse [7-9]. This implies that individuals with a high risk of falling ill are more likely to demand insurance or demand more comprehensive coverage compared to those with a lower risk of falling ill. Another branch of the theoretical literature has predicted the opposite of adverse selection and termed this advantageous selection. Advantageous selection implies that the demand for private health insurance and the risk of falling ill may be negatively correlated if individuals select themselves into private health insurance based on both their risk type and some other characteristic that is positively correlated with insurance coverage and at the same time negatively correlated with the risk of falling ill [10-13]. Potential sources of advantageous selection into private health insurance, i.e. individuals with a low risk of falling ill demanding more comprehensive coverage, are risk preferences [10-12] and cognitive ability [13]. In addition to these demand driven issues, supplier driven selection may arise through screening of applicants, restrictions in the coverage provided by the private insurers, and by targeting insurance policies to low risk individuals.

The theoretical predictions discussed above were derived in an institutional setting without tax-financed health care or social insurance, i.e. where private health insurance provides the primary source of coverage. Theoretical contributions that specifically modelled the demand for duplicate VPHI have emphasized the importance of the relative quality of care delivered by the tax-financed and the private health care sectors, respectively [14;15]. Moreover, assuming the quality of care is a normal good, this literature has shown that individuals select themselves into duplicate VPHI based on their incomes because the universal health care system limits the quality of health care available. Moreover, the theoretical finding of adverse selection has been replicated for the types of private health insurance that exists alongside a universal health care system [16]. Finally, Propper [17] hypothesised that some individuals may not consider duplicate VPHI to be within their choice set for ideological or political reasons. Such individuals are said to have preferences that are captive to the universal health care system.[2]

Hence, the theoretical predictions of what characterises the individuals with VPHI are diverse and sometimes conflicting, and it is likely that more ambiguity will be introduced if the theoretical models are extended to take into account the various institutional structures surrounding VPHI. This underlines the need for empirical analyses to shed light on some of the theoretical ambiguities.

2 Methods

2.1 Search strategy

The reviewed literature was identified by electronic searches in EconLit and PubMed. The searches were restricted to words included in the title. The search terms used were "health insurance *or* medical insurance *or* insurance" *and* "private *or* supplementary *or* duplicate" *and* "determinants *or* demand *or* selection". In addition to the electronic search, weekly reports on the latest working papers from the National Bureau of Economic Research within the programmes of health care, health economics, industrial organization, public economics, and political economy and the New Economic Papers mailing list were also examined in the period from September 2008 to September 2010.[3] The reference lists of identified articles and working papers were searched for additional literature.

2.2 Criteria for inclusion

The review considers English-language literature published up until September 2010, with no lower limit on inclusion time wise.[4] The review is restricted to include empirical studies of individually purchased VPHI in settings where this co-exists with a universal health care system. This implies that studies of private health insurance that allows individuals to opt-out of the universal system, i.e. where the privately insured are no longer entitled to use the universal health care system and do not contribute to its financing, are excluded.[5] This type of VPHI differs conceptually from the policies considered here. Moreover, studies of supplemental insurance purchase among the elderly in the United States (termed Medigap) are

[2] Although less likely in countries with well-developed universal health care systems, captivity may, however, also occur the other way around, so that individuals holding beliefs that are critical of the universal health care system are inclined to go private.

[3] More information about the NBER Working Paper Series can be found at http://www.nber.org/papersbyprog/, and the New Economic Papers mailing list is described at http://nep.repec.org/.

[4] An exception to this is Australia, where the review is restricted to consider studies based on data collected after 1984, when the current universal tax-financed health care system (termed Medicare) was introduced.

[5] This type of private health insurance is available among others for the upper income groups in the Netherlands and Germany [3].

excluded. While these policies may be argued to exist alongside a universal health care system, i.e. the Medicare system, the elderly may reasonably be argued to be subject to more health risks and have different risk preferences than the remaining population. Hence, the results of analyses of the elderly in the United States are judged not to be reasonably comparable to those obtained in universal health care systems covering entire populations. Moreover, Atherly [18] provides an excellent overview of the empirical literature seeking to characterise the elderly in the United States with supplementary insurance in addition to the coverage provided by Medicare – and there is no need to repeat his work. Finally, only studies based on data from developed countries were included in order to ensure some degree of overall homogeneity across the health care systems and institutional settings considered.

3 Results

The electronic search identified 61 journal publications, chapters in books, and working papers, of which 21 met the criteria for inclusion outlined in section 2.2. After adding the literature identified through other sources, the final review includes 24 articles published in peer-reviewed journals and 15 working papers.

The literature reveals that the characteristics of the privately insured have been studied empirically in a wide selection of countries. The majority of the empirical studies identified in the literature search are based on data from the UK, Spain, and Australia. In addition, multiple studies from Denmark, Ireland, France, and Israel were also identified. Table 1 summarises the key features of individually purchased VPHI in these countries around the time when the datasets used in the studies were collected. In most countries, it is possible to purchase different types of VPHI, just like employment-based insurance policies are usually also available for some groups. Table 1 is restricted to consider the features of the types of VPHI which are subject to analysis in the reviewed studies.[6]

Table 1 Key features of individually purchased VPHI in selected countries

	Type of coverage	Suppliers	Eligibility requirements	Premium setting	Tax treatment	% of pop. covered
United Kingdo m	Duplicate	Commercial	None, but pre-existing conditions excluded	Risk rating	No special[a]	2001: 11%
Spain	Duplicate	Mainly commercial	None	Risk rating	No special[b]	1999: 16% 1999: 23% (Catalonia)
Australi	Duplicate	Non-profit and	None	No risk	Various tax	2005: 43%

[6] For example, the Australian market for VPHI encompasses policies that are duplicate, complementary, and supplementary in relation to the universal health care system. However, given that the reviewed studies focus exclusively on duplicate VPHI giving access to privately financed providers, the type of coverage in Australia is classified as duplicate in Table 1.

a		commercial		rating[c]	punishments and rebates[d]	
Ireland	Complementary and duplicate	Mainly non-profit	None (open enrolment and lifetime coverage)	No risk rating	Premiums are tax deductible	1994: 37% 2005: 51%
France	Complementary	Non-profit and commercial	None	Risk rating[e]	No special	2000: 86%
Denmark	Mainly complementary	Non-profit	< 60 years old at the time of enrolment + health requirements	No risk rating	No special	2004: 29%
Israel	Duplicate	Commercial	< 65 years old Health requirements	Risk rating	No special	1997: 12%

Sources: United Kingdom [19]; Spain [3]; Australia [20-22]; Ireland [23;24]; France [25]; Denmark [26;27]; Israel [28;29].

Notes: [a]A tax relief on VPHI premiums for people over 60 years of age was introduced in 1991 but subsequently withdrawn in 1997. [b]A reform in 1998 shifted an existing tax deduction from individual to employment-based policies. [c]Once insured, there are community rating rules prohibiting risk-based adjustment of premiums. However, a policy change in 2000 (termed lifetime community rating) implied that premiums were allowed to vary according to the age at entry into the insurance fund for individuals over the age of 30. [d]In 1997, the government introduced tax subsidies for lower income groups that purchased VPHI and imposed tax penalties on higher income groups that did not. In 1999, a universal 30 percent subsidy for VPHI was introduced. [e]Premiums are allowed to vary with age, gender, and family size, but not directly with health status.

Overall, it is seen from Table 1 that the reviewed studies represent settings with both duplicate and complementary VPHI. Moreover, there is some variation in eligibility requirements, premium setting, and the tax treatment of insurance premiums among countries, with a tendency for commercial insurers to risk rate their premiums. The share of the population covered by individually purchased VPHI ranges from 11 percent in the UK to 86 percent in France. The highest shares of privately insured are found in France and Ireland. Both of these countries have universal health care systems with considerable copayment for the majority of the population.[7] As a consequence, the tradition for VPHI is strong in these countries, and insurers are not allowed to impose eligibility requirements by law. Another thing which may be noted from Table 1 is that the VPHI premiums are subject to various tax punishments and rebates in Australia. This is a consequence of a series of policy reforms intended to increase the take up of VPHI [20].

Table 2 provides key information about the reviewed studies, the majority of which were published within the recent decade.

[7] The exceptions being that French households with incomes below a certain threshold receive complementary VPHI free of charge, and that a small group of low income individuals are exempted from copayments in Ireland.

Table 2 Key information about the reviewed studies of individually purchased VPHI

Ref. no.	Author (year)	Country (region)	Data	Source of coverage	Theoretical focus	Econometric approach
Scandinavia						
[30]	Christiansen, Lauridsen, and Kamper-Jørgensen (2002)	Denmark	1994 National Health Interview Survey n = 4663, 16+ years	Individual	Effect on health care use also analysed	Binary, multinomial, and ordered logit models
[26]	Pedersen (2005)	Denmark	2000-01 postal survey n = 3221, 17+ years	Individual	Effect on health care use also analysed	Logit model
[31]	Aarbu (2010)	Norway	2004 computer-based interview survey and regional data n = 1800, 30-55 years	Individual Employer *(separately)*	Regional waiting times	Ordered probit models
United Kingdom						
[32]	Propper (1989)	England and Wales	1982 General Household Survey n = 6210, 16+ years	Individual	Determinants in general	Logit model
[17]	Propper (1993)	United Kingdom	1987 survey n = 911	Individual	Captive preferences	Double-hurdle probit model
[14]	Besley, Hall, and Preston (1999)	Great Britain	1986-91 British Social Attitudes Survey and regional data n = 10729, 18+ years	Individual Employer *(separately)*	Effect of NHS waiting times on insurance demand	Probit model Structural model
[33]	Emmerson, Frayne, and Goodman (2001)	United Kingdom	1995-96 to 1999-2000 Family Resources Survey n = 214334, 16+ years	Both	The case for subsidizing private health insurance	Probit model
[15]	Propper, Rees, and Green (2001)	United Kingdom	1978 to 1996 Family Expenditure Survey and regional data n = 77601, 16+ years	Individual	Effect of NHS quality on insurance demand	Weighted least squares model (repeated cross-sections)
[34]	Wallis (2003)	Great Britain	1996-2002 British Household Panel Survey and regional data	Individual	Effect of NHS quality and the availability of private	Random effects probit model

			n = 56436, 18+ years		care on insurance demand	
[35]	King and Mossialos (2005)	United Kingdom	1997 to 2000 British Household Panel Survey and Laing's Healthcare Market Review 1999-2000. n = 8025	Individual Employer *(separately)*	Determinants in general Waiting lists	Random effects logit model
[36]	Taylor and Ward (2006)	United Kingdom	1996 to 2002 British Household Panel Survey n = 28089	Individual Employer *(separately)*	Panel data analysis Endogeneity	Binary and two-stage random effects probit models
[16]	Olivella and Vera-Hernández (2006)	United Kingdom	1996 to 2003 British Household Panel Survey n = 4348	Individual Employer *(separately)*	Testing for adverse selection	Probit model
Spain						
[37]	Jofre-Bonet (2000)	Spain	1993 Spanish Health Survey and 1990-91 Spanish Family Budget Survey n = 7375	Mainly individual	Effect of NHS waiting times on insurance demand	Logit model
[38]	Costa and Garcia (2003)	Spain (Catalonia)	1999 computer-based interview survey n = 400	Mainly individual	Effect of gap in perceived quality on insurance demand	Probit model Two-stage least squares
[39]	Costa and Rovira (2005)	Spain (Catalonia)	focus groups (n = 20) and 1999 computer-based interview survey n = 400	Mainly individual	Motivation	Qualitative analysis Descriptive statistics
[40]	Costa-Font and Jofre-Bonet (2006)	Spain	2002 Health Care Barometer n = 6749	Individual	Satisfaction with the tax-financed system	Binary and instrumental variables probit models
[41]	Rodríguez and Stoyanova (2008)	Spain	1997 and 2001 National Health Surveys n = 5090 (1997) and n = 17150 (2001), 16+ years	Individual Employer *(separately)*	Shift in tax incentives	Bivariate probit model
[42]	Costa-Font and Garcia-Villar (2009)	Spain (Catalonia)	1999 computer-based interview survey n = 400	Mainly individual	Captive preferences	Probit model with sample selection

Ireland						
[23]	Harmon and Nolan (2001)	Ireland	1994 Living in Ireland Survey n = 9365, 16+ years	Individual	Effect on health care use also analysed	Probit model
[43]	Finn and Harmon (2006)	Ireland	1994 to 2001 Living in Ireland Survey n = 20513, 16+ years	Both	Panel data analysis	Fixed and random effects probit models Dynamic specification
[44]	Bolhaar, Lindeboom, and van der Klaauw (2008)	Ireland	1994 to 2001 Living in Ireland Survey n = 11025, 16+ years	Individual	Panel data analysis Effect on health care use also analysed	Fixed effects model Dynamic panel data model (GMM)
France						
[45]	Buchmueller, Couffinhal, Grignon, and Perronnin (2004)	France	1998 Enqueté sur la santé et al protection sociale (national household survey) n = 8161, 25+ years	Individual Employer *(separately)*	Effect on health care use also analysed	Probit model Multinomial logit model
[46]	Saliba and Ventelou (2007)	France	2000 Enqueté sur la santé et al protection sociale (national household survey) n = 3467 and n = 7711, 20+ years	Individual Employer *(separately)*	Determinants of the quality of coverage chosen also analysed	Binary and multinomial logit models
[47]	Grignon and Kambia-Chopin (2009)	France	2004 survey and administrative claims data n = 3618	Individual	Effect of premium subsidy on insurance demand	Tobit model Heckman sample-selection model
Australia						
[20]	Barrett and Conlon (2003)	Australia	1989 and 1996 Australian Bureau of Statistics National Health Survey n = 23051 (1989) and n = 11132 (1995), 20+ years	Mainly individual	Explain the decline in coverage over the period	Probit model
[48]	Savage and Wright (2003)	Australia	1989-90 Australian Bureau of Statistics National Health Survey n = 21612, 20+ years	Mainly individual	Effect on health care use also analysed	Probit models
[21]	Buchmueller, Fiebig, Jones, and Savage (2008)	Australia	2004-05 Australian National Health Survey n = 19012, 20+ years	Mainly individual	Advantageous selection	Semi-parametric regr. Multivariate probit models

[49]	Doiron, Jones, and Savage (2008)	Australia	2001 Australian Bureau of Statistics National Health Survey n = 17694, 18+ years	Mainly individual	The role of self-assessed health	Binary and ordered probit models
[50]	Ellis and Savage (2008)	Australia	2001 Australian Bureau of Statistics National Health Survey n = 13358, 23+ years	Mainly individual	Shift in tax incentives	Logit model
[51]	Johar, Jones, Keane, Savage, Stavrunova (2010)	Australia	2005-2006 Household, Income and Labour Dynamics in Australia and administrative data n = 2315, 18+ years	Individual	Regional waiting lists and waiting times	Probit models
[52]	Johar, Jones, Keane, Savage, Stavrunova (2010)	Australia (New South Wales)	2004-2005 National Health Survey, 2003-2004 Household Expenditure Survey and administrative data n = 3989, 18+ years	Individual	Individual waiting times	Factor analysis, probit models, and linear regression
[53]	Knox, Savage, Fiebig, Salale (2010)	Australia	2001 and 2004 Household Income and Labour Dynamics of Australia Survey n = 9196, 18+ years	Mainly individual	Evaluate effect of change in price structure.	Multinomial probit model and simulation of predicted probabilities
Others						
[54]	Godfried, Oosterbeek, and van Tulder (2001)	Netherlands	1995 interview survey n = 893	Individual	Testing for adverse selection into dental insurance	Probit model
[29]	Shmueli (2001)	Israel	1993-94 interview survey n = 1454, 45-75 years	Mainly individual	Separate selection by individuals from supply side restrictions	Binary and bivariate partial observability probit models
[55]	Jones, Koolman, and Doorslaer (2006)	Europe[a]	1994 to 1997 European Community Household Panel n = 43507, 16+ years	Individual	Effect on health care use also analysed	Probit model
[28]	Machnes (2006)	Israel	1997-98 National Household Consumption Survey n = 11090 households	Individual	Differences between self-employed and wage-earners	Tobit, logit, and probit models
[56]	Paccagnella, Rebba,	Europe[b]	2004 Survey of Health, Ageing and	Both	Effect on health care use	Probit model

	and Weber (2008)		Retirement in Europe n = 19467, 50+ years		also analysed	
[57]	Bolin, Hedblom, Lindgren, and Lindgren (2010)	Europe[c]	2004 Survey of Health, Ageing and Retirement in Europe n = 25390, 50+ years	Both	Separate selection by individuals from supply side restrictions	Binary and ordered probit models
[58]	Schokkaert, van Ourti, de Graeve, and Lecluyse (2010)	Belgium	2001 Health Interview Survey n = 5349, 15+ years	Both	Equity Effect on health care use also analysed	Bivariate probit model

Notes: [a]Ireland, Italy, Portugal, and the United Kingdom. [b]Austria, Belgium, Denmark, France, Germany, Greece, Italy, Netherlands, Spain, Sweden, and Switzerland. [c]Austria, Belgium, Denmark, France, Germany, Greece, Italy, Spain, Sweden, and Switzerland.

Considering the data and methods of the identified studies, it is seen from Table 2 that the datasets used in the various studies differ considerably in size, from 400 respondents living in the Spanish region of Catalonia [38;39;42] to large-scale nationally representative samples in most of the remaining studies. This must be taken into account when assessing the strength of the evidence. Moreover, it is seen that the vast majority of the empirical studies use variations of logit and probit models for the econometric analyses, with the exact model specification depending on the institutional setting and the focus of analysis. While the larger share of the studies uses data from single or repeated cross sections and corresponding methods, a few studies from Ireland use panel data and dynamic models [43;44].

Considering the focus of the studies, it is seen from Table 2 that the characteristics of the privately insured have been studied empirically from various theoretical perspectives. Several studies have analysed the determinants of VPHI and its effect on the use of health care services simultaneously [23;26;30;44;45;48;55;56;58]. This review only considers the methods and results concerning the characteristics of the privately insured for these studies. Another part of the literature has investigated how the demand for duplicate VPHI varies with different measures of the quality of care available within the universal health care system, usually in terms of waiting time for treatment [14;15;31;34;35;37;38;40;51;52]. The remaining studies have explored various issues, such as the role of captive preferences [17;42], the importance of supply side restrictions [29;57], and shifts in tax incentives and subsidies [41;47;50;53]. Moreover, some of the studies from Australia have investigated issues related to the series of policy reforms introducing the various tax punishments and rebates mentioned in Table 1 [20;50;53]. Finally, it is noted that while almost all studies include some sort of health-related variables, only a few studies had the health of the privately insured as their main focus [16;21;49;54].

The studies that used data from several countries took different approaches to account for this. Paccagnella et al. [56] and Jones et al. [55] estimated separate probit models for each country, while Bolin et al. [57] analysed the countries collectively and included country-specific dummies to capture the effects of differences in culture and institutions. In all cases, the determinants of having VPHI were found to differ between countries, reflecting differences in the institutional settings. However, the discussion provided in this section is restricted to consider results which were consistently found across countries.

The empirical findings of the various studies are accounted for by topic in the following subsections, which are intended to complement the information provided in Table 2. A summary of the results in tabular form is available from the author upon request.[8] The following sections account for the full content of this table.

[8] The table is stored electronically as an Excel spreadsheet. However, it is not practically feasible to include it in the paper due to its size.

The section is structured as follows. Section 3.1 reviews the evidence on the importance of various sociodemographic characteristics. This information may be used to assess the theoretical prediction of individuals selecting themselves into duplicate VPHI based on income. Section 3.2 reviews the evidence on health-related characteristics, including health status, use of health care services, and health-related behaviour, while section 3.3 discusses the results concerning the role of risk preferences. These issues are important in order to determine whether individuals select themselves into VPHI based on health risk and preferences, as predicted by economic theory. Section 3.4 reviews the evidence on whether the quality of care available within the universal health care system affects the demand for duplicate VPHI and, finally, section 3.5 accounts for the effects of premiums and tax-incentives. Significance refers to a five percent level if nothing else is mentioned. Moreover, for studies that estimate several alternative model specifications, this review only considers the results from what is considered to be the preferred/main model specification by the author(s) of the respective study.[9]

3.1 Sociodemographic characteristics

Considering first the importance of sociodemographic characteristics, the probability of VPHI ownership is consistently found to increase with income [14;15;17;20;21;23;28;30-38;40-52;55;59]. In addition to the overall effect of income, Ellis and Savage [50] revealed that the impact of male income was about 50 percent larger than that of female income in Australia. Likewise, educational attainment is generally found to be positively associated with the probability of having VPHI [14;23;26;28;30;33;35-38;41;43;44;50-52;55;57], although evidence from Norway [31;59] and France [45] does not find any significant association.

The effect of age on the probability of having VPHI is generally found to be positive [15;17;20;34;36-38;42] or positive until a given age and negative or insignificant thereafter [14;21;23;26;2830;33;35;40;41;43-45;47;49-52] across countries and insurance types. Only two studies found VPHI prevalence to be decreasing with age [29;46]. Moreover, Propper et al. [15] found a generational effect on VPHI purchase in the United Kingdom, such that the older generations are less likely to purchase VPHI than the younger ones.

The empirical evidence regarding gender-wise differences is mixed. Females are consistently found to be more likely to hold complementary VPHI in Denmark [26;30] and France [45;46], while the opposite relationship holds for duplicate VPHI in the United Kingdom [33-36]. Studies from Australia found either no association between VPHI status and gender [48;49;51] or females to be relatively more likely to hold

[9] An exception to this is [36], who argue that income is endogenous in the analysis of VPHI and estimate a two-stage model with bootstrapped standard errors in order to account for this alleged problem. However, given that the authors do not provide any justification for the exclusion restriction used to identify the model, this section considers the results from the simple model.

VPHI [20;21;50]. Based on data from Ireland, Harmon and Nolan [23] analysed individually purchased VPHI and found no association between gender and the probability of holding VPHI, while Finn and Harmon [43] found VPHI to be more prevalent among males when analysing individually purchased and employment-based policies collectively. These results may be taken to indicate that individually purchased policies are more prevalent among females, while employment-based policies are more prevalent among males. Along a similar line, Rodríguez and Stoyanova [41] used data from Spain and found no association between gender and VPHI when analysing individually purchased and employment-based policies collectively, while the individually purchased policies were found to be more prevalent among females. However, the finding of Jofre-Bonet [37] that gender is not a significant determinant of mainly individually purchased VPHI coverage in Spain blurs the picture somewhat.

Considering the effect of household composition, several studies found that the probability of having VPHI was negatively affected by the number of adults in the household [14;28;33;43;51]. The studies from Ireland also found a negative effect of the number of elderly [23;43]. In an Australian context, being a sole parent was found to be negatively related to the probability of having VPHI [21;50;53]. Along a similar line, living with a spouse or partner (either marital or non-marital) was found to increase the probability of having VPHI in Ireland [23;43], France [45], Australia [20;49;52], Israel [28], and across several European countries [57], but leave it unaffected [17;32;35;36] or reduced [33] in the United Kingdom. The evidence from Spain on this matter is conflicting. More precisely, Jofre-Bonet [37] found a negative effect of living alone and Costa-Font and Jofre-Bonet [40] found a negative effect of being married on the probability of having VPHI in Spain. Finally, there is no clear-cut association between the presence or number of children in the household and VPHI status across countries or insurance types, with some studies finding a positive effect of children on the probability of having VPHI [33;49], some studies finding a negative effect [14;21;23;36;43;51], and other studies again finding no significant association [30;35;50].

Socioeconomic position is measured at different levels of detail and using different categories across studies. Regarding labour market attachment, it is generally found that unemployment reduces the probability of having VPHI [21;32-35;37;46;46;49;50;58], although evidence from Israel [29] and Denmark [26] did not find any significant association. Being a pensioner was found to increase the probability of having individually purchased VPHI in France [45;46]. A possible explanation for this is that individuals tend to convert their employment-based contracts to individual contracts upon retirement [46]. The evidence from other countries is more mixed. Pedersen [26] found that being a pensioner does not significantly affect the probability of having VPHI in Denmark, while being a disability pensioner had a negative effect. Jofre-Bonet [37] found a negative effect of being a pensioner on the probability of having VPHI for heads of households but no effect for non-heads based on data from Spain. Within the group of employed, professionals and managers are found to be more likely to have duplicate VPHI in the United Kingdom [33;35;36] and Australia [49]. Along a similar line, a few studies found a tendency for unskilled workers to be less likely to have complementary VPHI in France [45] and Denmark [26]. Being self-employed was generally found to either increase [28;34;36;37;41;57] or have no effect [14;26;31-33] on the probability of having VPHI. For duplicate VPHI, this result may be explained by the greater cost of sickness absence among the self-employed.

A number of other sociodemographic characteristics have been found to affect the probability of VPHI ownership in various ways. Individuals who are exempted from copayment within the universal health care system due to low income or veteran status were found to be less likely to have complementary VPHI in Ireland [23;44] and France [46], respectively. Conservative supporters and center-right voters were consistently found to be more likely to purchase duplicate VPHI in the United Kingdom [34-36]. Homeowners were found to be more likely than tenants to have duplicate VPHI in the United Kingdom [14;17;33] and Australia [21;51]. Moreover, living in certain regions was found to increase the probability of VPHI ownership in the United Kingdom [14;15;33;34], Spain [38;40], and Australia [20;21;48-51]. Along a similar line, several studies found the probability of having VPHI to be higher for individuals living in larger cities [33;34;37;41;42;44;48;50-52]. Finally, evidence from Australia indicated that immigrants are less likely to purchase VPHI within this setting [20;48-50;52;58]. Likewise, Bolin et al. [57] found foreign born individuals to be less likely to have VPHI across a number of European countries.

Finally, evidence from Ireland indicated that the use of dynamic models may change the results. More precisely, Finn and Harmon [43] used a dynamic random effects probit model that included the lagged dependent variable and found a considerable degree of persistence in the purchase of VPHI. Moreover, the effects of various sociodemographic and health-related variables were smaller when using a dynamic model than a static model. Bolhaar et al. [44] found that while a cross-sectional model replicated most of the results usually found in the literature, the results changed dramatically when estimating fixed effects and dynamic panel data models allowing for individual specific effects. In particular, several individual and household specific characteristics, such as education level and household composition, were no longer significant determinants of VPHI coverage. This suggests that the larger part of the results from earlier cross-sectional studies may be spurious. Using a different approach, but reaching somewhat similar results, Costa and Rovira [39] used focus group interviews and descriptive statistics to analyse the motivation for taking out VPHI in Spain and found that cultural and non-economic factors played an important role.

3.2 Health-related characteristics

The empirical evidence on health-related characteristics is important in order to assess whether and how individuals select themselves into VPHI based on their health, as predicted by economics theory. Overall, the review shows that the literature takes several different approaches and considers several different types of health-related characteristics, which are grouped as follows. Section 3.2.1 reviews the evidence on how self-assessed health and chronic conditions affect the probability of having VPHI. Section 3.2.2 accounts for the findings concerning the use of health care services, and section 3.2.3 reviews the evidence on the role of various health-related behaviours.

3.2.1 Self-reported measures of health

Several studies included self-assessed health as an explanatory variable without finding any significant relationship with the probability of holding VPHI [26;32;35;38;45;47;48;59]. However, an equal number of studies found that individuals in better self-assessed health are more likely to have VPHI [20;23;30;36;43;49;50;55;58]. Across countries, the studies from Australia [49;50;52] and Ireland [23;43] generally found a positive association between self-assessed health and VPHI, and the studies from France [45;47] found no association. There is no clear pattern in the results regarding self-assessed health for the remaining countries.

The positive relationship between self-assessed health and VPHI frequently observed in the literature runs counter to the well-established theoretical prediction of individuals adversely selecting themselves into VPHI based on their health. Hence, the relationship has been subject to further investigation from different angles. Doiron et al. [49] found that the positive association between self-assessed health and duplicate VPHI in Australia is driven by correlated effects of other factors, such as risk preferences and socioeconomic characteristics, on self-assessed health and the demand for VPHI. Bolin et al. [57] analysed the relationships between observable health conditions, self-assessed health, and VPHI status among the elderly in several European countries and found evidence that part of the positive relationship between self-assessed health and VPHI coverage could be attributed to supply side restrictions by insurers (i.e. eligibility requirements), while no evidence unambigously supported the hypothesis of advantageous selection due to heterogeneous risk preferences. Finally, Johar et al. [52] hypothesised that self-assessed health mainly affects the demand for duplicate VPHI through its effect on health-related concerns over e.g. waiting times. This hypothesis was supported by empirical evidence from Australia, where the effect of self-assessed health on the demand for VPHI was substantially reduced and no longer significant when including waiting time variables in the analysis.

Measures of chronic conditions were largely found to be insignificant across countries and insurance types when included as explanatory variables [17;20;29;30;32;38;44;46;58;59]. An exception to this pattern is Australia, where Ellis and Savage [50] and Doiron et al. [49] found measures of chronic conditions to be negatively related to VPHI ownership. Likewise, Bolin et al. [57] found that heart problems, diabetes, and chronic lung disease reduced the probability of having VPHI, while cancer and high blood pressure had no effect on a five percent level of significance. On the contrary, Godfried et al. [54] found various measures of dental health conditions to be positively associated with the probability of having VPHI covering dental care in the Netherlands. Finally, Shmueli [29] analysed Israeli data using a partial observability model and found that individuals with chronic conditions were more likely to apply for VPHI coverage but less likely to be accepted by insurers.

3.2.2 Use of health care services

The studies including past use of health care services among the explanatory variables generally found this to be positively associated with VPHI coverage, although with some exceptions.

Taylor and Ward [36] found a positive association between having used the public health care system in the past year and VPHI ownership in the United Kingdom. Saliba and Ventelou [46] found a positive association between a dummy for auxiliary health care expenditures and the probability of having VPHI in France. Machnes [28] found a positive association between previous expenditures on medication and the probability of having VPHI in Israel, and Godfried et al. [54] found past use of dental care to be positively associated with the probability of having dental VPHI in the Netherlands. However, Propper [17;32] included previous use of general practice, outpatient care, and hospitalisation without finding any significant association with duplicate VPHI coverage in the United Kingdom.

A positive association between VPHI coverage and health care use is consistent with adverse selection into VPHI as well as moral hazard, while a negative association may be attributable to both advantageous selection and supply side restrictions. Which option is the most likely depends on the institutional setting.

Some of the studies also investigated whether the positive association between VPHI coverage and health care use is attributable to adverse selection or moral hazard. Saliba and Ventelou [46] found no signs of endogeneity when assessing the exogeneity of the health care expenditure variable in a bivariate probit model. Hence, the authors conclude that the positive association between auxiliary health care expenditures and the probability of having complementary VPHI in France is attributable to adverse selection. Godfried et al. [54] exploited an unexpected exclusion of dental services from the compulsory health insurance scheme[10] in 1995, which was accompanied by a generous acceptance policy among the private insurers and almost uniform premiums. Hence, the finding that individuals with poorer self-reported dental health and those who had more frequent dentist visits in the past were more likely to purchase VPHI following the policy change provides clear evidence of adverse selection in this case. Olivella and Vera-Hernández [16] used the presence of comparable individually purchased and employment-based VPHI contracts in the United Kingdom to explicitly test for adverse selection into VPHI. Assuming that the probability of having employment-based VPHI is mainly determined by the employer and hence independent of individual health, Olivella and Vera-Hernández [16] compared the group of employees who receive VPHI as a fringe benefit and those who have purchased it on an individual basis and found that the latter had a significantly higher probability of hospitalisation. Given that the difference could not be attributed to differences in insurance contracts, health, or preventive

[10] The compulsory health insurance scheme mentioned here is not strictly universal in the sense that it is limited to cover Dutch employees in the market sector with incomes below a certain threshold and their families, which makes up 60 percent of the population.

efforts between the two groups, the authors argue that it may reasonably be interpreted as evidence of adverse selection.

On the contrary, Buchmueller et al. [21] found a negative association between VPHI ownership and the predicted probability of having been hospitalised within the last 12 months in Australia. Given that premiums are not risk rated and there are no eligibility requirements to purchase VPHI in this setting, the negative association may be taken as evidence of advantageous selection into VPHI. Bolhaar et al. [44] also found evidence of advantageous selection into VPHI in Ireland, in that those with a higher level of health care use are also less likely to be insured. Moreover, Bolhaar et al. [44] found that the advantageous selection was largely driven by heterogeneity in education and income, with the highly educated and paid both more likely to insure and to be in better health.

3.2.3 Health-related behavior

The association between health-related behaviour and VPHI coverage has mainly been subjected to analysis based on data from the UK and Australia. The most frequently considered measure of health-related behaviour, smoking, was found to either not affect [31;32;36;37] or reduce [20;34;45;48;50] the probability of having individually purchased VPHI. Along a similar line, some studies have found that individuals who exercise regularly are more likely to have VPHI [37;45;57;58], while others found no association [20]. Being a heavy drinker is mostly found to reduce or not affect the probability of having VPHI [20;37;50], while overweight or obese individuals are either more likely to have VPHI [37] or do not differ significantly from the uninsured [20;58]. Johar et al. [52] included the factor loadings from a factor analysis on exercising, smoking habits, body mass index, and alcohol consumption and found obese, heavy smoking, and heavy drinking individuals are less likely to have VPHI than others in Australia. Finally, Buchmueller et al. [21] found strong associations between holding VPHI and other types of insurance and evidence of unobservables increasing the probability of various risky behaviours and reducing that of holding VPHI.

With the exception of the positive association between overweight and VPHI in Spain and the lack of an association between smoking and VPHI found in some studies from the UK, the empirical evidence thus generally points towards the privately insured having a healthier lifestyle. The exception being that of Bolin et al. [57], who found that smoking and drinking appeared to increase the probability of having VPHI among the elderly in various European countries.

3.3 Risk preferences

The empirical evidence on the role of risk preferences in the demand for VPHI is sparse and points in different directions. Propper [17] found that risk aversion measured by not being willing to pay for private health care at the point of demand as an alternative to taking out duplicate VPHI increases the probability of having VPHI in the UK. The reasoning behind this measure of risk preferences is that given VPHI reduces the risk carried by an individual, whether individuals would consider paying for private care at the point of demand as an alternative to purchase of VPHI reveals something about their risk preferences, and those who would are not willing to pay for private care may be defined as risk averse. Grignon and Kambia-Chopin [47] included some general measures[11] of risk preferences as potential determinants of complementary VPHI ownership in France, but subsequently dropped these from the preferred model because they were insignificant. Along a similar line, Costa and Garcia [38] found no significant association between self-reported risk preferences measured on a scale from one to ten and the probability of having duplicate VPHI in Spain. Also within the context of the Spanish health care system, Costa-Font and Garcia-Villar [42] hypothesised that captivity to the universal health care system constrains the demand for duplicate VPHI, and that the more risk averse are more likely to be captive to the universal system. This hypothesis was confirmed by empirical evidence indicating that the more risk averse are also more likely to stick to the universal health care system no matter what. Costa-Font and Garcia-Villar [42] argued that this might explain why prior studies failed to find evidence of risk preferences explaining the demand for duplicate VPHI.

Finally, the findings from Australia of strong associations between holding VPHI and other types of insurance and the existence of unobservables increasing the probability of various risky behaviours and reducing that of holding VPHI may be taken as evidence that individuals select themselves into duplicate VPHI based on both their probability of falling ill and their risk preferences in this setting [21].

3.4 Quality of the universal health care system

Considering the theoretical prediction of individuals selecting themselves into VPHI based on the quality of the universal health care system, most studies define quality in terms of waiting lists or waiting time for treatment [14;15;31;34;35;41;51;52]. Some of these studies consider quality in a broader sense by also including measures of spending on and capacity of the universal health care system [14;15;35]. Moreover, a few studies include the availability of private beds in the area [34;41].

Aarbu [31] found that the interest in buying VPHI as well as actual ownership increases with regional waiting times in Norway. Based on data from the United Kingdom, King and Mossialos [35] found a positive effect of regional waiting times within the universal health care system and the supply of private surgeons on VPHI holdings. Along a similar line, Wallis [34] found that regional waiting lists and lagged public health expenditure were significant determinants of having individually purchased VPHI in Great Britain. On the contrary, Besley et al. [14] included waiting lists, various measures of spending on the universal health care system, and availability of private beds without finding any significant relationships. Propper et al. [15] examined several measures of public and private sector quality and found that all quality indicators except waiting list length had a significant effect on insurance ownership. Along a

[11] Unfortunately, the exact content of these measures was not described in more detail in the paper.

similar line, Taylor and Ward [36] included attitude towards the universal health care system and found a positive association between thinking that the universal health care system is of poor quality and VPHI ownership.

Within the context of the Spanish health care system, Jofre-Bonet [37] found that the probability of having VPHI increased with regional waiting list length. Likewise, Costa and Garcia [38] and Costa-Font and Jofre-Bonet [40] found indices and perceptions of public sector quality to be important determinants of VPHI ownership, and Costa and Garcia [38] found the demand for VPHI to be positively affected by the quality gap between private and public sector care, defined as the perceived private health care quality minus perceived quality of the universal system. Costa-Font and Jofre-Bonet [40] also found a negative association between satisfaction with the tax-financed health care system and the probability of having VPHI.

Johar et al. [51] investigated the usefulness of public sector waiting lists as a proxy for waiting times in models of VPHI demand in Australia and found that long waiting times significantly increased VPHI demand, specifically for the upper tail of the waiting time distribution, while waiting lists had no effect. This result indicates that the relationship between waiting lists and waiting times is complex, and that waiting lists and waiting times do not necessarily measure the same. Johar et al. [52] found that overall expected waiting time (imputed for each individual as a function of demographics and chronic conditions) does not significantly affect the demand for VPHI in Australia. However, having a high probability of needing health care and expecting a wait in the upper decile of the waiting time distribution increased the probability of having VPHI.

Finally, while the studies from Ireland did not include any explicit measures of public sector quality as potential determinants, Harmon and Nolan [23] reported findings from an attitudinal survey about the motivation for buying VPHI. The results of this survey indicated that fear of large medical bills and getting faster access to treatment were the main reasons for buying private health insurance in 1999, while having a private room and other convenience aspects were considered much less important, thus emphasizing the importance of risk aversion and the waiting time aspect.

3.5 Premiums and tax-incentives

The studies including insurance premiums as potential determinant of VPHI coverage generally found a negative relationship between premiums and the probability of having VPHI. In particular, Wallis [34] found a negative relationship between the aggregate premium level and the prevalence of VPHI in Great Britain. Godfried et al. [54] found that although variation in premiums was fairly modest, individuals who face a higher premium were less likely to purchase dental VPHI in the Netherlands. This result is, however, only significant at the 10 percent level. Saliba and Ventelou [46] found that individuals facing lower premium levels than in the Paris region were more likely to purchase VPHI in France.

Based on data from Spain, Costa and Garcia [38] and Costa-Font and Garcia-Villar [42] found a negative relationship between premiums measured at the household level and the probability of having VPHI. Moreover, Costa and Garcia [38] estimated price elasticities for various subgroups and found that these were clearly below one for all groups, i.e. the demand for VPHI is price inelastic. Hence, the evidence from Spain indicates that while there is a negative association between premiums and demand, the relative change in demand caused by a given price change is less than the relative size of price change. Also within the context of the Spanish health care system, Rodríguez and Stoyanova [41] studied the effect of a shift in tax incentives that implicitly increased the price of individually purchased VPHI and reduced the price of employment-based VPHI and found that this lead to a decline in the prevalence of individually purchased VPHI, while the overall demand remained unchanged.

Within the context of the Australian health care system, Johar et al. [45] found that the predicted premium was insignificant when included as a potential determinant of VPHI coverage. One possible explanation for the lack of an association could be measurement error in the predicted insurance premium. Other possible explanations are the relatively low level of insurance premiums in Australia compared to other countries and price insensitive consumers. On the contrary, the studies that investigated issues related to the series of policy reforms introducing various tax punishments and rebates found that the tax penalty imposed on high income individuals without VPHI had a positive effect on the take up of VPHI [49;51]. Moreover, Ellis and Savage [50] found that while the three policy reforms increased the immediate take up of VPHI, the increase in insurance demand was not a pure premium reaction, it was also a response to advertising and a deadline. Along a similar line, Knox et al. [53] evaluated the effect of the policy change introduced in 2000 that allowed premiums to vary according to the age at entry and found that after controlling for other factors it mainly prompted moderately well-off working age adults to purchase VPHI before the 2000 deadline.

Finally, Grignon and Kambia-Chopin [47] used a somewhat different approach to evaluate the efficiency of using a premium subsidy to increase the take-up of VPHI in France. This study used the imputed premium as a measure of the quantity of VPHI coverage and estimated the determinants of the quantity of VPHI held by individuals. Subsequently, some of the estimated coefficients were used to simulate the effect of a subsidy on the quantity of coverage demanded by individuals at a given level of income. Subgroup analysis showed that the lower income groups were insensitive to price, which implies that a premium subsidy would not induce these individuals to purchase VPHI, while the higher income groups, who were mostly already insured, would benefit. Hence, it is concluded that subsidies are not an efficient way to increase the uptake of VPHI in France.

4 Discussion

This paper has reviewed the empirical literature on what characterises the privately insured in universal health care systems. In the following, it is assessed how well the empirical evidence corresponds with the theoretical predictions, and the methodological challenges of the literature are discussed. Moreover, possible explanations for main findings of the literature are discussed.

In accordance with economic theory, the probability of taking out VPHI on an individual basis is consistently found to increase with *income*, and in most cases also with *education level*. Considering some possible explanations for the main findings regarding the importance of the sociodemographic characteristics, the overall finding that the effect of *age* on the probability to insure is positive or positive until a given age and negative or insignificant thereafter may reflect the fact that health risk increases with age. When insurance premiums are not risk rated, it may reasonably be expected that the probability to insure increases with age due to adverse selection, while it is possible that premiums are prohibitive for the eldest when premiums are risk rated based on age. The ambiguous relationship between *gender* and the probability to insure may have several possible explanations. The finding that women are more likely to purchase complementary VPHI is consistent with the fact that empirical studies within behavioural economics generally find women to be more risk averse than men [60]. Moreover, given that women generally use more health care services than men [61], and that this is not always accounted for in the premium setting, it may also indicate that some extent of adverse selection takes place within these settings. On the contrary, the finding that men are more likely to purchase duplicate VPHI in some countries may reflect men being more willing or able to pay in order to avoid waiting for treatment within the universal health care system. Considering the effect of *household composition*, the general finding of a negative effect of household size on the probability to insure may indicate that there is an income constraint However, household composition in general may also capture determinants of the insurance decision that relate to taste or availability of other smoothing mechanisms than insurance. For example, the ability of households to self-insure may reasonably be expected to increase with household size. Finally, there is some evidence that the probability of having VPHI is associated with *socioeconomic position*, although this is much less pronounced than for income and education level. The general finding that *unemployment* reduces the probability of having VPHI may well have to do with financial resources, although this is somewhat adjusted for by including income in most studies. Moreover, the tendency for the *self-employed* to be more likely to have primarily duplicate VPHI may be explained by a greater cost of sickness absence among the self-employed, and the fact that they do not have employment-based VPHI per definition.

Considering the case for selection into VPHI based on health risk, as predicted by economic theory, this has been studied empirically in several countries and taking different approaches. While a few studies tested explicitly for adverse selection by regressing the use of health care services on a set of explanatory variables including VPHI status [16;21], the larger share of the empirical literature assesses the health of the privately insured by including various health-related characteristics as explanatory variables. In essence, these studies do not explicitly test for health-based selection into VPHI. However, their results may still be interpreted in the light of health-based selection.

Most of the studies that measure health status by *previous use of health care* find evidence of adverse selection. On the contrary, the vast majority of the studies that included *self-assessed health status* and chronic conditions as explanatory variables found this to be positively or insignificantly related to the probability of having VPHI, which runs counter to the notion of adverse selection. The empirical literature provides several possible reasons for this. For one thing, it is possible that some individuals are both more likely to take efforts to reduce the probability of falling ill and to purchase VPHI, in which case the health-based selection into VPHI may be advantageous. Moreover, the absence of a positive association between health risk and the probability of having VPHI coverage does not necessarily mean that the high risk individuals do not demand VPHI. It may also be the case that insurers have successfully managed to prevent adverse selection by risk rating their premiums or making purchase contingent on eligibility criteria. Hence, policy discussions of VPHI should not assume by default that adverse selection is present but rather consider carefully whether the conditions for adverse selection (i.e. no risk rating of premiums or eligibility criteria) are present. And even then, adverse selection is not given if individuals select themselves into VPHI on several dimensions.

Finally, considering the evidence on *health-related behaviour*, the evidence generally points towards the privately insured having a healthier lifestyle. This is consistent with the theory of advantageous selection, which predicts that the more risk averse individuals are both more likely to purchase VPHI and to maintain a healthy lifestyle. In particular, the results from an Australian setting, where premiums are not risk rated and there are no eligibility requirements for VPHI, are argued to provide evidence of advantageous selection into VPHI driven by risk preferences [21].

Despite the predominant role of risk preferences in the economic theory on private health insurance demand [5;6;10-12], the empirical evidence on the importance of risk preferences is sparse and points in different directions. While the majority of the few studies including measures of risk preferences directly as a potential determinant of insurance status found no association [38;47], indirect evidence indicated that individuals select themselves into duplicate VPHI based on their preferences for risk [21]. Costa-Font and Garcia-Villar [42] have argued that prior studies may fail to find evidence of risk preferences explaining the demand for duplicate VPHI because they do not take into account that the more risk averse individuals are also more likely to be captive to the universal health care system, in which case the absence of an association is due to two opposite effects cancelling out. Another and, perhaps, more obvious weakness of the existing literature is that the empirical proxies of risk preferences used in the literature are rather crude, and none are directly related to economic theory. Suggestions for future research thus include using theoretically well-founded measures of risk preferences along the lines of e.g. Holt and Laury [62], Anderson and Mellor [63], and Dohmen et al. [64], and combining direct and indirect methods of assessing the importance of risk preferences in order to investigate whether the experienced differences are real or may be attributed to the use of different methods.

The theoretical prediction of individuals selecting themselves into duplicate VPHI based on the quality of care available within the universal health care system is generally supported by the empirical evidence. The majority of the studies define quality in terms of waiting lists or waiting time for treatment, which is plausible given that this is often mentioned as a chief concern in universal health care systems, while some studies also consider other proxies of quality, such as the amount of resources spent on the universal health care system. Other studies again seek to proxy the quality gap between private and public sector care by including variables such as the supply of private sector surgeons and the number of private beds available in the region as potential determinants of the prevalence of duplicate VPHI. From a policy perspective, the association between duplicate VPHI and the quality of the universal health care system implies that policy makers may indirectly affect the prevalence of duplicate VPHI by improving the quality of the universal health care system, e.g. through waiting time guarantees.

Another channel through which policy makers may affect the prevalence of VPHI is through *tax-incentives*, given that the individual demand for VPHI is generally found to be affected by the effective insurance premium. However, low price elasticity estimates from indicate that while subsidizing VPHI through tax deductions have little effect, relative changes in the quality of care delivered within the universal health care system may be more effective in producing a significant impact on the demand for duplicate VPHI [41]. Compared to its policy relevance, the empirical evidence on how premium levels and tax-incentives affect the individual demand for VPHI is relatively sparse, most likely due to difficulties in obtaining data on the premiums.

Overall, there are several complications related to drawing firm conclusions based on the empirical literature that characterises the privately insured in universal health care systems. One issue is that with a few exceptions, the estimated models are reduced form models in the sense that they consider the characteristics of the privately insured net of demand- and supply-side effects. This imposes some limitations on the ability to identify causal relationships, and it does not allow for the identification of how specific factors impact either side of the market. However, given that estimation of full structural models requires exogenous variables that relate exclusively to either demand or supply, and that these are notoriously hard to find in private insurance markets, where most factors tend to affect supply and demand simultaneously, this limitation of the literature seems inevitable [35]. Moreover, the limitation is noted to be most severe in settings with eligibility requirements and restrictions in coverage, such as the United Kingdom, Denmark, and Israel, whereas the estimated equations may reasonably be assumed to reflect demand in the absence of eligibility requirements, as argued by among other Buchmueller et al. [21].

Another issue that applies to a large share of the literature is that considering the quality of data, the information on VPHI coverage leaves something to wish for. For example, some of the studies from the United Kingdom [33], Spain [37-39;42], and Australia [20;21;48-50;53] do not appear to be able to distinguish empirically between individually purchased and employment-based policies. Although it is argued that the majority of the privately insured holds individually purchased policies in these countries, it cannot be ruled out that the inclusion of individuals with employment-based VPHI may affect the results somewhat. Similarly there is rarely information on key variables such as premiums and exact coverage.

The rather diverse results (on some issues also within countries) indicate that some of the differences observed in the literature may also to varying degrees reflect differences in sample sizes, included variables, econometric approach, and theoretical focus between studies rather than actual differences. In particular, the estimated coefficient for a particular variable most likely depends on the other variables included in the regression. This calls into question the strategy of evaluating the results of the literature by area.

The main implication of this review is thus that policymakers need to evaluate the quality of relevant studies carefully when assessing the evidence on a particular issue, and avoid basing their decisions on regulatory issues and the like on the results of a single study. Moreover, given that the characteristics of the privately insured differ considerably across types of VPHI coverage and institutional settings, empirical knowledge obtained in one setting is not likely to be immediately transferable to other settings.

Finally, it is noted that disagreements between the theoretical predictions and the empirical evidence may also point toward problems with the theoretical framework. For example, when the literature generally finds no association between risk preferences and the probability of having VPHI coverage, this may also call into question the application of theory developed for private health insurance that provides the primary source of coverage to VPHI in universal health care systems.

5 Conclusions

This review of the empirical literature on what characterises the privately insured in universal health care systems has revealed that while some findings may reasonably be taken as well-established knowledge, the literature still faces considerable challenges in other areas.

In accordance with economic theory, the probability of taking out VPHI on an individual basis is consistently found to increase with income. Moreover, the empirical evidence generally supports the theoretical prediction of individuals selecting themselves into duplicate VPHI based on the quality of care available within the universal health care system, just like the individual demand for VPHI is affected negatively by the effective insurance premium. On the contrary, the findings regarding the relationships among health risk, risk preferences and the decision to purchase VPHI are less clear-cut. While the majority of the reviewed studies have investigated the relationship between health risk and insurance status in one way or another, using different approaches and reaching different conclusions, the empirical evidence on the importance of risk preferences is sparse. Further empirical research is thus needed in order to understand more fully the relationships among health risk, risk preferences and the decision to purchase VPHI. For one thing, it may be useful to focus on identifying the circumstances under which selection based on health risk occurs rather than trying to solve the question of whether it occurs, since this broader question can probably not be solved once and for all. Moreover, the varying results call for more focus on the extent to which a given result depends on the chosen method of approach. Indications that the use of panel data models changes the results considerably, such that several individual and household specific characteristics are no longer significant determinants of VPHI coverage, imply that future studies might benefit from increased emphasis on the use of panel data and methods in order to be able to capture dynamic effects. In this way, it can be investigated further whether the larger share of the results from the cross-sectional studies are really spurious.

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CHAPTER 3

Determinants of employment-based private health insurance coverage in Denmark

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Abstract:
This study estimates the determinants of having employment-based private health insurance (EPHI) based on data from a survey of the Danish workforce conducted in 2009. The study contributes to the literature by exploring the role of satisfaction with the tax-financed health care system as a potential determinant of EPHI ownership and by taking into account that some employees receive EPHI free of charge, while others pay the premium out of their pre-tax income and thus make an actual choice. The results indicate that the probability of having EPHI is positively affected by private sector employment, size of the workplace, whether the workplace has a health scheme, income, being employed as a white-collar worker, and age until the age of 49, while the presence of subordinates, gender, education level, membership of 'denmark' and living in the capital region are not significantly associated with EPHI coverage. As expected, the characteristics related to the workplace are by far the quantitatively most important determinants. The association between EPHI and self-assessed health is found to be quadratic such that individuals in good self-assessed health are more likely to be covered by EPHI than those in excellent and fair, poor or very poor self-assessed health, respectively. Finally, the probability of having EPHI is found to be negatively related to the level of satisfaction with the tax-financed health care system. The findings of the study are not affected notably by distinguishing empirically between employees who receive EPHI free of charge and those who pay the premium out of their pre-tax income.

Keywords: duplicate health insurance; determinants; inequity in access; health care satisfaction; Denmark

JEL Classification: I11; I18

Table of contents:

1 Introduction

In several European countries with universal tax-financed health care systems, such as the United Kingdom, Spain, and the Scandinavian countries, considerable parts of the populations now have private health insurance that covers treatment at private facilities (Aarbu, 2010; Mossialos and Thomson, 2002). Hence, the analysis of this type of private health insurance is of both theoretical and policy relevance. Private health insurance that covers treatment at private facilities for treatment that is also available free of charge at public hospitals may be classified as duplicate vis-a-vis the universal system. The main perceived benefits are faster access to care, greater freedom of choice, and in some cases also better amenities (Colombo and Tapay, 2004; OECD, 2004).

As reviewed by Propper and Green (2001), private funding in public health care systems may have several possible consequences. On the one hand, duplicate private health insurance may be thought of as accommodating differences in preferences, and it allows for greater freedom of choice than would be feasible in a purely tax-financed system with only public hospitals. Moreover, it may relieve the pressure on the public system and reduce the waiting times for treatment at public facilities, which in turn may decrease sickness absence to the extent that this is associated with waiting time for treatment. On the other hand, the main arguments against private health insurance are that it may cause inequity in the access to medical care and possibly also increase the total medical spending due to moral hazard and dynamic effects on wages in the health care sector. In the longer run, increasing reliance on private health insurance may also bring about reduced support for the universal health care system, thereby possibly worsening the access to health care for the individuals who rely exclusively on this.

While the determinants of individually purchased duplicate private health insurance have been studied extensively in the literature, empirical evidence on what characterises the group of individuals with policies that are purchased through and typically also paid by their employer is confined to a few studies.[1] This paper contributes to the growing literature on employment-based duplicate private health insurance (EPHI) in universal tax-financed health care systems based on a recently collected dataset from Denmark.

The share of the occupationally active Danish population with EPHI has increased steadily during the past decade. Following legislation enacted in 2002 that tax-exempted employees for the income value of EPHI conditional on the insurance being offered to all employees in the company, the share with EPHI has gone

[1] Empirical studies of the determinants of *individually purchased* private health insurance include, but are not limited to, Besley et al. (1999), Costa and Garcia (2003), Costa-Font and Jofre-Bonet (2006), Harmon and Nolan (2001), Jofre-Bonet (2000), King and Mossialos (2005), Olivella and Vera-Hernández (2006), Propper (1989), Propper et al. (2001), and Rodríguez and Stoyanova (2008). Empirical studies of the determinants of *employment-based* private health insurance are confined to Aarbu (2010), Besley et al. (1999), Bræmer (2008), Grepperud and Iversen (2011), King and Mossialos (2005), Kjellberg et al. (2010), and Seim et al. (2007). These studies are reviewed in section 4.

from 5 percent to 32 percent of the employed in 2009 (Statistics Denmark, 2010; The Danish Insurance Association, 2010). The purpose of tax-exemption was to make it more attractive for employers to assume a social responsibility and to improve the overall welfare by reducing waiting times for treatment at public facilities and decreasing sickness absence. In addition, it was hoped that making the tax-exemption contingent on the insurance being offered to all employees in the company would induce a more equal distribution of EPHI within the companies (The Danish parliament, 2002).[2] Premiums are either fully paid by the employers or (for about 26 percent of the insured based on the data used in this paper) deducted from the pre-tax income of the employees. The EPHI contracts available in the Danish market primarily cover diagnostics and elective surgery at private facilities for treatments that are also available at public hospitals, but often with some waiting time (The Danish Insurance Association, 2010). Hence, as noted above, they may be classified as primarily duplicate in relation to the tax-financed health care system.

The distributional consequences of EPHI may be assessed based on the principle of horizontal equity in the access to health care, which implies equal access to treatment for individuals in equal need. The condition that the insurance should be offered to all employees in a company in order to qualify for the tax-exemption may well be expected to eliminate horizontal inequity within companies. Defining horizontal inequity as any differences, EPHI generates horizontal inequity in the access to health care between those in the workforce holding EPHI and those not holding EPHI by definition, by allowing individuals with the same need for health care to differ in their access to treatment depending on insurance status. Another frequently used definition of equity argues that while need should be the crucial factor in determining access to treatment, social and economic circumstances are irrelevant (Nørredam and Christiansen, 2010). Following this definition, there is inequity in the access to health care when access varies systematically with sociodemographic determinants; while randomly distributed differences do not by themselves imply inequity. Regardless of which definition is used, the presence of EPHI generates horizontal inequity between the workforce and students, pensioners, and unemployed, who do not have EPHI through their workplace by definition.

Theoretically, insurance status is the outcome of a decision process encompassing the choice of employer, the decisions of the employer to employ the employee, and to offer private health insurance, and in some cases also the decision of the employee to accept or reject this offer. When insurance premiums are fully paid by employers, the insurance status of the employees is predominantly determined by the decision of the employer to offer EPHI. On the contrary, when the premium is deducted from the pre-tax income of

[2] The condition that the insurance should be offered to all employees in a company in order to qualify for the tax-exemption was not included in the initial bill, but added during the readings of the bill (The Danish parliament, 2002).

the employees, they face an actual choice and may reject the insurance offer.[3] Hence, the decision framework as well as determinants may well differ depending on whether the insurance premium is fully paid by the employer or deducted from the pre-tax income of the employee.

The aim of this paper is to estimate the determinants of EPHI coverage within the Danish workforce. Given the expectation from the political side that making the tax-exemption contingent on the insurance being offered to all employees would induce an equal distribution of EPHI coverage within companies, and preferably also reduce the importance of socioeconomic determinants in the distribution of EPHI within the workforce, knowledge on the resulting determinants of EPHI is highly relevant for Danish policy-makers. The paper contributes to the international literature in two ways. For one thing, it is the first study to explore the role of satisfaction with the tax-financed health care system as a potential determinant of EPHI coverage. From a theoretical point of view, companies and employees who are unsatisfied with the public system may reasonably be expected ascribe greater value to duplicate private health insurance. Secondly, it is explored whether the main results change when taking into account that some employees receive the insurance free of charge, while others pay the premium out of their pre-tax income, thus also making a choice at the individual level. To the best knowledge of the author, this study is the first to make such distinction, which may be crucial given that the decision framework differs for the two cases.

The paper is organised as follows. Section 2 describes the development of EPHI and its institutional setting in Denmark. Section 3 accounts for the theoretical framework of the decision process that leads to EPHI coverage. The purpose of this section is not to develop new theory, but to provide an overview of the existing framework. Section 4 summarizes the empirical knowledge about the determinants of EPHI in universal health care systems. Section 5 describes the data used in the empirical analysis, accounts for expected associations between explanatory variables and EPHI coverage, and provides some descriptive evidence. Section 6 accounts for the econometric specification. The results are reported in section 7. Section 8 discusses possible interpretations and implications of the results as well as the limitations of the study. Section 9 concludes.

2 Institutional setting

The Danish health care system is a comprehensive tax-financed system with universal access. General practitioner and specialist visits, out-patient ambulatory care as well as hospitalisation are free at the point of use for all citizens. General practitioners act as gatekeepers in the sense that in most cases a referral

[3] A telephone survey of HR-staff in several larger companies offering EPHI which is paid for by the employees by having the premium deducted from their pre-tax income confirmed that in this case EPHI is always presented as an optional choice and the employees are required to make an active choice. Hence, it may reasonably be expected that the employees do perceive that they face an actual choice and may reject the offer in this case.

from a general practitioner is needed to be able to access more specialised treatment. Copayment and waiting time are frequently used to ration the use of health care services for which demand is price or time sensitive. There is considerable private copayment for adult dental care, prescription medication, physical therapy, chiropractic care, and psychological counselling (Strandberg-Larsen et al., 2007). Private copayment accounted for about 14 percent of total health expenditures in 2009 (OECD, 2009). For other types of treatment, mainly elective surgery, there may be waiting time for treatment at public hospitals. This has attracted considerable public and political attention over time (Madsen, 2010).

The EPHI policies available in the Danish market are supplied by commercial insurance companies. The exact benefits differ slightly between insurance companies, just like policies are often tailored to specific firms. EPHI is mainly offered in the private sector. As previously mentioned, the EPHI contracts available in the Danish market primarily cover diagnostics and elective surgery at private facilities for treatments that are also available at public hospitals, but often with some waiting time.[4] In addition, EPHI is increasingly used to finance health care services for which private copayment is common in the public sector, such as physiotherapy, chiropractic care, and psychological counselling (The Danish Insurance Association, 2010). In 2009, the total gross compensations paid out by the commercial insurers were distributed as follows: 67 percent covered operations and the like, 9 percent covered psychologist consultations, 17 percent covered physiotherapy, chiropractic care and the like, and 7 percent covered other services (The Danish Insurance Association, 2010).

Gross compensations from private health insurance (individually purchased and employment-based) make up 1.6 percent of the total Danish health expenditure (OECD, 2010).

As previously mentioned, premiums are either paid by employers or (for about 26 percent of the insured based on the data used in this paper) deducted from the pre-tax income of the employees. The premium for fully employer paid insurance is not, like the value of many fringe benefits, subject to income tax when insurance is offered to all employees in a company.[5] This implies an indirect tax subsidy of about 40-60 percent of the premium depending on the taxable income of the employee. The annual premium per employee varies depending on the benefit scheme and the size of the workplace. Larger companies generally pay a smaller premium per employee because the scope for risk pooling increases with company size. There is no risk rating of premiums within companies due to the conditions of the tax-exemption; it

[4] However, given that hospital waiting times have declined in recent years among other things due to the introduction of free hospital choice (Kjellberg et al., 2010), some commentators might argue that duplicate EPHI in fact does not imply quicker access to hospital care anymore (thanks to an anonymous reviewer for pointing this out).

[5] The legislative framework opens up for that companies may differentiate somewhat in the health benefits offered to their employees based on seniority and number of working hours and maintain the tax exemption (Danish Tax and Customs Association, 2005). This option is, however, not likely to be widely used due to the administrative costs of this.

is, however, likely to occur between companies. The average premium per person has been constant around DKK 1000/EUR 134 since 2003, but increased to DKK 1428/EUR 191 in 2009 (The Danish Insurance Association, 2010).[6]

While it is possible that screening of firms occurs, insurance eligibility within the firm is usually not conditional on health status. However, there may be a deferred period for treatment of existing conditions and limitations on the annual number of consultations with physiotherapists, chiropractors, and psychologists. Moreover, private insurance patients are subject to gate keeping given that coverage is contingent on having a documented need for treatment (The Danish parliament, 2002). For private hospital treatment, need is typically documented by obtaining a referral from a general practitioner.

Duplicate private health insurance can also be purchased from the commercial insurance companies on an individual basis. The benefits are roughly the same as for the employment-based contracts, but premiums are not subject to special tax treatment and are risk rated based on age. Existing conditions are usually excluded from coverage. According to industry numbers, approximately 100,000 individuals had taken out private health insurance through a commercial insurance company on an individual basis in 2009 (The Danish Insurance Association, 2010).

In addition to EPHI, some employers also have company health schemes in place, which provide prevention and treatment of work-induced injuries, typically with physical therapy, chiropractic care, massage, and reflexology. The health schemes differ from EPHI in the sense that they do not provide any type of elective surgery at private facilities, and that they treat only work-induced injuries.

Finally, more than two millions Danes (approximately 42 percent of the adult population) have taken out private health insurance through the non-profit mutual insurance company ‘denmark’ in 2009 (Health Insurance denmark, 2009). This type of private health insurance is mainly complementary to the tax-financed health care system in that it primarily covers copayments for treatment in the public health care system. Approximately 25 percent of the members of ‘denmark’ are also partly reimbursed for elective surgery at private hospitals (according to internal material from ‘denmark’).

Despite some overlap in the coverage between the individually purchased and employment-based insurance contracts, some individuals hold both. In the sample described in section 5.1, 23 percent of the respondents are covered by both EPHI and ‘denmark’. One obvious reason for this is that employees are not very likely to reject an offer of practically free EPHI even though they are already covered through ‘denmark’. Another possible and likely reason is that the EPHI contracts usually expire when the insurance holder changes job or retires, while insurance through ‘denmark’ is life-long with a fixed

[6] The figures are calculated as total premium income of the commercial insurers divided by the number of insured. Conversion from DKK to EUR is undertaken using the March 2011 average exchange rate of 745.74 (Danske Bank, 2011).

premium. Moreover, the EPHI policies do not cover copayment for some treatments provided within the tax-financed health care system, such as adult dental care and prescription drugs, which are the most important benefits covered by ‘denmark’. The determinants of membership of ‘denmark’ are not subject to analysis in this paper; its existence is, however, taken into account when analysing determinants of EPHI.

3 Theoretical framework

The insurance status of an employee is the outcome of a decision process encompassing the individual’s choice of employer, the decision of the employer to employ the employee and to offer EPHI, and in some cases also the decision of the employee to accept or reject the offer. While EPHI has been found to have important implications for labour market choices in the US (Currie and Madrian, 1999), it is not expected to notably affect labour market choices in Denmark, where the the value of EPHI makes up a negligible small share of the total compensation package.[7] Hence, this part of the decision process is not considered in the following. Moreover, the theoretical literature on private health insurance in general and EPHI in particular mainly takes its point of departure in the US health care system, where EPHI provides the primary source of coverage for all health care (i.e. both acute and elective) for the working age population. This must be kept in mind when applying the theories outlined in the following to settings where private insurance provided through the workplace primarily covers elective surgery at private hospitals and clinics for treatments that are also available at public hospitals.

When insurance premiums are fully paid by employers and tax-exempted, the insurance status of the employees is predominantly determined by the decision of the employer to offer EPHI. Section 3.1 discusses various approaches to modelling employer provision of private health insurance. The additional considerations when employees pay all or part the premium out of their pre-tax income, thus also facing a choice at the individual level, are accounted for in section 3.2.

3.1 The decision of employers to offer duplicate private health insurance

Employer behaviour as regards the provision of health insurance is surprisingly little explored in economics, and the theoretical literature is characterised by several different angles of approaches rather than a unified approach (Currie and Madrian, 1999). Regardless which theoretical approach is taken, employers may have a cost advantage over private individuals in the provision of health insurance given that group purchase has the potential to reduce adverse selection and lower administrative expenses through pooling (Gruber 2000). The benefits from risk pooling imply that larger companies are expected to be relatively more likely to offer EPHI. In addition, the preferential tax treatment of EPHI which is found in some countries, including Denmark, may distort the preferences for the composition of the compensation package in favour of EPHI.

[7] The value of EPHI makes up less than 0.5 percent of the average money wages for the permanently employed in Denmark (Statistics Denmark, 2009b; The Danish Insurance Association, 2010).

The employers' decision to offer EPHI may be analysed within the theoretical framework of compensating wage differentials for fringe benefit provision (Currie and Madrian 1999). This framework considers EPHI as part of the total compensation package, which may be used by companies to attract and retain labour. Within this framework, firms are assumed to minimise their total labour costs, subject to maintaining the employees' utility at the level required to keep the firm competitive in the labour market (Feldman et al., 1997). Hence, the employers' decision to offer health insurance depends on the price at which they can purchase it in the market and the preferences of current as well as potential employees.

Another approach to modelling employer provision of EPHI is to assume that the decision is made by aggregating employee preferences, either within firms or through union bargaining (Goldstein and Pauly, 1976). A common critique of this approach is that it is debatable how closely the mechanism used to determine the employers' provision of PHI resembles actual decision making processes within companies. In particular, the assumption that unions arbitrarily decide on the employers' provision of PHI has been argued to be unrealistic.

Considering the employers' demand for EPHI in a similar way as the individual demand, it may be argued that employers demand duplicate EPHI in order to protect themselves against the risk imposed by sickness absence, assuming that people get back to work quicker with EPHI. One implication of this is that companies using more specialised labour, which is usually highly paid and hard to replace in the case of illness, are more likely to invest in the health of their employees by taking out duplicate EPHI, again assuming that EPHI reduces sickness absence. Along a similar line, Grepperud and Iversen (2011) argued that provided that premiums are not risk rated, companies with a large share of employees in bad health and those operating in industries exposed to considerable health risks may be relatively more inclined to purchase EPHI, i.e. adverse selection at the company level.

Finally, Bolin et al. (2002) extended the health capital approach of Grossman (1972) to include employers and found that they may also have an interest in investing in the health of their employees, given that employees who are off work sick are costly in terms of sickness benefits and lost labour. The marginal benefit of an investment in health is shown to depend on the technology used in the employer's production, i.e. whether it is labour or capital intensive, as well as government regulation. Moreover, in an uncertain world, risk averse employers are predicted to make larger investments in the health of their employees (e.g. by providing EPHI) than they would in a perfectly certain world.

3.2 The employees' demand for duplicate private health insurance

In situations where employees are facing an actual choice, several factors may affect the decision to accept an offer of EPHI. For one thing, the demand for private health insurance has been shown to increase with the degree of risk aversion under full information (Cutler and Zeckhauser, 2000). When asymmetric information is present, economic theory predicts that individuals may select themselves into private health insurance, either adversely based on their probability of falling ill (Rothschild and Stiglitz, 1976) or advantageously based on their probability of falling ill and their risk preferences (de Meza and Webb, 2001; Hemenway, 1990). The finding of adverse selection has been replicated for private health insurance that exists alongside a universal health care system by Olivella and Vera-Hernández (2006). However, the potential for selection at the individual level is reduced considerably for group based policies, and in regulatory settings such as the Danish, where EPHI is usually offered to all employees in a company or members of a trade union and premiums are tax-exempted.

Theoretical contributions that specifically modelled the demand for duplicate coverage have shown that individuals select themselves into this type of insurance by income (Besley et al., 1999), and emphasized the importance of the geographical accessibility of private facilities and the relative quality of care delivered by the tax-financed and the private health care sectors, respectively (Propper et al., 2001). The selection on income implies that if employers take into account the preferences of their employees in deciding whether to offer EPHI, companies with highly paid employees will be more likely to include duplicate EPHI in the compensation package.

Another motive for taking out private health insurance is in order to gain access to health care that would otherwise be unaffordable (Nyman, 1999). In universal health care systems where treatment is typical free at the point of demand and hence there is no financial loss associated with illness, the access motive may be interpreted as gaining quick access to treatment (Jones et al., 2006).

4 Previous empirical findings

This section is restricted to consider studies of the determinants of EPHI in institutional settings that are somewhat similar to the Danish in the sense that EPHI duplicates the coverage provided by a universal health care system. The data, particular focus, and econometric methods of the reviewed studies are accounted for in Appendix A.

Empirical evidence on the employers' decision to take out duplicate EPHI on behalf of their employees in universal health care systems is sparse; only one study based on company-level data from Norway was identified. This study by Seim et al. (2007) found the probability of companies purchasing EPHI to some or all of their employees to be increasing with company size and profit, the share of younger employees, the education level of the staff of employees, and operating in industries exposed to considerable health risks (such as building and construction, farming, forestry, and mining).

The predominant part of the empirical literature is based on individual-level data, and the analyses were in all cases restricted to the populations of occupationally active individuals. Overall, it is noted that the majority of the empirical literature is based on a rather sparse theoretical framework.

The findings of the various studies are accounted for by area as follows: 1) Sociodemographic characteristics, 2) health, 3) interactions with the state of the universal health care system, and 4) tax incentives.

Considering first the importance of sociodemographic determinants, the probability of EPHI ownership has consistently been found to increase with income. Likewise, males are generally found to be more likely to have EPHI than females (Aarbu, 2010; Besley et al., 1999; Bræmer, 2008; Grepperud and Iversen, 2011; King and Mossialos, 2005). The effect of age on the probability of having EPHI has been found to be positive until a given point and negative or insignificant thereafter in the United Kingdom and parts of it (Besley et al., 1999; King and Mossialos, 2005) and negative in Norway (Aarbu, 2010; Grepperud and Iversen, 2011).[8] For education level, the empirical evidence is mixed. Studies from the United Kingdom found a positive association between education level and the probability of having EPHI (Besley et al., 1999; King and Mossialos, 2005). Likewise, descriptive evidence from Denmark indicated that the privately insured a better educated (Bræmer, 2008). On the contrary, Aarbu (2010) and Grepperud and Iversen (2011) found a negative association between higher education and EPHI coverage in Norway. However, additional analysis of the Norwegian data by Grepperud and Iversen (2011) revealed that the negative effect of education and the positive effect of being male lost their significance when dummies for sector of employment were included as explanatory variables. Regarding the importance of occupation, self-employed and public employees were generally found to be less likely to be insured through their workplace, while the opposite applied to private sector employees, professionals, and individuals in managerial positions (Besley et al., 1999; Grepperud and Iversen, 2011; King and Mossialos, 2005). Finally, King and Mossialos (2005) found centre-right voters to be more likely to have EPHI in England.

The empirical evidence on the association between EPHI and health is ambiguous. Kjellberg et al. (2010) found that those in good or very good self-assessed health were relatively more likely to have EPHI in Denmark. On the contrary, dummy variables for good or very self-assessed health were largely insignificant in studies from England and Norway (Grepperud and Iversen, 2011; King and Mossialos, 2005), as were the presence of at least one chronic condition (Grepperud and Iversen, 2011). Moreover, Grepperud and Iversen (2011) found contacts with general practitioners and hospitalisations to be negatively and positively associated with the probability of having EPHI, respectively. The positive relationship between hospitalisations and EPHI ownership may be consistent with adverse selection into EPHI as well as moral hazard.Finally, King and Mossialos (2005) found a negative effect of smoking on the probability of having EPHI in England, while Aarbu (2010) found the opposite based on data from Norway.

[8] This individual-level finding from Norway corresponds well with the previously discussed company-level result of Seim et al. (2007) that companies with a larger share of younger employees are more likely to offer EPHI.

Considering potential interactions between the state of the universal health care system and EPHI coverage, Besley et al. (1999) found the prevalence of private health insurance to be increasing with the regional long term waiting times for treatment at public hospitals in the United Kingdom, although the relationship was much weaker for EPHI than for individually purchased policies. Along a similar line, King and Mossialos (2005) found that regional outpatient waiting times and the supply of private surgeons were important determinants of EPHI ownership in England. Among the Scandinavian countries, Aarbu (2010) found no significant relationship between regional waiting lists and the prevalence of EPHI coverage in Norway.

Finally, Rodríguez and Stoyanova (2008) found that a shift in tax incentives which implicitly increased the price of individually purchased insurance and reduced the price of EPHI in Spain reduced the prevalence of the former and increased the prevalence of EPHI, as expected.

5 Data

The empirical analysis is based on a cross-sectional sample of the Danish population aged 18-75. This dataset contains the most detailed information on private health insurance coverage available to date. The data were collected in June 2009 using an internet-based questionnaire. The pilot-tested final questionnaire was e-mailed to a sample of 13,246 respondents via YouGov Zapera's Denmark panel.[9] In total 5,447 respondents answered the questionnaire, which corresponds to a response rate of 41 percent. The sample is representative with respect to age, gender, and the region of residence, while individuals with only basic schooling or vocational training are somewhat underrepresented in the data.

The questionnaire and the data collection process, including further analyses of non-response and representativity, are fully documented in (Kiil and Pedersen, 2009). In the following, the variables measuring private health insurance coverage are described in detail in section 5.1, the selection of explanatory variables and their expected associations with EPHI coverage are accounted for in section 5.2, and section 5.3 presents some descriptive evidence for the explanatory variables by EPHI status.

5.1 Private health insurance coverage

The questionnaire included a series of questions on private health insurance coverage. First, the respondents were briefly introduced to the concept of private health insurance. Employed respondents

[9] YouGov Zapera's Denmark panel is an actively managed internet-based panel containing 38.600 members in Denmark as of July 2009. The YouGov Zapera Denmark panel meets the Esomar international code on marketing and social research practice. This implies among other things that its members are recruited through a wide selection of channels in order to ensure an appropriate demographic balance, and that panel members must log on with a password when participating in surveys in order to ensure that the intended person completes the survey (YouGov Zapera Ltd., 2009).

were asked whether they were covered by private health insurance through their employer; and those who answered affirmatively were asked whether the employer paid the entire premium. Married and cohabiting respondents were asked whether they had a private health insurance through their partner's employer. Finally, all respondents were asked whether they had taken out private health insurance elsewhere (not counting membership of 'denmark'). Individuals who do not know their insurance status are dropped from the data, reducing the sample size from 5,447 to 5,031 individuals.

Table 1 shows the distribution of the private health insurance supplied by commercial insurance companies in Denmark for the total sample and for the subsample of employed. It is evident from Table 1 that the primary source of private health insurance coverage is through one's own employer. Moreover, the percentage with insurance coverage is seen to be higher for the occupationally active part of the population for all insurance types.

Table 1 Source of private health insurance coverage for the total sample of the Danish population aged 18-75 and the subsample of employed, 2009

Source of coverage	All[a] (n = 5,031)		Employed[a] (n = 3,206)	
Privately insured through commercial insurance company				
Individually purchased	5.98%	(n = 301)	6.86%	(n = 220)
Through own employer (EPHI)[b]	25.04%	(n = 1,260)	38.15%	(n = 1,223)
Through partner's employer	5.29%	(n = 266)	6.74%	(n = 216)
Not insured	66.96%	(n = 3,369)	52.78%	(n = 1,692)

[a] Percentages add up to more than 100 percent in the columns because some individuals have private health insurance coverage through more than one source.
[b] The group of 37 individuals (1,260-1,223=37) who are not classified as employed but nevertheless have EPHI through their employer is made up of 12 apprentices or trainees, 15 full time students, 7 individuals on long term sick leave, and 3 individuals reporting to have an occupation other than the options available in the questionnaire.

The sample is restricted to the subsample of occupationally active for the purpose of this study, because individuals outside the labour force do not have private health insurance through their workplace by definition. This reduces the sample size from 5,031 to 3,206 individuals. In addition, the 216 individuals with private health insurance through their partner's employer and the 220 individuals who have purchased private health insurance from a commercial insurance company on an individual basis are excluded from the primary analysis based on the following considerations. The individuals who are covered through their partner's employer are excluded because the characteristics of the employer offering the insurance are not identified in the data. Hence, the determinants of this type of private health insurance cannot be meaningfully estimated and interpreted. The individuals with individually purchased private health insurance are excluded because even though these policies largely cover the same as the employment-based policies, the decision process that leads to this type of private health insurance coverage can reasonably be expected to differ markedly from the decision process that leads to EPHI coverage. Moreover, the number of individuals with individually purchased private health insurance is still modest.[10] The resulting dataset includes 2,813 individuals.

5.2 Hypotheses

This section identifies the potential determinants of EPHI coverage and forms some hypotheses based on the theoretical framework and previous empirical findings, taking into account the particular institutional features that are present in the Danish health care system. The drawing up of hypotheses is intended to guide the selection of explanatory variables from the information available in the data and provide some benchmark against which to discuss the results.

Table 2 provides an overview of the potential determinants and accounts for a priori expectations regarding their relationship with EPHI coverage.

Table 2 Hypotheses for potential determinants

Variable	Expected association with EPHI coverage
Employer-related characteristics	
Sector of employment	positive for private; negative for public
Employer size	positive
Subordinates	insignificant
Sociodemographic characteristics	
Male	positive
Age	positive until a given point then negative
Personal pre-tax income per year	positive
Education level	ambiguous
Occupation	positive for white-collar
Member of ‘denmark’	insignificant
Company health scheme	ambiguous
Capital region	positive
Health-related characteristics	
Self-assessed health	ambiguous
Chronic conditions	ambiguous
Attitudinal characteristics	
Satisfaction with tax-financed system	negative

As accounted for in section 3, the theoretical literature suggests that employer-related characteristics are important determinants of EPHI coverage, given that the initial decision to take out private health insurance is initiated at the company-level. This study includes sector of employment, employer size, and

[10] An exploratory analysis of the determinants of having purchased private health insurance from a commercial insurance company on an individual basis revealed only very few statistically significant associations.

whether the individual has any subordinates as potential determinants.[11] The presence of subordinates is not expected to affect the probability of having EPHI in Denmark, given that the condition for the tax-exemption discourages companies from offering private health insurance to management level employees only.

The hypotheses regarding the sociodemographic characteristics gender, age, income, and education level are derived from the existing empirical literature. As far as occupational status is concerned, the probability of having EPHI coverage is expected to be higher for white-collar workers than for skilled and unskilled blue-collar workers. This expectation is motivated by the Danish labour market legislation, according to which white-collar workers are entitled to full pay during sickness, while this is not a matter of course for employees who are paid on an hourly basis (as often applies to skilled and unskilled workers). As a consequence, companies with a large share of white-collar workers are facing a larger financial risk as regards to the sickness absence of their employees, and they may thus be expected to attach a greater value to EPHI, causing white-collar workers to be more likely to have EPHI. Finally, living in the capital region is expected to increase the probability of having EPHI due to a higher concentration of knowledge-intensive enterprises as well as private treatment facilities in this area compared to the rest of the country.

Membership of the non-profit mutual insurance company ‘denmark’ is not expected to affect the probability of having EPHI, given that these two insurance types perform fundamentally different functions in relation to the tax-financed health care system. As for company health schemes, which differ from EPHI in the sense that they treat work-induced injuries only and do not provide any type of elective surgery at private facilities, the expected association with EPHI is ambiguous. While the most likely relationship among the two fringe benefits is that both tend to be offered by the same employers, i.e. those who assign a high value to having healthy employees, it is also possible that employers choose to offer company health schemes instead of EPHI.

A priori, the relationship between EPHI ownership and health (measured by self-assessed health status and a set of dummy variables indicating the presence of eight chronic conditions) is expected to be ambiguous, given the theoretical framework and the previous empirical findings accounted for in sections 3 and 4, respectively. Contacts to health care providers were not included as explanatory variables given that these variables may likely be affected by EPHI coverage and thus endogenous. Moreover, it was decided not to

[11] Given the major importance of the employers in offering EPHI in the first place, it would be desirable to include more employer-related characteristics in the analysis, such as the average age, sickness absence, and education level of the staff of employees in the company in which an individual is employed, as well as the work environment, human resource policies, etc. However, this information is not available in the data, and it cannot be obtained from Statistics Denmark and linked due to the absence of social security numbers in the data.

include various health-related behaviours, such as smoking, drinking, and exercising, as well as self-reported measures of attitude to economic and health-related risk in the model (even though the information was available in the data), since there are no compelling theoretical arguments or empirical evidence in favour of doing so.[12]

Finally, the link between the state of the tax-financed system and EPHI coverage is explored by including satisfaction with the tax-financed health care system as an explanatory variable. The association between the level of satisfaction and EPHI ownership is expected to be stronger for individuals who pay the premium out of their pre-tax income and thus make an actual choice than for those who receive EPHI free of charge. The reason for including satisfaction rather than information on regional waiting times or other quality measures is that the combination of free hospital choice for many elective procedures and low geographical distances in Denmark implies that any differences in waiting time for treatment between the regions should be levelled out.

5.3 Descriptive evidence

Table 3 shows how the characteristics of the individuals are distributed on the explanatory variables for all employed and by EPHI status, and tests for equality of proportions or means between individuals with and without EPHI, respectively. This allows for a first inspection of possible differences between the groups.

Respondents who answered 'don't know' or 'other' than the categories specified in the questionnaire to one or more of the explanatory variables are dropped from the data before commencing the analysis, reducing the sample size further from 2,813 to 2,536 individuals.[13] The main motivation for this data restriction is that it is questionable whether the individuals in the 'don't know' and 'other' groups have anything in common. Moreover, the signs of potential marginal effects for these categories cannot meaningfully be interpreted. Due to a particularly large share of respondents who do not wish to disclose their personal pre-tax income, a dummy variable is included that equals one whenever respondents do not wish to disclose their income and zero otherwise.[14]

As evident from Table 3, the resulting dataset includes 2,536 individuals, of whom 42 percent are covered by private health insurance through their employer. Within the group of individuals with EPHI, 71 percent

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[12] It was checked that including health-related behaviours and risk preferences as explanatory variables did not affect the results notably, and that the coefficients for these variables were largely insignificant. These results are available from the author upon request.

[13] The dropped individuals are distributed as follows: 6 did not know their sector of employment; 66 did not know the size of their workplace; 17 did not know their personal pre-tax income; 29 stated to work in a sector other than those specified in the questionnaire; 42 stated to have an education other than those specified in the questionnaire; and 123 individuals stated to have an occupation other than those specified in the questionnaire.

[14] An alternative strategy would be to impute all missing values.

receives the insurance free of charge, 26 percent pays the premium themselves out of their pre-tax income, and 3 percent do not know how the premium is paid. In other words, the employer pays the entire premium for the majority of the insured.

Table 3 Distribution on explanatory variables for all employed and by EPHI status

	All employed	EPHI	No EPHI	Two-sided test for equality (EPHI vs. no EPHI)
	%	%	%	z-statistic
Employer-related characteristics				
Sector of employment				
Public company	36.24	6.49	57.71	-26.47***
Independent public company	3.46	3.95	3.67	0.65
Private company	60.09	89.56	38.83	25.74***
Employer size				
1-9 employees	17.07	9.69	22.40	-8.40***
10-49 employees	27.76	25.68	29.26	-1.99**
50-249 employees	27.13	28.03	26.48	0.87
250+ employees	28.04	36.59	21.86	8.15***
Any subordinates	21.92	23.24	20.98	1.36
Sociodemographic characteristics				
Male	53.12	57.67	49.83	3.90***
Age, mean	45.07	43.82	45.98	-4.70***
(std. err.)	(0.23)	(0.33)	(0.31)	
Personal pre-tax income per year (in 1,000s)				
DKK 0-399/EUR 0-54	55.09	44.31	62.86	-9.27***
DKK 400-799/EUR 54-107	34.03	42.90	27.63	8.01***
DKK 800+/EUR 107+	2.60	3.67	1.83	2.87***
Do not wish to disclose	8.28	9.13	7.67	1.31
Education level				
Basic or high school	13.13	12.61	13.51	-0.67
Vocational	26.81	29.82	24.64	2.90***
College	60.06	57.57	61.85	-2.17**
Occupation				
White-collar worker	77.29	81.75	74.07	4.56***
Skilled worker	7.06	7.43	6.79	0.62
Unskilled worker	7.49	7.53	7.47	0.05
Self-employed or assisting spouse	8.16	3.29	11.68	-7.61***
Member of ’denmark’	54.89	56.16	53.97	1.09
Company health scheme	28.94	41.86	19.62	12.17***
Capital region	33.52	36.50	31.36	2.70***
Health-related characteristics				
Self-assessed health status				
Excellent	16.68	15.80	17.31	-1.00
Good	56.62	61.05	53.43	3.82***
Fair, poor or very poor	26.70	23.14	29.26	-3.44***
Chronic conditions				
Asthma	5.88	5.55	6.11	-0.59
Allergies	23.90	25.59	22.67	1.70*
Diabetes	3.94	3.76	4.07	-0.40
Hypertension	13.29	11.95	14.26	-1.69*
Emphysema	1.81	1.69	1.90	-0.39

Arthritis	13.56	10.63	15.68	-3.67***
Osteoporosis	1.10	0.85	1.29	-1.05
Tinnitus	7.93	7.06	8.55	-1.38
Attitudinal characteristics				
Satisfaction with tax-financed system				
Very satisfied	4.89	3.39	5.97	-2.98***
Predominantly satisfied	41.64	39.42	43.25	-1.93*
Neither satisfied nor unsatisfied	27.52	29.82	25.87	2.20**
Predominantly unsatisfied	21.45	23.14	20.23	1.76*
Very unsatisfied	4.50	4.23	4.68	-0.54
N	2,536	1,063	1,473	

* denotes significance at 10 percent level; ** denotes significance at 5 percent level; *** denotes significance at 1 percent level. Conversions from DKK to EUR are undertaken using the March 2011 average exchange rate of 745.74 (Danske Bank, 2011).

The expectations that EPHI is mainly a private sector phenomenon and that it is more frequently offered in larger companies are confirmed by Table 3. Likewise for the sociodemographic characteristics, where the differences in the distributions between group with EPHI and the group without are by and large as expected. One exception to this is education, where it is seen that EPHI is relatively more frequent in the group of vocationally trained, while the opposite applies to the group of individuals with at least college level education. Members of ‘denmark’ are equally distributed in the two groups. Considering self-assessed health, individuals with EPHI are overrepresented in the group with good self assessed health and reversely for the remaining categories, although the difference is not significant for the individuals in excellent health. The share with one or more chronic conditions does not differ significantly between the two groups. As expected, Table 3 reveals a pattern of relatively more individuals who are satisfied with the tax-financed health care system in the group without EPHI and the other way around for the group with EPHI coverage, although the percentage of very unsatisfied individuals does not differ significantly.

6 Econometric specification

The determinants of having EPHI altogether, either fully paid by the employer or deducted from the pre-tax income of the employee, are estimated using a standard binary probit model. This model compares the total group of individuals with EPHI to the group of individuals without EPHI.

Taking into account that some employees receive EPHI free of charge, while others pay the premium out of their pre-tax income and thus make an actual choice, the econometric specification becomes less straight forward. One way to address this complication is by estimating a bivariate probit model with sample selection (Greene, 1999; Van de Ven et al., 1981).[15] This model is somewhat in between a full

[15] This approach is preferred over estimating two separate probit models (i.e. one for employees who receive EPHI free of charge and one for those who pay the premium out of their pre-tax income) given that the error terms of two such equations may be correlated.

bivariate probit model and a bivariate probit model with partial observability, in the sense that we observe more than in the partial observability model but less than in the full bivariate probit model.[16]

The econometric specification consists of two simultaneous equations:

$$(1) \qquad \begin{aligned} y_{1i}^* &= X_{1i}\beta_1 + \varepsilon_{1i} \\ y_{2i}^* &= X_{2i}\beta_2 + \varepsilon_{2i} \end{aligned} \qquad \text{, for } i = 1,\dots, N$$

where y_{1i}^* and y_{2i}^* are unobserved latent variables indicating an individual's propensity to have EPHI and to have paid the premium, respectively; X_{1i} and X_{2i} denote the vectors of explanatory variables, where the first variable in each vector is set to unity; β_1 and β_2 are the two vectors of parameters to be estimated; and ε_{1i} and ε_{2i} are the random error terms, which are assumed to follow a standard bivariate normal distribution with correlation coefficient ρ. Assuming that the model is correctly specified, $\rho \neq 0$ implies that the processes determining y_{1i}^* and y_{2i}^* are interdependent. In the special case where $\rho = 0$, the bivariate probit model with sample selection is equivalent to estimating two separate probit models (although of course for the latter model on a restricted subsample). The latent variables, y_{1i}^* and y_{2i}^*, are measured by the two binary variables, y_{1i} and y_{2i}, which are generated by the following rule:

$$(2) \qquad y_{1i} = \begin{cases} 1 & if\ y_{1i}^* > 0 \\ 0 & if\ y_{1i}^* = 0 \end{cases}, \qquad y_{2i} = \begin{cases} 1 & if\ y_{2i}^* > 0 \\ 0 & if\ y_{2i}^* = 0 \end{cases}$$

The first equation identifies whether the respondent has EPHI, y_{1i}, and the second equation identifies whether the respondent has paid the premium for the EPHI out if its pre-tax income, y_{2i}, conditional on having EPHI. Selection occurs because for a given individual y_{2i} is only observed when y_{1i} equals one. In other words, it is only observed whether the individual pays the premium or receives the insurance for free for the subsample of insured. For the uninsured, it is not known whether they would have had to pay the premium themselves, had they been insured.

Thus, there are three types of observations in the sample with the following probabilities:

[16] Previous applications of this model include among others Berinsky (2004) who examined attitudes towards race issues in the US and Rodríguez and Stoyanova (2008) who estimated the impact of a tax reform on the demand for private health insurance in Spain. The presentation of the bivariate probit model with sample selection in this section follows that of Rodríguez and Stoyanova (2008).

$$(3) \qquad \begin{array}{ll} y_{1i}=1, y_{2i}=1 & \Pr(y_{1i}=1, y_{2i}=1)=\Phi_2(X_{1i}\beta_{1i}, X_{2i}\beta_{2i}, \rho) \\ y_{1i}=1, y_{2i}=0 & \Pr(y_{1i}=1, y_{2i}=0)=\Phi_2(X_{1i}\beta_{1i}, -X_{2i}\beta_{2i}, -\rho) \\ y_{1i}=0 & \Pr(y_{1i}=0)=1-\Phi(X_{1i}\beta_{1i}) \end{array}$$

where Φ and Φ_2 are the univariate and the bivariate standard normal cumulative distribution functions, respectively. The first line in equation system (3) models individuals who are insured through their employer but pay the premium out of their pre-tax income and thus make an actual choice, the second line models individuals who are insured free of charge through their employer, and the third line models individuals who do not have any type of private health insurance through their workplace.

The log-likelihood function based on these probabilities is:

$$(4) \qquad \mathrm{Log}L = \sum_{\substack{y_{1i}=1 \\ y_{2i}=1}} \log \Phi_2(X_{1i}\beta_1, X_{2i}\beta_2, \rho) + \sum_{\substack{y_{1i}=1 \\ y_{2i}=0}} \log \Phi_2(X_{1i}\beta_1, -X_{2i}, \beta_2, -\rho) + \sum_{y_{1i}=0} \log(1-\Phi(X_{1i}\beta_1))$$

The log-likelihood function is maximised with respect to the two vectors of coefficients, β_1 and β_2, and the correlation coefficient ρ.

As in several other models involving multiple equations, the magnitude and the signs of the simple coefficients in the bivariate probit model with sample selection can be misleading. Hence, marginal effects are calculated at the means of the explanatory variables in accordance with Greene (1996). For continuous variables, the marginal effects are given by then derivatives of the probabilities stated in (3) with respect to the explanatory variable of interest. For binary variables, they are computed as the effect of changing the variable from zero to one, holding all other variables constant.

The bivariate probit model with sample selection is identified through functional form. However, it is preferable to include one or more variables that affect the probability of having EPHI, but not whether this is received free of charge or paid for, when such variables are available in the data.

7 Results

Stata/IC 11 was used to estimate the models and compute marginal effects and standard errors. Table 4 reports the results of the binary probit model which analyses the determinants of having EPHI altogether, i.e. either fully paid by the employer or deducted from the pre-tax income.

As expected, the characteristics related to the workplace are by far the quantitatively most important determinants of whether or not one has EPHI, except for the presence of subordinates, which is insignificant. Compared to public employees, those working at independent public companies are 46.15 percentage points more likely to have EPHI and private employees are 64.22 percentage points more likely. Likewise, the association between employer size and the probability of having EPHI is positive as expected.

Table 4 Marginal effects from binary probit model

	$y_i = 1$ for individuals with EPHI		Expected sign
	Marg. eff.	**Std. err.**	
Employer-related characteristics			
Sector of employment			
Public company (baseline)	n/a	n/a.	
Independent public company	0.4615***	(0.0435)	+
Private company	0.6422***	(0.0164)	+
Employer size			
1-9 employees (baseline)	n/a	n/a	
10-49 employees	0.1951***	(0.0408)	+
50-249 employees	0.2598***	(0.0421)	+
250+ employees	0.3405***	(0.0415)	+
Any subordinates	0.0133	(0.0304)	insig.
Sociodemographic characteristics			
Male	0.0266	(0.0259)	+
Age	0.0297***	(0.0079)	+
Age^2	-0.0003***	(0.0001)	-
Personal income (in 1,000s)			
DKK 0-399/EUR 0-54	-0.0490*	(0.0294)	-
DKK 400-799/EUR 54-107 (baseline)	n/a	n/a	
DKK 800+/EUR 107+	0.1615**	(0.0811)	+
Do not wish to disclose	-0.0007	(0.0467)	insig.
Education level			
Basic or high school (baseline)	n/a	n/a	
Vocational	0.0415	(0.0412)	ambig.
College	0.0543	(0.0374)	ambig.
Occupation			
White-collar worker (baseline)	n/a	n/a	
Skilled worker	-0.0962**	(0.0412)	-
Unskilled worker	-0.1028**	(0.0406)	-
Self-employed or assisting spouse	-0.2928***	(0.0281)	-
Member of ’denmark’	0.0333	(0.0238)	insig.
Company health scheme	0.2540***	(0.0270)	ambig.
Capital region	0.0361	(0.0255)	+
Health-related characteristics			
Self-assessed health status			
Excellent	-0.0774**	(0.0306)	ambig.
Good (baseline)	n/a	n/a	
Fair, poor or very poor	-0.0768***	(0.0282)	ambig.
Chronic conditions			
Asthma	-0.0158	(0.0523)	ambig.
Allergies	0.0379	(0.0293)	ambig.
Diabetes	0.0512	(0.0664)	ambig.
Hypertension	0.0031	(0.0383)	ambig.
Emphysema	0.0165	(0.0887)	ambig.
Arthritis	-0.0853**	(0.0347)	ambig.
Osteoporosis	0.0301	(0.1216)	ambig.
Tinnitus	-0.0639	(0.0413)	ambig.

Attitudinal characteristics			
Satisfaction with tax-financed system			
Very satisfied (baseline)	n/a	n/a	
Predominantly satisfied	0.1071*	(0.0613)	+
Neither satisfied nor unsatisfied	0.1178*	(0.0643)	+
Predominantly unsatisfied	0.1417**	(0.0662)	+
Very unsatisfied	0.2380***	(0.0846)	+
N	2,536		
Log-likelihood	-1,060.04		
LR χ^2 (df = 34)	1,328.99***		

* denotes significance at 10 percent level; ** denotes significance at 5 percent level; *** denotes significance at 1 percent level. n/a is used to denote not applicable. Conversions from DKK to EUR are undertaken using the March 2011 average exchange rate of 745.74 (Danske Bank, 2011).

Considering the sociodemographic characteristics, the association between age and the probability of having EPHI is seen to change at different points in the distribution of age. In particular, an additional year of age increases the probability of having EPHI by 2.97 percentage points until the age of 49, whereafter EPHI prevalence decreases with age. Individuals with an annual pre-tax income of DKK 800,000 or more are 16.15 percentage points more likely to have EPHI compared to individuals in the middle group with annual incomes of DKK 400,000-799,999, while those who earn less than DKK 400,000 are 4.90 percentage points less likely. Compared to white-collar workers, skilled and unskilled workers are 9.62 and 10.28 percentage points, respectively, less likely to have EPHI, and self-employed or assisting spouses are 29.28 percentage points less likely. Working for a company with a health scheme increases the probability of having EPHI by 25.40 percentage points.

Considering next the association between EPHI status and health, individuals in excellent self-assessed health are seen to be 7.74 percentage points less likely to be covered by EPHI compared to those in good self-assessed health, and individuals in fair, poor or very poor health are 7.68 percentage points less likely. The dummy variables indicating the presence of eight chronic conditions are all insignificant except for arthritis, which is found to decrease the probability of having EPHI by 8.53 percentage points.

Finally, it is seen from Table 4 that compared to the group of individuals who are very satisfied with the tax-financed health care system, individuals who are predominantly unsatisfied are 14.17 percentage points more likely to have EPHI and those who are very unsatisfied are 23.80 percentage points more likely. This confirms the hypothesis that the demand for EPHI that covers treatment at private facilities for treatments which are also available within the universal tax-financed health care system is somehow related to the perception of the public alternative.

Table 5 reports the results of the bivariate probit model with sample selection. This model takes into account that some employees receive the insurance free of charge while others pay the premium out of their pre-tax income by modelling the probability of having EPHI altogether and the probability that it is paid for and thus resulting from an actual choice simultaneously. The 32 individuals who do not know who paid the premium for their EPHI are excluded from the analysis.

Table 5 Marginal effects from bivariate probit model with sample selection

	$y_{1i} = 1$ for individuals with EPHI		$y_{2i} = 1$ for individuals who pay the premium	
	Marg. eff.	**Std. err.**	**Marg. eff.**	**Std. err.**
Employer-related characteristics				
Sector of employment				
Public company (baseline)	n/a	n/a	n/a	n/a
Independent public company	0.4592***	(0.0462)	-0.1001	(0.2758)
Private company	0.6389***	(0.0162)	-0.2208	(0.3774)
Employer size				
1-9 employees (baseline)	n/a	n/a	n/a	n/a
10-49 employees	0.1889***	(0.0410)	0.0375	(0.1270)
50-249 employees	0.2586***	(0.0424)	0.2229	(0.1809)
250+ employees	0.3397***	(0.0420)	0.1728	(0.1982)
Any subordinates	0.0234	(0.0304)	0.0440	(0.0447)
Sociodemographic characteristics				
Male	0.0229	(0.0259)	0.0163	(0.0374)
Age	0.0291***	(0.0078)	-0.0086	(0.0163)
Age^2	-0.0003***	(0.0001)	0.0001	(0.0002)
Personal income (in 1,000s)				
DKK 0-399/EUR 0-54	-0.0622*	(0.0294)	0.0499	(0.0452)
DKK 400-799/EUR 54-107 (baseline)	n/a	n/a	n/a	n/a
DKK 800+/EUR 107+	0.1517	(0.0823)	-0.0373	(0.1027)
Do not wish to disclose	-0.0135	(0.0467)	0.0295	(0.0603)
Education level				
Basic or high school (baseline)	n/a	n/a	n/a	n/a
Vocational	0.0487	(0.0411)	0.0306	(0.0628)
College	0.0482	(0.0371)	0.0032	(0.0579)
Occupation				
White-collar worker (baseline)	n/a	n/a	n/a	n/a
Skilled worker	-0.0942*	(0.0408)	0.0844	(0.0698)
Unskilled worker	-0.0974*	(0.0400)	0.0971	(0.0744)
Self-employed or assisting spouse	-0.2856***	(0.0272)	0.1548	(0.1804)
Member of ’denmark’	0.0342	(0.0238)	0.0259	(0.0366)
Company health scheme	0.2513***	(0.0274)	-0.0837	(0.0942)
Capital region	0.0248	(0.0256)	-0.0464	(0.0358)
Health-related characteristics				
Self-assessed health status				
Excellent	-0.0748*	(0.0305)	0.0825	(0.0501)
Good (baseline)	n/a	n/a	n/a	n/a
Fair, poor or very poor	-0.0667*	(0.0281)	0.0200	(0.0484)
Chronic conditions				
Asthma	-0.0183	(0.0527)	-0.0193	(0.0788)
Allergies	0.0382	(0.0293)	-0.0255	(0.0419)
Diabetes	0.0558	(0.0661)	-0.0407	(0.0928)
Hypertension	0.0098	(0.0389)	-0.0390	(0.0555)
Emphysema	0.0149	(0.0879)	-0.1898	(0.1355)
Arthritis	-0.0862*	(0.0342)	0.0137	(0.0656)
Osteoporosis	0.0227	(0.1203)	-0.1931	(0.1797)

Tinnitus	-0.0820*	(0.0409)	0.0142	(0.0723)
Attitudinal characteristics				
Satisfaction with tax-financed system				
Very satisfied (baseline)	n/a	n/a	n/a	n/a
Predominantly satisfied	0.1050	(0.0612)	-0.0228	(0.0987)
Neither satisfied nor unsatisfied	0.1082	(0.0644)	-0.0206	(0.0996)
Predominantly unsatisfied	0.1391*	(0.0665)	-0.0095	(0.1079)
Very unsatisfied	0.2448**	(0.0857)	0.0530	(0.1502)
Correlation of error terms (ρ)	-0.5075	(0.5582)		
N	2,500			
Log-likelihood	-1,599.23			
Wald χ^2 (df = 34)	56.89***			

* denotes significance at 10 percent level; ** denotes significance at 5 percent level; *** denotes significance at 1 percent level. n/a is used to denote not applicable. Conversions from DKK to EUR are undertaken using the March 2011 average exchange rate of 745.74 (Danske Bank, 2011).

It is seen from Table 5 that none of the marginal effects of the various explanatory variables on the probability of having EPHI which is paid for out of the pre-tax income (y_{2i}) differ significantly from zero. Hence, the determinants of having EPHI which is paid for out of the pre-tax income do not differ significantly from the determinants of having EPHI altogether (i.e. either fully paid by the employer or deducted from the pre-tax income). In addition, the marginal effects of the various explanatory variables on the probability of having EPHI altogether are largely similar to those obtained by a binary probit model, besides from a slight drop in the level of significance for some variables (high income, skilled and unskilled worker, self-assessed health status, arthritis, and the level of satisfaction with the tax-financed system). The bivariate probit model with sample selection for which results are reported in Table 5 is only identified through functional form because no suitable exclusion restrictions were identified in the data.[17]

8 Discussion

Like all studies, this study is subject to some methodological considerations regarding the data and econometric specifications. These are discussed in sections 8.1 and 8.2, respectively. Section 8.3 discusses possible interpretations and implications of the results and holds them against previous empirical findings.

[17] The various sociodemographic, health-related, and attitudinal characteristics are disregarded because they may reasonably be expected to affect the probability of having EPHI which is paid out of the pre-tax income through the mechanisms discussed in section 3.2. This leaves the employer-related characteristics. Excluding sector of employment from the second equations brings about a slight change in the results such that the size of the workplace increases the probability of having paid the premium. However, sector of employment is most likely not a valid exclusion restriction given that the share of individuals who are required to pay the EPHI out of their pre-tax income is considerable higher in the public sector compared to what is expected for private companies (Kjellberg et al., 2010). Excluding the size of the workplace from the second equation changes the results slightly such that being self-employed and employed in the public sector is found to increase the probability of having EPHI which is paid for out of the pre-tax income at a 5 percent level of significance.

8.1 Data

The use of data collected using an internet-based questionnaire constitutes a source of bias if the individuals who can be reached through the internet differ from those without internet access on the characteristics that are subject to investigation. This is, however, not expected to be a major issue in the present study, given that 86 percent of the Danish population had internet access in their homes in 2009 (Statistics Denmark, 2009a). In addition, the percentage with internet access is most likely higher among the occupationally active, to whom the analysis is restricted. Along a similar line, the identification of respondents through YouGov Zapera's Denmark panel constitutes a weakness of the study if the panel members differ from the remaining population on the relevant characteristics.[18] While none of these data issues can be dismissed with complete certainty, it is, however, worth noting that there are no indications that the sample deviates considerably from the population on essential characteristics besides from individuals with only basic schooling or vocational training being somewhat underrepresented (Kiil and Pedersen, 2009).

Although it is in line with what is commonly seen in internet-based surveys (Cook et al. 2000; Sheehan 2006), the response rate of 41 percent is not impressive and may be argued to hamper the ability to make inferences about the study population. However, the extent of bias entailed by a low response rate is a function of the response rate itself as well as differences between respondents and non-respondents on the variables of interest. In the present study, it is possible that the respondents differ from those who did not answer the questionnaire by having a greater interest in the subject of the survey, i.e. private health insurance. Such an interest could be spurred by being strongly for or against private health insurance, and it may be positively or negatively related to health. Moreover, it is uncertain how this relates to the remaining variables used in this study. Hence, while caution should always be exercised when generalising results based on survey data to populations, there are no obvious reasons to believe that the results of this study are systematically biased by non-response.

8.2 Econometric specification

Considering the decision process that leads to EPHI coverage, i.e. the supply of private health insurance by the commercial insurance companies, the decision of employers to offer EPHI, and the decision of the employees to accept or reject this offer when this is relevant, it appears that the ideal econometric specification would be a multilevel model. This approach would enable a separation of the effects of the

[18] An additional, although somewhat hypothetical, issue with the identification of respondents through web panels is that when it is possible to enrol in the panel on a voluntary basis, the established principles of statistical inference are in theory not applicable. These are only applicable to probability based samples where all members of the population have known and positive probabilities of selection (Couper, 2000). However, the practical importance of some extent of voluntary enrolment in web panels has yet to be assessed.

determinants on the various participants in the decision process. It is, however, not possible given the data at hand.

Both the binary probit model and the bivariate probit model with sample selection estimated in this study are reduced form models in the sense that they estimate the determinants of EPHI coverage net of demand- and supply-side effects. This imposes some limitations on the ability to identify causal relationships, and it does not allow for the estimation of how specific factors impact either side of the market. More precisely, it is not possible to separate the effects of the determinants on the various participants in the decision process that leads to EPHI coverage. Attempting to identify the demand and supply functions separately and estimate the full structural model would require one to find exogenous variables that relate exclusively to either demand or supply (Maddala, 2001). Such variables are notoriously hard to find in private health insurance markets, where most factors tend to affect supply and demand simultaneously (King and Mossialos, 2005).

8.3 Results

Due to the finding of the bivariate probit model that the determinants of EPHI which is paid for out of pre-tax income of the employee do not differ significantly from the determinants of having EPHI altogether, the determinants of EPHI coverage are discussed jointly for individuals who receive fully employer paid EPHI and those who have the premium deducted from their pre-tax income in the following.

As expected, the probability of having EPHI increases substantially with private sector employment and the size of the workplace. The finding that private sector employees are more likely to be insured through their workplace corresponds well with the previous literature (Besley et al., 1999; Grepperud and Iversen, 2011; King and Mossialos, 2005) and the fact that fringe benefits are generally more predominant in the private sector in Denmark. In addition to that, it may be argued that it would seem somewhat paradoxical if employees at public hospitals are given insurance that covers elective surgery at private facilities as part of their pay. The positive effect of employer size is likely to reflect the fact that larger companies generally pay less per employee covered because the scope for risk pooling increases with company size. The positive association between EPHI ownership and working for an employer with a company health scheme in place suggests that both benefits are offered by employers who focus on the health of their employees and play an active part in promoting this.

The lack of an effect of whether the individual has any subordinates suggests that it is not common practice within Danish companies to offer EPHI exclusively to highly ranked employees, as opposed to what was found to be the case in the United Kingdom and Norway (Besley et al., 1999; Grepperud and Iversen, 2011; King and Mossialos, 2005). The explanation for this is undoubtedly the Danish legislation, which implies that employees are tax-exempted for the income value of EPHI conditional on the insurance being offered to all employees in the company.

Considering the importance of the various sociodemographic characteristics, the probability of having EPHI was found to increase with income, being employed as a white-collar worker, and age until the age of 49 at a five percent level of significance or below. Following the definition of Nørredam and Christiansen (2010), this means that EPHI generates horizontal inequity in the access to health care services along the dimensions of income, occupation, and age, assuming that the privately insured have preferential access (in the form of shorter waiting time) to some treatments.

On the contrary, the marginal effects of gender, education level, and living in the capital region were found not to be significantly associated with EPHI coverage once the remaining variables were controlled for. Comparing the estimates obtained by the binary and bivariate probit models to the descriptive evidence that males are generally more likely to have EPHI than females and that the privately insured are relative better educated, it appears that the differences in the distributions for these variables is attributable to something else, such as sector of employment. This suspicion is supported by empirical evidence from Norway, where Grepperud and Iversen (2011) found that the coefficients for education and gender lost their significance when dummies for sector of employment were included as explanatory variables. A similar argument applies to living in the capital region, where the larger concentration of knowledge-intensive enterprises in the capital area may be captured by the variables measuring the education level of the employees and to some extent also the size of the workplaces. As expected, membership of the non-profit mutual insurance company 'denmark' is also not associated with the probability of having EPHI, although the two types of private health insurance cover some of the same things.

Considering next the implications of the results for the health-related characteristics, these are less clear-cut. Overall, the group of occupationally active may reasonably be expected to be healthier than pensioners and unemployed, who are unable to take out private health insurance through their workplace by definition. Hence, the targeting of the occupationally active which is implicit in EPHI may be interpreted as cream skimming by the commercial insurers. Restricting the analysis to the workforce, the findings of this study indicate that the relationship between the probability of having EPHI and health is ambiguous. This is in agreement with the major part of the empirical literature. More precisely, the association between EPHI coverage and self-assessed health was found to be quadratic such that individuals in good self-assessed health are more likely to be covered by EPHI than individuals in excellent self-assessed health as well as those in fair, poor or very poor self-assessed health. While the former relationship is consistent with adverse selection into private health insurance by companies with a large share of employees in relatively bad health (in this case good rather than excellent health), the latter might indicate advantageous selection into EPHI.[19] Alternatively, it may be the result of supply-side

[19] The theory of advantageous selection has found some support in recent studies of the market for supplementary private health insurance (termed Medigap insurance) among the elderly in the US. In particular, the negative

restrictions and risk rating of premiums between companies. The relationship between self-assessed health and EPHI coverage revealed in this study does not necessarily contradict the previous finding of Kjellberg et al. (2010), that those in good or very good self-assessed health considered jointly are relatively more likely to have EPHI. However, the finer categories add additional nuances. The finding that the probability of having EPHI is largely unaffected by the presence of several chronic conditions suggests that insurance companies do not (and cannot) exclude employees with chronic conditions from obtaining coverage. However, there may still be a deferred period for treatment of existing conditions. One possible explanation for the negative and significant effect of arthritis on the probability of having EPHI is that arthritis could cause some individuals to work part-time, in which case employers would be allowed to exclude them from coverage and maintain the tax exemption (Danish Tax and Customs Administration, 2005).

Finally, assuming that the employer's decision to offer private health insurance may be modelled as an aggregation of the employees' preferences, the negative association between the level of satisfaction with the tax-financed health care system and the probability of having duplicate EPHI suggests that EPHI has succeeded in accommodating differences in preferences across individuals. This is done by allowing individuals who are unsatisfied with the tax-financed health care system to receive treatment at private facilities. However, this interpretation is subject to the reservation that satisfaction with the tax-financed health care system may be endogenous, in which case the observed association cannot be interpreted as a causal effect. Endogeneity may occur if EPHI coverage affects the satisfaction with the tax-financed health care system, e.g. through experience (positive or negative) with private sector treatment. Hence, the only thing that can be inferred for sure is that the probability of having EPHI and the level of satisfaction with the tax-financed health care system are negatively associated.

9 Concluding remarks

Overall, it is concluded that individuals who receive fully employer paid EPHI and those who have the premium deducted from their pre-tax income may reasonably be combined in future analyses of EPHI in Denmark, even though the underlying decision processes differ somewhat.

Considering the importance of specific determinants, it is concluded that the characteristics related to the workplace (i.e. sector of employment, size of the workplace, and the presence of a company health scheme) are by far the quantitatively most important determinants. However, the lack of an effect of whether the individual has any subordinates suggests that the special condition of the tax exemption, i.e. that the insurance should be offered to all employees in the company in order to be tax-exempted, has succeeded in preventing companies from offering EPHI exclusively to managerial employees. Given the

relationship between the risk of illness and health insurance coverage has been found to weaken and in some cases change sign when controlling for risk attitude (Cutler et al., 2008) and cognitive capacity (Fang et al., 2008).

major importance of employer-related characteristics in determining the probability of EPHI coverage, the employers' decision to offer private health insurance to their employees, including the tradeoffs between EPHI, other fringe benefits, and money wages, are obvious candidates for future research. This would require company-level data on characteristics such as the age distribution and gender composition of the staff of employees, the composition of the compensation package, how risky the firm sector is, and the profit level of the firm, possibly combined with qualitative interviews of key personnel.

The lack of a clear-cut relationship between health status and the probability of having EPHI suggests that the individuals with EPHI do not systematically belong to companies with a large share of employees in bad health; neither do they select themselves into EPHI in a systematic way based on their probability of falling ill. On the contrary, the picture is more clear when it comes to interactions between the public health care system and EPHI, where it is found that individuals with EPHI coverage are on average more unsatisfied with the tax-financed health care system.

Considering the sociodemographic determinants, it is concluded that EPHI generates some extent of horizontal inequity in the access to health care services along the dimensions of income, occupational status, and age, while gender, education level, membership of 'denmark', and living in the capital region are not significantly associated with EPHI coverage. These findings are noted to be robust to various model specifications, and they are not challenged by the various limitations of the study discussed in the previous section.

Brought to a head, the tax-exemption may thus be interpreted as a transfer from low-income workers in the upper and lower age groups to middle-aged individuals employed in highly paid white-collar jobs. It must, however, be emphasized that overall evaluations of the policy of tax-exempting employees for the value of EPHI conditional on the insurance being offered to all employees in the company should also take into account other factors, such as how EPHI influences the use of health care services, sickness absence, and the health of the privately insured, as well as information on the tax revenue lost as a direct consequence of the tax-exemption.[20] Moreover, it must be kept in mind that this study has shown only that EPHI generates horizontal inequity in the access to health care, which does not necessarily lead to inequity in actual use. EPHI ownership is purely a matter of whether an employee is covered by this type of insurance or not; it does not necessarily imply that the employee agrees with the employer's decision to

[20] In 2008 when the work on this paper started, the group of individuals with EPHI was largely unexplored territory in Denmark. Since then, the effect of EPHI on the total use of health care services has been explored in a conference paper by the present author and the effect on the use of publicly financed services has been analysed by Søgaard et al. (2011). The effect of EPHI on sickness absence has been analysed in a report published by the Danish Insurance Association (Borchsenius and Hansen, 2010) and a conference paper by Kjeld Møller Pedersen. Finally, the Center for Political Studies (CEPOS) have given their estimate of how EPHI affects the public finances overall (Holstein, 2010).

take out EPHI on his or her behalf, nor that the employee intends to use the insurance to gain access to treatment at a private facility in the case of illness.

Finally, concerns about inequity in the access to health care generated by EPHI may be argued to be based on the underlying assumptions that the treatment received at private facilities is superior to that received at public hospitals, and that the universal tax-financed health care system is insufficient. These assumptions are debatable in the context of the Danish health care system. In particular, it may be argued that the tax-financed health care system ensures equal access to health care of a sufficient quality for equal need for all citizens, independent of social and economic circumstances, in which case the equity considerations put forward in this paper are somewhat redundant (Rodríguez and Stoyanova, 2004).

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Appendix A

Table A1 Key information about the data and econometric methods of the empirical literature on EPHI determinants

Author(s) (year)	Country	Data	Focus	Econometric model(s)
Aarbu (2010)	Norway	2004 computer-based interview survey and regional data (n = 1,800; 30-55 years)	To estimate the determinants of 1) expressing interest in, 2) the stated willingness to pay for, and 3) actual ownership of individually purchased and employment-based private health insurance.	Ordered probit models.
Besley, Hall, and Preston (1999)	United Kingdom	1986-91 British Social Attitudes Survey and regional data (n = 10,729; 18+ years)	To estimate the determinants of individually purchased and employment-based private health insurance coverage, in particular the importance of waiting time for NHS treatments.	Bivariate probit model where the first step models the determinants of EPHI and the second step models the determinants of individually purchased insurance ownership for individuals who are not already insured through their workplace.
Bræmer (2008)	Denmark	Survey conducted by Capacent Epinion on behalf of the weekly newsletter A4 (n = 724; 18+ years)	To describe the characteristics of individuals with employment-based private health insurance.	Tables and bar charts.
Grepperud and Iversen (2011)	Norway	2008 Statistisk Sentralbyrås Levekårsundersøkelse (n = 3,989; 16+ years)	To estimate the determinants of employment-based private health insurance.	Binary logit models.
King and Mossialos (2005)	England	1997-2000 British Household Panel Survey and Laing's Healthcare Market Review (n = 8,025; 15+ years)	To identify the determinants of individually purchased and employment-based private health insurance.	Separate random effects logit models comparing individuals with individually purchased and employment-based policies, respectively, to the group of uninsured.

Kjellberg, Andreasen, and Søgaard (2010)	Denmark	2005 National Health Interview Survey (number of observations not stated)	To investigate the development of private health insurance and assess its consequences.	Comparison of insured and uninsured adjusting for gender, age, education level, and income.
Seim, Løvaas, and Hagen (2007)	Norway	2005 questionnaire survey to companies with two or more employees (n = 1,004)	To estimate the characteristics of companies which have purchased private health insurance.	Binary logit model.
Rodríguez and Stoyanova (2008)	Spain	1997 and 2001 National Health Surveys (n = 24,488; 16+ years)	To investigate the effect of a shift in tax incentives.	Bivariate probit with sample selection where the first step models the determinants of any private health insurance and the second step models the determinants of individually purchased policies.

CHAPTER 4

Does employment-based private health insurance increase the use of health care services? A matching estimator approach

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Abstract:
This study estimates the effect of employment-based private health insurance (EPHI) on the use of covered health care services based on Danish survey data collected in 2009. The paper provides the first estimates of how EPHI affects the use of health care services in a Scandinavian country. The effect of EPHI is estimated using propensity score matching. This method is argued to provide plausible estimates given the institutional setting of EPHI in Denmark and a wide set of relevant covariates. Estimates of the average treatment effect on the treated (ATT) for the effect of EPHI on the probability of having used covered services (hospitalisations, physiotherapist, chiropractor, psychologist, specialist, or ambulatory contacts) are not significant. The estimated effects are positive except for psychologist visits. Restricting the sample to private sector employees, the ATT for any ambulatory contacts (such as examinations, scans, same-day surgery, and control visits) is statistically significant; EPHI is found to increase the probability of having had any ambulatory contacts by 6-7 percentage points in addition to the baseline probability of 22.4 percent.

Keywords: duplicate health insurance; demand for health care; moral hazard; matching estimator; Denmark

JEL Classification: C31; I11

Table of contents:

1 Introduction

The framework of a tax-financed health care system supplemented by employment-based private health insurance (EPHI) is found in many countries worldwide, such as Canada, Australia, the United Kingdom, France, Spain, Portugal, Sweden, and Norway (Aarbu, 2010; Colombo and Tapay, 2004; Mossialos and Thomson, 2002). The Danish health care system is no exception. During the recent decade, Danish employers have increasingly taken out private health insurance on behalf of their employees. The percentage with some sort of private health insurance coverage through their workplace has gone from 5 percent in 2002 to 32 percent of the employed in 2009 (Copenhagen Economics, 2008; Statistics Denmark, 2010; The Danish Insurance Association, 2010). The EPHI schemes taken out by the Danish employers primarily cover elective surgery at private hospitals and clinics, thereby allowing employees to circumvent waiting times for treatment at public hospitals or accommodate their preference for private treatment. Hence, the coverage provided by this type of private health insurance may be classified as primarily duplicate in relation to the tax-financed health care system (OECD, 2004). Some private insurance schemes also provide free access to physiotherapy, chiropractic care, and psychological counselling, however, often with a limitation on annual number of consultations (Kjellberg et al., 2010).

The aim of this paper is to estimate the effect of EPHI on the use of covered health care services based on Danish survey data collected in 2009. The following health care services are considered: Physiotherapy, chiropractic care, psychological counselling, specialist care, ambulatory care, and hospitalisation. These are the main benefits covered by EPHI in Denmark. In a policy context the answer to this question adds to our knowledge of the extent to which private health insurance generates horizontal inequity in the use of health care services. As such, the research question is of general relevance to countries in which universal health care systems and duplicated by EPHI.

Economic theory predicts that private health insurance induces moral hazard in the use of health care services for which the demand is price or time elastic by lowering the price or waiting time, respectively, that patients are facing at the point of use, thereby leading to higher utilization levels (Arrow, 1963; Pauly, 1974). In addition to moral hazard, private health insurance may also increase the use of health care through risk reductions, i.e. because the desired level of utilisation is greater under the financial certainty created by insurance than under uncertainty (de Meza, 1983; Vera-Hernández, 1999), an income transfer effect (Nyman, 1999a; Nyman and Maude-Griffin, 2001; Pauly, 1968), and supplier-induced demand (Evans, 1974).[1] Institutional barriers such as the use of gatekeepers and restrictions in the coverage provided by the private insurers may moderate the effect of private health insurance. E.g. private insurance patients in Denmark must, like everybody else, obtain a referral to for instance elective surgery, typically from their general practitioner who acts as a gatekeeper in this respect.

[1] I am not able to distinguish empirically between these four channels in the present study.

EPHI is usually not randomly distributed within the workforce in universal health care systems. Selection into this type of insurance may occur at various levels. For the EPHI contracts available in the Danish market, selection is mainly expected to occur at the firm level because the insurance contracts are free or heavily subsidised for the employee contingent on the policy being offered to all employees in a company. For instance, EPHI is mainly a private sector phenomenon. However, it cannot be ruled out that some extent of selection may also occur at the individual level, since some employees are required to pay the premium out of their pre-tax wage when taking out private health insurance through their workplace. In this case employees face an actual choice and may reject the insurance offer. This is the case for about 26 percent of the employees with EPHI.

This study distinguishes the causal effect of EPHI from selection effects by applying a propensity score matching estimator. The approach is based on the identifying assumption that there is no selection on unobservables after conditioning on a set of covariates. It is argued that this assumption is plausible in the context of the present study, due to the wide set of relevant covariates available in the data and the institutional setting of EPHI in Denmark.

The paper contributes to the existing literature in two ways. First, the effect of EPHI on the use of health care services has not previously been studied in Denmark or any of the other Scandinavian countries. To the best knowledge of the author, the data used in the present study contain the most detailed information on private health insurance coverage in the Danish population available to date. Second, while matching estimators have traditionally been used to evaluate effects of labour market programmes (Imbens and Wooldridge 2009), the method has only previously been used to estimate the impact of insurance on health care use in two recent studies by Barros et al. (2008) and Jones et al. (2006). The method of matching differs from linear regression in that it emphasises common support by dropping treated individuals without support in the non-treated population from the analysis and it avoids the functional form assumptions that are implicit in linear regression and other parametric methods (Bryson et al., 2002).

The paper proceeds as follows. The next section provides the background for the empirical analysis. The second section outlines the method of propensity score matching. The third section describes the data used in the empirical analysis and presents some descriptive statistics. In the fourth section the justification for and implementation of the propensity score matching estimator is accounted for in the context of this study. The results are reported in the fifth section and robustness checks are undertaken in the sixth section. Section seven concludes and discusses.

2 Background and empirical evidence

2.1 Employment-based private health insurance in Denmark

The Danish health care system is a comprehensive tax-financed system with universal access. General practitioner and specialist visits, out-patient ambulatory care as well as hospitalisation are free at the point of use for all citizens. General practitioners act as gatekeepers in the sense that in most cases a referral from a general practitioner is needed to be able to access more specialised treatment. Copayment and waiting time are frequently used to ration the use of health care services for which demand is price or time sensitive. There is considerable private copayment for adult dental care, prescription medication, physical therapy, chiropractic care, and psychological counselling (Strandberg-Larsen et al., 2007). Private copayment accounted for about 14 percent of total health expenditures in 2009 (OECD, 2009). For other types of treatment, mainly elective surgery, there may be waiting time for treatment at public hospitals. This has attracted a considerable amount of public and political attention over time (Madsen, 2010). Emergency and acute care is only available at public hospitals, whereas elective surgery is also performed private hospitals and clinics (The Ministry of Interior and Health, 2010).

Following legislation that tax-exempted employees for the value of private health insurance premiums, the share of the employed with private health insurance through their workplace has gone from negligible in 2002 to 32 percent of the employed in 2009 (Statistics Denmark, 2010; The Danish Insurance Association, 2010). Motivated by equity considerations, the tax-exemption was contingent on the insurance being offered to all employees in a company. The decision to offer private health insurance is that of the employer. In 2007, private health insurance (individually purchased and employment-based) made up 1.6 percent of the total Danish health expenditure (OECD, 2010).

The EPHI contracts are supplied by commercial insurance companies. The exact benefits differ slightly between insurance companies, just like policies are often tailored to specific firms. As previously mentioned, EPHI may be classified as primarily duplicate in relation to the tax-financed health care system given that its primary function is to cover diagnostics and some types of elective surgery at private facilities for treatments that are also available within the tax-financed health care system, but usually with some waiting time. In addition, the EPHI contracts are increasingly being used for health care services where co-payment is common, e.g. physiotherapy, chiropractic care, and psychological counselling. However, often with a limitation on the annual number of consultations (Kjellberg et al., 2010).

In 2009, the total gross compensations paid out by the commercial insurers were distributed as follows: 67 percent covered operations and the like, 9 percent covered psychological counselling, 17 percent covered physiotherapy, chiropractic care and the like, and 7 percent covered other types of treatments (The Danish Insurance Association, 2010).

Premiums are either paid by employers or, for about 26 percent of the insured based on the data used in this paper, deducted from the pre-tax income of the employees. As previously mentioned, the premium for fully employer paid insurance is not subject to income tax when insurance is offered to all employees in a company. This implies an indirect tax subsidy of about 40-60 percent of the premium. The annual premium per employee varies depending on the coverage level and the size of the buying company. Larger companies generally pay a smaller premium per employee because the scope for risk pooling increases with company size. There is no risk rating of premiums within companies due to the conditions of the tax-exemption, but it is likely to occur between companies. The average premium per person has been constant around DKK 1000/USD 187.71 since 2003, but increased to DKK 1428/USD 268.04 in 2009 (The Danish Insurance Association, 2010).[2]

While it is possible that screening of firms occurs, insurance eligibility within the firm is usually not restricted by health requirements, again due to the tax-exemption. However, there may be a deferred period for treatment of existing conditions and limitations on the annual number of consultations with physiotherapists, chiropractors, and psychologists.

Duplicate private health insurance coverage can also be purchased from the commercial insurance companies on an individual basis. The benefits are roughly the same as for the EPHI, but premiums are not subject to special tax treatment and are risk rated based on age. In 2009, approximately 100,000 individuals had taken out private health insurance through a commercial insurance company on an individual basis (The Danish Insurance Association, 2010). In addition, more than two millions Danes (approximately 42 percent of the adult population) were covered by private health insurance through the non-profit mutual insurance company ‘denmark’ in 2009 (Health Insurance denmark, 2009). This type of private health insurance is mainly complementary to the tax-financed health care system in that it primarily covers copayments for treatment in the public health care system. Approximately 25 percent of the members of ‘denmark’ are also partly reimbursed for elective surgery at private hospitals (according to internal material from Health Insurance ‘denmark’).

Despite some overlap in the coverage between the individually purchased and employment-based insurance contracts, some individuals hold both (23 percent of the sample of employed described in the data section are covered by both EPHI and ‘denmark’). The effect of membership of ‘denmark’ on the use of health care is not subject to analysis in this paper; it is, however, taken into account when analysing the effect of EPHI.

[2] The figures are calculated as total premium income of the commercial insurers divided by the number of insured. Conversion from DKK to USD is undertaken using the March 2011 average exchange rate of 532.75 (Danske Bank, 2011).

2.2 Empirical methods and findings

There is a large and growing empirical literature seeking to identify the effect of private health insurance on the use of health care services. Identification of the effect of private health insurance is complicated by the fact that in most settings there is likely to be some sort of selection into private health insurance, either adversely (Rothschild and Stiglitz, 1976) or advantageously (de Meza and Webb, 2001; Finkelstein and McGarry, 2006; Hemenway, 1990), which may cause insurance status to be endogenous in models of health care use. In addition to selection issues, there are also other potential sources of endogeneity, although these have not received much attention in the literature. For one thing, screening of applicants by the private insurance companies may lead to downward biased estimates of the effect of private health insurance (Coulson et al., 1995). Moreover, measurement error in the insurance variable where individuals are not aware of whether or how much private health insurance they have can also be interpreted as an endogeneity problem. Overall, the prevalence of endogeneity as well as the importance of the various factors causing it and the optimal handling are largely dependent on the institutional and regulatory setting in which the private health insurance operates.

The most far-reaching study of the impact of insurance on health care use to date is the RAND Health Insurance Experiment, which randomly assigned approximately 6,000 US citizens to insurance plans with varying levels of cost sharing. The overall finding of this study was that health care expenditure is responsive to the level of cost sharing in the context of the US health care system, and that the observed change in expenditure is larger for outpatient care than for inpatient care (Manning et al., 1987).

The greater part of the empirical literature is, however, based on observational data. The majority of these studies consider private health insurance that is purchased on an individual basis (Christiansen et al., 2002; Gerfin and Schellhorn, 2006; Höfter, 2006; Holly et al., 1998; Jones et al., 2006; Pedersen, 2005; Riphahn et al., 2003; Savage et al., 2003), some consider employment-based contracts (Barros et al., 2008; Chiappori et al., 1998; Ruthledge, 2009; Stabile, 2001), and other again consider both, either combined (Schokkaert et al., 2010) or separately (Buchmueller et al., 2004).[3]

A few studies have estimated the effect of private health insurance on the use of health care services using various count data models, treating insurance as exogenous and relying on an extensive set of control variables to mitigate potential selection bias (Christiansen et al., 2002; Pedersen, 2005; Stabile, 2001). Along a similar line, Barros et al. (2008) argued that selection on observables is plausible in the context of private health insurance given to civil servants and their dependents in Portugal and applied a matching estimator.

[3] A few studies did not explicitly state whether they analysed employment-based or individually purchased contracts (Cameron et al., 1988; Coulson et al., 1995).

In the larger share of the literature, the potential endogeneity of private health insurance status is taken into account by using various multiple equation strategies, including joint estimation of insurance and health care use (Buchmueller et al., 2004; Harmon and Nolan, 2001; Schokkaert et al., 2010) and two-stage estimation procedures where the predicted values from a first stage reduced form model of insurance choice are included in the utilization equation (Cameron et al., 1988; Coulson et al., 1995; Höfter, 2006; Holly et al., 1998; Riphahn et al., 2003; Savage and Wright, 2003; Schellhorn, 2001; Vera-Hernández, 1999). The functional forms applied in the various models of health care use are generally determined by the nature of the dependent variable as well as computational convenience.

The various jointly estimated and two-stage models of insurance choice and health care use are in principal identified by functional form due to non-linearity in the structure of the error terms, which occurs when the model of insurance choice is non-linear. It is, however, preferable to exclude one or more variables affecting the probability of having private health insurance but not the use of health care services from the utilization equation for more robust identification.[4]

In the following, the exclusion restrictions used in the empirical literature to date are summarised and discussed. Holly et al. (1998) excluded age squared and body mass index squared from the utilization equation without providing any explicit justification for the validity of these exclusion restrictions. Schellhorn (2001) used differences between Swiss cantons regarding the availability of private health insurance and premium levels for identification. The remaining studies used different socioeconomic characteristics as exclusion restrictions. Buchmueller et al. (2004) excluded an indicator of public sector employment from the utilization equation. This restriction was argued to be theoretically valid given that all public employees are offered private health insurance contracts and most of them take up these contracts, while public sector employment is not expected to impact neither health status nor the use of care. Höfter (2006) excluded dummies for self-employed, in permanent job, and a measure of risk from the utilization equation.[5] Vera-Hernández (1999) excluded measures of social class, occupation, and some interaction terms from the utilization equation for identification. Harmon and Nolan (2001) excluded education variables from the utilization equations. The majority of the studies using socioeconomic characteristics as exclusion restrictions did not provide any explicit theoretical justification for this; thereby emphasizing the point made by Barros et al. (2008) that theoretically valid exclusion restrictions are hard to find when seeking to identify the effect of private health insurance on health care use. Finally, Jones et al. (2006) compared the results obtained by a simple probit model, propensity score matching, and a jointly estimated model. Identification in the joint model was obtained by including regressors

4 The terms ‘exclusion restriction’ and ‘instrumental variable’ are sometimes used interchangeably in the literature. This paper uses the term ‘exclusion restriction’ to denote both concepts for consistency.

5 The measure of risk was defined by an interaction between the number of individuals depending on the head of the household and a continuous score based on age-sex factors provided by one of the largest insurers in the market.

measured at a previous point in time in the insurance equation, while the regressors in the utilization equation were measured at the current time. In addition, lagged information on whether individuals had access to employer-provided free or subsidized health care or insurance were included in the insurance equation for identification. It might be added that neither of these studies used exclusion restrictions based on some sort of natural experiment, which could provide plausible exogenous variation in insurance status without theoretical justification.

Another branch of the literature relies on identification strategies (other than standard regression) where there is no need for exclusion restrictions. Chiappori et al. (1998) identified the effect of private health insurance on the use of health care services using exogenous variation in coverage stemming from a policy change which implied that one subgroup was exposed to a 10 percent copayment-rate for physician services while no change occurred for another subgroup. Along a similar line, Ruthledge (2009) used variation in health plan offers across employers in the US to separate the effects of moral hazard and adverse selection. Anderson et al. (2011) exploited a sharp change in insurance coverage rates in the US that occurs when young adults age out of their parents' insurance plans and used a regression discontinuity design to estimate the effect of private health insurance coverage. Kaestner and Khan (2010) estimated the effect of ageing into prescription drug coverage under Medicare Part D on the use of prescription drugs and health care services using difference-in-difference regression.

Finally, Gerfin and Schellhorn (2006) estimated non-parametric bounds around the effect of deductibles in the basic health insurance, assuming monotone treatment response (i.e. that the sign of the treatment effect is known) and using the premium as an exclusion restriction.

Regarding the findings of the empirical studies, the early study by Cameron et al. (1988) revealed a higher usage of a broad range of health care services among the privately insured in Australia, which was attributable to both adverse selection and moral hazard. Along a similar line, Ruthledge (2009) found that more generous insurance coverage lead to increased spending on medical care in non-managed plans but not in managed care plans in the US.

The estimates of how private health insurance affects the use of specific health care services are not quite as clear-cut.

Considering first the effect on the use of hospital care, private health insurance was on the one hand found to have a positive effect on the length of hospital stays in Australia (Savage and Wright, 2003) and on the probability of having had a hospital stay within the past year in Ireland (Harmon and Nolan, 2001). Likewise, Holly et al. (1998) found that having supplemental private health insurance in addition to the basic insurance increases the probability of having at least one inpatient stay given a positive use of medical care in Switzerland. On the other hand, Höfter (2006) found that private health insurance does not affect the probability or length of hospital stays in Chile. Along a similar line, Riphahn et al. (2003) found no significant effect of private health insurance on the number of visits to hospitals (except among males) and doctors in Germany. Finally, Schokkaert et al. (2010) found that private health insurance does not affect the number of hospital spells, but decreases the number of nights per spell significantly in Belgium.

Considering next the use of outpatient services, Höfter (2006) found a positive effect of private health insurance in Chile. Chiappori et al. (1998) found evidence of moral hazard for home visits but not for office doctor visits or specialist treatments in France. Also based on data from France, Buchmueller et al. (2004) found a large and significant positive effect of private health insurance on the number of physician visits, but not on the decision of whether to see a specialist or a general practitioner. The magnitude of the effect was found to be comparable for individually purchased and EPHI. Vera-Hernández (1999) found a positive effect on the number of visits to specialists for the subgroup of non-heads of household in Spain, but not for the heads of household. Stabile (2001) found that private health insurance in addition to the coverage provided by the public health care system leads to moral hazard in the use of publicly funded physician services in Canada. Jones et al. (2006) found a positive effect of private health insurance on the probability of specialist visits in Ireland, Italy, Portugal, and the UK. The magnitude of this effect was sensitive to the choice of estimator. Coulson et al. (1995) found that the pattern of average prescription use across the insurance options among the elderly in the US is consistent with the presence of moral hazard. Barros et al. (2008) found significant evidence of moral hazard in the use of diagnostic tests for the overall sample and in particular for the youngest cohort of 18-30 year-olds in Portugal, while the number of doctor visits and the probability of visiting a dentist are not significantly affected.[6] In a similar way, previous studies based on data from Denmark found that individually purchased private health insurance has a positive effect on the use of dental and chiropractic care (Christiansen et al., 2002) and physiotherapy (Pedersen, 2005), while the use of several other health care services is not affected. In the context of the Swiss health care system, Schellhorn (2001) found that choosing a higher deductible than is minimally required does generally not affect the demand for physician visits. On the contrary, Gerfin and Schellhorn (2006) found that at least one third of the difference in the probabilities of visiting a doctor between individuals with low and high deductibles was attributable to a reduced moral hazard effect, assuming monotone treatment response and using the premium as an exclusion restriction. Weakening the assumption that the treatment response is mean independent of the exclusion restriction reduces the effect of deductibles somewhat, but it remains different from zero.

[6] The larger effect for the youngest cohort is noted to be consistent with a long-term positive health effect of private health insurance, such that those who have been subject to double coverage for a longer period of time may have accumulated health benefits over time and enjoy better unobserved health.

3 Estimation of treatment effects with propensity score matching

Estimation of treatment effects using observational data is surrounded by an inherent identification issue. The counterfactual notation of among others Rubin (1974) is used to present the identification problem. Let $d_i \in \{0,1\}$ denote a binary treatment indicator and let y_i^1 and y_i^0 denote the potential outcomes of interest for treated and non-treated individuals respectively. The treatment effect for each individual *i* may then be defined as:

$$\tau_i = y_i^1 - y_i^0 \tag{1}$$

The fundamental identification problem arises because no individual is observed in both states at once. Hence, the focus is on population average treatment effects. Estimation of average treatment effects requires the stable unit-treatment value assumption to hold, i.e. that the treatment effect for each individual *i* is independent of the treatment status of the other individuals.

Two common parameters of interest are the average treatment effect on all individuals (ATE) and the average treatment effect on the treated (ATT), which are given by:

$$\tau_{ATE} = E[\tau_i] = E\left[y_i^1 - y_i^0\right] \tag{2}$$

and

$$\tau_{ATT} = E\left[\tau_i \middle| d_i = 1\right] = E\left[y_i^1 \middle| d_i = 1\right] - E\left[y_i^0 \middle| d_i = 1\right] \tag{3}$$

where E is the population mean operator. The ATT is the relevant measure when the interest centres on the effect of treatment on the group of individuals who actually received the treatment, and it is neither feasible nor policy relevant to treat everybody in the population. The ATE is the relevant measure when the treatment has universal applicability and it is reasonable to consider the hypothetical effect of treatment for a randomly selected member of the study population (Heckman, 1997).

Using the fact that the observed outcome is an average of the potential outcomes, $y_i = y_i^0 + d_i\left(y_i^1 - y_i^0\right)$, it is shown in (4) that the standard difference in sample averages of treated and non-treated yields a biased estimate of the ATT when assignment to treatment is not random.

$$\begin{aligned}
&E\left[y_i^1 \middle| d_i = 1\right] - E\left[y_i^0 \middle| d_i = 0\right] \\
&= E\left[y_i^1 \middle| d_i = 1\right] - E\left[y_i^0 \middle| d_i = 0\right] + \left\{E\left[y_i^0 \middle| d_i = 1\right] - E\left[y_i^0 \middle| d_i = 0\right]\right\} \\
&= \tau_{ATT} + \left\{E\left[y_i^0 \middle| d_i = 1\right] - E\left[y_i^0 \middle| d_i = 0\right]\right\}
\end{aligned} \tag{4}$$

where the second term in (4) is the selection bias. An additional challenge when estimating the ATE is that both counterfactual outcomes, $E\left[y_i^1 \middle| d_i = 0\right]$ and $E\left[y_i^0 \middle| d_i = 1\right]$, have to be constructed.

This study estimates treatment effects using the method of propensity score matching. Matching estimators are based on the identifying assumption that conditional on covariates x_i, the outcome y_i is independent of the treatment d_i:

$$y_i^1, y_i^0 \perp d_i | x_i \tag{5}$$

This assumption is commonly referred to as the ignorability assumption (Wooldridge, 2002), the conditional independence assumption (Cameron and Trivedi, 2005), or the unconfoundedness assumption (Imbens and Wooldridge, 2009). It implies that there is no omitted variable bias and hence no selection on unobservables when conditioning on the covariates.

If the covariate vector has a high dimension or if there are continuous variables among the covariates, it is impractical to match directly on the covariates in smaller samples due to the curse of dimensionality. This problem was circumvented by Rosenbaum and Rubin (1983) who showed that given the propensity score defined as the conditional probability of receiving treatment given x_i:

$$p(x_i) = \Pr(d_i = 1 | x_i) = E[d_i | x_i] \tag{6}$$

and an assumption of covariate balance:

$$d_i \perp x_i | p(x_i) \tag{7}$$

then (5) implies:

$$y_i^1, y_i^0 \perp d_i | p(x_i) \tag{8}$$

In other words, if outcomes are independent of assignment to treatment given a set of observed covariates then they are also independent given the propensity score. The assumptions needed to identify treatment effects using propensity score matching are explicitly written out in the following. The balancing condition stated in (7) implies that observations with the same propensity score have similar distributions of observable characteristics independent of treatment status. As pointed out by Heckman et al. (1998b) and others, the conditional independence assumption stated in (5) is stronger than necessary to identify the ATE. Mean conditional independence is sufficient:

$$\begin{aligned} E[y_i^0] \perp d_i | p(x_i) &\Rightarrow E[y_i^0 | d_i = 1, p(x_i)] = E[y_i^0 | d_i = 0, p(x_i)] = E[y_i^0 | p(x_i)] \\ E[y_i^1] \perp d_i | p(x_i) &\Rightarrow E[y_i^1 | d_i = 1, p(x_i)] = E[y_i^1 | d_i = 0, p(x_i)] = E[y_i^1 | p(x_i)] \end{aligned} \tag{9}$$

And only the former is necessary to identify the ATT. Finally, the overlap condition specified in (10) ensures that for each value of x_i there are both treated and untreated cases.

$$0 < \Pr(d_i = 1 | x_i) < 1 \tag{10}$$

Again, only the first inequality is needed to estimate the ATT.

For practical purposes the propensity score is usually unknown and needs to be estimated. The estimation of the propensity score should include all variables that influence simultaneously the probability of treatment and the outcome, subject to the reservation that the included variables should not be affected by treatment or the anticipation of it.

Propensity score matching estimates the treatment effect for each treated individual by contrasting its outcome with treatment with a weighted average of the controls that are chosen as matches based on the propensity score. Subsequently, the average ATT may be estimated by the mean difference in outcomes over the area of common support, appropriately weighted by the propensity score distribution of participants (Caliendo and Kopeinig, 2005). Standard errors including the variance due to the estimation of the propensity score and the imputation of common support may be obtained by bootstrapping.[7]

The method of matching thus differs from linear regression in that it avoids the functional form assumptions that are implicit in linear regressions and it emphasises common support in the sense that it is explicitly examined if for certain values of x_i or $p(x_i)$ in the sample of treated individuals there are no corresponding non-treated individuals (Bryson et al., 2002).

The practical implementation of the propensity score matching estimator and the particular choices made in the present study are accounted for in detail in a later section.

4 Data

The empirical analysis is based on cross-sectional survey data on the Danish population aged 18-75. The data were collected in June 2009 using an internet-based questionnaire. The pilot-tested final questionnaire was e-mailed to a sample of 13,246 respondents via YouGov Zapera's Denmark panel.[8] In total 5,447 respondents answered the questionnaire, which corresponds to a response rate of 41 percent. Individuals with only basic schooling or vocational training are somewhat underrepresented in the data. The questionnaire and the data collection process, including analyses of non-response and representativity, are fully documented in Kiil and Pedersen (2009).

[7] This method is widely applied in the literature. It is, however, noted that there is little formal evidence to justify bootstrapping for matching estimators (Caliendo and Kopeinig, 2005).

[8] YouGov Zapera's Denmark panel is an actively managed internet-based panel containing 38.600 members in Denmark as of July 2009. The YouGov Zapera Denmark panel meets the Esomar international code on marketing and social research practice. This implies among other things that its members are recruited through a wide selection of channels in order to ensure an appropriate demographic balance, and that panel members must log on with a password when participating in surveys in order to ensure that the intended person completes the survey (YouGov Zapera Ltd., 2009). The panel may be classified as a discontinuous online panel in the sense that respondents are asked to participate in surveys on different topics across time (Nancarrow and Cartwright, 2007).

For the purpose of the present study, the sample is restricted to the subsample of occupationally active, because individuals outside the labour force do not have private health insurance through their workplace by definition. This restriction reduces the sample size from 5,447 to 3,301 individuals.

4.1 Treatment (employment-based private health insurance)

The binary treatment indicator d_i equals one for individuals who are covered by private health insurance through their workplace and zero otherwise. The exact wording of the question can be found in Kiil and Pedersen (2009). Individuals who do not know their insurance status were dropped from the data, reducing the sample size from 3,301 to 3,068. Moreover, 207 individuals who are covered by private health insurance through the employer of a family member and 172 individuals who have purchased private health insurance from a commercial insurance company on an individual basis were also dropped from the data. It is questionable whether it is possible to control appropriately for selection into these two alternative types of private health insurance. Hence, it was chosen to restrict the dataset in order to ensure the plausibility of the conditional mean independence assumption throughout the analysis. The resulting sample includes 2,689 individuals, of whom 41 percent are covered by private health insurance through their own employer. Within the group of individuals with EPHI, 70 percent receives the insurance free of charge, 26 percent pays the premium themselves out of their pre-tax income, and 4 percent do not know how the premium is paid.

4.2 Outcomes (health care use)

The outcome y_i is defined as health care use. The use of physiotherapy, chiropractic care, psychological counselling, and specialist care is measured by whether the individual had any contacts with the provider in question in the 12 months prior to the interview. For ambulatory care and hospitalisation, use is likewise measured by any contacts or admissions, respectively, within the previous 12 months.[9] It was decided to use whether the individual had any contacts to the various health care providers rather than the number of contacts as outcome due to a large number of zeros and ones in the number of contacts.[10] Moreover, for health care providers which are subject to private copayment when accessed through the public health care system, the number of contacts is likely to be more susceptible to supplier inducement than the probability of a contact given that the providers are paid per visit by the commercial insurers (Barros et al., 2008).

Table 1 shows some descriptive statistics for the outcome measures of health care use for the full sample of employed and by EPHI status.

[9] Ambulatory care is defined as hospital contacts without actual hospitalisation, such as examinations, scans, same-day surgery, and control visits.

[10] Additional analyses showed that the choice of outcome is of no importance to the main conclusions of the study.

Table 1 Any contacts with selected health care providers within the previous 12 months

	All employed	Covered by EPHI	No EPHI	Two-sided test for equality of (2) and (3)
	(1)	(2)	(3)	(4)
Percentage with any contacts				**z-statistic**
Physiotherapists	0.177	0.203	0.159	-2.956***
Chiropractors	0.129	0.147	0.117	-2.325**
Psychologists	0.056	0.054	0.057	0.327
Specialists	0.275	0.273	0.277	0.207
Ambulatory care	0.251	0.231	0.265	1.991**
Hospitalisation	0.089	0.083	0.093	0.826
Number of observations	2,636	1,092	1,544	

* significance at 10 percent level; ** significance at 5 percent level; *** significance at 1 percent level.

It is seen from Table 1 (columns 2-4) that the share of the employed with at least one physiotherapist or chiropractor contact during the previous 12 months is significantly larger for the group of individuals with EPHI than for those who rely exclusively on the tax-financed health care system. The opposite relationship holds for ambulatory care, where the share of individuals with at least one contact is significantly smaller for the privately insured. This is somewhat surprising given that the privately insured enjoy preferential access to elective surgery at private hospitals and clinics. It should, however, be kept in mind that the use of health care services reported in Table 1 includes both privately and publicly financed services, and that the relationships revealed in Table 1 are raw associations, which may well change once covariates are controlled for.

4.3 Covariates

The vector of covariates x_i includes variables that may reasonably be expected to influence both the probability of having EPHI and the use of health care services, subject to the condition that the covariates should not be affected by the treatment or the anticipation of it. The covariates are selected from the information available in the data based on economic theory and previous empirical findings, taking into consideration the particular institutional features that are present in the Danish health care system.

The probability of having EPHI is mainly determined by the employer's decision to offer private health insurance, and sometimes also by the decision of the employee to accept or reject this offer.[11] Compared to

[11] One could also argue that the individual's choice of employer should enter into this decision process. However, employment-based private health insurance is not expected to notably affect labour market choices in Denmark, given that the value of this type of health insurance is usually very modest compared with average money wages (less than 0.5 percent of the average money wages for the permanently employed (Statistics Denmark, 2009b; The Danish Insurance Association, 2009). The theoretical possibility that individuals do actually select themselves into employment where private health insurance is provided is considered further when implementing the estimator.

the substantial theoretical literature on individual health insurance demand (see e.g. Besley et al. (1999); de Meza (1983); Friedman and Savage (1948); Nyman (1999b); Propper et al. n (2001); Rothschild and Stiglitz (1976)), the theoretical foundation for the employers' decision to offer private health insurance is surprisingly sparse and exclusively focused on the US health care system. Therefore, the selection of variables that may affect the probability of having EPHI is mainly guided by previous empirical findings and institutional circumstances.

The covariates included in this study may be broadly classified into four groups. The first group of covariates includes the following characteristics related to the workplace: Size, sector of employment, and number of subordinates. The size of the workplace has previously been found to affect the probability of employers offering insurance in the context of the Norwegian health care system (Seim et al., 2007). The sector of employment is included because EPHI is mainly a private sector phenomenon in Denmark (Kjellberg et al., 2010). The importance of this covariate is emphasised by implementing the propensity score matching estimator separately on the subsample of privately employed. This corresponds to insisting on a perfect match in terms of sector of employment. It is uncertain to what extent the employer-related characteristics affect the use of health care services. They are, nevertheless, included as covariates because they are expected to be the most important determinants of EPHI.

The second group of covariates includes basic individual sociodemographic variables such as gender, age, marital status, household income, household composition, educational level, occupational group, and membership of 'denmark'. These variables have previously been shown to affect the probability of having EPHI in Norway, Spain, Denmark, and the UK (Aarbu, 2010; Besley et al., 1999; King and Mossialos, 2005; Kjellberg et al., 2010; Rodríguez and Stoyanova, 2008). The effect of the sociodemographic characteristics on the demand for health care is modelled theoretically based on the human capital approach in Grossman (1972). In the Grossman-model, the demand for medical care is derived from the demand for health. Assuming that the costs of producing health as well as the benefits from being healthy differ with among other things sociodemographic characteristics, it is clear the these characteristics will also affect the demand for health care. Membership of 'denmark' is included based on an expectation that the members of 'denmark' are less likely to accept an offer of EPHI in the cases where the premium is deducted from the pre-tax income, due to the overlap in coverage between the two types of insurance. Moreover, membership of 'denmark' has been shown to increase the use of selected health care services by Christiansen et al. (2002) and Pedersen (2005).

The third group of covariates includes dummy variables for the presence of eight chronic conditions intended to proxy the need for health care. These health related variables as well as the sociodemographic variables may also affect the employer's decision to offer private health insurance to the extent that this decision is affected by the characteristics and preferences of current and potential employees, as suggested in the economic literature (Bundorf, 2002; Feldman et al., 1997; Glied and Zivin, 2004). Perceived health was not considered as a measure of need, since this variable has frequently been argued to be endogenous with respect to the use of health care (Barros et al., 2008; Windmeijer and Santos Silva, 1997).

The fourth and final group of covariates includes the region of residence. This information is included in order to capture geographical variation in the occupational structure (Danish Agency for Science, 2008) as well as the pattern of health care use that has been found to exists in Denmark (Bech and Lauridsen, 2009).

Respondents who answered ‘don’t know’ or ‘other’ than the categories specified in the questionnaire to one or more of the explanatory variables are dropped from the data before commencing on the analysis, reducing the sample size further from 2,689 to 2,636 individuals. The main motivation for this data restriction is that it is questionable whether the individuals in the ‘don’t know’ and ‘other’ groups have anything in common. An alternative strategy would be to impute the missing values. For the variable measuring gross household income, which was plagued by a particularly large number of missing values, two dummies were generated that equal one whenever respondents don’t know or do not wish to disclose their income, respectively, and zero otherwise.

5 Implementation of the propensity score matching estimator

This section accounts for the implementation of the propensity score matching estimator.[12] First, the estimation of the propensity score is discussed and different specifications of the propensity score are considered. Second, the plausibility of the conditional mean independence assumption is accounted for. Third, the choice of matching algorithm is discussed. The fourth and final sub-section is concerned with matching quality issues. More precisely, the common support condition is checked and some evidence is provided that matching eliminates observable differences between the group of treated individuals with EPHI coverage and the controls without EPHI. The various steps are implemented in Stata/IC 11 using version 3.1.5 of the ‘psmatch2’ module written by Leuven and Sianesi (2003). The average treatment effects are reported in the next section.

5.1 Propensity score estimation

There are several important decisions to make when estimating the propensity score. The first decision concerns the choice of econometric model. The theoretical literature provides little advice regarding this decision (see e.g. the discussion in Smith (1997)). For the binary treatment case, commonly applied functional forms are probit, logit, and linear probability models. Zhao (2008) has shown that the results

[12] The section takes it point of departure in Bryson et al. (2002) and Caliendo and Kopeinig (2005), who have reviewed and discussed the various aspects of implementing propensity score matching and laid out some practical guidelines.

are insensitive to the choice between these models when the conditional independence assumption holds. Hence, the choice of functional form may not be too critical in the present study.

The second decision concerns which variables to include in the propensity score estimation. The selected set of covariates should render the conditional independence assumption probable, i.e. that the outcomes are independent of assignment to treatment conditional on the propensity score. As previously mentioned, this is achieved by including variables that influence simultaneously the probability of treatment and the outcome, subject to the reservation that the included variables should not be affected by treatment or the anticipation of it. The inclusion of variables that are affected by treatment could mask possibly important effects of the treatment, thereby undermining the interpretability of the results (Heckman et al., 1999). In order to avoid this, perceived health was deliberately not included in the estimation of the propensity score, given that this variable may be affected by EPHI through additional use of health care. In addition, some random variation is needed in order to ensure that the overlap condition specified in (10) is satisfied.

In the previous section, a set of potential covariates was selected following economic theory and in particular the empirical literature. The condition that the covariates should not be affected by treatment or the anticipation of it is accommodated by including variables that may reasonably be assumed to be either largely fixed over time for the study population or unaffected by EPHI coverage.[13] However, the optimal specification of the propensity score model is not always obvious; and careful judgement is required. On the one hand, it has been shown that omitting important variables can seriously increase bias in the resulting estimates (Dehejia and Wahba, 1999; Heckman, 1997). On the other hand, including extraneous variables in the propensity score model may increase the variance of the estimates and exacerbate the common support problem (Bryson et al., 2002).

The decision of how to specify the propensity score model may be partly guided by formal statistical tests. Two frequently used measures are the hit-rate and the pseudo R^2 (see e.g. Caliendo et al. (2005) and Drichoutis et al. (2009)) for applications).[14] The pseudo R^2 indicates how well the covariates explain the probability of treatment. The hit-rate reflects the within-sample correct prediction rate. This method implies that the overall prediction rate is maximized for the sample, assuming that the costs of misclassification are equal for the two groups (Heckman et al., 1998a).

[13] The treatment and the covariates were measured at one point in time (i.e. June 2009). Hence, information on the values of the covariates before participation is not available in the data.

[14] There are several pseudo R^2 measures in the econometric literature on limited dependent variable models (Maddala, 1983). Here I use McFadden's pseudo R^2 defined as $1-(\log L(UR))/\log L(R)$, where UR denotes the unrestricted model including a constant and the full set of covariates and R denotes the restricted model containing only a constant. This is the default choice when estimating logit and probit models in Stata.

Table 2 shows hit-rates and pseudo R^2s for various specifications of the propensity score model calculated for both the sample of employed and the subsample of private employees. The potential covariates may be grouped into four categories: Sociodemographic variables (including gender, age, marital status, household income, household composition, educational level, occupational group, and membership of ‘denmark’), employer-related characteristics (including subordinates, employer size, and sector of employment), health-related indicators (including dummies for eight chronic conditions), and region of residence. The first four specifications in Table 2 (rows 1-4) included variables from the aforementioned categories one at a time. The next six specifications (rows 5-10) considered all possible combinations including two categories of variables, while the following 2 specifications (rows 11-14) added yet another group of variables. The final specification (row 15) included the full set of covariates in the estimation of the propensity score.

Table 2 Hit-rates and pseudo R^2 for different propensity score specifications

	Specification (sets of variables included)				All employed		Privately employed	
	Socio-demogr.[b]	Employer-related[c]	Health-related[d]	Region[e]	Hit-rate	Pseudo R^2	Hit-rate[a]	Pseudo R^2
(1)	x				62.86	0.060	49.24	0.174
(2)		x			79.36	0.371	50.83	0.167
(3)			x		58.57	0.006	43.17	0.012
(4)				x	58.57	0.005	44.73	0.005
(5)	x	x			80.27	0.354	51.99	0.230
(6)	x		x		63.73	0.062	49.62	0.181
(7)	x			x	62.52	0.064	49.58	0.179
(8)		x	x		79.67	0.330	51.78	0.175
(9)		x		x	79.32	0.330	50.61	0.172
(10)			x	x	58.88	0.011	44.12	0.017
(11)	x	x	x		80.42	0.357	52.24	0.236
(12)	x	x		x	80.50	0.357	51.93	0.234
(13)	x		x	x	62.67	0.067	49.85	0.185
(14)		x	x	x	79.29	0.333	51.63	0.179

(15)	x	x	x	x	80.39	0.359	53.07	0.239

[a] Hit-rates are computed in the following way: If the estimated propensity score is larger than the sample proportion of treated individuals, i.e. $\hat{P}(X) > \bar{P}$, observations are classified as '1'. If $\hat{P}(X) \leq \bar{P}$ observations are classified as '0'.
[b] Socio-demographic variables include gender, age, age squared, marital status, household income, household composition, educational level, occupational group, and membership of 'denmark'.
[c] Employer-related variables include subordinates, employer size, and sector of employment.
[d] Health-related variables include dummies for asthma, allergies, diabetes, hypertension, chronic bronchitis or emphysema, osteo- or rheumatoid arthritis, osteoporosis, tinnitus.
[e] Regional variables include dummies for each of the five regions in Denmark.

Considering first the privately employed, it is seen from Table 2 that the hit-rates are consistently lower for this subsample than for the total sample of employed. Both the pseudo R^2 and the hit-rate are maximized for the specification that includes the full set of covariates. Hence, this specification of the propensity score is preferred for the privately employed according to the statistical tests. Considering next the sample of all employed, both the hit-rate and the pseudo R^2 are consistently found to be higher when employer-related characteristics are included in the propensity score model. Actually, the pseudo R^2 is maximized for the specification that includes only the characteristics related to the workplace. This finding stresses the shortcoming of relying exclusively on statistical tests to decide which variables to include in the propensity score model, given that economic theory as well as previous empirical findings suggest a more extensive specification.

Keeping in mind that the purpose of the propensity score is not to explain selection into EPHI as well as possible, but to control for factors that simultaneously influence the probability of having EPHI and the use of health care, we proceed with the full model (row 15) and the specification that includes sociodemographic, employer-related, and regional variables (row 12). The full model was chosen because overall it performs well and there are sound theoretical and empirical reasons for including all four categories of variables. The reduced model including all groups of variables except for the health-related indicators is interesting because it is possible, although not very likely in the Danish context, that the privately insured are healthier due to years of preferential access to some types of health care services or other reasons. If this is the case there is an endogeneity problem and my estimates may be biased.

Table 3 shows the results of the various logit models used to estimate the propensity scores for the sample of employed and the subsample of private employees. The odds ratios measure the change in the odds of treatment for a one unit change in the independent variable, holding all other variables constant.[15] An odds ratio of one corresponds to no effect.

Table 3 Selected propensity score specifications

	All employed		Privately employed	
	Full model	**Reduced model**	**Full model**	**Reduced model**

[15] For dummy variables a one unit change is defined by the switch from zero to one.

	Odds ratio	Std. err.	Odds ratio	Std. err.	Odds ratio	Std. err.	Odds ratio	Std. err.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sociodemographic variables								
Male	1.154	(1.074)	1.175	(1.084)	1.073	(1.035)	1.092	(1.044)
Age	1.148	(4.942) ***	1.142	(4.631) ***	1.131	(4.301) ***	1.121	(3.873) ***
Age^2	0.998	(0.196) ***	0.999	(0.201) ***	0.999	(0.220) ***	0.999	(0.237) ***
Married	1.245	(1.114)	1.247	(1.115)	1.317	(1.147) *	1.317	(1.147) *
DKK 400,000-799,999/USD 75,082-150,164[a]	1.275	(1.129)	1.296	(1.138)	1.283	(1.133)	1.293	(1.137)
DKK 800,000+/USD 150,164+[a]	1.744	(1.262)*	1.791	(1.276)***	1.999	(1.346)***	2.069	(1.366)***
Don't know income[a]	1.108	(1.012)	1.114	(1.012)	0.847	(0.982)	0.868	(0.984)
Do not wish to disclose[a]	1.351	(1.087)	1.411	(1.100)	1.331	(1.089)	1.412	(1.108)
# children in household	0.947	(0.951)	0.954	(0.958)	0.983	(0.984)	0.996	(0.997)
# adults in household	0.827	(0.851) **	0.822	(0.847) **	0.882	(0.903)	0.877	(0.898)
Vocational education[b]	1.204	(1.085)	1.212	(1.088)	1.272	(1.116)	1.298	(1.127)
Higher education[b]	1.218	(1.102)	1.232	(1.108)	1.386	(1.177) *	1.417	(1.190) *
Other education[b]	1.078	(1.009)	1.024	(1.003)	0.836	(0.977)	0.790	(0.970)
Skilled worker[c]	0.651	(0.895) **	0.632	(0.888) **	0.515	(0.830) ***	0.512	(0.829) ***
Unskilled worker[c]	0.557	(0.856) ***	0.546	(0.852) ***	0.375	(0.752) ***	0.373	(0.751) ***
Self-employed[c]	0.232	(0.669) ***	0.237	(0.672) ***	0.211	(0.587) ***	0.217	(0.593) ***
Member of 'denmark'	1.180	(1.086)	1.175	(1.084)	1.265	(1.124) *	1.260	(1.122) *
Employer-related characteristics								
# of subordinates	1.026	(1.011)	1.014	(1.006)	0.997	(0.999)	0.989	(0.995)
Indep. public employer[d]	10.285	(1.558) ***	10.315	(1.559) ***				
Private employer[d]	39.690	(6.100) ***	39.023	(6.049) ***				
Other employer[d]	8.356	(1.243) ***	8.064	(1.239) ***				
5-9 employees[e]	2.654	(1.277) ***	2.667	(1.278) ***	2.698	(1.304) ***	2.665	(1.299) ***
10-49 employees[e]	4.039	(1.869) ***	4.059	(1.873) ***	4.153	(1.867) ***	4.128	(1.862) ***
50-249 employees[e]	5.902	(2.205) ***	5.910	(2.206) ***	6.143	(2.171) ***	6.006	(2.150) ***
250+ employees[e]	9.741	(2.769) ***	9.785	(2.774) ***	12.055	(2.992) ***	12.022	(2.988) ***
Health-related indicators								
Asthma	0.886	(0.972)			1.003	(1.001)		
Allergies	1.169	(1.069)			1.244	(1.098)		
Diabetes	1.242	(1.043)			1.456	(1.070)		
Hypertension	0.971	(0.990)			1.240	(1.075)		
Emphysema	1.028	(1.004)			0.779	(0.967)		
Arthritis	0.673	(0.872) **			0.601	(0.843) ***		
Osteoporosis	0.957	(0.996)			1.502	(1.039)		
Tinnitus	0.843	(0.955)			0.857	(0.958)		
Regions								
Zealand[f]	0.948	(0.981)	0.951	(0.982)	1.382	(1.124)	1.389	(1.126)
South Denmark[f]	0.915	(0.965)	0.913	(0.963)	1.126	(1.048)	1.118	(1.045)
Central Jutland[f]	0.840	(0.931)	0.839	(0.931)	1.046	(1.019)	1.034	(1.014)
Northern Jutland[f]	0.576	(0.854) ***	0.576	(0.855) ***	0.672	(0.896) *	0.659	(0.892)
Log likelihood	-1146.259		-1150.690		-791.333		-797.305	
LR chi^2	1283.87*** (df = 37)		1275.00*** (df = 29)		498.09*** (df = 34)		486.15*** (df = 26)	

Pseudo R^2	0.359	0.357	0.239	0.234
N	2,636	2,636	1,565	1,565

* significance at 10 percent level; ** significance at 5 percent level; *** significance at 1 percent level. Conversion from DKK to USD is undertaken using the March 2011 average exchange rate of 532.75 (Danske Bank, 2011).
[a] Reference level for the income dummies is DKK 0-399,999/USD 0-75,082.
[b] Reference level for the education dummies is basic or high school education.
[c] Reference level for the occupation dummies is white-collar worker.
[d] Reference level for the sector of employment dummies is public employee.
[e] Reference level for the employer size dummies is 1-4 employees.
[f] Reference level for the region dummies is the Capital Region.

Considering first the sample of all employed in Table 3 (columns 1-4), it is seen that the characteristics related to the workplace are, not surprisingly, by far the most important determinants of EPHI ownership. Compared to public employees, the odds are having EPHI are 10 times larger for individuals working for independent public companies and 39 times larger for private sector employees, holding all other observed variables constant. The large odds ratio of private sector employment for the propensity score that is estimated based on the sample of all employed supports the strategy of implementing the propensity score matching estimator separately on the subsample of privately employed. The size of the firm measured in terms of employees is also found to increase the odds of having EPHI. Compared to individuals working in companies with one to four employees, the odds of insurance ownership are almost 10 times larger for individuals who are employed at the largest workplaces with more than 250 employees. Among the sociodemographic variables, the odds of having EPHI increases significantly with household income, number of adults in the household, and age until a certain point. Education level does not affect the odds of having EPHI significantly, while the odds are approximately 0.60 times smaller for skilled workers and 0.55 times smaller for unskilled workers compared to the baseline category of white-collar workers. The odds of having EPHI are 0.5 times smaller for the residents of the region of Northern Jutland compared to individuals living in the capital area. Considering the health-indicators, the odds of having EPHI are 0.6 times smaller for individuals with osteo- or rheumatoid arthritis in the full model specification. Other than the negative and significant effect of arthritis, there are no substantial differences between the full and the reduced specifications of the propensity score.

Finally, Table 3 shows that restricting the sample used in the estimation of the propensity score from all employed (columns 1-4) to private sector employees (columns 5-8) produces very similar results.

5.2 Conditional mean independence

The identifying assumption of conditional mean independence implies that after conditioning on the propensity score, the use of health care is assumed be independent of the process that leads to EPHI coverage. It is argued in the following that this assumption is plausible in the present study, given the comprehensive set of covariates used to estimate the propensity score and the institutional setting of EPHI in Denmark.

The conditional mean independence assumption relies on several partial assumptions to hold. For one thing, it must be the case that individuals do not purposely select themselves into jobs with EPHI based on some unobserved characteristic that is also associated with the use of health care. Given the existence of a comprehensive universal tax-financed health care system and the fact that the value of EPHI makes up only a very small share of the total compensation package in Denmark, it is argued that individuals are not expected to purposely select themselves into jobs with EPHI.

Moreover, the decision to employ a given employee should not differ between employers who offer EPHI and those who do not based on health variables other than those included in the estimation of the propensity score. Given that employers are not allowed to ask questions related to health at any point during recruitment and employment (The Ministry of Employment, 1996), it is considered unlikely that the employers who offer EPHI are able to select their employees in a different manner than those not offering EPHI based on unobservable health characteristics.

Considering next the employer's decision to offer EPHI, two opposite effects may be at play (Grepperud and Iversen, 2011). On the one hand, it may be the case that companies with high sickness absence or those operating in industries exposed to considerable health risks may be relatively more inclined to purchase EPHI, i.e. adverse selection at the company level.[16] On the other hand, it is also possible that companies using highly educated and specialised labour, which is hard to replace in the case of illness, are more likely to invest in the health of their employees by taking out EPHI, assuming that EPHI reduces sickness absence. These effects are opposite because sickness absence decreases with the qualification and education level of the employee in all sectors of employment and for all available measures of sickness absence (Statistics Denmark, 2008). Empirical evidence based on company-level data from Norway indicates that both of these effects may be present (Seim et al., 2007).[17] The occupational, educational, and health-related covariates included in the estimation of the propensity score are argued to account for most of this company level selection.

Finally, it may reasonably be argued that the privately insured are not unobservably healthier because they have enjoyed preferential access to some types of health care services over a long period of time, given that EPHI did not gain foothold in Denmark until 2003.

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[16] As for adverse selection at the individual level, this relationship is based on an assumption of asymmetric information, implying that the price at which insurance is offered to a company does not increase proportionally with expected payouts for the company.

[17] More specifically, Seim et al. (2007) found that the probability of companies offering EPHI to some or all of their employees increases with company size and profit, the share of younger employees, the education level of the staff of employees, and operating in one of several industries considered to be particularly exposed to health risks (including building and construction, farming, forestry, and mining).

Based on these arguments, it is thus assumed for now that there is no unobserved selection on behalf of either individuals or their employers. The section with robustness checks explores this issue further and presents some empirical evidence on the plausibility of the conditional mean independence assumption.

5.3 Choice of matching algorithm

Several algorithms may be used to match treated and control observations based on the estimated propensity score (see e.g. the reviews provided in Heckman et al. (1998a) and Smith and Todd (2005)). The performance of the available matching algorithms depends largely on the data structure at hand. It thus seems reasonable to try out a couple of approaches to test the sensitivity of our results with respect to the choice of matching algorithm. If we get similar results by applying different matching algorithms, the choice may be of minor importance. Should the results differ notably, further investigation is needed in order to identify the source of the disparity (Bryson et al., 2002).

We implement five different matching algorithms: One-to-one and five-to-one nearest neighbour matching with replacement, kernel matching using the Epanechnikov kernel, and radius matching with caliper levels 0.1 and 0.01. These algorithms are asymptotically identical as they all become closer to comparing only exact matches as the sample size grows. In practice, the choice of matching algorithm may nevertheless affect the results in finite samples (Smith, 2000). With a sample of 2,636 individuals it is thus uncertain whether the choice of matching algorithm will affect the results in this study.

Each algorithm involves tradeoffs in terms of bias and efficiency. The nearest neighbour matching algorithm matches each treated individual with a specified number of nearest neighbours in terms of the propensity score. This approach minimises bias, but increases the variance given that observations other than the chosen number of neighbours, which may be quite similar in terms of the propensity score, are be disregarded. Increasing the number of neighbours reduces the variance because more information is used to construct the counterfactual for each individual, but increases bias due to poorer matches on average. Matching with replacement allows each individual in the control group to be used in more than one match, which reduces bias but increases variance (Smith and Todd, 2005). Nearest neighbour matching faces the risk of bad matches if the nearest neighbour is far away. Radius matching responds to this problem by imposing a caliper on the maximum distance allowed and matching treated individuals with all controls within this area. Treated observations with no neighbours within the caliper are excluded from the analysis, which is one way of imposing common support. The main drawback of this algorithm is that it is difficult to know a priori what levels of the caliper are reasonable. Finally, kernel matching constructs the counterfactual outcomes as weighted averages of potentially all individuals in the control group, with the highest weight placed on controls with propensity scores closest to the treated individual. This reduces the variance because more information is used, but possibly increases bias given that some of the individuals used to construct the counterfactuals may be bad matches. As for radius matching with caliper, the drawback of kernel matching is that it involves a choice of kernel function and bandwidth that determines the amount of smoothing. The average of the outcomes is weighted according to the density function of the Epanechnikov kernel, using the default bandwidth of 0.06.

5.4 Matching quality

To establish the quality of matched pairs used in our estimation I follow the strategy of among others Lechner (2002). I focus on matched control groups derived from the propensity score estimates based on the full set of covariates and the reduced set of covariates excluding the health-related indicators. As shown in Table 4, the sample of employed contains 1,092 individuals with EPHI and 1,544 individuals who rely exclusively on the tax-financed health care system. The corresponding numbers for the privately employed are 968 and 597 (columns 1 and 2). Hence, the treated individuals make up 41.4 percent of the employed sample and 61.9 percent of the subgroup of private employees, respectively, before matching (column 3). The share of treated individuals outside the common support ranges from 0.57 to 1.09 percent (column 8). The area of common support is assessed graphically in Appendix A. Given that the share of treated outside the common support is low, and that the distributions of the propensity scores graphed in Appendix A do not give rise to concern, the overlap condition is not expected to pose a problem in the present study. Hence, the analyses of the balancing property as well as further estimations are restricted to the region of common support.

Table 4 Some summary measures of covariate balancing before and after matching

	No. of treated	No. of controls	Share of treated before	Logit model pseudo R^2 before	Logit model pseudoR^2 after	Median bias before	Median bias after	Share of treated outside CS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<u>All employed</u>								
Full model								
NN, one-to-one					0.027		3.989	0.57
NN, five-to-one					0.012		2.309	0.57
Kernel (epan.)	1,092	1,544	0.414	0.357	0.008	5.617	2.444	0.57
Radius, cal.=0.1					0.010		2.698	
Radius, cal.=0.01					0.009		2.434	
Reduced model								
NN, one-to-one					0.018		3.350	0.91
NN, five-to-one					0.008		2.212	0.91
Kernel (epan.)	1,092	1,544	0.414	0.354	0.006	6.599	2.072	0.91
Radius, cal.=0.1					0.009		3.577	
Radius, cal.=0.01					0.007		2.182	
<u>Privately employed</u>								
Full model								
NN, one-to-one					0.031		4.167	1.09
NN, five-to-one					0.011		2.779	1.09
Kernel (epan.)	968	597	0.619	0.240	0.007	10.046	2.065	1.09
Radius, cal.=0.1					0.011		2.177	
Radius, cal.=0.01					0.011		3.160	

Reduced model								
NN, one-to-one					0.022		4.263	1.09
NN, five-to-one					0.008		2.756	1.09
Kernel (epan.)	968	597	0.619	0.235	0.005	12.598	2.117	1.09
Radius, cal.=0.1					0.008		2.224	
Radius, cal.=0.01					0.005		1.985	

The overall covariate balancing may be assessed by performing balancing tests for the individual covariates and by comparing the pseudo R^2 from the logit estimation of the propensity score and the median absolute standardized bias obtained before and after matching, respectively. Balancing tests performed separately for each covariate included in the estimation of the propensity score are available from the author upon request.[18]

The pseudo R^2 indicates how well the covariates explain the probability of treatment. After matching, the covariates should have no explanatory power for selection into treatment. The estimations in Table 5 show that the pseudo R^2 statistics drop from between 23.5 and 33.7 percent before matching (column 4) to 3.1 percent or less after matching (column 5) for all specifications. This indicates that matching has succeeded in balancing the covariates between the treated and the control groups for all propensity score specifications.

Following Rosenbaum and Rubin (1985), the standardized difference for a single covariate x_i before and after matching is calculated as follows:

$$\begin{aligned} B_{before}(x_i) &= 100 \cdot \frac{\bar{x}_{i1} - \bar{x}_{i0}}{\sqrt{v_1(x_i) + v_2(x_i)/2}} \\ B_{after}(x_i) &= 100 \cdot \frac{\bar{x}_{i1M} - \bar{x}_{i0M}}{\sqrt{v_1(x_i) + v_2(x_i)/2}} \end{aligned} \qquad (11)$$

where $\bar{x}_{i1}$ denotes the sample means for the subsample of treated, $\bar{x}_{i0}$ denotes the sample means for the subsample of controls, both as a percentage of the square root of the average of the sample variation in the treated and non-treated groups. The post-matching standardized difference $B_{after}(x_i)$ is restricted to consider only treated individuals that fall within the area of common support. Table 4 shows the median absolute standardized bias taken over all the covariates included in the estimation of the propensity score before and after matching. The standardization allows for comparisons across variables and, for a given x_i, comparisons before and after matching.

[18] In summary, the balancing checks performed separately for each covariate showed that the groups of treated and controls do not balance on several covariates when matching is performed using the one-to-one nearest neighbour matching algorithm and on a few covariates when using the five-to-one nearest neighbour matching algorithm. The balancing property is typically satisfied for all variables when matching is performed by the kernel or the radius matching algorithms.

Across propensity score specifications and study populations, matching reduces the median absolute standardized bias by approximately 30 to 80 percent. The largest bias reductions are found for the subsample of privately employed. The theoretical literature does not seem to provide any formal criteria by which to judge the size of the standardized bias (Becker and Muendler, 2008). However, the absolute level of median bias after matching of 2.065 to 4.263 (column 7), depending on model specification and matching algorithm, is in the same range as other microeconometric evaluation studies (e.g. Lechner (2002), Sianesi (2004), and Becker and Muendler (2008)). Across specifications of the propensity score, the median absolute standardized bias is consistently minimized for five-to-one nearest neighbour and the kernel matching algorithms.

6 Average treatment effects

Table 5 shows the estimates of how EPHI affects the probability of having had any physiotherapist, chiropractor, psychologist, specialist, and ambulatory contacts and hospitalisations within the previous 12 months for the sample of all employed for the various matching algorithms implemented in the previous section. Table 6 shows the corresponding results for the subsample of private sector employees. Estimates obtained by ordinary least square (OLS) regression of health care use on the same set of covariates as used in the estimation of the propensity score are also reported for comparison. The ATT is considered to be the appropriate parameter of interest here, given that it is neither feasible nor policy relevant to impose EPHI on the entire group of employed.

The ATT estimates presented in Table 5 are largely insignificant at the commonly considered levels of statistical significance. However, it is noted that the estimates of the effect on the probability of having used physiotherapy and chiropractic care in the previous 12 months are insignificant but positive for both specifications of the propensity score and across all matching algorithms. A similar pattern applies to the effect on having had one or more contacts to specialists, ambulatory treatments, and hospitalisations, where the majority of the estimates are also positive but insignificant. The ATT estimates of EPHI on the probability of having had one or more psychologist contacts do not differ significantly from zero and are predominantly negative. Table 6 shows that insisting on a perfect match in terms of sector of employment changes the results somewhat. Along with Table 5 the evidence presented in Table 6 thus suggests that some unexplained variation between public and private employees remain after conditioning on the propensity score. The ATT for any ambulatory contacts (column 5), such as examinations, scans, same-day surgery, and control visits, reaches statistical significance for all matching algorithms. In particular, EPHI is found to increase the probability of having had any ambulatory contacts within the previous 12 months by approximately 6-7 percentage points for the subsample of privately employed. This effect must be interpreted in relation to the baseline probability of having had any ambulatory contacts for the privately employed without EPHI, which is seen in Table 6 to be 22.4 percent. Thus, EPHI increases the probability of having had any ambulatory contacts within a 12 month period from 22.4 percent to around 28-29 percent.[19]

Table 5 Average treatment effects on the treated (ATTs) for all employed (n=2,656)

	Physioth. contacts ATT (Std. err.)	Chiropr. contacts ATT (Std. err.)	Psychol. contacts ATT (Std. err.)	Specialist contacts ATT (Std. err.)	Ambulatory contacts ATT (Std. err.)	Hospitali-sations ATT (Std. err.)
	(1)	(2)	(3)	(4)	(5)	(6)
Full model[a]						
OLS regression	0.033 *	0.012	-0.007	-0.013	-0.004	0.001
	(0.019)	(0.017)	(0.012)	(0.022)	(0.022)	(0.015)
NN, one-to-one	0.035	0.011	0.008	-0.004	0.057 *	0.017
	(0.033)	(0.029)	(0.019)	(0.037)	(0.031)	(0.019)
NN, five-to-one	0.023	0.014	0.004	0.034	0.033	0.023
	(0.029)	(0.025)	(0.015)	(0.031)	(0.028)	(0.018)
Kernel (epan.)	0.029	0.016	-0.001	0.026	0.038	0.017
	(0.024)	(0.021)	(0.014)	(0.026)	(0.023)	(0.015)
Radius, cal.=0.1	0.028	0.014	-0.005	0.023	0.033	0.018
	(0.023)	(0.020)	(0.014)	(0.027)	(0.027)	(0.018)
Radius, cal.=0.01	0.031	0.018	0.001	0.019	0.043	0.021
	(0.025)	(0.022)	(0.015)	(0.030)	(0.029)	(0.019)
Reduced model[b]						
OLS regression	0.028	0.009	-0.007	-0.016	-0.008	-0.003
	(0.020)	(0.017)	(0.012)	(0.023)	(0.022)	(0.015)
NN, one-to-one	0.044	0.016	-0.018	-0.012	0.029	0.021
	(0.037)	(0.027)	(0.017)	(0.037)	(0.032)	(0.021)
NN, five-to-one	0.020	0.027	-0.002	0.014	0.032	0.011
	(0.033)	(0.026)	(0.015)	(0.032)	(0.027)	(0.018)
Kernel (epan.)	0.023	0.013	-0.003	0.016	0.032	0.016
	(0.026)	(0.023)	(0.014)	(0.027)	(0.024)	(0.024)
Radius, cal.=0.1	0.020	0.009	-0.007	0.008	0.026	0.018
	(0.023)	(0.020)	(0.014)	(0.027)	(0.027)	(0.017)
Radius, cal.=0.01	0.027	0.020	-0.001	0.015	0.036	0.019
	(0.025)	(0.022)	(0.015)	(0.030)	(0.029)	(0.019)
Baseline prob.	0.159	0.117	0.057	0.277	0.265	0.093

* significance at 10 percent level; ** significance at 5 percent level; *** significance at 1 percent level. Standard errors for the ATTs are bootstrapped with 300 replications.

[19] Using the number of visits as outcome resulted in a similar pattern, the only substantial differences being that the ATT on the number of ambulatory contacts are statistically significant at the 10 percent level for the sample of all employed and that sign of the ATT on the number of chiropractor contacts turns negative (but remain insignificant) across all specifications of the propensity score and matching algorithms. These results for number of contacts are available from the author upon request.

[a] Full model refers to the specification of the propensity score including sociodemographic and employer-related characteristics, health-related indicators, and regional variables.
[b] Reduced model refers to the specification of the propensity score including sociodemographic and employer-related characteristics, and regional variables.

Table 6 Average treatment effects on the treated (ATTs) for the privately employed (n=1,565)

	Physioth. contacts ATT (Std. err.)	Chiropr. contacts ATT (Std. err.)	Psychol. contacts ATT (Std. err.)	Specialist contacts ATT (Std. err.)	Ambulatory contacts ATT (Std. err.)	Hospitali-sations ATT (Std. err.)
	(1)	(2)	(3)	(4)	(5)	(6)
Full model[a]						
OLS regression	0.022	0.018	-0.010	-0.005	0.033	0.020
	(0.024)	(0.021)	(0.014)	(0.027)	(0.026)	(0.017)
NN, one-to-one	0.018	0.019	-0.017	0.028	0.066 *	0.044
	(0.038)	(0.034)	(0.021)	(0.042)	(0.034)	(0.025)
NN, five-to-one	0.023	0.023	-0.010	0.027	0.064 **	0.026
	(0.032)	(0.028)	(0.018)	(0.036)	(0.030)	(0.021)
Kernel (epan.)	0.022	0.019	-0.007	0.023	0.063 **	0.026
	(0.028)	(0.026)	(0.016)	(0.030)	(0.028)	(0.018)
Radius, cal.=0.1	0.026	0.009	-0.010	0.024	0.058 **	0.027
	(0.026)	(0.023)	(0.016)	(0.031)	(0.029)	(0.019)
Radius, cal.=0.01	0.029	0.021	-0.006	0.021	0.069 **	0.031
	(0.029)	(0.025)	(0.018)	(0.035)	(0.032)	(0.021)
Reduced model[b]						
OLS regression	0.019	0.017	-0.010	-0.006	0.032	0.016
	(0.024)	(0.021)	(0.014)	(0.027)	(0.026)	(0.017)
NN, one-to-one	-0.026	0.009	0.002	0.006	0.074 **	0.040
	(0.036)	(0.031)	(0.021)	(0.041)	(0.034)	(0.024)
NN, five-to-one	0.011	0.027	-0.011	0.027	0.064 **	0.026
	(0.032)	(0.029)	(0.018)	(0.037)	(0.028)	(0.022)
Kernel (epan.)	0.020	0.020	-0.009	0.017	0.057 **	0.023
	(0.029)	(0.024)	(0.016)	(0.030)	(0.028)	(0.017)
Radius, cal.=0.1	0.019	0.008	-0.011	0.014	0.055 *	0.027
	(0.026)	(0.023)	(0.016)	(0.031)	(0.029)	(0.019)
Radius, cal.=0.01	0.018	0.022	-0.009	0.026	0.062 **	0.024
	(0.028)	(0.025)	(0.018)	(0.033)	(0.031)	(0.021)
Baseline prob.	0.171	0.124	0.057	0.285	0.224	0.080

* significance at 10 percent level; ** significance at 5 percent level; *** significance at 1 percent level.
Standard errors for the ATTs are bootstrapped with 300 replications.
[a] Full model refers to the specification of the propensity score including sociodemographic and employer-related characteristics, health-related indicators, and regional variables.
[b] Reduced model refers to the specification of the propensity score including sociodemographic and employer-related characteristics, and regional variables.

The estimates obtained by OLS regression and propensity score matching are noted to differ somewhat, although both methods result in estimates that are largely insignificant. As previously mentioned the method of matching differs from linear regression in that it avoids functional form assumptions and restricts estimates to controls and treated with a common support. Moreover, it has been pointed out by among others Angrist and Pischke (2009) that the two methods differ in the weights used to combine the covariate-specific effects into a single average effect. While matching uses the distribution of covariates among the treated to combine the covariate-specific estimates into an estimate of the effect of treatment on the treated, regression produces a variance-weighted average of the effects. In this way matching puts most weight on covariate cells containing those who are most likely to be treated, while regression puts most weight on covariate cells where the conditional variance of treatment status is largest, i.e. where the number of treated and controls is equal. Considering the assessments of common support provided in Table 4 and Appendix A, it is unlikely that common support problems are the main driver of the observed difference. It may thus be the case that the difference is due to OLS regression being more restrictive than matching after all.

Finally, it is noted that the tradeoffs in terms of bias and efficiency that are involved in the various matching algorithms (discussed in the previous section) are evident from Tables 5 and 6. In particular, it is seen that using more information to construct the counterfactuals reduces the variance but increases the bias of the estimates due to poorer matches on average. Considering the standard errors of the estimates obtained by nearest neighbour matching, the variance decreases as the number of neighbours used to construct the counterfactual outcome increases. Likewise for radius matching, where the variance drops as the size of the caliper increases. The kernel matching algorithm, which uses potentially all the individuals in the control group to construct the counterfactual outcomes, is also seen to produce standard errors in the lower range of the scale but with possibly larger bias. However, given that the statistically significant estimates obtained by matching do not differ much depending on the matching algorithm (the ATT estimates for ambulatory contacts among the privately employed reported in Table 6 range from 0.055 to 0.074), the tradeoff between bias and efficiency does not seem to be of crucial importance in this study.

7 Robustness checks

This section assesses the robustness of the results with respect to the conditional mean independence of the insurance plan, which is the main identifying assumption. The maintained assumption of conditional mean independence implies that after conditioning on the propensity score, the outcomes must be independent of assignment to treatment, i.e. treatment should be unrelated to unobserved variables which may also affect the outcome. For an unobserved variable to be a source of selection bias, it must thus affect the probability of treatment as well as the outcome.

For the analysis of how EPHI affects the use of covered health care services, this identification strategy relies on several partial assumptions to hold. Following the approach of Barros et al. (2008), the robustness of these assumptions is assessed by running regressions of several variables, which may affect both the probability of having EPHI and the use of health care, on the reduced set of covariates included in the estimation of the propensity score and an EPHI dummy. The variables considered in this section were not included in the estimation of the propensity score either due to endogeneity concerns, i.e. that they may be affected by EPHI status, or because there were no compelling reason as to include them.

First, it must hold that the employers who offer EPHI do not select their employees in a different manner than those not offering EPHI based on health variables that are unobservable to the researcher. Along a similar line, it must be the case that individuals who expect to use more health care services do not select themselves into jobs that offer private health insurance. As argued previously, the value of private health insurance makes up a negligible small share of the total compensation package (less than 0.5 percent of the average money wages for the permanently employed). Moreover, given that EPHI is mainly a private sector phenomenon; many other characteristics of private sector jobs, such as wages and fringe benefits in general, may well be expected to have more influence on the choice of job. Nevertheless, there is still the theoretical possibility that those who expect to use more health care, e.g. because they are sicker, more focused on health, or more risk averse, are more likely to end up in jobs offering private health insurance. In order to investigate whether the privately insured are more focused on health or more risk averse than their counterparts without EPHI, linear regressions of several risky lifestyle habits and preventive efforts are run on the reduced set of covariates and the EPHI dummy. These regressions show that after controlling for the reduced set of covariates, the group of individuals with EPHI do not differ significantly from those without EPHI with respect to smoking, drinking, exercising habits, bicycle helmet use, influenza vaccinations, and participation in screening programs for cervical- and breast cancer among women. Likewise, regressions of self-reported financial and health-related risk preferences (measured on a scale from one to ten) on the reduced set of covariates and the EPHI dummy did not reveal any statistically significant relationships.

Second, for the assumption of conditional mean independence to hold, it must be the case that the privately insured are not unobservably healthier, either due to advantageous selection or cream-skimming by insurers, or because they have enjoyed more years of preferential access to some types of health care services. If this was the case, the privately insured individuals would use less health care services than their counterparts without EPHI. Given that EPHI did not gain foothold in Denmark until 2003, we do not expect the insurance policies to have affected the health of the insured just yet. This expectation is supported by running a logistic regression of a dummy variable for poor or very poor self-assessed health status (versus fair, good, or excellent health) and a linear regression of the standardised measure of health EQ-5D on the reduced set of covariates and the EPHI dummy. The coefficient for having EPHI was not significantly different from zero in any of these additional regressions.

Third, there may be argued to be company level selection into EPHI in addition to that captured by the occupational status of the employee and by employer size and sector. This issue is investigated by running various logistic regressions of trade union affiliation on the reduced set of covariates and the EPHI dummy. In several of these regressions, the coefficient for having EPHI is statistically significant. Overall, the regressions revealed a negative relationship between EPHI coverage and membership of a trade union in the federation of trade unions for workers (abbreviated by LO) or the federation of trade unions for professional and managerial staff graduated from universities (abbreviated by AC) relative to other trade unions or no union. This indicates that some company level selection remains after conditioning on the propensity score. In relation to this, it is noted that LO have not had EPHI high on their agenda when negotiating contracts, and they have a large share of hourly paid workers among their members, who are traditionally less likely to be offered EPHI than employees in companies primarily employing salaried workers. Although several occupational and employer-related variables are included in the estimation of the propensity score, it thus appears that these variables do not completely capture the existing differences between occupational groups.

In order to assess the possibility that the observed effect of EPHI on the use of ambulatory care is driven by additional company level selection (as indicated by the negative relationship between EPHI coverage and membership of a trade union in LO or AC), the ATTs presented in Tables 5 and 6 are re-estimated including trade union affiliation in the propensity score. Including trade union in the propensity score is found to reduce the effect of EPHI on the probability of having had any ambulatory contacts within the previous 12 months from 6-7 percentage points to 3-4 percentage points for the subsample of privately employed. This implies that at least part of the observed effect of EPHI on the use of ambulatory care is attributable to company level selection into EPHI in addition to that captured by the occupational status of the employee and by employer size and sector. However, the estimated effect for ambulatory care remains positive and statistically significant at the 10 percent level for the subgroup of private sector employees across all matching algorithms.

The full results of the various regressions and matching estimators discussed in this section are available from the author upon request.

Summing up, the conditional mean independence assumption is inherently untestable. The empirical evidence provided here indicates that possible violations of the conditional mean independence assumption are most likely on the company level, and that unobserved heterogeneity may bias the results somewhat upwards. However, the vast majority of the empirical evidence does not contradict the identifying assumption; as a matter of fact it suggests that the conditional mean independence assumption is plausible.

8 Conclusion and discussion

This paper analyses how EPHI affects the use of covered health care services in Denmark. In a policy context, the answer to this question adds to our knowledge of the extent to which private health insurance that primarily duplicates the coverage provided by a universal tax-financed health care system generates inequity in the use of health care. The results of the study are of relevance to the various countries with universal health care systems and duplicate private health insurance; in particular the Danish health care system where EPHI is tax-exempted and thus implicitly subsidised.

The overall maintained hypothesis deduced from economic theory is that EPHI increases the use of covered health care services, all else equal. Institutional barriers such as the use of gatekeepers and restrictions in the coverage provided by the private insurers may, however, moderate the effect. A review of the empirical literature shows that the effect of private health insurance on health care use differs across types of health care services and institutional settings as well as possibly also with the econometric methods applied.

The ATTs for the total sample of occupationally active show that EPHI does not significantly affect the probability of having had one or more hospitalisations, physiotherapist, chiropractor, psychologist, specialist, or ambulatory contacts within the 12 months prior to the interview. However, there is a tendency towards a positive effect on the use of physiotherapy and chiropractic care, where the estimates are positive but insignificant across all specifications of the propensity score and matching algorithms. A similar pattern occurs for specialist and ambulatory contacts and hospitalisations, where the majority of the estimated ATTs are positive. Restricting the sample of analysis to the privately employed changes the results somewhat. In particular, EPHI is found to increase the probability of having had any ambulatory contacts within the previous 12 months by 6-7 percentage points in addition to the baseline probability of 22.4 percent for the subsample of privately employed. The somewhat different results for the sample of privately employed indicates that some unexplained variation between public and private sector employees remain after conditioning on the propensity score. Such differences may be attributable to among other things differences in the skill mix of the workforce and the pay and conditions of employment between the two sectors, which are not completely captured by the variables included in the propensity score. Moreover, it is possible that the fact that only very few public employers offer EPHI to their employees increases the uncertainty of the estimates which include public employees.

The finding that EPHI increases the use of ambulatory care, such as examinations, scans, same-day surgery, and control visits, among private sector employees corresponds well with the classification of EPHI as primarily duplicate in relation to the tax-financed health care system and the fact that 67 percent of the total gross compensations paid out by the commercial insurers were allocated towards operations and the like in 2009 (The Danish Insurance Association, 2010).

The predominantly positive but insignificant estimates of how EPHI affects the use of the remaining health care providers may reflect the use of gatekeepers as well as restrictions in the coverage provided by the commercial insurers. Moreover, it must be stressed that this study considers only the probability of having had any contacts within a 12 month period; it does not differentiate between tax-financed and privately paid contacts. Hence, another possible, and perhaps more likely, explanation of the absence of significant effects of EPHI is that of substitution, i.e. that duplicate EPHI shifts the use from tax-financed contacts to privately paid contacts, while the total use of health care stays the same.

The study is subject to several methodological considerations and limitations, some more important than others, which are discussed in the following. Considering first the data, the use of data collected using an internet-based questionnaire constitutes a source of bias if the individuals who can be reached through the internet differ from those without internet access on the characteristics that are subject to investigation. The use of an internet-based questionnaire is, however, not expected to be a major issue in this study, given that 86 percent of the Danish population had internet access in their homes in 2009 (Statistics Denmark, 2009a). In addition, the percentage with internet access is most likely higher among the occupationally active, to whom the analysis is restricted. Along a similar line, the identification of respondents through YouGov Zapera's Denmark panel constitutes a weakness of the study if the panel members differ from the remaining population on the relevant characteristics.[20] While none of these data issues can be dismissed with complete certainty, it is, however, worth noting that there are no indications that the sample deviates from the population on essential characteristics (Kiil and Pedersen, 2009).

The definition of treatment in studies of how private health insurance affects the use of covered health care services is not straight forward. In accordance with what is common practice in the empirical literature, this study defines treatment as EPHI coverage, i.e. potential use of private care. An alternative approach would be to define treatment as actual use of private care, given that this is the channel through which EPHI is expected to affect the total use of health care services. However, defining treatment as use of private care would make it very hard to justify the assumption of selection on observables. As a consequence of this, and in order to comply with the literature, treatment is defined as having EPHI. Moreover, the use of self-reported data on health care use as outcome also calls for a brief discussion. Based on the findings of a review of the empirical literature on the use of self-reported health care data (Bhandari and Wagner, 2006), some extent of underreporting is expected to be present in the data, and the estimates for the use of inpatient care are expected to be more precise than those for outpatient care. The inaccuracies are, however, not expected to bias the results of this study in any particular direction.

Considering next the choice of econometric method, there are advantages as well as disadvantages related to the method of matching in general and propensity score matching in particular. At the general level, it is possible that the stable-unit treatment assumption may not hold. For one thing individuals with EPHI may release capacity in public hospitals, thereby facilitating quicker access for those who rely exclusively on the tax-financed health care system. If this is the case, the treatment effect for individual *i* is not

[20] An additional, although somewhat hypothetical, issue with the identification of respondents through web panels is that when it is possible to enrol in the panel on a voluntary basis (i.e. some non-probability based sampling occurs), the established principles of statistical inference are in theory not applicable (Couper, 2000). However, the practical importance of some extent of voluntary enrolment in web panels has yet to be assessed.

independent of the treatment status of the other individuals. However, EPHI may also bring along a slide in the indications for treatment, such that the capacity in the public hospitals remains unchanged or even decreases (Propper and Green, 2001). In the context of the Danish health care system, there is no evidence as to which effect dominates.

The general advantages of matching estimators are characterised by avoidance of the functional form assumptions which are implicit in parametric estimators, emphasis of common support, and most importantly by the lack of need for exclusion restrictions. On the negative side, the inherently untestable assumption of conditional mean independence poses a challenge. In addition, an obvious shortcoming is the lack of estimates of the effects of exogenous variables other than the treatment.

Regarding the decision to match on the propensity score, the choice of whether to match on the covariates or the propensity score is not theoretically clear-cut. On the one hand, matching on the propensity score is practical in finite samples when the covariate vector has a high dimension or there are continuous variables among the covariates. One the other hand, the variance of the estimator increases by the variance contribution of the propensity score when this needs to be estimated, as is usually the case. Despite this, matching on the covariates does not necessarily dominate matching on the propensity score, given that the additional variance may be arbitrarily close to zero (Heckman et al., 1998b).

Finally, there are many choices associated with the implementation of matching estimators in general and propensity score matching in particular. Each choice may affect the final results and thus requires careful consideration. The present study seeks to comply with this drawback of the method by considering several specifications of the propensity score and presenting results for two propensity score specifications and several matching algorithms. In this way, the sensitivity of the results with respect to the various choices is assessed. Moreover, the identifying assumption of conditional mean independence is thoroughly discussed, and some empirical evidence in favour of the assumption is presented. These features of the study place great confidence in its main conclusions that EPHI induces some extent of moral hazard in the use of ambulatory care among private sector employees, thereby generating horizontal inequity in the use of this type of health care, while the probability of having had one or more hospitalisations, physiotherapist, chiropractor, psychologist, or specialist contacts within the 12 months prior to the interview is not significantly affected by EPHI.

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Appendix A Common support

Given that the propensity scores were found to be very similarly distributed across the various matching algorithms, this appendix contains only the results for one-to-one NN matching with replacement. The corresponding graphs for five-to-one NN matching with replacement, kernel matching using the Epanechnikov kernel, and radius matching with caliper levels 0.1 and 0.01 are available from the author upon request.

Fig. 1 Propensity scores for treated and non-treated (all employed, full model)

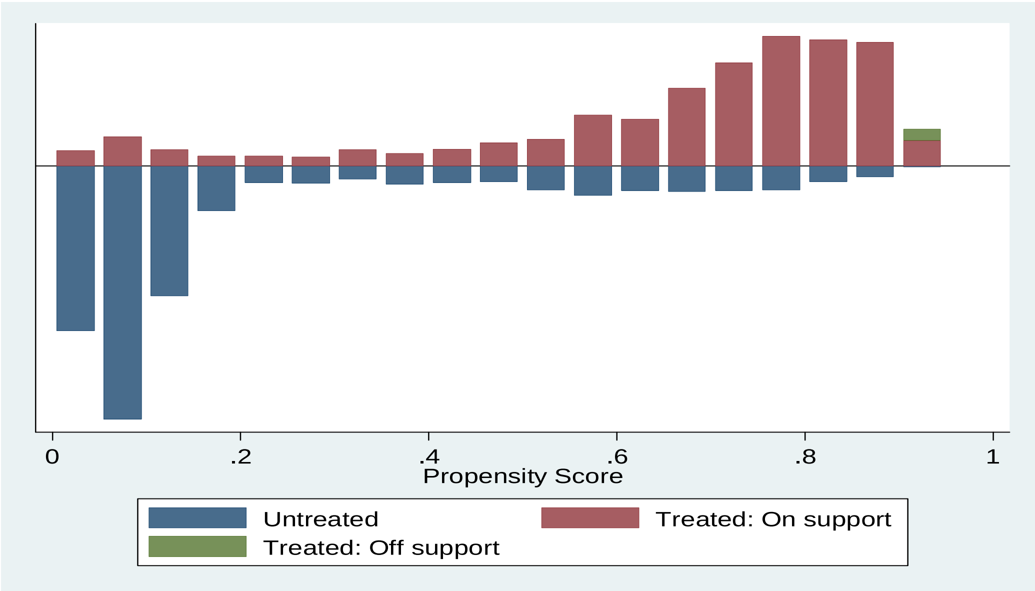


Fig. 2 Propensity scores for treated and non-treated (all employed, reduced model)

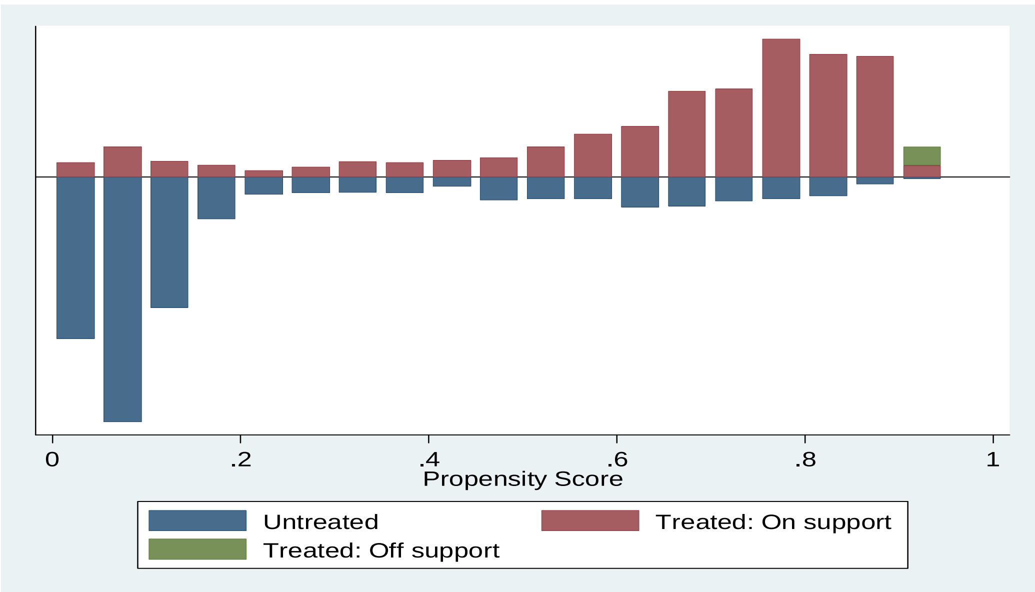


Fig. 3 Propensity scores for treated and non-treated (private sector, full model)

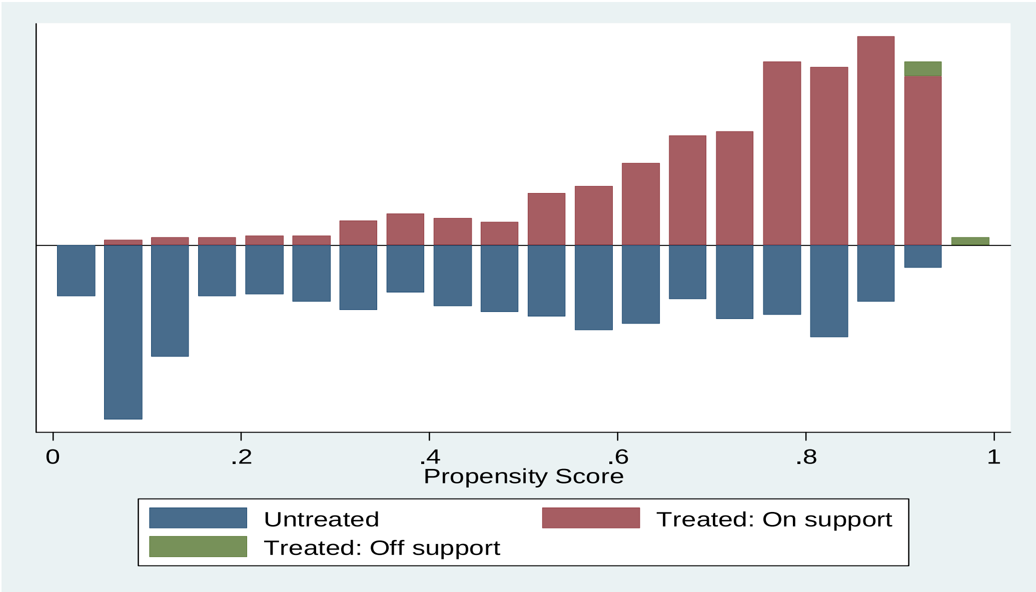
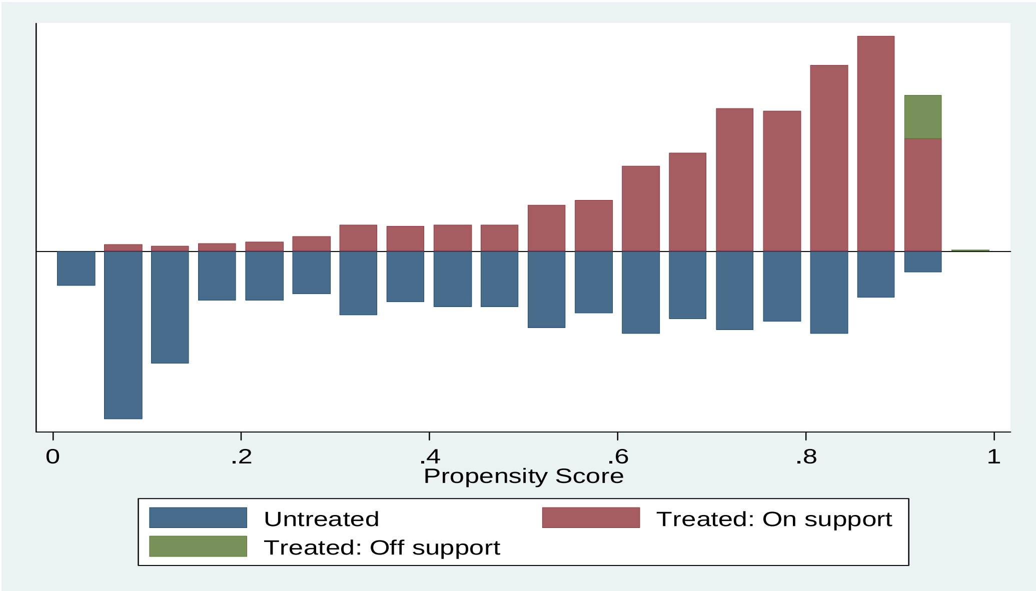


Fig. 4 Propensity scores for treated and non-treated (private sector, reduced model)



CHAPTER 5

The effect of private health insurance on the use of health care services: A comparison of identification strategies

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Abstract:
This study estimates the effect of private health insurance on the use of health care services using four fundamentally different identification strategies: 1) Joint parametric modelling relying on functional form and an instrumental variable, 2) propensity score matching relying on selection on observables, 3) a standard univariate parametric estimator relying on functional form and selection on observables and finally 4) non-parametric bounds using weaker assumptions. The empirical analysis focuses on an institutional setting where empirical findings are still limited; namely on voluntary private health insurance that is complementary to a universal tax-financed health care system. We find evidence of a positive and significant incentive effect of private health insurance on the use of dental care, physiotherapy, and chiropractic care, irrespective of the method applied. For the use of ambulatory care the effect is insignificant, while the results differ across methods for general practice and prescription drug use.

Keywords: treatment effects; parametric estimators; nonparametric bounds; private health insurance; moral hazard

JEL Classification: C31; I11

Table of contents:

1 Introduction

This paper addresses whether private health insurance increases the use of health care services. This is a crucial question both from the perspective of understanding the behavioural responses that lead to the purchase of insurance and the responses that insurance itself induces on health care use, and thus from the perspective of understanding the extent to which insurance is a key contributor to the increasing health care costs observed in many countries.

A number of novel theoretical contributions in economics predict that private health insurance increases the use of covered health care services. The most cited is probably that private health insurance induces moral hazard in the use of health care services for which the demand is price elastic by lowering the price that patients are facing at the point of use, thereby leading to higher utilization levels (Arrow, 1963; Pauly, 1968). In addition to moral hazard, private health insurance may also increase the use of health care through financial risk reductions, i.e. because the desired level of utilization is greater under the financial certainty created by insurance than under uncertainty (de Meza, 1983; Vera-Hernández, 1999), an income transfer effect (Nyman and Maude-Griffin, 2001; Pauly, 1968), and supplier-induced demand (Evans, 1974). These four channels through which private health insurance may increase the use of covered health care services are referred to collectively as the incentive effect of private health insurance in the present study.

Empirically, it is, however, not straight forward to identify the causal effect of private health insurance on the use of health care services, as both the decision to take out private health insurance and the use of health care are determined by a multitude of correlated and often unobserved factors, which may cause insurance status to be endogenous in models of health care use (Cameron et al., 1988). The dominant theoretical explanation for the possible endogeneity of insurance status in models of health care use is one of self-selection. When private health insurance is purchased on a voluntary basis, individuals may select themselves into private health insurance, either adversely based on their risk type (Rothschild and Stiglitz, 1976) or advantageously based on their risk type and preference (de Meza and Webb, 2001; Finkelstein and McGarry, 2006; Hemenway, 1990). In addition to these demand driven issues, supplier driven selection may arise through screening of applicants by the private insurance companies, although this has not received much attention in the literature (Coulson et al., 1995).

The purpose of this paper is to discuss and compare different methods by which we can identify the causal effect of private health insurance on the use of health care services covered by the insurance. Four fundamentally different identification strategies are applied: Joint parametric modelling relying on functional form and an instrumental variable, propensity score matching relying on selection on observables, a standard univariate parametric estimator relying on functional form and selection on observables and finally non-parametric bounds using weaker assumptions. This multi-facetted approach allows us to examine how the estimated effect of insurance varies with different untestable assumptions. The use of non-parametric bounds is a promising, yet rarely applied method that allows further scrutiny of the identifying power from separate sets of assumptions on behaviour, instrument validity, selection, and functional form.

The paper focuses on a particular institutional setting where empirical findings are still limited; namely on voluntary private health insurance that is complementary to a tax-financed health care system with universal access. The empirical analysis is based on a Danish dataset recently collected specifically for the current study. The Danish health care system is particularly suitable for empirical analysis of complementary health insurance due to the dominance of one supplier offering highly standardized insurance plans.

We consider the impact of holding health insurance ‘denmark’ on the main services that it covers: Prescription medicine, dental care, physiotherapy, chiropractic care, and ambulatory care. The effect on general practice is also included to consider the presence of public moral hazard effects. Irrespective of method, we find a positive and significant incentive effect of insurance on the use of dental care, physiotherapy and chiropractor, and an insignificant effect on ambulatory care. For general practice and prescription medicine, results differ across methods. Effects from models relying on selection on observables are similar and smaller than the joint model. It is shown by means of bounding that the exclusion restriction does not have much identifying power, that strong assumptions of selection do not rule out incentive effects and that one set of bounds identifies a positive sign of the average treatment effect of insurance for all outcomes.

The paper proceeds as follows. Section 2 reviews the approaches taken in the empirical literature seeking to identify the effect of private health insurance on the use of health care services and provides some background information about voluntary private health insurance in Denmark. Section 3 describes the data used in the empirical analysis. Section 4 accounts for the econometric methods. The results are reported in section 5 and discussed in section 6. Section 7 concludes.

2 Background

2.1 The empirical literature

There is a large and growing empirical literature seeking to identify the effect of private health insurance on the use of health care services. This section focuses on the identification strategies used in the literature.

The most far-reaching study of the impact of insurance on health care use to date is the RAND Health Insurance Experiment, which randomly assigned approximately 6,000 US citizens to insurance plans with varying levels of cost sharing (Manning et al., 1987).

The greater part of the empirical literature is, however, based on observational data. A few studies have estimated the effect of private health insurance on the use of health care services using various count data models, treating insurance as exogenous i.e. relying on selection on observables, using extensive sets of control variables to mitigate potential selection bias (Christiansen et al., 2002; Pedersen, 2005; Stabile, 2001). Along a similar line, Barros et al. (2008) argued that selection on observables is plausible in the context of private health insurance given exclusively to civil servants and their dependents in Portugal and applied a matching estimator.

In the larger share of the literature, the potential endogeneity of private health insurance status is taken into account by using various bivariate modelling strategies, including joint estimation of insurance and health care use (Buchmueller et al., 2004; Schokkaert et al., 2010) and various two-stage estimation procedures (Cameron et al., 1988; Coulson et al., 1995; Harmon and Nolan, 2001; Höfter, 2006; Holly et al., 1998; Riphahn et al., 2003; Savage and Wright, 2003; Schellhorn, 2001; Vera-Hernández, 1999). Jones et al. (2006) identified the effect of private health insurance using both joint estimation of insurance status and health care use, and binary probit and matching estimators assuming exogeneity of insurance. The functional forms applied in the various models of health care use are generally determined by the nature of the dependent variable as well as computational convenience rather than explicit theoretical considerations.

When the model of insurance choice is non-linear, the various bivariate models of insurance choice and health care use are in principal identified by functional form due to non-linearity in the structure of the error terms. It is, however, preferable (and required in the linear case) to find an instrumental variable, i.e. one or more variables affecting the probability of having private health insurance (the relevance condition) but not the use of health care services (the exclusion restriction) from the utilization equation for more robust identification. In the following, the instruments for health insurance used in the empirical literature to date are summarised and discussed.

Holly et al. (1998) used age squared and body mass index squared as instrumental variables without providing any explicit justification for their validity. Schellhorn (2001) used differences between Swiss cantons regarding the availability of private health insurance and premium levels for identification. A number of studies used different socioeconomic characteristics as instrumental variables. Buchmueller et al. (2004) excluded an indicator of public sector employment from the utilization equation. This restriction was argued to be theoretically valid given that all public employees are offered private health insurance contracts and most of them take up these contracts, while public sector employment is not expected to impact neither health status nor the use of care. Höfter (2006) used dummies for being self-employed, in a permanent job, and a measure of risk as instrumental variables for insurance.[1] Vera-Hernández (1999) used measures of social class, occupation, and some interaction terms as instrumental variables for insurance. Harmon and Nolan (2001) used education as instrumental variable. Finally, Jones et al. (2006) used lagged information on whether individuals had access to employer-provided free or subsidized health care or insurance as instrumental variable for privately paid insurance.

The majority of the studies did not provide any explicit theoretical justification for the untestable exclusion restrictions; thereby emphasizing the point made by Barros et al. (2008) that theoretically valid instrumental variables are hard to find when seeking to identify the effect of private health insurance on health care use. We find it fair to say that there is reason to be skeptical towards the validity of socioeconomic variables as instrumental variables for insurance in health care use models. Numerous studies have found that such variables are intimately related to health care use (e.g. Doorslaer et al. (2004) and Fletcher and Frisvold (2009)). Similar concerns could be made about prior access to health care or other insurance types as instrumental variables.

Another branch of the literature relied on different natural experiments, which could provide plausible exogenous variation in insurance status without theoretical justification. Chiappori et al. (1998) identified the effect of private health insurance on the use of health care services using exogenous variation in coverage stemming from a policy change which implied that one subgroup was exposed to a 10 percent copayment-rate for physician services while no change occurred for another subgroup. Along a similar line, Ruthledge (2009) used variation in health plan offers across employers in the US to separate the effects of moral hazard and adverse selection. Anderson et al. (2011) exploited a sharp change in insurance coverage rates in the US that occurs when young adults age out of their parents' insurance plans and used a regression discontinuity design to estimate the effect of private health insurance coverage. Kaestner and Khan (2010) estimated the effect of ageing into prescription drug coverage under Medicare Part D on the use of prescription medicine and health care services using difference-in-difference regression.

Finally, Gerfin and Schellhorn (2006) estimated non-parametric bounds around the effect of different levels of deductibles in the basic health insurance in Switzerland on the use of health care under various assumptions. They relied on bounds developed by Manski and Pepper (2000) that presumed a priori knowledge of the sign of the treatment effect combined with exclusion restrictions.

2.2 The Danish health care system

The Danish health care system is a comprehensive tax-financed system with universal access. General practitioner and specialist care, out-patient ambulatory care as well as hospitalisations are free at the point

[1] The measure of risk was defined by an interaction between the number of individuals depending on the head of the household and a continuous score based on age-sex factors provided by one of the largest insurers in the market.

of use for all citizens. General practitioners act as gatekeepers in the sense that in most cases a referral from a general practitioner is needed to be able to access more specialised treatment.

There is substantial private copayment for adult dental care, prescription medicine, glasses and contact lenses, physical therapy, chiropractic care, and psychological counselling (Strandberg-Larsen et al., 2007). Private copayment accounted for about 14 percent of the total health expenditures in 2009 (OECD, 2010). The presence of co-payment provides a basis of existence for private health insurance. The percentage of the Danish population with voluntary private health insurance in addition to the coverage provided by the tax-financed health care system has increased steadily during recent decades. In 2009, more than two millions Danes (approximately 42 percent of the adult population) were covered by private health insurance through the non-profit mutual insurance company ‘denmark’ (Health Insurance denmark, 2009).

The insurance contracts supplied by ‘denmark’ are highly standardised. Their primary purpose is to provide partial coverage of the private copayment for treatments which are partly financed by and delivered within the public health care system. Hence, this type of private health insurance may be classified as primarily complementary in relation to the tax-financed health care system (OECD, 2004; Colombo and Tapay, 2004). In addition to copayments, approximately 25 percent of the members of ‘denmark’ are also partly reimbursed for elective surgery at private hospitals (according to internal material from ‘denmark’). The coverage provided by ‘denmark’ leaves a small copayment to be paid out-of-pocket in order to counter moral hazard.

For some types of health care services, such as prescription medicine, physical therapy, and elective surgery, patients must obtain a prescription or a referral from their general practitioner in order to qualify for the public subsidy and reimbursement by ‘denmark’, while they have direct access to other services, such as dental care, chiropractic care, optician services, and glasses or contact lenses (Strandberg-Larsen et al., 2007).

In order to be eligible for membership of ‘denmark’, applicants must be less than 60 years old at the time of enrolment in ‘denmark’, in good health (i.e. have no chronic conditions), and not having used any medication or obtained treatment from physical therapists, chiropractors or other health care providers during the 12 months prior to enrolment (Health Insurance denmark, 2010a). However, once a member it is possible to stay insured as long as one may wish, and importantly, premiums are not risk rated. Children are covered for free through the parental membership until the age of 16.

There are four groups of membership, which differ in terms of coverage levels and premiums (see Health Insurance denmark (2010b) for a brief description). One of the groups provides something that may be termed passive coverage in the sense that it does not provide any direct benefits, but allows individuals to switch to one of the other groups at a later point in time without having to re-qualify for membership. In addition to the member groups, there are some options for additional coverage. Depending on the chosen level of coverage, the annual premium for a membership of ‘denmark’ (excluding the passive membership group) is approximately DKK 1300-3700/USD 240-700.[2]

Private health insurance can also be purchased through other insurance companies than ‘denmark’ or obtained through the workplace. In 2009, approximately 6 percent of the adult population held a private insurance other than ‘denmark’ and 28 percent held an insurance contract obtained through the workplace of themselves or their partner (according to the data used in this paper). These types of insurance are supplied by commercial insurance companies, and they primarily cover elective surgery at private facilities (Statistics Denmark, 2010; The Danish Insurance Association, 2010). Hence, the overlap in coverage with that of ‘denmark’ is only partial.

3 Data

The empirical analysis is based on data from a cross-sectional survey of the Danish population aged 18-75. These data contain detailed information on the private health insurance status of each individual, various measures of health care use, and several socioeconomic and health related characteristics. The data were collected in June 2009 using an internet-based questionnaire. The pilot-tested final questionnaire was e-mailed to a sample of 13,246 respondents via YouGov Zapera’s Denmark panel.[3] In total 5,447 respondents answered the questionnaire, corresponding to a response rate of 41 percent. The questionnaire and the data collection process, including analyses of non-response and representativity, are fully documented in Kiil and Pedersen (2009).

3.1 Private health insurance (treatment)

Private health insurance status is measured by a dummy variable which equals one for individuals who have taken out voluntary private health insurance through active membership of ‘denmark’ (i.e. individuals in the passive group that has no actual coverage are classified as uninsured) and is zero otherwise. We perform a sensitivity analysis to check whether excluding passive individuals or classifying them as insured changes the results substantially. An intrinsic problem in studies of private health insurance is how to account for different types of insurance coverage and avoid that controls hold some sort of insurance. This problem is usually solved by collapsing all observed insurance types into one group or neglecting the problem. Collapsing substantially different insurance types makes it difficult to look at

[2] Conversion from DKK to USD is undertaken using the March 2011 average exchange rate of 532.75 (Danske Bank, 2011).

[3] YouGov Zapera’s Denmark panel is an actively managed internet-based panel containing 38.600 Danes as of July 2009. The panel meets the Esomar international code on marketing and social research practice. This implies among other things that its members are recruited through a wide selection of channels in order to ensure an appropriate demographic balance, and that panel members must log on with a password when participating in surveys in order to ensure that the intended person completes the survey (YouGov Zapera Ltd., 2009).

the impact of insurance on covered services. In the current study we do the following. Individuals who do not know their insurance status are dropped from the data, reducing the sample size from 5,447 to 5,396. Moreover, the 327 individuals who have purchased private health insurance from a commercial insurance company on an individual basis were also dropped from the data, reducing the sample size to 5,069. The reason for this restriction is that it may be difficult to control appropriately for selection into this type of private health insurance. Finally, individuals with employment-based private health insurance are kept in the sample, as one may argue that self-selection is much more limited for this type of insurance and likely not affected by membership of ‘denmark’. The resulting sample thus includes 5,069 respondents, of whom 48.53 percent are covered by private health insurance through ‘denmark’ (53.03 percent including passive members).

3.2 Health care use (outcomes)

The use of health care services is captured by a set of outcome variables measuring the use of prescription medicine (MED) and contacts to dentists (DEN), physical therapists (PHY), chiropractors (CHI), general practitioners (GP), and ambulatory health care providers (AMB). The outcome variables are defined as dummy variables indicating whether the individual had one or more contacts to the provider in question or used prescription medicine within the previous 12 months. The choice of dummy variables indicating whether any use took place is motivated by the fact that the main choice individuals are facing is whether to see a given health care provider or not, while further visits are, to a large extent, out of their control (Barros et al., 2008; Gerfin and Schellhorn, 2006). Moreover, a dummy variable captures the majority of the variation in outcomes due to a large number of zeros and ones in the number of contacts.

Prescription medicine and dental care are interesting outcomes because approximately three quarters of the total gross compensations paid out by ‘denmark’ covers copayments for these two health care services (Health Insurance denmark, 2009). Likewise, physical therapy and chiropractic care are considered because substantial shares of the financing for these health care services are raised by copayments, which are partly reimbursed by ‘denmark’. Ambulatory care is included due to the fact that approximately 25 percent of the members of ‘denmark’ are partly reimbursed for elective surgery at private hospitals. Hence, the use of prescription medicine, dental care, physical therapy, chiropractic care, and ambulatory care is expected to be positively affected by having private health insurance through ‘denmark’ due to what is termed the incentive effect of private health insurance in this study. However, institutional barriers such as the use of gatekeepers and restrictions in the coverage provided by ‘denmark’ may moderate the positive effect. The use of general practice is free of charge within the tax-financed health care system and thus not covered by ‘denmark’. However, given that ‘denmark’ requires a referral from a general practitioner in order to cover e.g. physical therapy, medication, and elective surgery, it is possible that the presence of private health insurance may increase use of general practice indirectly. This indirect effect of private health insurance is commonly referred to as ’public moral hazard’ (Stabile, 2001; Folland et al., 2007). General practice therefore serves as an interesting benchmark case.

Table 1 shows some descriptive statistics for the outcome measures of health care use for the total sample and separately by insurance status.

Table 1 Contacts with selected health care providers within the previous 12 months by insurance status

	Total sample	Members of 'denmark' (excl. passive)	Non-members of 'denmark'	Two-sided test for equality z-value
Any use/contacts				
MED (%)	46.91	50.09	43.85	4.134***
DEN (%)	82.00	87.92	76.33	9.966***
PHY (%)	18.18	20.04	16.40	3.116***
CHI (%)	11.35	13.67	9.12	4.737***
GP (%)	81.96	83.90	80.10	3.259***
AMB (%)	28.15	29.78	26.59	2.335
Number of obs.	4,362 (100.00%)	2,136 (48.97%)	2,226 (51.03%)	

* significance at 10 percent level; ** significance at 5 percent level; *** significance at 1 percent level.

It is seen from Table 1 that the percentage with one or more contacts to the providers in question within the previous 12 months is higher for the members of 'denmark' than for non-members for all types of health care services considered. The difference is statistically significant for contacts to dentists, physiotherapists, chiropractors, and general practitioners, but not for ambulatory contacts and the use of prescription medicine.

3.3 Covariates and instrumental variable

Next, we follow economic theory and the empirical literature in selecting a set of potential covariates from the information available in the data. The covariates should influence both the probability of having private health insurance and the use of health care services, subject to the condition that they must not be affected by having private health insurance coverage or the anticipation of getting it.

The set of potential covariates includes the basic sociodemographic variables age, gender, household income and composition, highest level of education completed, occupational status, and whether the individual has employment-based private health insurance coverage. The theoretical importance of the various sociodemographic characteristics is motivated by the human capital approach as developed by Grossman (1972). In the Grossman-model, the demand for health care is derived from the demand for health. Assuming that the costs of producing health as well as the benefits from being healthy differ with among other things age, gender, education level, and occupational status, it is clear that these characteristics will also affect the demand for health care services and private health insurance coverage. Household income and composition are intended to measure the consumption possibility set, which is expected to affect the demand for private health insurance directly as well as through the ability to self-insure. Moreover, given that children are covered for free through the parental membership, having children is expected to increase the probability of insurance coverage, and it may affect health care use through increased attention and motivation towards sickness prevention. Employment-based private health insurance coverage is included in the set of covariates due to the possibility that individuals with this type of insurance are less likely to enrol in ‘denmark’, due to an overlap in the coverage provided by the two types of private health insurance. In addition, it is possible that employment-based private health insurance coverage increases the use of covered health care services. We also include a simple measure of risk preferences in the set of covariates, given that risk preferences have been shown by economic theory to affect the demand for private health insurance (Cutler and Zeckhauser, 2000) as well as the use of health care services (Nocetti and Smith, 2010). Risk preferences are measured as self-reported attitude to economic risk on a scale from zero to ten, where zero indicates that you prefer to avoid economic risk and ten indicates that you gladly take an economic risk.[4] Similar measures of risk preferences have been used by among others Costa and Garcia (2003) and Dohmen et al. (2011). Along a similar line, variables indicating the presence of eight chronic conditions, self-assessed dental health, and whether the individual smokes daily, drinks more than the official recommendations, and is physically active at least 30 minutes 6-7 days per week are included in the set of potential covariates. These variables are intended to proxy the need for health care, which is theoretically thought to be an important determinant of both the use of health care services and the demand for private health insurance. The choice of covariates is not a simple task, and some judgement is necessary. We discuss the trade-offs to be made and present results for different sets of covariates in the results section.

Finally, some of the identification strategies which will be outlined in the following section require an instrument, i.e. the presence of one or more variables which are mean independent of health care use but affect health insurance status. We use a dummy variable for whether individuals wear glasses or contact lenses as instrumental variable. The relevance criterion for this instrumental variable is likely to be fulfilled as there are no restrictions with respect to the use of glasses or contact lenses upon enrolment in ‘denmark’. Yet, all insurance groups cover part of the expenditures for glasses and contact lenses. A membership of ‘denmark’ thus constitutes a price reduction for foreseeable and permanently returning expenditures without increasing the insurance premium at the individual level.[5] We argue that the exclusion restriction is likely to be fulfilled as well based on the reasoning that after conditioning of the set

[4] The dataset also contains a measure of self-reported attitude to health and risk, where zero indicates that you focus on having a healthy and safe behaviour and prefer to avoid risk and ten indicates that you do not worry about health risk. This variable is not included in the main specification. It is, however, checked whether including health risk as a covariate would change the results substantially.

[5] All insurance plans cover a maximum of DKK 360/USD 68 for single focal glasses or sunglasses, DKK 680/USD 128 for multifocal glasses, and DKK 38/USD 7 per month for contact lenses (Health Insurance denmark, 2010).

of covariates of age, gender, health, attitude towards risk, and socioeconomic characteristics, we see little reason to believe that the use of health care should depend on whether individuals wear glasses or lenses.

Table 2 shows descriptive statistics for the full set of covariates and the exclusion restriction for the total sample and separately by insurance status. Respondents who answered ‘don’t know’ or ‘other’ than the categories specified in the questionnaire on one or more of the covariates are dropped from the data, reducing the sample size further from 5,069 to 4,362. The main motivation for this restriction is that it is questionable whether the individuals in the ‘don’t know’ and ‘other’ groups have anything in common. For household income, which is plagued by a particularly large number of missing values, a dummy variable that equals one whenever respondents do not wish to disclose their income and zero otherwise is defined. The sample to be used in the econometric analyses thus includes 4,362 respondents, of whom 48.97 percent are covered by private health insurance through ‘denmark’.

Table 2 Distribution of covariates and instrumental variable by insurance status

	Total sample	**Members of ‘denmark’ (excl. passive)**	**Non-members of ‘denmark’**	**Two-sided test for equality z-value**
Age (ave.)	47.67	50.42	45.04	12.417***
Gender (%)				
Male	49.11	45.22	52.83	-5.023***
Female	50.89	54.78	47.17	
Household income in 1,000s (%)				
DKK 0-400/USD 0-75	32.78	29.21	36.21	-4.920***
DKK 400-800/USD 75-150	41.06	42.88	39.31	2.400**
DKK 800+/USD 150+	16.51	17.65	15.41	1.993**
Do not wish to disclose	9.65	10.25	9.07	1.317
# of adults in household (ave.)	1.89	1.91	1.87	1.231
# of children in household (ave.)	0.44	0.40	0.47	-2.678***
Education level (%)				
Basic school	9.58	7.35	11.73	-4.907***
High school	10.80	8.05	13.43	-5.723***
Vocational education	25.72	26.73	24.75	1.495
Higher education	53.90	57.87	50.09	5.150***
Occupational status (%)				
White-collar worker	49.11	51.45	46.86	3.035***
Skilled worker	4.52	4.54	4.49	0.078
Unskilled worker	4.86	3.89	5.80	-2.932***
Self-employed or ass. spouse	5.18	5.20	5.17	0.045
Unemployed	3.94	2.81	5.03	-3.770***
Student	7.59	5.52	9.57	-5.042***
Pensioner	23.75	25.98	21.61	3.394***
Long-term sick	1.05	0.61	1.48	-2.824***
Attitude to economic risk (%)				
Prefers to avoid risk (scale 0-4)	63.11	64.09	62.17	1.312
Neutral (scale 5)	19.65	19.52	19.77	-0.203

Likes to take a risk (scale 6-10)	17.24	16.39	18.06	-1.463
Employment-based private health insurance (%)				
Yes	29.73	30.48	29.02	1.052
No	70.27	69.52	70.98	
Chronic conditions (%)				
Asthma	7.02	5.81	8.18	-3.065***
Allergies	24.12	23.50	24.71	-0.931
Diabetes	5.89	6.04	5.75	0.405
Hypertension	17.65	19.29	16.08	2.776***
Emphysema	3.32	2.90	3.73	-1.521
Arthritis	19.56	21.68	17.52	3.459***
Osteoporosis	2.18	2.76	1.62	2.590***
Tinnitus	9.79	10.07	9.52	0.602
Self-assessed dental health (%)				
Very good	18.59	16.01	21.07	-4.292***
Rather good	40.35	41.99	38.77	2.171**
Neither good nor poor	28.31	30.38	26.33	2.974***
Rather or very poor	12.75	11.61	13.84	-2.204**
Daily smoker (%)				
Yes	23.66	20.18	27.00	-5.299***
No	76.34	79.82	73.00	
Drinks more than recommended (%)				
Yes	8.71	9.55	7.91	1.925*
No	91.29	90.45	92.09	
Physical active 6-7 days per week (%)				
Yes	19.19	17.98	20.35	-1.990**
No	80.81	82.02	79.65	
Glasses or contact lenses (%)				
Yes	72.08	79.40	65.05	10.562***
No	27.92	20.60	34.95	
Number of obs.	4,362 (100.00%)	2,136 (48.97%)	2,226 (51.03%)	

* significance at 10 percent level; ** significance at 5 percent level; *** significance at 1 percent level.

It is seen from Table 2 that the individuals with voluntary private health insurance through ‘denmark’ differ significantly from the non-members on the majority of the covariates included. In particular, the percentage of glasses or contact lens users is considerably higher for the members of ‘denmark’ than for non-members, i.e. the exclusion restriction is relevant.

4 Identification and estimation strategies

The identification problem is presented using the counterfactual notation of among others Rubin (1974). Let $D_i \in \{0,1\}$ denote a binary indicator of received treatment, Y_i^1 and Y_i^0 denote the potential outcomes of interest for the treated and controls, respectively, and X_i denote a vector of covariates for individual *i*. The subscript *i* is dropped in the following in order to simplify the notation.

A common parameter of interest is the average treatment effect (ATE) on all individuals in the population, which is given by:

$$\tau_{ATE} = E\left[Y^1 - Y^0\right] \tag{1}$$

where *E* is the population mean operator. This is the relevant parameter when the treatment has universal applicability and it is reasonable to consider the hypothetical effect of treatment for a randomly selected member of the study population, as is the case in the present study (Heckman, 1997). The fundamental identification problem arises because no individual is observed in both states at once. This means that using the simple difference in sample averages of treated and non-treated provides a biased estimate of the ATE, because of both a pre-treatment bias (e.g. because those who select treatment are in more need prior to treatment) and a post-treatment bias (those who select treatment expect a certain outcome):

$$E\left[Y \middle| D=1\right] - E\left[Y \middle| D=0\right]$$

$$= E\left[Y^1 - Y^0\right] + P\left\{E\left[Y^0 \middle| D=1\right] - E\left[Y^0 \middle| D=0\right]\right\} + (1-P)\left\{E\left[Y^1 \middle| D=1\right] - E\left[Y^1 \middle| D=0\right]\right\} \tag{2}$$

$$= ATE + P\{\text{pre} - \text{treatment bias}\} + (1-P)\{\text{post} - \text{treatment bias}\}$$

where *P* is the probability of receiving treatment. We also see from this that when estimating the ATE both counterfactual outcomes, $E\left[Y^1 \middle| D=0\right]$ and $E\left[Y^0 \middle| D=1\right]$, have to be constructed. In the following we will present four identification strategies to obtain knowledge on the size and sign of the ATE. These are a univariate parametric model, a joint parametric model of outcome and treatment with an exclusion restriction, propensity score matching and non-parametric bounds. Interestingly, the latter includes bounds based solely on the exclusion restriction, bounds based on a hypothesis of adverse selection, and bounds based on monotonicity restrictions which are implicit in the joint parametric model.

4.1 Univariate parametric model

The standard univariate estimator for the analysis of dummy outcomes is a parametric model; here we use a probit model. Given observed covariates *X*, it is useful for later comparison of identifying assumptions to write the model in terms of a latent variable specification:

$$Y = 1(\beta_1 X + \gamma D - U > 0), \quad U \sim N(0,1) \tag{3}$$

where *U* is an unobserved latent variable which is standard normally distributed, β_1 is a vector of coefficients for the covariates *X*, and γ is the coefficient for the treatment *D*. Consistent estimation of the unknown parameters β_1 and γ can be obtained by the method of maximum-likelihood. Identification and consistent estimates hinges upon both functional form restrictions (correct mean specification) and exogeneity of *D* and *X*, that is, selection on observables:

$$E(U|D,X)=0 \tag{4}$$

4.2 Joint parametric model

A natural generalization of the univariate parametric model that relaxes the assumption that *D* is exogenous in (4) is to apply a joint parametric model of received treatment *D* and outcome *Y* that allows for correlation between unobservables. This is naturally specified using the bivariate probit model:[6]

$$\begin{aligned} &Y = 1(\beta_1 X + \gamma D - U > 0), D = 1(\beta_2 X + \pi Z - V > 0), \\ &(U,V) \sim N\left(\begin{pmatrix}0\\0\end{pmatrix},\begin{pmatrix}1 & \rho\\ \rho & 1\end{pmatrix}\right) \end{aligned} \tag{5}$$

where *V* is a new unobserved latent variable, and *U* and *V* follow a bivariate standard normal distribution with correlation coefficient *ρ*. Assuming that the model is correctly specified, $\rho \neq 0$ implies that *D* is endogenous with respect to *Y*. Identification of the effect of *D* on *Y* is obtained by the non-linearity of the bivariate normal distribution (Wilde, 2000). An additional source of identification can be utilized if an instrumental variable, *Z*, which affects *D* but not *Y* directly, is available. The latter is an additional exogeneity restriction, also referred to as the exclusion restriction:

$$E(Y|D,X,Z)=E(Y|D,X) \tag{6}$$

Note that even without the instrument this model relaxes the exogeneity assumption of *D* in the univariate model at the cost of other assumptions, namely the specification of the process that determines *D* and the exogeneity assumption:

$$E(V|Z,X)=0 \tag{7}$$

4.3 Propensity score matching

Matching estimators relaxe the other key assumption of the univariate parametric model, namely the functional form assumptions in the mean specification. Matching estimators preserve the exogeneity assumptions of both *D* and *X*, however, sometimes stated as the stronger conditional independence assumption. Heckman et al. (1998b) and others have shown that mean independence of potential outcomes and treatment given *X* suffice to identify the ATE:

[6] A related estimator is the two-stage least squares estimator, but due to the discrete nature of both treatment and outcomes, this will at best be an approximation.

$$E\left[Y^0 \middle| D=1, X\right] = E\left[Y^0 \middle| D=0, X\right] = E\left[Y^0 \middle| X\right]$$
$$E\left[Y^1 \middle| D=1, X\right] = E\left[Y^1 \middle| D=0, X\right] = E\left[Y^1 \middle| X\right] \tag{8}$$

These assumptions are similar but weaker than the exogeneity assumption utilized in the parametric models. The method on matching emphasizes the overlap condition specified in (9) in order to ensure that for each value of *x* there are both treated and untreated cases.

$$0 < P\left(D = 1 \middle| X = x\right) < 1 \tag{9}$$

This is circumvented in fully parametric models by extrapolating through functional form assumptions when needed.

If the covariate vector has a high dimension or if there are continuous variables among the covariates, it is practical to condition on the propensity score as opposed to the full dimensional *X*. The propensity score is the conditional probability of receiving treatment given *X*. For a known score, conditioning on *X* is equivalent to conditioning on *P(X)* (Rosenbaum and Rubin, 1983). For an estimated score, one needs to check covariate balance:

$$D \perp X \middle| \hat{P}(X) \tag{10}$$

Propensity score matching estimates the treatment effect for each treated individual by contrasting its outcome with a weighted average of the controls that are chosen as matches based on the propensity score. In this study treated and controls are matched using the five-to-one nearest neighbour (NN) matching algorithm with replacement, which matches each treated individual with its five nearest neighbours in terms of the propensity score.

4.4 Non-parametric bounds

Both parametric models and matching rely on untestable assumptions to obtain point estimates of the ATE. Manski (1989) shows that without any assumptions on the data generating processes of outcome and treatment, the ATE for a dummy outcome is bounded. These “worst-case” bounds always contain zero and have width one, and are therefore not very informative. A number of more narrow bounds have been derived, some of which are based on assumptions used in the methods described above, while others are based on assumptions on individual behaviour or selection processes. We use bounds based on assumptions that we find relevant for the current purpose. In the following we present these assumptions, while the bounds are presented in Appendix A.

1) Roy model (Roy)

Manski (1990) bounded the ATE under the assumption: $D = 1\left(Y^1 \geq Y^0\right)$. This states that treatment is selected by those who will have a higher outcome if treated. Manski called it “more is better”, but it can be viewed as a simplified version of a Roy selection model (Roy, 1951). We therefore refer to it as the Roy model assumption. The model rules out individuals for whom $D=1$ and $Y^0 \geq Y^1$ and individuals for whom $D=0$ and $Y^1 \geq Y^0$. In the current context, the latter may arise if individuals are unaware of the benefits of insurance or e.g. because insurance is too costly.

2) Monotone treatment selection (MTS)

The monotone treatment selection assumption was first considered by Manski and Pepper (2000). The assumption is stated as:

$$E\left[Y^j \middle| D=1\right] \geq E\left[Y^j \middle| D=0\right] \quad , \ j=0,1 \tag{11}$$

That is, mean outcomes are weakly increasing with treatment status (the bounds are different if we assume a decreasing relationship, but we view an increasing relationship as being the far most likely in our case). This is a statement about selection, i.e. those who are observed treated would on average have a higher outcome both as treated and as non-treated compared to those who are observed non-treated. Note that in contrast to the Roy model, nothing is assumed about how treatment is selected. Neither is anything assumed on individual treatment effects, so it allows for individuals who are not treated but have a positive treatment effect.

3) Exclusion restriction (EX)

This is the untestable assumption of an instrumental variable. An exclusion restriction is available if one identifies a variable, *Z*, which is mean independent of *Y*:

$$E\left[Y^j \middle| Z=z\right] = E\left[Y^j\right] \quad , \ j=0,1 \tag{12}$$

Note that for simplicity we consider the assumption without other covariates. This of course makes it a stronger assumption. Manski (1990) derived sharp bounds under EX, which he labelled a “level set restriction”.

4) Monotone instrumental variable (MIV)

Manski and Pepper (2000) consider the monotone instrumental variable restriction:

$$E\left[Y^j \middle| Z=z_2\right] \geq E\left[Y^j \middle| Z=z_1\right], \quad z_2 \geq z_1 \tag{13}$$

This is weaker than the exclusion restriction because it allows for selection on the variable *Z* (in which case it is not a valid instrument), but in a known direction.

5) Monotonicity in treatment and outcome with an exclusion restriction (MO+EX)

The monotonicity assumption of treatment and outcome assignment is:

$$D_1 \geq D_0 \text{ or } D_0 \geq D_1 \ \text{ and } \ Y_1 \geq Y_0 \text{ or } Y_0 \geq Y_1 \tag{14}$$

When applied only to the treatment, this is the monotonicity assumption of Imbens and Angrist (1994), which is needed e.g. when interpreting two-stage least squares as an estimate of a local average treatment effect. Note that it is not assumed which way the monotonicity goes. Vytlacil (2002) showed that when the instrument, *Z*, is independent of potential outcomes of both *Y* and *D*, this is identical to the latent variable models:

$$
\begin{aligned}
Y &= 1(Y^* > 0) = 1(F(D, X) - U > 0) \\
D &= 1(D^* > 0) = 1(S(X, Z) - V > 0)
\end{aligned}
\qquad (15)
$$

which is both a generalization of the Roy model (with $D^* = Y_1 - Y_0$) and of the probit models (with indices $F(D, X)$ and $S(X, Z)$ being linear and *U* and *V* being normal distributed). Sharp bounds are provided by Shaikh and Vytlacil (2010).

5 Results

This section presents selected results for the various estimation strategies. All estimations were carried out in Stata/IC 11.[7]

5.1 Choice of covariate set

When choosing the covariates to control for, one face the problem that the controls themselves might be endogenous, i.e. correlated with unobservables or affected by outcomes or treatment. For this reason the ATEs are reported for different combinations of the set of potential covariates introduced in section 3.

One possible strategy is to condition only on a basic set of covariates including gender, age, and age squared (covariate set 1). These variables are for sure not affected by health care use or whether individuals have private health insurance coverage or anticipate getting it. Hence, we avoid including potentially endogenous variables, which could induce bias.

Another possible strategy is to condition on a more comprehensive set of covariates, that may reasonably be argued to be unaffected by insurance status. This includes household income and composition, education level, occupational status, employment-based private health insurance status, and risk preferences in addition to gender, age, and age squared (covariate set 2). A potential source of bias is that some of the variables could be endogenous with respect to the use of health care services. In particular, income and occupational status may be affected by health care use either because substantial health care

[7] The built-in commands 'probit' and 'biprobit' were used to estimate the standard and joint parametric models, and the propensity score matching estimator was implemented using version 3.1.5 of the 'psmatch2' module written by Leuven and Sianesi (2003). The non-parametric bounds and the ATEs and standard errors for the remaining estimators were computed manually in Stata.

use is time consuming or because the condition for which treatment is received or the treatment itself reduces work capacity. It may also be argued that common unobserved factors (health endowments) affect both e.g. educational attainment and later health care use.

A third option is to condition on all factors that we can a priori think of would affect health care use that at are also likely to be related to insurance status. Following this line of thought we include measures of the presence of eight chronic conditions, self-assessed dental health, and smoking, drinking, and exercising habits in addition to the variables included in covariate set 2 (covariate set 3). On the one hand, the strategy of conditioning on the widest set of relevant covariates available in the data increases the chance that the assumption of selection on observables is satisfied. On the other hand, measures of perceived health and other subjective health measures may, as for some of the variables in covariate set 2, be argued to be endogenous with respect to the use of health care services. Further, while health variables are obvious candidates as sources of selection, they are also likely affected by current or previous private health insurance coverage and could mask possibly important effects of insurance coverage.

It is our view that covariate set 1 is preferred when allowing for selection on unobservables and identification is obtained from a valid exclusion restriction (in the joint model), while covariate sets 2 or 3 are preferred when relying on selection on observables (in the univariate model and with matching). It is not clear which of the two sets are preferred as covariate set 2 may not control for all channels of selection, while covariate set 3 may include bad controls, and thus mask part of the causal effect, thereby undermining the interpretability of the results (Heckman et al., 1999).

5.2 Average treatment effects

Table 3 shows the ATEs of voluntary private health insurance on the use of selected health care services obtained by the univariate and joint parametric models, and propensity score matching. The standard errors of the ATEs are bootstrapped with 500 replications for all estimators.[8] The full results underlying Table 3 are reported in Appendix B.

Overall, it is seen from Table 3 that the effect of private health insurance differs considerably across health care services as well as estimation strategies, while the set of covariates matters less. Considering first the results of the univariate parametric model, which relies on selection on observables and correct functional form, it is found that voluntary private health insurance increases the probability of using dental care, physiotherapy, chiropractic care, and for some covariate sets also general practice with 10, 3, 9, and 2

[8] While bootstrapping is widely applied in the literature, there is noted to be little formal evidence to justify the method for matching estimators (Caliendo and Kopeinig, 2005). Therefore, we also computed analytical standard errors for the matching estimates using the 'nnmatch' module written by Abadie et al. (2004). The analytical standard errors (which do not include variance due to estimation of the propensity score and imputation of common support) do not to differ notably from the bootstrapped ones and are therefore not reported in Table 3.

percentage points, respectively. The use of prescription medicine and ambulatory care is not significantly affected by insurance coverage.

Table 3 Average treatment effect (ATE) of voluntary private health insurance on the probability of having had one or more contacts within the previous 12 months

(n = 4,362)	MED	DEN	PHY	CHI	GP	AMB
	ATE (std. err.)	**ATE (std. err.)**	**ATE (std. err.)**	**ATE (std. err.)**	**ATE (std. err.)**	**ATE (std. err.)**
Univariate parametric model						
Covariate set 1	-0.021 (0.013)	0.110*** (0.011)	0.033*** (0.012)	0.094*** (0.009)	0.016 (0.012)	0.004 (0.014)
Covariate set 2	0.010 (0.015)	0.096*** (0.012)	0.033*** (0.012)	0.086*** (0.010)	0.022* (0.012)	0.020 (0.014)
Covariate set 3	0.017 (0.011)	0.093*** (0.012)	0.029** (0.012)	0.086*** (0.010)	0.025** (0.012)	0.021 (0.014)
Joint parametric model						
Covariate set 1	0.226** (0.093)	0.253*** (0.052)	0.349** (0.143)	0.306*** (0.091)	0.139 (0.215)	0.066 (0.106)
Covariate set 2	0.276*** (0.099)	0.208*** (0.064)	0.301* (0.179)	0.272*** (0.089)	0.189 (0.151)	0.086 (0.119)
Covariate set 3	0.274*** (0.066)	0.153*** (0.056)	0.281 (0.175)	0.280** (0.113)	0.189 (0.227)	0.086 (0.152)
Prop. score matching						
Covariate set 1	-0.021 (0.014)	0.096*** (0.011)	0.020* (0.012)	0.043*** (0.009)	0.013 (0.012)	0.003 (0.014)
Covariate set 2	0.011 (0.016)	0.083*** (0.013)	0.026** (0.013)	0.035*** (0.011)	0.028** (0.014)	0.024 (0.016)
Covariate set 3	0.017 (0.014)	0.074*** (0.013)	0.020 (0.013)	0.043*** (0.011)	0.026* (0.013)	0.019 (0.016)

* significance at 10 percent level; ** significance at 5 percent level; *** significance at 1 percent level. Standard errors for the ATEs are bootstrapped with 500 replications (the standard errors for the bivariate probit model of general practice, specifications 2 and 3, are bootstrapped with 50 replications due to severe problems with convergence).

Covariate set 1 refers to the specification including gender, age, and age squared.

Covariate set 2 refers to the specification including gender, age, age squared, household income and composition, education level, occupational status, employment-based private health insurance status, and risk preferences.

Covariate set 3 refers to the specification including gender, age, age squared, household income and composition, education level, occupational status, employment-based private health insurance status, risk preferences, chronic conditions, dental health, daily smoker, drinks more than recommended, and physical activity.

Once selection on unobservable characteristics is taken into account in the joint parametric model, the estimated ATEs are seen to increase; provided a valid instrumental variable. The magnitude of the increase ranges from a factor of two for dental care to a factor of 28 for prescription medicine. Moreover, the relative magnitude of the effects of private health insurance differs compared to the univariate parametric model. The dispersion in the effects across different types of health care services is reduced so that the ATEs are all around 20-30 percentage points for prescription medicine, dental care, physiotherapy, and chiropractic care. Considering changes in statistical significance, the estimated effects on the use of prescription medicine become significant, while the estimates for the use of general practice are largely insignificant.

Assuming that the instrumental variable is valid, the joint parametric model allows us to test whether individuals select themselves into insurance based on unobservables, i.e. whether insurance status is endogenous, by assessing the significance of the correlation coefficient, ρ. Likelihood-ratio tests of the null hypothesis that $\rho = 0$ reject the hypothesis of no selection on unobservables in the models of prescription medicine, physiotherapy, and chiropractic care, whereas the hypothesis cannot be rejected for general practice, ambulatory care, and dental care. Correlation coefficients and likelihood-ratio tests are reported in Appendix B. In addition, it is seen from the full results reported in Appendix B that the instrumental variable, wearing glasses or contact lenses, is relevant in the sense of having a large positive impact on the probability of being insured.

Relaxing the assumptions about functional form and instrumental variables and reinstating the assumption of selection on observables, the ATEs obtained by propensity score matching are seen to be very similar in magnitude to those obtained by the univariate parametric estimator. Various checks of matching quality reported in Appendix B indicate that matching succeeds in balancing the covariates between the treated and control groups, and that the overlap condition does not pose a problem. Moreover, it was found that using alternative matching algorithms to match treated and controls gave similar results, indicating that our sample is sufficiently large that the choice of matching algorithm does not matter.

Table 4 presents the non-parametric bounds on the ATEs under various assumptions. The bounds in turn relax the assumptions of functional form, selection on observables, and the presence of a valid instrumental variable and impose weaker assumptions.

Table 4 Non-parametric bounds on the average treatment effect (ATE) of voluntary private health insurance on the probability of having had one or more contacts within the previous 12 months

(n = 4,362)	MED		DEN		PHY		CHI		GP		AMB	
	lower	**upper**	**lower**	**upper**	**lower**	**upper**	**lower**	**upper**	**lower**	**upper**	**lower**	**upper**
Assumptions												
Roy	-0.193	0.277	-0.333	0.490	-0.066	0.117	-0.024	0.090	-0.390	0.430	-0.120	0.162
MTS	-0.468	0.062	-0.449	0.116	-0.475	0.036	-0.469	0.046	-0.488	0.038	-0.480	0.032
EX	-0.319	0.503	-0.393	0.429	-0.356	0.466	-0.352	0.470	-0.421	0.400	-0.352	0.470
MIV	-0.475	0.503	-0.474	0.429	-0.482	0.466	-0.479	0.470	-0.495	0.400	-0.485	0.470
MO+EX	0.240	0.573	0.095	0.486	0.056	0.487	0.034	0.488	0.062	0.437	0.082	0.501

The worst-case bounds have been estimated but are not shown as they are almost symmetric around zero, and thus not informative. We start by imposing two different assumptions of selection. Imposing the assumption of the Roy model, i.e. that individuals are choosing insurance only if they expect to use more health care with insurance, narrows the bounds with a greater mass on the positive side for outcomes, however, without identifying the sign of the ATE. The bounds are most narrow for physiotherapy [-0.07; 0.12] and chiropractic care [-0.02; 0.09], and widest for general practice and dental care use. When applying the MTS assumption, which can be viewed as an assumption of adverse selection, the upper bound shrinks and is close to zero for all outcomes, but the sign of the ATE is still not identified. Imposing the assumption that wearing glasses or lenses fulfils the exclusion restriction (EX bounds), we see that the instrument does not provide much identifying power on its own, as the bounds are all very wide. This is even more pronounced if allowing for the instrument to be endogenous and affect health care use in a positive direction.

It is only when combining monotonicity of both treatment and outcome with the exclusion restriction that we identify the sign of the ATE of insurance on health care use. Under these assumptions, i.e. the bounds of Shaikh and Vytlacil (2010), the ATE of insurance is between 0.24 and 0.57 for prescription medicine, between 0.10 and 0.49 for dental care, between 0.06 and 0.49 for physiotherapy, between 0.03 and 0.49 for chiropractic care, between 0.06 and 0.44 for general practice, and between 0.08 and 0.50 for ambulatory care. These bounds contain the ATEs from the joint parametric model. With the exception of chiropractic care, the estimates obtained by propensity score matching are all below the lower limits of the bounds.

Corresponding results excluding individuals with passive coverage or classifying them as insured are very similar in nature to the results reported in this section (where individuals in the passive group that has no actual coverage are classified as uninsured). These results are available from the authors upon request.

6 Discussion

The approach of comparing four identification strategies that rely on fundamentally different assumptions allows us to examine how the results vary with different sets of assumptions.

For the use of dental care, physiotherapy, and chiropractic care we find evidence of a positive and significant incentive effect of private health insurance, irrespective of the method applied. This is in line with previous Danish studies by Christiansen et al. (2002) and Pedersen (2005). The predominantly positive but largely insignificant estimates of the effect of insurance on the use of ambulatory care may reflect the fact that only one fourth of the members of ‘denmark’ are partly reimbursed for elective surgery at private hospitals as well as the presence of restrictions in the coverage provided by ‘denmark’ for this type of health care.[9] The estimates for general practice and prescription medicine differ in significance across the methods.

Most of the bounds do not identify the sign of the ATE, yet it is our interpretation that something is learned nevertheless. In particular, imposing the strong assumptions of selection according to either the Roy model or MTS does not rule out an incentive effect of private insurance. The MTS assumption is plausible if individuals who take out private health insurance also seek care more actively in case of health problems, and is therefore strongly related to a hypothesis of adverse selection into health insurance.

The correlation coefficients estimated in the joint parametric models indicate that insurance status is exogenous in the models of general practice, ambulatory, and dental care use and endogenous when considering the use of prescription medicine, physiotherapy, and chiropractic care. Hence, the evidence seems to favour the findings of a substantial effect of private health insurance on the use of prescription medicine and a negligible effect on the use of general practice, indicating that public model hazard effects are not dominant among the general practitioners in Denmark. The significant correlation coefficients are large and negative, indicating that the insured have a propensity to use less of these health care services irrespective of insurance status. This has two implications, assuming that the instrumental variable is valid: 1) The MTS assumption is not fulfilled when conditioning on covariates, and 2) the models relying on selection on observables identify lower bounds for the true ATE of insurance on the use of prescription medicine, physiotherapy, and chiropractic care. The finding of a negative correlation coefficient is in line with a hypothesis of advantageous selection into private health insurance (de Meza and Webb, 2001; Finkelstein and McGarry, 2006; Hemenway, 1990). Moreover, the eligibility requirements imposed by ‘denmark’ (i.e. that applicants must be less than 60 years old and in good health at the time of enrolment) may also have contributed to the insured being unobservably healthier than the uninsured.

The estimates of the ATE based on an assumption of selection on observables, i.e. the univariate probit model and propensity score matching, are much lower than the estimates from the joint parametric model. This is a common finding when using instrumental variables and it is in line with the results of Jones et al. (2006) on the effect of private health insurance on specialist visits. The typical explanation for this divergence is either that selection on observables does not hold or that the instrumental variable models identify a local average treatment effect. The latter is the effect for the compliers (Angrist et al., 1996), which in the present case are those who take out private health insurance because they wear glasses or lenses. Given the relatively small reimbursement for glasses or lenses, these individuals may be particularly price sensitive and therefore also respond more to price changes for other health care services.

[9] Private insurance patients in ‘denmark’ must, like everybody else, obtain a referral to elective surgery, typically from their general practitioner, who acts as a gatekeeper in this respect. Moreover, ‘denmark’ is indemnity insurance in the sense that it covers various elective procedures by reimbursing a fixed amount of money, which usually does not cover the full price of the surgery.

In that sense, the ATE estimates produced by the joint parametric model are not directly comparable to those obtained by the univariate parametric model and propensity score matching, and both results may be true.

The bounds also provide evidence about the identifying power of the exclusion restriction. They show that the assumption that wearing glasses or lenses does not affect the use of health care directly does not provide identifying power in itself. This does not invalidate the exclusion restriction, but it tells us that the results from the joint parametric model mainly rely on functional form. This is stressed by the fact that adding the assumptions of monotonicity in treatment and outcomes (implicit in the bivariate probit model) identifies the sign of the ATE to be positive for all outcomes.

Like all studies, there are limitations to this study. Considering first the data, the use of data collected using an internet-based questionnaire constitutes a source of bias if the individuals who can be reached through the internet differ from those without internet access on the characteristics that are subject to investigation. Given that 86 percent of the Danish population had internet access in their homes in 2009 (Statistics Denmark, 2009), and that this study restricts analysis to individuals aged 18-75, the use of an internet-based questionnaire is not expected to be a major issue in this particular study. It is also worth noting that the sample does not deviate notably from the population on essential characteristics, except for individuals with only basic schooling or vocational training being somewhat underrepresented (Kiil and Pedersen, 2009).

More generally, even though different identification strategies are used, and some conclusions have been stressed to hold across all strategies, they may in principle all be wrong. The main identifying assumptions are selection on observables, an exclusion restriction, functional form and monotonicity. In contrast to most of the literature, we made an effort to justify selection on observables as well as the exclusion restriction. Furthermore, the results did not depend on the chosen covariate set nor on the functional form of the outcome equation. Therefore, it is mainly the exclusion restriction and the monotonicity assumptions that may be questioned. The similarity of results from the univariate probit (that implicitly assumes monotonicity in outcomes) and matching provides evidence that monotonicity in outcomes does not affect the results. Monotonicity in treatment implies that if some individuals take out insurance when they wear glasses or lenses, no one must stop using insurance when wearing glasses or lenses. We cannot think of any reason why this should occur. If a large positive effect should be refuted by invalidity of the exclusion restriction, it must hold that individuals wearing glasses or lenses are more prone to use health care. This exact hypothesis was underlying the MIV bounds, and they did not rule out an incentive effect of insurance.

Given that we do not know whether the use of the relevant health care services without voluntary private health insurance is efficient or inefficiently high or low, it is not possible to evaluate how the increase in use induced by private health insurance affects the welfare of society based on the results of this study.

The analyses of the study may be extended in several directions. One suggestion for future research is to consider alternative definitions of health care use, such as the number of contacts within the previous 12 months. While this extension can readily be implemented for propensity score matching and the univariate parametric estimator, modifying the joint parametric model is not straightforward and the number of known bounds on ATEs for unbounded outcomes is also limited. An example is the monotone treatment response together with the monotone treatment selection (Manski & Pepper, 2000), but this impose knowledge of the sign of the treatment effect. An alternative could be to apply the bounds for dummy variables for having a gradually larger use of health care (e.g. 1-3 visits annually, 4-8 visits, etc.). Along a similar line, one may attempt to distinguish the effects of the four member groups within 'denmark' by expanding the analyses to ordered treatments.

7 Concluding remarks

There is an ongoing research agenda within health economics on how to identify the causal effect of voluntary private health insurance on health care use. Given that experimental data are rare, one is usually left with observational data and inherently untestable identifying assumptions. This paper contributes to the literature by examining how the estimated effect of insurance varies with different untestable assumptions and how nonparametric bounds can be used to assess the identifying power of these and other theoretically meaningful assumptions.

Taken together, the evidence of this study tends to favour the conclusion that voluntary private health insurance in addition to the coverage provided by the tax-financed health care system has a positive impact on the use of prescription medicine, dental care, physiotherapy, and chiropractic care, while the use of general practice and ambulatory care is largely unaffected.

This implies that voluntary private health insurance is not simply a marker of a higher propensity to use health care but induces additional use of some health care services over and above what would be used in the absence of such cover.

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Appendix A: Non-parametric bounds

Roy model

Under the Roy model, Manski (1990) shows that the bounds for the ATE for a dummy outcome narrow to:

$$\begin{aligned} B_L &= E\left[Y^1 \middle| D=1\right]P\left[D=1\right]-E\left[Y^0 \middle| D=0\right] \\ B_U &= E\left[Y^1 \middle| D=1\right]-E\left[Y^0 \middle| D=0\right]P\left[D=0\right] \end{aligned} \tag{A1}$$

Monotone treatment selection (MTS)

Under the MTS assumption, the bounds for mean potential outcome (here written for a dummy outcome) are (Manski and Pepper, 2000):

$$\begin{aligned} &E\left[Y \mid D=0\right] \le E\left[Y^0\right] \le P(D=1)+E\left[Y \middle| D=0\right]P(D=0) \\ &E\left[Y \mid D=1\right]P(D=1) \le E\left[Y^1\right] \le E\left[Y \middle| D=1\right] \end{aligned} \tag{A2}$$

This gives the following bounds on the ATE:

$$\begin{aligned} B_L &= E\left[Y \mid D=1\right]P(D=1)-P(D=1)-E\left[Y \middle| D=0\right]P(D=0) \\ B_U &= E\left[Y \middle| D=1\right]-E\left[Y \mid D=0\right] \end{aligned} \tag{A3}$$

Exclusion restriction (EX)

Under the EX condition, which is a special form of the level set restrictions considered by Manski (1990), the bounds for a dummy outcome narrow to:

$$\begin{aligned} B_L &= \sup_Z \left\{E\left[Y_t^1 \middle| D_t=1, Z=z\right]P\left[D=1 \middle| Z=z\right]\right\}- \\ &\inf_Z \left\{E\left[Y_t^0 \middle| D_t=0, Z=z\right]P\left[D=0 \middle| Z=z\right]+P\left[D=1 \middle| Z=z\right]\right\} \\ B_U &= \inf_Z \left\{E\left[Y_t^1 \middle| D_t=1, Z=z\right]P\left[D=1 \middle| Z=z\right]\right\}+P\left[D=0 \middle| Z=z\right]- \\ &\sup_Z \left\{E\left[Y_t^0 \middle| D_t=0, Z=z\right]P\left[D=0 \middle| Z=z\right]\right\} \end{aligned} \tag{A4}$$

Here, *sup* and *inf* are taken over all possible values of the excluded variable.

Monotone instrumental variable (MIV)

Manski and Pepper (2000) show that the bounds under MIV are:

$$B_L = \sum_{z' \in Z} P(Z = z') sup_{z \le z'} \left\{ E\left[Y_t^1 \middle| D_t = 1, Z = z \right] P\left[D = 1 \middle| Z = z \right] \right\} -$$
$$\sum_{z' \in Z} P(Z = z') inf_{z \ge z'} \left\{ E\left[Y_t^0 \middle| D_t = 0, Z = z \right] P\left[D = 0 \middle| Z = z \right] + P\left[D = 1 \middle| Z = z \right] \right\}$$
$$B_U = \sum_{z' \in Z} P(Z = z') inf_{z \ge z'} \left\{ E\left[Y_t^1 \middle| D_t = 1, Z = z \right] P\left[D = 1 \middle| Z = z \right] \right\} + P\left[D = 0 \middle| Z = z \right] -$$
$$\sum_{z' \in Z} P(Z = z') sup_{z \le z'} \left\{ E\left[Y_t^0 \middle| D_t = 0, Z = z \right] P\left[D = 0 \middle| Z = z \right] \right\} \tag{A5}$$

Note that *sup* and *inf* are not over all possible values of the conditioning variable *Z*, but a subset.

Monotonicity of treatment and outcome and an exclusion restriction (MO+EX)

Shaikh and Vytlacil (2010) show that under monotonicity of both treatment and outcome and when an instrument is available that is independent of potential outcomes, the ATE is bounded by (provided the reduced form, $E(Y \mid Z = 1) - E(Y \mid Z = 0)$, is positive; for a negative reduced form, see Shaikh and Vytlacil, 2010):

$$B_L = E(Y \mid Z = 1) - E(Y \mid Z = 0)$$
$$B_U = P(Y = 1, D = 1 \mid Z = 1) - P(Y = 1, D = 0 \mid Z = 0) + P(D = 0 \mid Z = 1) \tag{A6}$$

The bounds always identify the sign of the ATE when the first stage is non-zero. Balke and Pearl (1997) derived bounds under the independence assumption alone. We have estimated these and they are close to the EX bounds, hence they are not shown. When adding monotonicity of treatment to the independence of instrument assumption, the upper (lower) bound is identical to the upper (lower) bound of the MO+EX bound if the reduced form is positive (negative). Another related set of bounds is those derived by Manski and Pepper (2000) under a monotone treatment response assumption. If the sign of the ATE is positive, these bound also coincide with the MO+EX bounds, even though a monotonicity assumption in the outcome is *not* the same as the monotone treatment response of Manski and Pepper (2000), see Vytlacil (2002).

All bounds and statistics can be estimated consistently from a random sample by simple sample means.

Appendix B: Diagnostics and regression results

This appendix contains the full set of regression results underlying Table 3 and some diagnostics of matching quality. The full sets of results are reported only for covariate set 3. Full results and diagnostics for the alternative covariate sets are available from the authors upon request.

Table A1 Univariate parametric probit model coefficients

Outcome variable (n = 4,362)	MED		DEN		PHY		CHI		GP		AMB	
	coeff.	**(std. err)**	**coeff.**	**(std. err)**	**coeff.**	**(std. err)**	**coeff.**	**(std. err)**	**coeff.**	**(std. err)**	**coeff.**	**(std. err)**
Member of 'denmark'	0.050	(0.048)	0.330***	(0.049)	0.073	(0.047)	0.218***	(0.054)	0.088*	(0.049)	0.054	(0.043)
Male	-0.182***	(0.049)	-0.182***	(0.051)	-0.241***	(0.049)	-0.039	(0.055)	-0.351***	(0.050)	-0.181***	(0.045)
Age	0.024	(0.015)	0.019	(0.014)	0.039***	(0.014)	0.049***	(0.017)	-0.026*	(0.014)	0.032**	(0.013)
Age^2	0.000	(0.000)	0.000	(0.000)	0.000***	(0.000)	0.000***	(0.000)	0.000*	(0.000)	0.000**	(0.000)
DKK400-800/USD75-150[a]	-0.114*	(0.064)	0.224***	(0.066)	0.199***	(0.063)	0.209***	(0.073)	0.085	(0.066)	0.089	(0.056)
DKK800+/USD150+[a]	-0.160*	(0.086)	0.313***	(0.093)	0.246***	(0.085)	0.157	(0.098)	-0.049	(0.087)	-0.048	(0.079)
Do not wish to disclose[a]	-0.266***	(0.089)	0.215**	(0.092)	0.009	(0.088)	0.196**	(0.098)	0.078	(0.094)	-0.084	(0.080)
# of adults in household	0.017	(0.026)	0.045	(0.035)	-0.001	(0.025)	-0.036	(0.035)	0.008	(0.028)	-0.032	(0.023)
# of children in household	-0.074**	(0.032)	-0.152***	(0.030)	-0.015	(0.031)	0.052	(0.034)	-0.016	(0.031)	-0.003	(0.029)
High school[b]	-0.190	(0.116)	0.048	(0.108)	0.142	(0.120)	0.018	(0.135)	-0.048	(0.117)	-0.008	(0.106)
Vocational education[b]	-0.089	(0.093)	0.208**	(0.090)	0.147	(0.092)	0.077	(0.103)	-0.041	(0.099)	0.042	(0.081)
Higher education[b]	-0.185**	(0.089)	0.119	(0.085)	0.155*	(0.088)	-0.084	(0.100)	-0.117	(0.094)	0.101	(0.077)
Skilled worker[c]	-0.125	(0.117)	-0.038	(0.118)	0.154	(0.114)	0.156	(0.118)	0.217*	(0.122)	0.118	(0.105)
Unskilled worker[c]	-0.013	(0.113)	-0.084	(0.111)	0.057	(0.119)	-0.084	(0.132)	-0.136	(0.110)	0.046	(0.106)
Self-emp. or ass. spouse[c]	0.085	(0.105)	0.003	(0.114)	0.203*	(0.107)	0.165	(0.114)	-0.159	(0.103)	-0.048	(0.102)
Unemployed[c]	0.481***	(0.118)	-0.224*	(0.116)	0.105	(0.130)	-0.226	(0.164)	-0.022	(0.124)	0.026	(0.115)
Student[c]	0.079	(0.124)	0.128	(0.116)	0.018	(0.136)	0.007	(0.157)	-0.083	(0.118)	0.001	(0.119)
Pensioner[c]	0.275***	(0.088)	-0.013	(0.094)	0.246***	(0.086)	-0.034	(0.098)	0.084	(0.095)	0.266***	(0.076)
Long-term sick[c]	1.397***	(0.267)	0.086	(0.225)	0.907***	(0.195)	0.076	(0.245)	*omitted*		0.894***	(0.200)
Employment-based ins.	-0.076	(0.056)	0.143**	(0.060)	0.215***	(0.057)	0.188***	(0.062)	0.074	(0.056)	-0.077	(0.053)
Risk averse[d]	-0.027	(0.059)	0.104*	(0.061)	0.094	(0.060)	-0.035	(0.066)	0.056	(0.060)	0.088	(0.055)
Likes to take a risk[d]	-0.116	(0.077)	-0.034	(0.077)	-0.003	(0.078)	-0.100	(0.086)	0.032	(0.075)	0.012	(0.071)
Asthma	1.170***	(0.104)	-0.095	(0.095)	0.097	(0.093)	0.200**	(0.100)	0.167	(0.112)	0.119	(0.085)
Allergies	0.248***	(0.056)	0.067	(0.058)	-0.008	(0.055)	0.120**	(0.061)	0.378***	(0.062)	0.041	(0.051)
Diabetes	2.042***	(0.214)	-0.023	(0.106)	0.014	(0.100)	-0.011	(0.114)	0.221*	(0.123)	0.456***	(0.085)
Hypertension	1.727***	(0.088)	0.007	(0.071)	-0.031	(0.064)	0.027	(0.072)	0.584***	(0.082)	0.073	(0.057)
Emphysema	0.346**	(0.168)	0.056	(0.136)	-0.034	(0.131)	0.099	(0.143)	0.161	(0.171)	0.110	(0.116)
Arthritis	0.392***	(0.064)	-0.007	(0.067)	0.424***	(0.058)	0.178***	(0.067)	0.488***	(0.077)	0.291***	(0.054)
Osteoporosis	1.367***	(0.232)	-0.235	(0.163)	0.455***	(0.138)	0.221	(0.165)	0.360	(0.233)	0.642***	(0.136)

Tinnitus	0.132	(0.081)	-0.012	(0.084)	-0.071	(0.079)	0.066	(0.086)	0.218**	(0.090)	0.160**	(0.069)
Rather good dental health[e]	0.049	(0.065)	-0.069	(0.071)	0.033	(0.065)	-0.038	(0.071)	0.057	(0.064)	-0.072	(0.060)
Neither good/poor dent.[e]	0.086	(0.071)	-0.412***	(0.075)	-0.075	(0.071)	-0.103	(0.078)	-0.042	(0.070)	0.014	(0.064)
Rather or very poor dent.[e]	0.264***	(0.089)	-0.942***	(0.087)	0.103	(0.086)	-0.284***	(0.103)	0.105	(0.093)	0.045	(0.078)
Daily smoker	0.032	(0.056)	-0.185***	(0.056)	-0.100*	(0.057)	0.051	(0.063)	0.005	(0.058)	0.014	(0.051)
Drinks more than recomm.	-0.246***	(0.084)	0.022	(0.088)	0.032	(0.082)	0.038	(0.092)	-0.201**	(0.082)	-0.019	(0.075)
Physical active 6-7 days	-0.071	(0.060)	-0.058	(0.061)	-0.030	(0.059)	-0.061	(0.068)	-0.120**	(0.060)	-0.057	(0.053)
Constant	-1.535***	(0.345)	-0.021	(0.332)	-2.270***	(0.346)	-2.589***	(0.405)	1.239***	(0.340)	-1.529***	(0.312)
Log likelihood	-1949.329		-1808.124		-1955.651		-1476.768		-1870.742		-2434.530	
LR chi^2	2131.64 (df=36)		495.70 (df=36)		224.82 (df=36)		132.40 (df=36)		358.12 (df=35)		316.36 (df=36)	

* significance at 10 percent level; ** significance at 5 percent level; *** significance at 1 percent level.

[a] Reference level for household income in 1,000s dummies is DKK 0-399/USD 0-75. [b] References level for education dummies is basic education.
[c] Reference level for occupation dummies is white-collar worker. [d] Reference level for risk attitude dummies is risk neutral. [e] Reference level for self-assessed dental health dummies is very good dental health.

Table A2 Joint parametric bivariate probit model coefficients

Outcome variable (n = 4,362)	MED		DEN		PHY		CHI		GP		AMB	
	coeff.	**(std. err)**	**coeff.**	**(std. err)**	**coeff.**	**(std. err)**	**coeff.**	**(std. err)**	**coeff.**	**(std. err)**	**coeff.**	**(std. err)**
Health care use												
Member of 'denmark'	1.014***	(0.223)	0.659**	(0.331)	1.031***	(0.299)	1.249***	(0.252)	-1.219***	(0.209)	0.286	(0.443)
Male	-0.067	(0.057)	-0.147**	(0.063)	-0.120*	(0.066)	0.067	(0.057)	-0.403***	(0.044)	-0.157**	(0.065)
Age	0.032**	(0.014)	0.023	(0.014)	0.045***	(0.013)	0.054***	(0.015)	-0.035***	(0.013)	0.034**	(0.013)
Age^2	0.000	(0.000)	0.000	(0.000)	-0.001***	(0.000)	-0.001***	(0.000)	0.001***	(0.000)	0.000**	(0.000)
DKK400-800/USD75-150[a]	-0.164***	(0.060)	0.199***	(0.071)	0.113	(0.069)	0.111	(0.073)	0.150***	(0.058)	0.073	(0.064)
DKK800+/USD150+[a]	-0.202**	(0.081)	0.288***	(0.097)	0.158*	(0.088)	0.068	(0.094)	0.045	(0.078)	-0.062	(0.083)
Do not wish to disclose[a]	-0.288***	(0.083)	0.195**	(0.095)	-0.043	(0.084)	0.115	(0.093)	0.128	(0.081)	-0.097	(0.083)
# of adults in household	0.018	(0.024)	0.046	(0.034)	0.002	(0.023)	-0.028	(0.032)	0.001	(0.023)	-0.031	(0.023)
# of children in household	-0.068**	(0.030)	-0.151***	(0.030)	-0.015	(0.029)	0.045	(0.031)	-0.009	(0.027)	-0.004	(0.029)
High school[b]	-0.221**	(0.109)	0.029	(0.109)	0.072	(0.116)	-0.043	(0.125)	0.029	(0.104)	-0.021	(0.109)
Vocational education[b]	-0.166*	(0.088)	0.175*	(0.096)	0.047	(0.093)	-0.021	(0.097)	0.076	(0.089)	0.021	(0.090)
Higher education[b]	-0.260***	(0.084)	0.084	(0.092)	0.043	(0.092)	-0.174*	(0.093)	0.032	(0.088)	0.077	(0.090)
Skilled worker[c]	-0.142	(0.110)	-0.048	(0.117)	0.110	(0.109)	0.107	(0.111)	0.202*	(0.107)	0.111	(0.106)
Unskilled worker[c]	0.030	(0.106)	-0.068	(0.111)	0.090	(0.111)	-0.027	(0.122)	-0.166*	(0.099)	0.055	(0.107)
Self-emp. or ass. spouse[c]	0.108	(0.099)	0.013	(0.114)	0.210**	(0.101)	0.179*	(0.105)	-0.167*	(0.092)	-0.040	(0.103)
Unemployed[c]	0.487***	(0.112)	-0.201*	(0.118)	0.154	(0.123)	-0.130	(0.152)	-0.111	(0.111)	0.041	(0.118)
Student[c]	0.049	(0.117)	0.122	(0.115)	-0.001	(0.127)	-0.007	(0.142)	-0.054	(0.106)	-0.004	(0.119)
Pensioner[c]	0.358***	(0.083)	0.027	(0.102)	0.332***	(0.083)	0.097	(0.096)	-0.093	(0.089)	0.291***	(0.089)
Long-term sick[c]	1.419***	(0.250)	0.143	(0.230)	0.979***	(0.188)	0.243	(0.230)	6.299	(73544)	0.930***	(0.208)
Employment-based ins.	-0.089*	(0.053)	0.134**	(0.060)	0.169***	(0.058)	0.142**	(0.059)	0.086*	(0.050)	-0.081	(0.053)
Risk averse[d]	-0.028	(0.056)	0.102*	(0.060)	0.081	(0.057)	-0.032	(0.060)	0.047	(0.053)	0.087	(0.054)
Likes to take a risk[d]	-0.100	(0.073)	-0.031	(0.076)	0.000	(0.073)	-0.083	(0.079)	0.020	(0.067)	0.013	(0.071)
Asthma	1.102***	(0.110)	-0.072	(0.097)	0.151*	(0.089)	0.245***	(0.092)	0.068	(0.100)	0.134	(0.089)
Allergies	0.207***	(0.055)	0.062	(0.058)	-0.021	(0.052)	0.089	(0.057)	0.310***	(0.061)	0.038	(0.051)
Diabetes	1.807***	(0.225)	-0.019	(0.106)	0.028	(0.094)	0.005	(0.105)	0.182*	(0.108)	0.456***	(0.085)
Hypertension	1.534***	(0.126)	0.009	(0.070)	-0.022	(0.060)	0.030	(0.066)	0.450***	(0.086)	0.074	(0.057)

Emphysema	0.337**	(0.155)	0.067	(0.135)	0.005	(0.124)	0.125	(0.132)	0.109	(0.150)	0.117	(0.117)
Arthritis	0.330***	(0.065)	-0.013	(0.067)	0.356***	(0.068)	0.133**	(0.064)	0.404***	(0.076)	0.285***	(0.056)
Osteoporosis	1.145***	(0.230)	-0.256	(0.163)	0.331**	(0.146)	0.106	(0.158)	0.364*	(0.190)	0.622***	(0.143)
Tinnitus	0.132*	(0.075)	-0.006	(0.083)	-0.047	(0.075)	0.073	(0.079)	0.156*	(0.080)	0.162**	(0.069)
Rather good dental health[e]	-0.021	(0.063)	-0.092	(0.074)	-0.038	(0.065)	-0.103	(0.067)	0.137**	(0.058)	-0.088	(0.066)
Neither good/poor dent.[e]	0.002	(0.070)	-0.433***	(0.076)	-0.146**	(0.069)	-0.174**	(0.073)	0.074	(0.065)	-0.005	(0.073)
Rather or very poor dent.[e]	0.223***	(0.085)	-0.935***	(0.088)	0.076	(0.082)	-0.265***	(0.095)	0.104	(0.082)	0.041	(0.078)
Daily smoker	0.093*	(0.055)	-0.160***	(0.062)	-0.024	(0.060)	0.117**	(0.059)	-0.088	(0.053)	0.029	(0.059)
Drinks more than recomm.	-0.241***	(0.079)	0.012	(0.088)	0.002	(0.077)	0.007	(0.085)	-0.119	(0.076)	-0.025	(0.076)
Physical active 6-7 days	-0.005	(0.058)	-0.037	(0.064)	0.031	(0.059)	0.011	(0.065)	-0.174***	(0.053)	-0.042	(0.060)
Constant	-1.757***	(0.323)	-0.157	(0.356)	-2.407***	(0.326)	-2.688***	(0.374)	1.517***	(0.301)	-1.611***	(0.341)
Private health insurance												
Male	-0.242***	(0.042)	-0.245***	(0.042)	-0.247***	(0.042)	-0.246***	(0.042)	-0.255***	(0.042)	-0.244***	(0.042)
Age	-0.036***	(0.012)	-0.035***	(0.012)	-0.036***	(0.012)	-0.037***	(0.012)	-0.031**	(0.012)	-0.036***	(0.012)
Age^2	0.001***	(0.000)	0.001***	(0.000)	0.001***	(0.000)	0.001***	(0.000)	0.001***	(0.000)	0.001***	(0.000)
DKK400-800/USD75-150[a]	0.186***	(0.053)	0.179***	(0.054)	0.176***	(0.054)	0.178***	(0.053)	0.187***	(0.053)	0.179***	(0.053)
DKK800+/USD150+[a]	0.175**	(0.073)	0.171**	(0.074)	0.169**	(0.074)	0.164**	(0.073)	0.181**	(0.073)	0.171**	(0.073)
Do not wish to disclose[a]	0.154**	(0.074)	0.147**	(0.074)	0.145*	(0.074)	0.148**	(0.074)	0.148**	(0.074)	0.149**	(0.075)
# of adults in household	-0.010	(0.021)	-0.007	(0.022)	-0.007	(0.023)	-0.008	(0.022)	-0.004	(0.022)	-0.008	(0.022)
# of children in household	0.019	(0.027)	0.021	(0.027)	0.019	(0.027)	0.025	(0.027)	0.018	(0.027)	0.021	(0.027)
High school[b]	0.150	(0.099)	0.134	(0.099)	0.128	(0.099)	0.124	(0.099)	0.139	(0.098)	0.135	(0.099)
Vocational education[b]	0.253***	(0.078)	0.243***	(0.078)	0.242***	(0.078)	0.242***	(0.078)	0.237***	(0.077)	0.243***	(0.078)
Higher education[b]	0.277***	(0.075)	0.266***	(0.075)	0.264***	(0.074)	0.260***	(0.074)	0.259***	(0.074)	0.265***	(0.075)
Skilled worker[c]	0.077	(0.098)	0.086	(0.098)	0.082	(0.099)	0.086	(0.098)	0.114	(0.098)	0.085	(0.099)
Unskilled worker[c]	-0.104	(0.099)	-0.110	(0.099)	-0.109	(0.099)	-0.096	(0.098)	-0.096	(0.098)	-0.108	(0.099)
Self-emp. or ass. spouse[c]	-0.091	(0.092)	-0.091	(0.093)	-0.099	(0.093)	-0.087	(0.093)	-0.085	(0.093)	-0.089	(0.093)
Unemployed[c]	-0.175	(0.108)	-0.189*	(0.109)	-0.190*	(0.108)	-0.180*	(0.108)	-0.143	(0.108)	-0.189*	(0.109)
Student[c]	0.029	(0.106)	0.037	(0.106)	0.037	(0.105)	0.045	(0.105)	0.062	(0.105)	0.035	(0.106)
Pensioner[c]	-0.319***	(0.076)	-0.321***	(0.075)	-0.313***	(0.075)	-0.317***	(0.075)	-0.307***	(0.075)	-0.322***	(0.076)
Long-term sick[c]	-0.505**	(0.204)	-0.511**	(0.206)	-0.523**	(0.207)	-0.508**	(0.205)	-0.502**	(0.206)	-0.511**	(0.206)
Employment-based ins.	0.046	(0.049)	0.045	(0.049)	0.045	(0.049)	0.048	(0.049)	0.040	(0.048)	0.045	(0.049)
Risk averse[d]	0.004	(0.051)	0.002	(0.051)	0.001	(0.051)	0.003	(0.051)	0.012	(0.051)	0.000	(0.051)
Likes to take a risk[d]	-0.007	(0.065)	-0.007	(0.065)	-0.005	(0.065)	-0.002	(0.065)	-0.004	(0.065)	-0.008	(0.065)
Asthma	-0.186**	(0.082)	-0.187**	(0.082)	-0.185**	(0.082)	-0.178**	(0.082)	-0.209**	(0.082)	-0.187**	(0.082)
Allergies	0.026	(0.048)	0.028	(0.048)	0.023	(0.048)	0.027	(0.048)	0.038	(0.048)	0.027	(0.048)

Diabetes	-0.032	(0.086)	-0.033	(0.086)	-0.020	(0.086)	-0.035	(0.086)	-0.064	(0.087)	-0.031	(0.086)
Hypertension	-0.011	(0.056)	-0.013	(0.056)	-0.014	(0.056)	-0.016	(0.056)	-0.023	(0.056)	-0.014	(0.056)
Emphysema	-0.088	(0.116)	-0.093	(0.117)	-0.090	(0.115)	-0.096	(0.115)	-0.115	(0.115)	-0.095	(0.117)
Arthritis	0.052	(0.053)	0.052	(0.054)	0.051	(0.053)	0.052	(0.053)	0.053	(0.053)	0.053	(0.054)
Osteoporosis	0.203	(0.140)	0.198	(0.141)	0.207	(0.142)	0.192	(0.138)	0.211	(0.139)	0.201	(0.141)
Tinnitus	-0.052	(0.067)	-0.052	(0.067)	-0.054	(0.067)	-0.055	(0.067)	-0.052	(0.067)	-0.053	(0.067)
Rather good dental health[e]	0.204***	(0.055)	0.199***	(0.055)	0.197***	(0.055)	0.200***	(0.055)	0.195***	(0.055)	0.198***	(0.055)
Neither good/poor dent.[e]	0.241***	(0.060)	0.234***	(0.060)	0.231***	(0.060)	0.232***	(0.060)	0.230***	(0.060)	0.233***	(0.060)
Rather or very poor dent.[e]	0.069	(0.075)	0.060	(0.075)	0.060	(0.075)	0.057	(0.075)	0.057	(0.074)	0.061	(0.075)
Daily smoker	-0.181***	(0.048)	-0.175***	(0.048)	-0.176***	(0.048)	-0.172***	(0.048)	-0.173***	(0.048)	-0.176***	(0.048)
Drinks more than recomm.	0.072	(0.071)	0.067	(0.071)	0.076	(0.071)	0.067	(0.071)	0.078	(0.070)	0.069	(0.071)
Physical active 6-7 days	-0.164***	(0.051)	-0.159***	(0.051)	-0.159***	(0.050)	-0.159***	(0.050)	-0.158***	(0.050)	-0.160***	(0.051)
Glasses	0.258***	(0.047)	0.250***	(0.049)	0.251***	(0.047)	0.258***	(0.047)	0.184***	(0.050)	0.250***	(0.049)
Constant	-0.203	(0.285)	-0.206	(0.288)	-0.189	(0.286)	-0.168	(0.286)	-0.299	(0.289)	-0.190	(0.287)
ρ	-0.600	(0.138)	-0.206	(0.208)	-0.599	(0.187)	-0.648	(0.154)	0.800	(0.124)	-0.144	(0.274)
LR test of $\rho = 0$	6.918***		0.879		3.233*		4.910**		1.273		0.254	
Log likelihood	-4774.269		-4636.084		-4782.433		-4302.712		-4698.505		-5262.802	
LR chi^2	2123.15 (df=72)		869.21 (df=72)		840.64 (df=72)		678.6 (df=72)		1035.25 (df=72)		690.25 (df=72)	

* significance at 10 percent level; ** significance at 5 percent level; *** significance at 1 percent level.

[a] Reference level for household income in 1,000s dummies is DKK 0-399/USD 0-75. [b] References level for education dummies is basic education. [c] Reference level for occupation dummies is white-collar worker. [d] Reference level for risk attitude dummies is risk neutral. [e] Reference level for self-assessed dental health dummies is very good dental health.

Fig. A1 Propensity scores for treated and non-treated

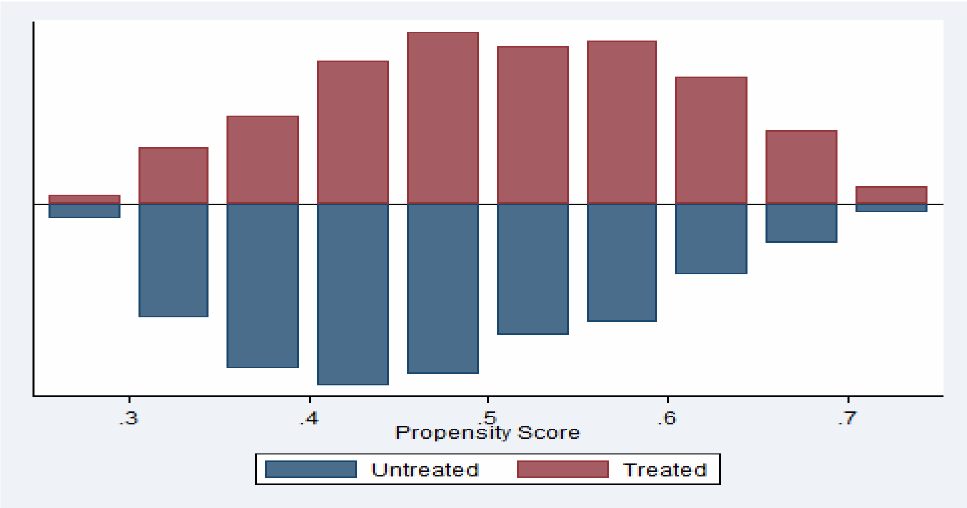

Table A3 Summary measures of covariate balancing before and after matching

(n = 4,362)	Share of treated before	Logit model pseudo R^2 before	Logit model pseudoR^2 after	Median bias before	Median bias after	Number of treated outside common support
NN, five-to-one	0.490	0.060	0.002	7.271	1.004	0

Table A4 Propensity score matching balancing tests for covariates

(n = 4,362)	**Sample**	**Mean**		**% reduction**		**t-test**	
		Treated	**Control**	**% bias**	**|bias|**	**t**	**p>|t|**
Member of ’denmark’	Unmatched	0.452	0.528	-15.3		-5.040	0.000
	Matched	0.452	0.449	0.7	95.3	0.230	0.815
Male	Unmatched	50.416	45.040	37.6		12.420	0.000
	Matched	50.416	50.402	0.1	99.7	0.030	0.975
Age	Unmatched	2743.800	2234.900	37.8		12.470	0.000
	Matched	2743.800	2743.300	0.0	99.9	0.010	0.989
Age^2	Unmatched	0.429	0.393	7.3		2.400	0.016
	Matched	0.429	0.427	0.5	93.5	0.150	0.877
Inc. DKK400-800/ USD75-150	Unmatched	0.177	0.154	6.0		1.990	0.046
	Matched	0.177	0.170	1.8	70.1	0.580	0.563
Inc. DKK 800+/ USD150+	Unmatched	0.103	0.091	4.0		1.320	0.188
	Matched	0.103	0.112	-3.2	20.9	-0.980	0.325
Do not wish to disclose	Unmatched	1.910	1.874	3.7		1.230	0.218
	Matched	1.910	1.887	2.4	36.3	0.800	0.422
# of adults in household	Unmatched	0.403	0.470	-8.1		-2.680	0.007
	Matched	0.403	0.409	-0.7	91.8	-0.220	0.823
# of children in household	Unmatched	50.416	45.040	37.6		12.420	0.000
	Matched	50.416	50.402	0.1	99.7	0.030	0.975
High school	Unmatched	0.081	0.134	-17.4		-5.740	0.000
	Matched	0.081	0.077	1.1	94.0	0.390	0.694
Vocational education	Unmatched	0.267	0.248	4.5		1.500	0.135
	Matched	0.267	0.261	1.4	69.2	0.450	0.651
Higher education	Unmatched	0.579	0.501	15.6		5.160	0.000
	Matched	0.579	0.582	-0.8	95.2	-0.250	0.805
Skilled worker	Unmatched	0.045	0.045	0.2		0.080	0.938
	Matched	0.045	0.043	1.3	-472.0	0.440	0.656
Unskilled worker	Unmatched	0.039	0.058	-8.9		-2.930	0.003
	Matched	0.039	0.039	-0.1	99.2	-0.030	0.979
Self-emp. or ass. spouse	Unmatched	0.052	0.052	0.1		0.050	0.964
	Matched	0.052	0.049	1.3	-833.9	0.420	0.672
Unemployed	Unmatched	0.028	0.050	-11.5		-3.780	0.000
	Matched	0.028	0.027	0.5	95.3	0.210	0.835
Student	Unmatched	0.055	0.096	-15.4		-5.060	0.000
	Matched	0.055	0.051	1.6	89.7	0.610	0.544
Pensioner	Unmatched	0.260	0.216	10.3		3.400	0.001
	Matched	0.260	0.260	-0.1	99.0	-0.030	0.975
Long-term sick	Unmatched	0.006	0.015	-8.6		-2.830	0.005
	Matched	0.006	0.005	0.6	92.5	0.280	0.777

Employment-based insurance	Unmatched	0.305	0.290	3.2		1.050	0.293
	Matched	0.305	0.309	-1.0	68.5	-0.320	0.745
Risk averse	Unmatched	0.641	0.622	4.0		1.310	0.190
	Matched	0.641	0.648	-1.4	64.9	-0.460	0.646
Likes to take a risk	Unmatched	0.164	0.181	-4.4		-1.460	0.144
	Matched	0.164	0.157	1.7	62.0	0.570	0.571
Asthma	Unmatched	0.058	0.082	-9.3		-3.070	0.002
	Matched	0.058	0.061	-1.1	87.8	-0.400	0.690
Allergies	Unmatched	0.235	0.247	-2.8		-0.930	0.352
	Matched	0.235	0.230	1.3	55.5	0.410	0.678
Diabetes	Unmatched	0.060	0.058	1.2		0.410	0.685
	Matched	0.060	0.061	-0.3	75.2	-0.100	0.922
Hypertension	Unmatched	0.193	0.161	8.4		2.780	0.005
	Matched	0.193	0.193	-0.1	98.7	-0.030	0.973
Emphysema	Unmatched	0.029	0.037	-4.6		-1.520	0.128
	Matched	0.029	0.029	-0.1	98.9	-0.020	0.985
Arthritis	Unmatched	0.217	0.175	10.5		3.460	0.001
	Matched	0.217	0.231	-3.6	65.5	-1.130	0.260
Osteoporosis	Unmatched	0.028	0.016	7.8		2.590	0.010
	Matched	0.028	0.022	3.6	54.2	1.100	0.273
Tinnitus	Unmatched	0.101	0.095	1.8		0.600	0.547
	Matched	0.101	0.098	0.8	58.8	0.240	0.808
Rather good dental health	Unmatched	0.420	0.388	6.6		2.170	0.030
	Matched	0.420	0.428	-1.6	75.2	-0.530	0.597
Neither good nor poor dental health	Unmatched	0.304	0.263	9.0		2.980	0.003
	Matched	0.304	0.300	0.9	90.1	0.290	0.776
Rather or very poor dental health	Unmatched	0.116	0.138	-6.7		-2.200	0.028
	Matched	0.116	0.111	1.4	79.2	0.480	0.633
Daily smoker	Unmatched	0.202	0.270	-16.1		-5.320	0.000
	Matched	0.202	0.206	-0.9	94.4	-0.310	0.757
Drinks more than recomm.	Unmatched	0.096	0.079	5.8		1.930	0.054
	Matched	0.096	0.092	1.2	78.9	0.390	0.698
Physical active 6-7 days per week	Unmatched	0.180	0.204	-6.0		-1.990	0.047
	Matched	0.180	0.181	-0.2	96.3	-0.070	0.941

Table A5 Comparison of ATEs obtained by alternative matching estimators

(n = 4,362)	**MED**	**DEN**	**PHY**	**CHI**	**GP**	**AMB**
NN, one-to-one	0.020	0.073	0.026	0.045	0.025	0.028
NN, five-to-one	0.017	0.074	0.020	0.043	0.026	0.019
Kernel (Epanechnikov)	0.018	0.075	0.021	0.041	0.023	0.020
Radius, caliper=0.1	0.020	0.080	0.021	0.041	0.023	0.019
Radius, caliper=0.01	0.016	0.074	0.021	0.040	0.021	0.019

Covariate set 1 refers to the specification including gender, age, and age squared as covariates.

Covariate set 2 refers to the specification including gender, age, age squared, household income and composition, education level, occupational status, employment-based private health insurance status, and risk preferences as covariates.

Covariate set 3 refers to the specification including gender, age, age squared, household income and composition, education level, occupational status, employment-based private health insurance status, risk preferences, chronic conditions, dental health, daily smoker, drinks more than recommended, and physical activity as covariates.

CHAPTER 6

Discussion and conclusions

Table of contents:

1 Summing up

The preceding chapters have investigated the determinants of VPHI coverage and its effect on the use of health care services. Overall, the main focus of the thesis is empirical, and so are its primary contributions to the literature.

1.1 Research contributions

The thesis contributes to the existing literature in several ways. Overall, the empirical analyses are based on a comprehensive dataset from Denmark collected specifically for the purpose. This dataset contains exceptionally detailed information on VPHI coverage and whether contracts are purchased on an individual basis or provided through the workplace, as well as a wide range of other variables that are relevant in relation to the analysis of VPHI. The empirical analyses are based on a theoretical foundation laid out in *chapter 1*. However, it is noted that the relevant theory for duplicate VPHI and the employers' decision to purchase VPHI on behalf of their employees is somewhat sparse.

Chapter 2 reviews the empirical literature on what characterises the privately insured in universal health care systems and assesses how well the empirical evidence corresponded with the theoretical framework. In many cases the link between economic theory and the empirical work is far from perfect with both ad hoc theorising and imperfect data. The review, however, is useful in and by itself vis-a-vis the research objectives of the present thesis as it provides a guide for the selection of covariates in subsequent empirical analyses.

Chapter 3 contributes to the empirical literature by exploring the role of satisfaction with the tax-financed health care system as a potential determinant of employment-based VPHI ownership, and by taking into account that some employees receive VPHI free of charge, while others pay the premium out of their pre-tax income and thus make an actual choice. To the best knowledge of the author, this study is the first to make such distinction, which may be crucial given that the theoretical framework differs for the two cases.

The last two chapters contribute to an ongoing research agenda on how to identify the causal effect of VPHI on the use of health care services in the absence of experimental data, taking into account that insurance status is potentially endogenous.

Chapter 4 estimates the causal effect of employment-based VPHI on the use of covered health care services using the method of propensity score matching. Firstly, it has not previously been investigated how employment-based VPHI affects the use of health care services in Denmark or any of the other Scandinavian countries. Secondly, at the time when the chapter was written, matching methods had only previously been used to estimate the impact of insurance on health care use in two recent studies by Barros et al. (2008) and Jones et al. (2006).

Along a similar line, *Chapter 5* contributes to the literature by examining how the estimated effect of individually purchased VPHI varies with different identifying assumptions and by using non-parametric bounds to assess the identifying power of the various assumptions. In this regard, it is noted that the use of non-parametric bounds is a promising, yet rarely applied method that allows further scrutiny of the identifying power from separate sets of assumptions on behaviour, instrument validity, selection, and functional form.

1.2 Some results

The literature review in *chapter 2* reveals that socioeconomic characteristics are strong determinants of VPHI coverage. In accordance with economic theory, the probability of taking out VPHI on an individual basis is consistently found to increase with income. Moreover, the empirical evidence generally supports the theoretical prediction of individuals selecting themselves into duplicate VPHI based on the quality of care, however defined, available within the universal health care system, just like the individual demand for VPHI is affected negatively by the effective insurance premium. The majority of the reviewed studies have investigated the relationship between health risk and insurance status in one way or another. With very few exceptions, the results point in the direction of advantageous or no health-based selection into VPHI. Finally, it is found that despite the predominant role of risk preferences in the economic theory on private health insurance demand, the empirical evidence on the importance of risk preferences is sparse and points in different directions.

Chapter 3 finds that within the Danish workforce, the probability of having employment-based VPHI is positively affected by private sector employment, size of the workplace, whether the workplace has a health scheme, income, being employed as a white-collar worker, and age until the age of 49, while the presence of subordinates, gender, education level, membership of 'denmark' and living in the capital region are not significantly associated with insurance coverage. As expected, the characteristics related to the workplace are by far the quantitatively most important determinants. In addition, individuals in good self-assessed health are found to be more likely to be covered by employment-based VPHI than those in excellent and fair, poor or very poor self-assessed health, respectively, and the probability of being insured is negatively related to the level of satisfaction with the tax-financed health care system. These results are not notably affected by distinguishing empirically between employees who receive VPHI free of charge and those who pay the premium out of their pre-tax income. Hence, these two groups may reasonably be combined in future analyses of employment-based VPHI in Denmark, even though the underlying decision processes leading to insurance coverage differ somewhat.

In *chapter 4*, the focus is on ex post moral hazard. It is found that employment-based VPHI coverage does not significantly affect the probability of having had one or more hospitalisations, physiotherapist, chiropractor, psychologist, specialist, or ambulatory contacts within the previous 12 months. However, the estimated effects are positive for all health care services except for psychologist visits. Restricting the sample to private sector employees, it is found that employment-based VPHI increases the probability of having had any ambulatory contacts by 6-7 percentage points in addition to the baseline probability of 22.4 percent, while the remaining estimates remain insignificant. These results are robust to different specifications of the propensity score and the use of alternative matching algorithms.

Finally, *chapter 5* points to evidence of a positive and significant effect of individually purchased VPHI on the use of dental care, physiotherapy, and chiropractic care, irrespective of the method applied. For the use of ambulatory care the effect is insignificant, while the results differ across methods for general practice and prescription drug use. The correlation coefficients estimated in the joint parametric models indicate that insurance status is exogenous in the models of general practice, ambulatory, and dental care use and endogenous when considering the use of prescription medicine, physiotherapy, and chiropractic care. Hence, the evidence seems to favour the findings of a substantial and statistically significant effect of VPHI on the use of prescription medicine and an insignificant effect on the use of general practice, indicating that public model hazard effects are not dominant among the general practitioners in Denmark. The significant correlation coefficients are large and negative, which means that the insured have a propensity to use less of these health care services irrespective of insurance status. Finally, the non-parametric bounds provide an important insight into how different identifying assumptions that are frequently used in the literature may affect the size and interpretation of the identified effect.

1.3 Policy implications

While the number of individuals with VPHI coverage in Denmark and several other European countries implies that this research area potentially has policy relevance, it is also clear that policy recommendations must be made with caution in a controversial area such as private financing of health care.

This section discusses the policy implications of the thesis regarding the distribution of VPHI and its effect on the use of health care services in a positive manner. Some of the burning political questions of the day, such as the possible welfare implications of especially duplicate VPHI and the side effects of tax exempting employment-based VPHI, cannot be addressed based on the present thesis. In particular, the results of the thesis do not shed light on the normative issue of whether VPHI may reasonably be perceived as a problem that necessitates policy initiatives. Hence, the section deliberately refrains from making any such policy recommendations.

Firstly, the literature review in *chapter 2* suggests that policy makers need to evaluate the quality of empirical studies carefully when assessing the evidence on a particular issue, and avoid basing their decisions on regulatory issues on the results of a single study. Moreover, given that the characteristics of the privately insured differ considerably across types of VPHI coverage and institutional settings, empirical knowledge obtained in one setting is not necessarily immediately transferable to other settings.

Secondly, the knowledge on the determinants of employment-based VPHI within the Danish workforce generated in *chapter 3* is highly relevant for Danish policy makers, given the expectation from political side that tax-exempting employment-based VPHI contingent on the insurance being offered to all employees would induce an equal distribution of employment-based VPHI coverage within companies, and preferably also reduce the importance of socioeconomic determinants within the workforce. Brought to a head, the findings of *chapter 3* imply that the tax-exemption brings along a transfer from low-income workers in the upper and lower age groups to middle-aged individuals employed in highly paid white-collar jobs, though most likely of a limited size relative to various other social imbalances that exists within the health care system. Whether this is desirable or not is a political issue.

Thirdly, the question of whether VPHI increases the use of health care services is crucial both from the perspective of understanding the behavioural responses that lead to the purchase of VPHI and the responses that insurance itself induces on health care use, and thus from the perspective of understanding the extent to which insurance is a key contributor to the increasing health care costs observed in many countries. In this regard, *chapter 4* finds that employment-based VPHI does not give rise to moral hazard when considering the total sample of occupationally active. One possible reason for this is that employment-based VPHI in Denmark primarily duplicates the coverage provided by the universal health care system, thereby possibly causing individuals to substitute use from tax-financed contacts to privately paid contacts rather than affecting total use. However, restricting the sample to private sector employees, there is some evidence of moral hazard in the use of ambulatory care. The findings of *chapter 5* imply that individually purchased VPHI induces moral hazard in the use of dental care, physiotherapy, chiropractic care, and prescription drugs, but not ambulatory care and general practice. Hence, the findings of *chapters 4* and *5* imply that VPHI contributes to the increasing health care costs for some types of health care services, but not others. Whether this is desirable or not from a policy perspective is a normative issue, given that it is not quite clear which level of health care use is preferred by society.

Fourthly, given that the probability of having individually purchased as well as employment-based VPHI coverage increases with income, the presence of moral hazard implies that both insurance types generate some extent of horizontal inequity in the use of health care services, although to varying degrees. More precisely, the results of *chapter 5* suggest that an expansion or reduction of individually purchased VPHI will, through its effects on the use of health care services, have an important effect on the degree to which the use of dental care, physiotherapy, chiropractic care, and prescription drugs is distributed by socioeconomic characteristics. On the contrary, the results of *chapter 4* suggest that except for ambulatory care, changing the availability of employment-based VPHI coverage will not alter the degree to which the use of health care services is related to income significantly. Given that equity may reasonably be considered a fundamental value in societies with a universal health care system in place, this may reasonably be considered undesirable from a policy perspective, as discussed in detail in section 4 of the introductory *chapter 1*.

2 Limitations

Like any other thesis, the current thesis is subject to some limitations and uncertainties, some more important than others. The following section describes the main limitations of the thesis and the most general issues encountered in the empirical analyses. The various limitations discussed in this section, as well as other more specific issues, have also been dealt with in the discussion sections of the empirical chapters.

2.1 Focus of the thesis

For one thing, the thesis focuses exclusively on private health insurance that is taken out on a voluntary basis in addition to the coverage provided by a universal health care system. However, private health insurance may also provide the primary source of coverage for all health care for the entire or part of the population, in which case it may be classified as either principal or substitute. These types of private health insurance are not subject to analysis in the current thesis.

As is usually the case for PhD theses, the current thesis considers a relatively narrowly defined set of research questions. While this limitation is necessary, it does, however, also imply that other interesting aspects are ignored. For example, while *chapters 4 and 5* analyse the effect of VPHI on the use of health care services, neither of the chapters differentiate between tax-financed and privately paid contacts. Moreover, given that we do not know which level of health care use is preferred by society, it is not possible to evaluate how the increase in use (although of varying magnitudes) induced by VPHI affects the welfare of society based on the results of this thesis. Finally, it must be emphasized that in addition to knowledge on the distribution of VPHI and its effect on the use of health care services, an overall evaluation of VPHI in Denmark should also include other factors as accounted for in section 4 of the introductory *chapter 1*, such as sickness absence and the health of the privately insured, as well as information on the tax revenue lost as a direct consequence of the tax-exemption of employment-based VPHI.

2.2 Data

The limitations of and issues related to the dataset used in the empirical analyses are accounted for in detail in *chapter 1*. Hence, this section is merely intended to summarise and discuss the main issues.

For one thing, the use of *self-reported data* on health care use calls for a brief discussion. Based on the findings of a review of the empirical literature on the use of self-reported health care data (Bhandari and Wagner 2006), some extent of underreporting is expected to be present in the data, and the estimates for the use of inpatient care are expected to be more precise than those for outpatient care. The inaccuracies are, however, not expected to bias the results of this study in any particular direction.

The collection of data using an *internet-based questionnaire* may also constitute a source of bias if the individuals who can be reached through the internet differ from those without internet access on the characteristics that are subject to investigation. While this is not expected to be a major issue in the present study, given that 86 percent of the Danish population had internet access in their homes in 2009 (Statistics Denmark 2009), it is nevertheless worth noting. Along a similar line, the identification of respondents through *YouGov Zapera's Denmark panel* constitutes a weakness of the study if the panel members differ from the remaining population on the relevant characteristics.

Moreover, although it is in line with what is commonly seen in internet-based surveys (Cook et al. 2000; Sheehan 2006), the *response rate* of 41 percent is not impressive and may be argued to hamper the ability to make inferences about the study population. The extent of bias entailed by a low response rate is a function of the response rate itself as well as differences between respondents and non-respondents on the variables of interest. In the present study, it is possible that the respondents differ from those who did not answer the questionnaire by having a greater interest in the subject of the survey, i.e. private health insurance. Such an interest could be spurred by being strongly for or against private health insurance, and it may be positively or negatively related to health. Moreover, it is uncertain how this relates to the remaining variables used in this study. Hence, while there are no obvious reasons to believe that the results of this study are systematically biased by non-response, caution should nevertheless be exercised when generalising results based on survey data to populations.

Finally, working with *cross-sectional data* generally implies that causal interpretations should be made with caution. In relation to the dataset used in the present thesis, especially the timing in the observation of the main variables is not optimal, given that the use of health care services is observed within the previous 12 months, while VPHI coverage is observed towards the end of this period. In principle, it is thus possible that some of the individuals who are classified as insured were not actually covered by VPHI in all or part of the period in which their use of health care services were observed, and vice versa.

2.3 Econometric methods

This section is confined to consider the overall limitations associated with the econometric methods used in the thesis. The reader is referred to consult the empirical chapters for more extensive and technical discussions of the various limitations and weaknesses related to specific methods.

Regarding the analysis of determinants of having employment-based VPHI, the applied models are *reduced form models* in the sense that they estimate the determinants of employment-based VPHI coverage net of demand- and supply-side effects. This imposes some limitations on the ability to identify causal relationships, and it does not allow for the estimation of how specific factors impact either side of the market. In particular, it is not possible to separate the effects of the determinants on the various participants in the decision process that leads to EPHI coverage.

Considering next the analysis of how VPHI affects the use of health care services, the all-important econometric issue is that the use of observational data necessitates the use of *inherently untestable* *identifying assumptions* to identify the causal effect of VPHI. Although the present thesis goes far in order to justify that the various assumptions hold and use several fundamentally different identification strategies simultaneously, the results may, in principle, all be wrong. However, this limitation is not specific to the current thesis, but applies to the vast majority of the empirical literature seeking to estimate causal effects of VPHI using observational data.

3 Suggestions for future research

Overall, VPHI that co-exists with a universal health care system may be analysed from several different angles. The empirical results presented in this thesis shed light on only a narrowly defined set of research questions, as outlined in the introductory *chapter 1*. Hence, several questions remain unanswered, and the demand for more knowledge on the workings of the market for VPHI and its effects on universal health care systems is not expected to ease off for a while.

Based on the review of the empirical literature on what characterises the privately insured in universal health care systems provided in *chapter 2*, it is concluded that while some findings may reasonably be taken as well-established knowledge, the literature still faces considerable challenges in other areas. In particular, further empirical research is needed in order to understand more fully the relationships among health risk, risk preferences and the decision to purchase VPHI.

In the author's view, one of the major challenges of the literature on employment-based VPHI lies in developing the theoretical framework for employer provision of VPHI in universal health care systems, given that the existing framework is sparse and takes its point of departure in settings where employment-based VPHI provides the primary source of coverage for all health care. Moreover, given the finding of *chapter 3* that characteristics related to the workplace are very important in determining the probability of having employment-based VPHI in Denmark, another obvious candidate for future research is the employers' decision to offer VPHI to their employees, including the tradeoffs between EPHI, other fringe benefits, and money wages. In particular, separating the effects of determinants on the various participants in the decision process that leads to employment-based VPHI coverage may provide important insights into the mechanisms in play at the market for employment-based VPHI.

Another major challenge that is frequently addressed in the literature is how to identify the causal effect of VPHI on the use of health care services empirically in the absence of experimental data, taking into account that insurance status is potentially endogenous. In this regard, the finding of the current thesis that the estimated effects of VPHI varies with identifying assumptions calls for more focus on the extent to which a given result depends on the chosen method of approach. In the author's view, an important future challenge is thus to be more explicit about and establish more knowledge on the appropriateness and consequences of imposing different identifying assumptions in analyses of different types of VPHI and institutional settings. Moreover, future analyses could also extend the analyses performed in *chapter 5* to consider alternative measures of health care use, such as number of visits or expenditure, and varying levels of VPHI coverage (such as the different groups within ‘denmark’). Given that the determinants of VPHI coverage and its effect on the use of health care services may reasonably be expected to depend largely on the exact coverage provided by the insurance as well as the institutional setting, one needs to be careful when drawing conclusions across countries regardless of which road is pursued.

Finally, it is noted that very little is known about the long-term relationships between VPHI, health care use, health status, and the universal health care system. For example, how does the availability of VPHI today affect health care use in one, two, or even three decades from now? Do the long-term consequences of VPHI differ depending on whether this is purchased on an individual basis of provided through the workplace? How does the presence of duplicate VPHI affect the support for the universal health care system? Along with the issues discussed above, these questions are obvious candidates for future research. However, a better understanding of the long-term relationships will require longitudinal data that follow individuals over longer periods of time. To the best knowledge of the author, such data are not available in Denmark at present.

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Dansk sammenfatning / Danish summary

Denne afhandling omhandler private syge- og sundhedsforsikringer, der eksisterer sammen med et universelt skattefinansieret sundhedsvæsen. Disse private sundhedsforsikring findes i én eller anden form i de fleste lande med et universelt sundhedsvæsen og er i stigende grad kommet i fokus i løbet af de seneste årtier. Mens de private syge- og sundhedsforsikringer kun i begrænset omfang bidrager til den samlede finansiering af sundhedsvæsenet i de fleste lande, så er store dele af de respektive befolkninger dækket.

Formål og struktur

Det overordnede formål med denne afhandling er at analysere determinanterne for private syge- og sundhedsforsikringer samt deres effekt på forbruget af sundhedsydelser i Danmark.

Afhandlingen består af et indledende *kapitel 1*, som danner baggrund for afhandlingens empiriske analyser ved at redegøre for de institutionelle og teoretiske rammer for analyserne samt beskrive og diskutere det datasæt, der bruges i de empiriske analyser. *Kapitel 2* gennemgår den empiriske litteratur om hvad der karakteriserer private forsikringstagere i lande med universelle sundhedsvæsener med henblik på at guide udvælgelsen af forklarende variable i de følgende empiriske kapitler.

Afhandlingens primære fokus såvel som dens bidrag til den akademiske litteratur er af empirisk karakter. Specifikke formål med de empiriske kapitler er at:

a) Estimere determinanterne for at have en arbejdsgiverbaseret sundhedsforsikring samt undersøge hvorvidt disse adskiller sig signifikant for medarbejdere som får sundhedsforsikringen gratis og medarbejdere som selv betaler en del af præmien via en bruttotræksordning *(kapitel 3)*.

b) Estimere den kausale effekt af arbejdsgiverbaseret sundhedsforsikring på forbruget af sundhedsydelser *(kapitel 4)*.

c) Estimere den kausale effekt af individuelt købt sundhedsforsikring på forbruget af sundhedsydelser, med særligt fokus på hvordan denne effekt varierer med forskellige identificerende antagelser *(kapitel 5)*.

Afhandlingen afrundes med et opsummerende *kapitel 6*, hvori de specifikke bidrag til litteraturen, resultaterne af de empiriske analyser, samt afhandlingens begrænsninger opsummeres og diskuteres.

Private syge- og sundhedsforsikringer i Danmark

Private syge- og sundhedsforsikringer kan enten købes på individuel basis eller via en arbejdsgiver, som typisk også betaler præmien helt eller delvist.

Den primære leverandør på det danske marked for individuelle syge- og sundhedsforsikringer er Sygeforsikringen ”danmark”. Det primære formål med forsikringer tegnet hos ”danmark” er at dække en del af brugerbetalingen for sundhedsydelser som er pålagt brugerbetaling i det universelle sundhedsvæsen, som f.eks. tandlægebesøg, fysioterapi og receptpligtig medicin. For omkring 25 procent af ”danmarks” medlemmer er udvalgte operationer på privathospitaler også delvist dækket.

De arbejdsgiverbaserede sundhedsforsikringer udbydes af kommercielle forsikringsselskaber. Disse forsikringer dækker primært operationer på privathospitaler, men bruges i stigende omfang også til at finansiere fysioterapi, kiropraktik og psykologhjælp. Siden 2002 har den enkelte medarbejder været fritaget for at betale indkomstskat af værdien af forsikringspræmien under forudsætning af, at forsikringen tilbydes til alle virksomhedens medarbejdere.

I 2009 havde omkring 2 millioner danskere (svarende til 42 procent af befolkningen i alderen 18-75 år) tegnet en privat forsikring via “danmark”, mens lidt over 932.606 personer (svarende til 32 procent af de beskæftigede) var dækket af en arbejdsgiverorganiseret sundhedsforsikring.

Funktionel klassifikation

Tabel 1 opsummerer de eksisterende klassifikationer af private sundhedsforsikringer, der eksisterer sideløbende med et universelt sundhedsvæsen. Fokus er på at adskille de forskellige funktioner, som de private sundhedsforsikringer kan have i forhold til det universelle sundhedsvæsen. Det fremgår af Tabel 1, at der ikke er generel enighed om definitionerne – hvilket skaber en del forvirring i litteraturen.

Tabel 1 Klassifikationer af private sundhedsforsikringer i universelle sundhedsvæsener

Dækning:	Brugerbetaling for behandlinger der er delvist dækket af det universelle sundhedsvæsen	Behandlinger der ikke er dækket indenfor det universelle sundhedsvæsen	Behandling hos private udbydere for behandlinger som også er tilgængelige indenfor det universelle sundhedsvæsen
White (2009)	Gap		Parallel
Colombo and Tapay (2004)	*Complementary*	*Supplementary*	*Duplicate*
OECD (2004)	*Complementary*	*Supplementary*	*Duplicate*
Henke and Schreyögg (2005)	Supplementary		Complementary
Mossialos and Thomson (2002)	Complementary		Supplementary

Denne afhandling anvender den funktionelle klassifikation fremsat af Colombo og Tapay (2004) samt OECD (2004). I forhold til de private sundhedsforsikringer der findes på det danske marked, så klassificeres forsikringer købt på individuel basis via Sygeforsikringen ”danmark” således som værende primært *complementary* i forhold til det universelle sundhedsvæsen, mens de arbejdsgiverbaserede sundhedsforsikringer klassificeres som primært *duplicate*.

Teoretisk ramme

Langt størstedelen af den teoretiske litteratur er udviklet for private sundhedsforsikringer i situationer hvor der ikke er noget universelt sundhedsvæsen. Denne type af forsikring omtales som primær privat sundhedsforsikring i det nedenstående.

Den individuelle efterspørgsel efter privat sundhedsforsikring

Den individuelle efterspørgsel efter primær privat sundhedsforsikring modelleres oftest med udgangspunkt i forventet nytteteori. Det antages således, at rationelle nyttemaksimerende individer sammenligner den forventede nytte henholdsvis med og uden forsikring (eller med forskellige niveauer af dækning) og vælger det alternativ, der maksimerer den forventede nytte under en budgetbegrænsning. Indenfor denne ramme viser økonomisk teori, at efterspørgslen efter primær privat sundhedsforsikring stiger med graden af risikoaversion, under antagelse af symmetrisk information mellem forsikringsgiver og -tager. Under antagelse af asymmetrisk information, så viser økonomisk teori, at efterspørgslen efter primær privat sundhedsforsikring er korreleret med risikoen for at blive syg.

De teoretiske forudsigelser for den individuelle efterspørgsel efter sundhedsforsikring kan umiddelbart overførelse på *complementary* og *supplementary* forsikring, der eksisterer sammen med et offentligt sundhedsvæsen. Dvs. at efterspørgslen efter disse forsikringstyper forventes at stige med graden af risikoaversion samt variere med risikoen for sygdom. Efterspørgslen efter *duplicate* forsikring er mere kompliceret at modellere, given at denne type af forsikring ikke dækker monetære tab på samme måde som primær sundhedsforsikring, men i stedet giver adgang til behandling hos private udbydere for behandlinger som også er tilgængelige indenfor det universelle sundhedsvæsen. Det er vist, at efterspørgslen efter denne type af forsikring stiger med indkomst og falder med kvaliteten af det universelle sundhedsvæsen, typisk målt ved ventetiden for behandling.

Virksomhedernes efterspørgsel efter privat sundhedsforsikring

Den teoretiske litteratur om virksomhedernes efterspørgsel efter private sundhedsforsikringer på vegne af deres medarbejdere er sparsom og karakteriseret ved flere forskellige tilgangsvinkler frem for et samlet teoriapparat. Uanset hvilket teoretisk tilgangsvinkel der tages udgangspunkt i, så forventes det at virksomheder har en omkostningsmæssig fordel over privatpersoner ved køb af sundhedsforsikring. Dette skyldes, at virksomhederne ved at købe et stort antal forsikringspolicer samtidig kan opnå en omkostningsmæssig gevinst ved pooling af risiko, ligesom de må forventes at stå stærkere end privatpersoner ved forhandling af pris. Fordelene ved risikopooling og forhandlingsstyrke betyder, at større virksomheder forventes at være relativt mere tilbøjelige til at tilbyde private sundhedsforsikringer til deres medarbejdere. Derudover kan skattelovning i nogle tilfælde gøre det mere fordelagtigt at modtage en privat sundhedsforsikring via sin arbejdsplads end at købe den selv. Den teoretiske litteratur om virksomhedens efterspørgsel er udelukkende udviklet for primær privat sundhedsforsikring, men de forskellige tilgangsvinkler kan i varierende omfang også anvendes på efterspørgslen efter de forskellige typer af sundhedsforsikring, der eksisterer ved siden af et universelt sundhedsvæsen.

Effekten af private syge- og sundhedsforsikring på forbruget af sundhedsydelser

Med hensyn til effekten af private sundhedsforsikringer på forbruget at sundhedsydelser, så viser økonomisk teori, der modellerer effekten af primære sundhedsforsikringer, at disse forsikringer har potentiale til at øge forbruget via flere mekanismer. I det omfang at forebyggende adfærd ikke er reflekteret i forsikringspræmierne, så er det muligt at tilstedeværelse af forsikring reducerer incitamentet til forebyggelse via ex ante moral hazard. Denne mekanisme forventes dog ikke at være særlig stærk for private sundhedsforsikringer. Den oftest nævnte mekanisme, som også er den vigtigste i forhold til private syge- og sundhedsforsikringer der eksisterer sammen med et universelt sundhedsvæsen, er ex post moral hazard. Ex post moral hazard opstår ved, at forsikringerne reducerer den pris, som patienterne står overfor. Herved øges forbruget af sundhedsydelser, hvis efterspørgsel er priselastisk. Derudover er det også vist, at private sundhedsforsikringer under forskellige omstændigheder også kan øge forbruget af sundhedsydelser ved at reducere økonomiske risiko, overføre indkomst fra de raske til de syge samt skabe bedre betingelser for udbyderinduceret efterspørgsel. Institutionelle barrierer samt begrænsninger i den dækning, der tilbydes af de private forsikringsselskaber, kan dog tænkes at reducere eller helt fjerne den positive effekt på forbruget.

Den teoretiske litteratur om hvordan private sundhedsforsikringer påvirker forbruget at sundhedsydelser kan umiddelbart overførelse på *complementary* og *supplementary* forsikringer, der eksisterer sammen med et offentligt sundhedsvæsen. For disse forsikringstyper forventes ex post moral hazard at være den dominerende effekt. Effekten af *duplicate* forsikring, der dækker behandling hos private udbydere for behandlinger som også er tilgængelige indenfor det universelle sundhedsvæsen, dog ofte med længere ventetid, er mere kompliceret. Hvorvidt *duplicate* forsikring øger forbruget af sundhedsydelser afhænger således af, om forsikringen ændrer indikationskriterierne for behandling, samt hvorvidt efterspørgslen efter de dækkede behandlinger er tidselastisk. Endelig er muligt, at *duplicate* forsikring, der primært dækker operationer på privathospitaler, flytter forbruget fra det universelle sundhedsvæsen til privathospitaler frem for at øge det samlede forbrug.

Data

De empiriske analyser er baseret på et datasæt, der blev indsamlet specifik til formålet i juni 2009 via en internetbaseret spørgeskemaundersøgelse af den danske befolkning i alderen 18-75 år. Undersøgelsen har en svarprocent på 41, og den endelige stikprøve inkluderer 5,447 respondenter. Design og pilottestning af det anvendte spørgeskema, dataindsamlingsprocessen samt det endelige datasæt er dokumenteret i afhandlingens *kapitel 1*.

Empiriske kapitler

Litteraturreviewet samt de tre empiriske kapitler udgør afhandlingens hoveddel, og de indeholder ligeledes afhandlingens bidrag til den akademiske litteratur.

Kapitel 2 med titlen *"What characterises the privately insured in universal health care systems? A review of the empirical evidence"* gennemgår den empiriske litteratur om hvad der karakteriserer private forsikringstagere i lande med universelle sundhedsvæsener samt diskuterer i hvilket omfang resultaterne stemmer overens med de teoretiske forudsigelser på området. Denne viden er nyttig i sig selv, såvel som med henblik på at guide udvælgelsen af forklarende variable i de følgende empiriske kapitler. Gennemgangen er begrænset til at omhandle private forsikringer købt på individuel basis, eftersom den teoretiske ramme for henholdsvis individuelt købte og arbejdsgiverbaserede forsikringer adskiller sig på væsentlige punkter. Relevant empirisk litteratur blev indsamlet ved at udføre søgninger i elektroniske databaser samt gennemgå ugentlige rapporter om ny sundhedsøkonomisk forskning. Litteratursøgning identificerede i alt 24 artikler og 15 arbejdspapirer, hvoraf størstedelen var udgivet indenfor det seneste årti. En gennemgang af resultaterne viser at socioøkonomiske karakteristika, inklusiv indkomst, generelt spiller en vigtig rolle i forhold til hvorvidt man vælger at købe en privat sundhedsforsikring. Litteraturen finder generelt en positiv sammenhæng mellem kvaliteten af det offentlige sundhedsvæsen, typisk målt ved ventetiden for behandling, og udbredelsen af privat sundhedsforsikring der dækker behandling på privathospitaler, ligesom efterspørgslen efter private syge- og sundhedsforsikringer påvirkes i negativ retning af den effektive forsikringspræmie. Den empiriske evidens i forhold til effekten af risikopræferencer er yderst sparsom og peger i flere forskellige retninger. Endelig så findes det, dog med enkelte undtagelser, at de private forsikringstagere har et bedre helbred end den øvrige befolkning, hvilket står i kontrast til teorien om adverse selection. Litteraturen giver flere mulige forklaringer på dette.

Mens langt størstedelen af den empiriske litteratur til dato har analyseret syge- og sundhedsforsikringer købt på individuel basis, så er den empiriske litteratur om sundhedsforsikringer tegnet via arbejdspladsen sparsom.

Kapitel 3 med titlen *"Determinants of employment-based private health insurance coverage in Denmark"* bidrager til den sparsomme litteratur om arbejdsgiverbaseret sundhedsforsikring ved at estimere determinanterne for at have sådan en blandt de beskæftigede i Danmark ved brug af forskellige probit modeller. Andelen af de beskæftigede med sundhedsforsikring via deres arbejdsplads er steget støt siden 2002, hvor de arbejdsgiverbaserede sundhedsforsikringer blev fritaget for indkomstskat for den enkelte medarbejder under forudsætning af, at de tilbydes til alle virksomhedens medarbejdere. Analyserne viser, at sandsynligheden for at have en sundhedsforsikring via sin arbejdsplads stiger med beskæftigelse i den private sektor, arbejdspladsens størrelse, tilstedeværelsen af en sundhedsordning på arbejdspladsen, graden af utilfredshed med det offentlige sundhedsvæsen, godt selvrapporteret helbred frem for henholdsvis fremragende og nogenlunde, dårligt og meget dårligt, ansættelse i en funktionærstilling, indkomst og alder indtil 49 år, hvorefter sandsynligheden påvirkes i negativ retning af alder. Som forventet er de arbejdsgiver-relaterede karakteristika kvantitativt langt de vigtigste determinanter. Køn, uddannelsesniveau, medlemskab af sygeforsikringen ‘danmark’, bopæl i region hovedstaden og tilstedeværelsen af underordnede på arbejdspladsen påvirker ikke sandsynligheden for at have en arbejdsgiverbaseret sundhedsforsikring, når der er kontrolleret for de øvrige karakteristika. Analyserne viser desuden, at determinanterne for medarbejdere som får sundhedsforsikringen gratis og medarbejdere som selv betaler en del af præmien via en bruttotræksordning ikke adskiller sig signifikant. Det bør således ikke give anledning til problemer at betragte disse to grupper samlet set i fremtidige analyser af arbejdsgiverbaseret sundhedsforsikring i Danmark.

Et andet fokusområde i litteraturen om private syge- og sundhedsforsikringer er at identificere hvordan forsikring påvirker forbruget af sundhedsydelser empirisk. Udfordringen består i at adskille den kausale effekt af forsikring fra forskelle i forbruget, der kan henføres til forskelle i uobserverede karakteristika, som både påvirker sandsynligheden for at være forsikret og forbruget af sundhedsydelser.

Kapitel 4 med titlen *“Does employment-based private health insurance increase the use of covered health care services? A matching estimator approach”* anvender propensity score matching til at estimere effekten af arbejdsgiverbaserede sundhedsforsikringer på forbruget af de sundhedsydelser, der er dækket af forsikringerne. Propensity score matching estimatoren er baseret på en antagelse om selektion på observerbare karakteristika. I forhold til den konkrete analyse betyder dette, at forbruget af sundhedsydelser antages at være uafhængigt af sandsynligheden for at have en forsikring, når der betinges på en række observerede karakteristika. Kapitel 4 argumenterer for, at denne antagelse er opfyldt, givet de institutionelle rammer for arbejdsgiverorganiserede sundhedsforsikringer i Danmark og det anvendte datasæt, ligesom der laves en række robusthedstjek. Analyserne viser, at de arbejdsgiverorganiserede sundhedsforsikringer øger sandsynligheden for at have været hospitalsindlagt samt modtaget fysioterapeutisk, kiropraktisk, specialist og ambulant behandling indenfor det seneste år. Ingen af de estimerede effekter er dog signifikant forskellige fra nul, når man kigger på hele gruppen af beskæftigede. Givet at de private sundhedsforsikringer er langt mere udbredte i den private sektor end indenfor det offentlige, så gentages analyserne for gruppen af privatansatte. Disse analyser viser, at de arbejdsgiverorganiserede sundhedsforsikringer øger sandsynligheden for at have modtaget ambulant behandling indenfor det seneste år signifikant med 6-7 procentpoint oveni udgangspunktet på 22 procent. De øvrige estimater forbliver insignifikante. Resultaterne er ikke følsomme overfor ændringer i specifikationen af propensity scoren og brugen af alternative matching algoritmer.

Kapitel 5 med titlen *”The effect of private health insurance on the use of health care services: A comparison of identification strategies”* estimerer effekten af medlemskab af sygeforsikringen ”danmark” på forbruget af udvalgte sundhedsydelser og undersøger hvordan den varierer med forskellige identificerende antagelser. Dette gøres ved at diskutere og sammenligne estimater baseret på fire fundamentalt forskellige identifikationsstrategier: 1) Joint parametrisk modellering baseret på antagelser om funktionel form og en instrument variabel, 2) propensity score matching baseret på en antagelse om selektion på observerbare karakteristika, 3) en standard univariat parametrisk estimator baseret på antagelser om funktionel form og selektion på observerbare karakteristika og 4) ikke-parametriske bounds baseret på svagere antagelser om selektion. Analyserne viser, at medlemskab af ”danmark” øger sandsynligheden for at have været ved tandlægen samt at have modtaget fysioterapi og kiropraktisk behandling indenfor det seneste år signifikant, uanset hvilken metode der anvendes. Effekten på forbruget af ambulant behandling er insignifikant, mens resultaterne varierer på tværs af de forskellige metoder for sandsynligheden for at have været i kontakt med en praktiserende læge og brug af receptpligtig medicin. Generelt så giver joint parametrisk modellering højere estimater end de metoder der baserer sig på en antagelse om selektion på observerbare karakteristika. Korrelationskoefficienterne fra de joint parametriske modeller indikerer, at forsikringsstatus er eksogen i analyserne af brug af praktiserende læge, ambulant behandling, samt tandlæge og endogen når man ser på receptpligtig medicin, fysioterapi og kiropraktisk behandling. Den empiriske evidens peger således i retning af, at medlemskab af ”danmark” har en signifikant effekt på brugen af receptpligtig medicin, mens effekten på sandsynligheden for brug af praktiserende læge er statistisk insignifikant. De signifikante korrelationskoefficienter er store og negative, hvilket betyder, at de forsikrede har en tilbøjelighed til at forbruge mindre af de relevante sundhedsydelser uanset forsikringsstatus. Endelig så giver de ikke-parametriske bounds et vigtigt indblik i, hvordan de forskellige identificerende antagelser, der ofte anvendes i den empiriske litteratur, potentielt kan påvirke størrelsen og fortolkningen af de estimerede effekter.