

# Claim patterns of private health insurance for individual and group contracts and the risk selection mechanisms

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# Abbreviations and shorter names

PHI: Private health insurance

FNO: Finance Norway

VHA: Vertikal Helseassistanse

GP: General Practitioner

SSB: Statistics Norway

Group contracts: Employer-provided PHI

Individual contracts: Individual PHI

Policyholder/Insuree: Person in whose name an insurance policy is issued

Individual/group policyholder/insuree: Person who is covered by an individual/group contract

# Abstract

This study is based on the analyses of the claim patterns in the light of the theory of risk-selection in the private health insurance market. Our aim is to study whether insures with group contracts have higher claims than the individual insures. However the limits in our data make it difficult to give a clear answer. The data is received from one of the Norwegian insurance companies and contains approximately 6300 processed claims from their customer portfolio in the period 2007-2010. We have analyzed both separate claims and aggregate claims per person for individual and group policyholders. We have controlled for type of the contract (group/individual), gender, age, geographical area, Oslo/other big city, industry sector (for group contracts) and reservations. Surprisingly, the type of the contract does not have any significant effect on the claim, neither considered separately nor aggregate per person.

The analysis of separate claims has shown that the age of the policyholder has a significant positive impact on the size of the claims independently of the contract type. Reservations have an effect as well. 1% of group and 12% of individual policyholders have received reservations not to cover expenses connected to some particular illness they have. The presence of reservations has contrary effect on the size of the separate claims: negative for groups and positive for individuals.

Further, we have analyzed what affects the likelihood of claiming for greater than average sums. We have found that age and gender (male) affect the likelihood positively for group contracts. Individual policyholders are more likely to claim for higher sums the older they are, if they have reservation, for children (i.e. being under 18 years old), while the likelihood is reduced for those who are registered in East Norway.

The second part of the analysis is dedicated to the effects on the aggregate claims in the period 2007-2010 per person. It has shown that only the age of the policyholder has positive effect on the aggregate claims for group contracts. However, age does not influence size of aggregate claims of individual policyholders. They claim for bigger aggregate sums if they have reservations, come from North Norway or a big city other than Oslo.

The analysis of the likelihood of higher aggregate claims has shown quite different results for individuals and groups. Group policyholders are more likely to ask for higher sums in the

long run the older they are, if they are males and if they come from West Norway or a big city. Individual policyholders are more likely to claim higher sums in long run the older they are and in a presence of reservations.

We have calculated relative numbers for the average claim ratio among the insured in 2010 and have found that it is smaller for the group contracts than for the individual. The ratio is equal to the number of persons who claimed in 2010 divided by the number of persons who were registered in 2010 as customers. The ratios contradict with the theory of risk selection. The theory predicts that “selected” customers are more profitable, and in our case the “selected” ones are individual policyholders because they are checked and they have to deliver health statement that can be used for giving them a reservation or even being rejected. The size of the aggregate claims that we have got from descriptive statistics for years 2007-2010 differs from the results of 2010. We assume that it is caused by tendencies in the development of PHI market that we did not take into account. The 2007-2010 data shows more or less the same numbers for group and individual policyholders, while the 2010 data shows much smaller number for group contracts than for individual. Aggregate data in year 2010 contradicts with the theory of risk selection and indicates that group policyholders (which are not selected) are more profitable customers. This shows that either risk-selection is not as profitable as expected or that group policyholders are a special type of people with special socio-economic characteristics (like that they have full-time job, and they are in the working age 18-68 years old and more). In addition group policyholders are usually subscribed automatically and therefore not all of them are clear that they have a PHI. Another factor is that the turnover of the customers with group contracts is smaller because of the automaticity of the group insurance registration process. Individual policyholders do have bigger turnover and they are more likely to drop insurance if they do not use it, thus, older and sicker are in the pool and, thus, the ratio of people with claims is higher for individuals than for groups. Even though the individual policyholders are selected on the basis of health status statements they might be an adversely selected group because of unobservable health differences. The aggregate data for 2007-2010 shows that there is not that much difference between aggregate claims of persons with group contracts and persons with individual contracts. In addition, the coefficient of the contract type in the regression of the aggregate data set shows that group policyholders spend less than individuals (although not significantly less). We conclude that we did not get a clear indication for or against profitability of risk-selection in our study, and we need more research in this field.

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# 1 Introduction

## 1.1 Aim, scope and methodology of the study

The topic of private treatment health insurance (PHI) in Norway is of a great interest because it is relatively new and there is not a lot written about it. There are a lot of studies made in Europe and the USA about PHI. However, the results of these studies are not completely applicable to the Norwegian case. Whereas PHI is a main health policy in majority of other countries, Norway practices universal public health insurance, where PHI is a supplementary policy. The number of people covered by PHI in Norway is growing very rapidly. Furthermore, it mainly consists of people covered by employer-paid insurance. The majority of the previous studies in Norway focus on the demand patterns for treatment insurance and descriptions of the policyholders.

The aim of our study is to detect claim patterns of people covered by PHI and to investigate the question of profitability of risk-selection. Customers of the insurance companies apply for the refund or payment for received medical help. It is called “claim”. Risk-selection is a situation when an insurance company selects predictably profitable customers, i.e. clients for whom the insurance company’s revenue exceeds the actually predicted expenses (p. 73, Van de Ven, 2003).

The scope of this research is restricted to the investigation of treatment health insurance that gives faster access to medical help and covers the charges for using medical institutions. Our study does not cover life insurance, insurance for chronicle or critical illnesses or key-personnel insurance.

We hypothesize that due to the risk-selection for individual policyholders, there are more claims from the “uncontrolled” group policyholders, and their expected claims are higher than those from individual policyholders, which were carefully scanned by the personnel of the insurance company.

When we were considering our methodology for the research, we took into account that insurance companies have the possibility to select (accept or refuse) and give reservations only among customers with individual contracts or smaller group contracts (<5 persons). We received a random sample of processed claims for the years 2007-2010 from an insurance

company.<sup>1</sup> Hence, we categorize the data according to the type of the contract (individual and group). We use OLS regression and logit analysis for finding significant factors that effect claims. In addition we undertake descriptive analysis of the reservation patterns. To receive a reservation for some particular health problem means that the insurance company does not cover charges connected to that problem. Then we find relative numbers of claiming group and individual policyholders to registered numbers of group and individual policyholders during a period of time for a given type of contract. Finally, we calculate expected average claims for these two categories for the period. We find this methodology the most appropriate for the limited amount of data at our disposal.

## 1.2 Previous research

To the best of my knowledge the research in the field of PHI in Norway is not abundant since PHI has been on the Norwegian market only over a decade (Aarbu, 2008). In this section we monitor the previous studies that focus mostly on demand patterns of Norwegian treatment insurance. The majority of the studies are based on the survey of living conditions from the Statistics Norway (SSB) combined with other available data, such as education, income etc.

According to Aarbu (2010) there is a strong preference for PHI among self-employed and smokers as well as people with higher income. Public waiting lists affect the demand for PHI among individual policyholders but not among policyholders of employer-paid insurance. His research is based on the analysis of survey data set combined with available public data on waiting times. Interestingly, per April 2011 the waiting time for elective treatment in hospital in Norway was 71 days (Dagens Næringsliv, 22.8.2011).

Grepperud and Iversen (2011) show that the probability of being covered by employer-paid PHI increases for young to middle aged men (25-44 years) with high income, low educational level and management position, as well as for private sector (financial sector, in particular). Their results suggest that it is less probable to have PHI for people with higher number of visits to a general practitioner (GP) and patients diagnosed with at least one chronic disease. At the same time, self-reported health status does not have any effect. Thus, there is some

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<sup>1</sup> This insurance company preferred to keep its name anonymous, and, therefore, we call it "the insurance company" or "our insurance company".

degree of selection regarding the types of employees being offered PHI (p. 15, Grepperud and Iversen, 2011).

Urkegjerde (2010) does not find any clear relationship between PHI and usage of medical services (visits to a GP or a specialist). However, visits to a physiotherapist significantly increase for people covered by employer-paid insurance. The probability of visits to a specialist outside of hospitals increases for women covered by individual contracts. At the same time, the expected number of visits to a GP decreases for women covered by group contracts (Urkegjerde, 2010).

The report of Berge and Hyggen (2010) from the Institute for Labor and Social Research that investigate the growth of PHI in Scandinavia, gives a good theoretical background about types of insurance and the situation regarding PHI in Norway, as well as neighboring Scandinavian countries.

## **1.3 Thesis structure**

Chapter 2 focuses on the Norwegian health system and PHI. It provides with background information and numbers for policyholders in Norway for recent years. Further it presents more specific description for the types of the contracts and their differences, calculation of the premiums and reasons for PHI purchase for either individuals or group policyholders. Chapter 3 looks into the theory of risk selection, its history and development, its characteristics and possible ways out. It takes up the questions of risk-adjustment and adverse-selection and shows mechanisms of selection in case of individual versus group insurees. Chapter 4 presents a descriptive analysis of data and statistical analysis in order to indicate significant correlations for group and individual contracts. Chapter 5 offers conclusions and further research possibilities.

# 2 Norwegian health system and PHI.

## 2.1 Background information

Norway is a welfare state that exercises social help, free education and universal health care coverage policies. Thus Norwegian private health treatment insurance is not compulsory, and it can be compared to the complementary or supplementary private health insurance in the US and other non-Scandinavian European countries. Generally, there are three types of private health insurance: substitutive, supplementary, and complementary. **Substitutive insurance** is an alternative to statutory insurance. It is available to groups of population that might be excluded from public coverage or that are free to opt out of the public system. In Germany and the Netherlands individuals with high incomes may purchase substitutive health insurance. **Supplementary** PHI allows faster access to services and the possibility to choose the time of visits and providers of medical services, which may result in differential access to the medical help depending on whether they are policyholders. **Complementary** PHI offers full or partial coverage of services that are excluded from or not fully covered by the statutory health care system (p. 19-20, Mossialos, Dixon, 2002).

Private health insurance in Norway gives faster access to medical help and covers the charges at private hospitals and clinics (FNO, 2008). During the last 5 years the number of PHI contracts has increased. Figure 1 shows the increase in number of PHI policyholders in the insurance companies that are members of the Finance Norway Organization for the period of 2003-2011 (Statistics of FNO, 2010, 2011). It is interesting to explore the PHI market in Norway as it is growing. In contrast to the situation on the Norwegian market, Danish insurance companies reached over one million policyholders, and this indicator remains steady for the last three years (Figure 2).

Figure 1. Increase in number of people covered by PHI for the period 2003-2011 for Norwegian companies (Finance Norway members only) (FNO, 2011)

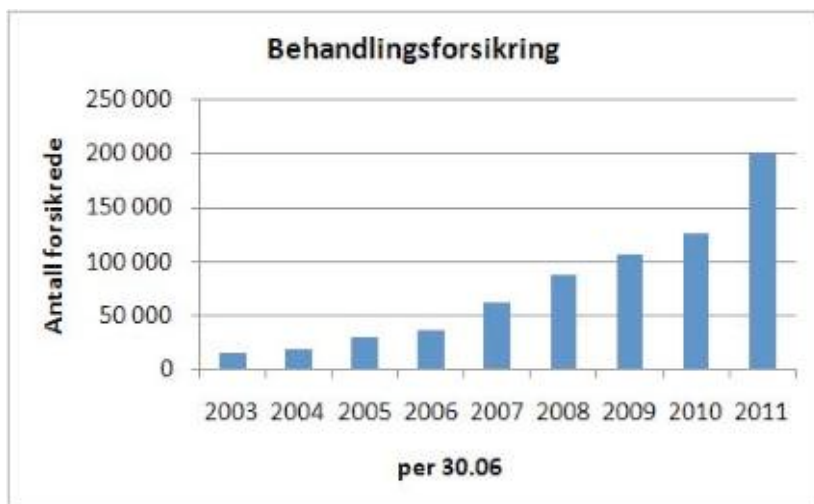
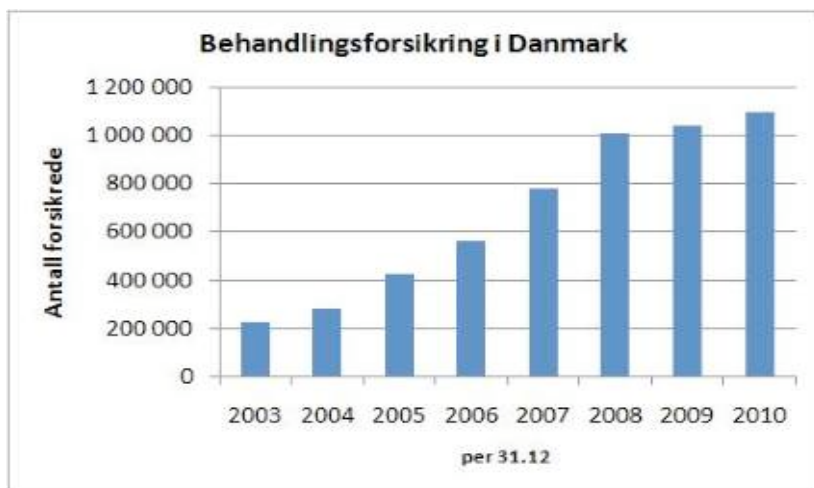


Figure 2. Growth in PHI during 2003-2010 in Denmark (FNO, 2011)

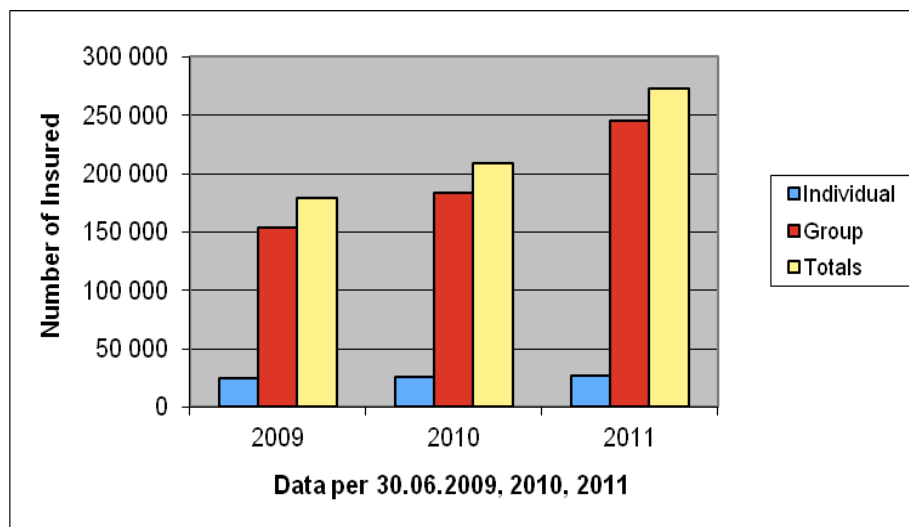


All together, approximately 272 000 Norwegians have PHI contracts per 30<sup>th</sup> of June 2011 (Statistics of FNO, 2011, VHA, 2011). Overview of the contracts you can see below in Table 1 and Figure 3.

Table 1. PHI in Norway (Statistics FNO, 2011 and VHA, 2011).

	<i>Number of insured</i>			<i>Market share</i>		
	30.06.11	30.06.10	30.06.09	30.06.11	30.06.10	30.06.09
<b><u>Companies members of FNO</u></b>						
<b><i>Individual contracts</i></b>						
Försäkrings AB Skandia, filial Norge	-	732	652	0,00	4,65	4,14
Gjensidige Forsikring	1 901	1 586	1 280	11,11	10,07	8,13
SpareBank 1 Skadeforsikring	806	-	-	4,71	0,00	0,00
Storebrand Helseforsikring	11 941	12 418	12 912	69,77	78,86	81,98
Terra Forsikring	34	38	25	0,20	0,24	0,16
Tryg Forsikring	2 433	972	881	14,22	6,17	5,59
<b>Total</b>	<b>17 115</b>	<b>15 746</b>	<b>15 750</b>	<b>100,00</b>	<b>100,00</b>	<b>100,00</b>
<b><i>Group contracts</i></b>						
Försäkrings AB Skandia, filial Norge	-	16 294	18 621	0,00	14,69	20,51
Gjensidige Forsikring	30 798	21 973	10 678	19,42	19,81	11,76
IfNUF	50 435	24 090	15 823	31,81	21,72	17,43
SpareBank 1 Skadeforsikring	18 732	-	-	11,81	0,00	0,00
Storebrand Helseforsikring	33 169	31 446	32 511	20,92	28,35	35,81
Tryg Forsikring	25 433	17 120	13 156	16,04	15,43	14,49
<b>Total</b>	<b>158 567</b>	<b>110 923</b>	<b>90 789</b>	<b>100,00</b>	<b>100,00</b>	<b>100,00</b>
<b>Totals (all contracts)</b>	<b>175 682</b>	<b>126 669</b>	<b>106 539</b>	<b>100,00</b>	<b>100,00</b>	<b>100,00</b>
<b><u>Vertikal Helseassistanse</u></b>						
VHA Individual	10 241	9 583	9 020	37	38	36
VHA Group	86 682	73 009	63 214	32	40	41
<b>VHA Totals</b>	<b>96 923</b>	<b>82 592</b>	<b>72 234</b>	<b>33</b>	<b>39</b>	<b>40</b>
<b>Totals (FNO + VHA)</b>						
<b>Individual</b>	<b>27 356</b>	<b>25 329</b>	<b>24 770</b>	<b>100,00</b>	<b>100,00</b>	<b>100,00</b>
<b>Group</b>	<b>245 249</b>	<b>183 932</b>	<b>154 003</b>	<b>100,00</b>	<b>100,00</b>	<b>100,00</b>
<b>Totals</b>	<b>272 605</b>	<b>209 261</b>	<b>178 773</b>	<b>100,00</b>	<b>100,00</b>	<b>100,00</b>

Figure 3 Growth in PHI 2009-2011 in Norway (based on the numbers above)



## 2.2 Premiums

The premiums can be risk, group, or community rated. Generally, a risk-rated premium is the most common way of calculating a premium for individual policyholders. They are based on the actuarial calculations of the probability that a policyholder makes a claim. When the policy is purchased through the employer, the premium is usually group-rated, and based on the calculations of average risk of the employees in that firm. Finally, we have community rated premiums that are based on the average risk in a geographically defined area (p. 20, Mossialos, Dixon, 2002).

In the case of our insurance company, the premiums of the basic insurance package are calculated with consideration of only the age of the applicant for individual contracts and number of insured employees for group contracts. The older is individual policyholder, the more expensive is the premium. The more employees a firm wishes to ensure, the cheaper the premium per person is. Individuals and smaller groups (<5 persons) can possibly receive reservations against some health problems based on their health statements. When issued, a reservation entails that the insurance company does not cover expenses for a particular health problem (source in the insurance company). The premium to be paid for a smaller group contract is still less than the average premium that has to be paid by individuals above 35 years old. Thus group coverage gives a great advantage to the people of middle age and above. There are no co-payments for the treatments; policyholders pay only the premium.

## **2.3 Practical difference between applications for individual and group contracts**

When applying for the insurance individually people are required to deliver a personal statement of their health status to the insurance company. They can get a reservation from the insurance company or even be rejected. The same rule applies for the smaller group contracts (where the number of insured is less than five). In case of group application the firm acts on behalf of its employees. If there are more than five people to insure, it is not required to turn in their health statements, and these people are not the subject to selection. It is only the employer who turns in a statement on behalf of all employees confirming that there are no health obstacles for them to make their work. Thus all of them have to pay the same premium regardless of the health state.

PHI is divided into modules, so that the applicant for the insurance can decide which modules fit best. Basic package includes treatments within the following categories: hospital, specialist, second opinion, rehabilitation, dental, substance abuse and addiction, plastic surgery, medications, rehabilitation, travel expenses, living expenses, travel companion. They can also choose to top up with physical treatments (like physiotherapy, manual therapy, chiropractor, acupuncture etc.), help from psychologist and emergency assistance or extended assistance (physiotherapist, manual therapy, chiropractor, classical acupuncture, home service).

## **2.4 Reasons to purchase PHI for firms and individuals.**

According to Grepperud and Iversen (2011), there can be several reasons for buying group PHI for firms. Among them there are reducing costs of sick leave or attracting more potential employees (Grepperud and Iversen, 2011). However, the study from 2010 has shown that among all the socioeconomic factors only employment at risky jobs and access to information about PHI increase likelihood of PHI coverage. As a fringe good, it got a third preference out of five in the survey of wanted fringe goods for employees (Czertkova, 2010).

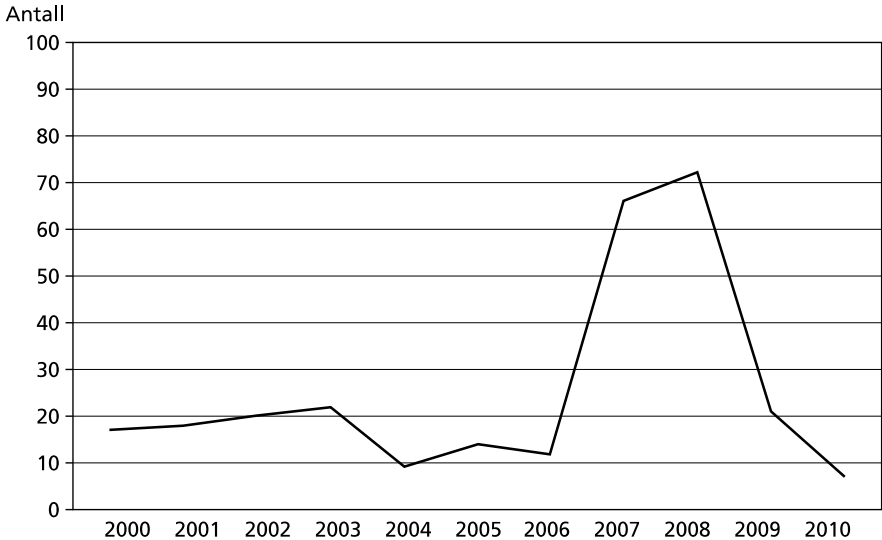
Furthermore, According to Grepperud and Iversen (2011), acquisition of PHI can function as a preventive measure against sick leaves. However, Sintef (2009), using selection of 300 of



members of the confederation of Norwegian Enterprise, shows that it is not possible to see the difference in development of absenteeism among those who have and who haven't PHI, and that main reasons for the firms to purchase the PHI for their employees is to reduce waiting time to receive treatment for sick employees, to reduce absenteeism and to show care for the employees.

As to individuals, the reasons could be more straightforward and be connected to the health state and negative talk in media regarding public health system (Source from the insurance company). Figure 4 below demonstrates the activity of media regarding the waiting time in the public health system (p. 31, Berge, 2010).

Figure 4. Instances of media reference to the waiting times in public health system in Norway (Berge, 2010)



# 3 Theoretical framework<sup>2</sup>

## 3.1 Risk-selection and risk-assessment

Risk selection is the situation when an insurance company chooses the more profitable customers. It is a complicated phenomenon that has its roots in Europe in 1970s when, one by one, insurance companies started to offer cheaper policies to students and more expensive to the elderly. Later on they also used discrimination towards people with high-risk of getting sick, which triggered a spiral of further risk selection (p. 231, Wasem, 2004). Politically, it is not encouraged in welfare states, where equality of opportunity is given priority. We can find arguments in media against PHI, as the existence of PHI creates class division in the health sector, where people who are employed, with bigger salaries and better health get better and faster medical help (Manifest, 2009). As we mentioned earlier, the number of group policyholders is growing rapidly, while the number of individual policyholders is quite steady. According to Manifest's analysis, the majority of the firms give PHI to a selection of people. Only 3% of them prioritize the employees in the health risk groups, 67% prioritize the firms' management, 44% insure key personnel and 42% insure the owners (Manifest, 2009).

Nowadays, from the point of view of insurance companies, risk assessment is a vital necessity that saves them from economic problems. They compare not properly checked customers with ticking bombs that might explode sooner or later. They can increase the claims to the insurance company and thereby stimulate an increase of premiums. This can be deterring for customers with average and below average claims. Left with old and sick, they would feel strong economic pressure and increase the premiums ratio again, worsening the loop. (p. 114-115, Brekken, 2010)

PHI companies use a lot of resources to check the health statement with different institutions. There are complete departments working only with risk assessment in order to give a suitable premium price. Premium elements usually are supposed to cover administration costs (annual costs), claim costs, and establishment costs (p. 114-115, 145, Brekken, 2010). Risk-assessment is necessary to make risk-adjusted premiums. Proper risk-adjusted premiums can remove financial uncertainty from the insurance companies. This is especially relevant for

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<sup>2</sup> I am using a lot of material from my term paper for the course in Structure, organization and financing of health care systems (HMM4202) "The problems of the risk selection" (2009).

parts of Europe and the USA, where private insurance companies (and not the state) play major role in the health insurance market. Van de Ven (2003) states a number of criteria for the risk-adjustment in order not to harm the solidarity. Among them there are appropriateness of incentives of companies (effectiveness and no selection), fairness (premiums should be consistent with the desired solidarity), feasibility (required data should be available and resistant to the manipulation of the insurance company) (p. 81-82, Van de Ven, 2003).

## **3.2 Different mechanisms of risk-selection**

### **3.2.1 Principal - agent relationship. Adverse selection**

We assume that there are two types of insurees: a “low-risk” (a person with good health) and a “high-risk” (a person with poor health). The “high-risk” is an individual with a high expected value of health care expenses, through either higher probability of needing health care or/and higher expected expenses if they do, and the “low-risk” is an individual with a low expected value of health care expenses. It is assumed that the insurance company can observe the distribution of health in the population, but not the health status of the individuals. The only two factors that they know for sure are age and occupation. Therefore the insurance company asks for health statement of the individual. However, some points of information could be hidden. This is a factor of asymmetric information.

We use the principal agent theory to explain it. Principal - agent relationship occurs when a principal makes a contract with an agent to make some tasks on his behalf (e.g. worker - employer, insurer - insuree) (p. 277, Pettersen, 1993). This relationship can often be characterized by information asymmetry, this is, hidden actions or hidden information from one of the parties in form of adverse selection, moral hazard or risk selection. “Moral hazard takes place when the act of insurance increases the likelihood of the situation that one is insured against” (p. 27, Mossialos, 2002). The moral hazard is ignored to set up the scope of the study. Adverse selection occurs because the insurer cannot calculate the accurate premium that will reflect the risks and sets an average premium (ibid.). However, “high-risk” individuals have a higher probability of needing health care or may expect higher expenses if they do. In both cases the expected value of their expenses will be higher than for “low-risk” individuals. For a given level of risk-aversion an individual with a higher expected value of health care expenses will find insurance more attractive than an individual with a low

expected value. Many “low-risk” individuals then prefer to leave the insurance, which increases the number of “high-risk” individuals per insurer and thus increases the average premium (p. 27, Mossialos, 2002).

### **3.2.2 Empirical evidence of adverse selection**

There is another point of view on the question of adverse selection. The study made in the USA has shown that there is no empirical evidence of adverse selection. Cardon and Hendel (2001) estimated a structural model of health insurance and health care choices using data from single individuals from the National Medical Expenditure Survey. They tested for unobservables linking health insurance status and health care consumption and did not find evidence of informational asymmetries. This observation entails that consumption of health care is not elastic but depends more on the real state of the health of an individual than on the PHI purchase. This study explains cheaper employer-provided insurance with observable geographic differences and price sensitivity, as well as fixed administrative costs and bargaining power. An alternative explanation, which is supported by very little empirical research, is the absence of long-term contracts, because the contracts have usually a duration of one year. Healthier individuals would drop contract, while individuals with poor health would stay in the pool. At the same time individuals with employer-provided insurance are not likely to withdraw from the pool (Cardon, 2001)).

### **3.2.3 Usage of different contracts with a purpose of self-selection**

From an economic and political point of view, it could be more optimal to apply a method of self-selection with price choice. A transition, from the method with reservations and the health check, to the method of self-selection and price choice, would allow to save costs on the risk assessment and to pave the way towards market equilibrium. In such a system at least two contracts would be offered, one with a low premium but high co-payments, and another with a high premium and low co-payments. A “low-risk” customer would prefer a cheaper policy that has higher co-payments. A “high-risk” customer prefers a more expensive policy that can cover more expenses and, by paying higher premium price for the policy, compensates the company for possible risks. Thus the customers can be induced to choose type of premium and coverage for the policy themselves (p 281, Pettersen, 1993).

Why would self-selection work? The higher the risk, the more expensive should the premium set by the insurance company (the price for the policy) be and the smaller should the co-payments be. There is a trade-off between premium price and co-payments price. Assume that the “high-risk” person mimics and tells the company that he has good health and, thus, he receives cheaper policy intended for the “low-risk” insuree. In this case, both of them buy the same policy, although the health of the “high-risk” person is worse than the health of the “low-risk” person. The number of health services will depend on the actual health state: the better is health, the smaller is the number of visits to doctor. If the “high-risk” person mimics good health and buys the cheaper policy, he pays the same low premium as “low-risk” person. However, he consumes more health services and pays more expensive co-payments than the “low-risk person”. Therefore, he spends a lot more than the “low-risk” insuree, and because of that the cheaper policy would not be as attractive to the “high-risk” insuree as it is to the “low-risk” insuree. The “low-risk” individual spends less money on the health care. He does not mind so much if the co-payments are high because he is not going to spend so much money anyway. This individual, therefore, chooses the package with high co-payments and smaller premium (assuming that the person is risk neutral). The person with poor health needs to spend more money on buying services and therefore prefers to have lower co-payments. By setting the co-payments high enough in the cheaper policy, the insurance company can make sure that the “high-risk” individual does not prefer to mimic the “low-risk” individual and buy the low-premium policy. Both types of insurees will then choose the most suitable policy.

The question is whether it would be reasonable to use the method of self-selection for Norwegian PHI customers today. The company we are cooperating with, as other Norwegian insurance companies, has a system of no-copayments for PHI. One may top-up with an additional package/modul (e.g. more help from psychologist or more from physiotherapist). This is equivalent in a way to a self-selection approach. It is possible that co-payments (as in car-insurance market) would be a better alternative for the insurance company in order to reduce the risks, and would be more politically correct towards the people (as they would be allowed to choose suitable for themselves price-policy). However, the difficulty is to optimize size of the premium and co-payments in such a way that it would be deterring from mimicking and attracting customers.

### **3.2.4 Relevance of adverse selection for group versus individual contracts**

Above described phenomenon of risk-selection is applicable only to the individual insurees in our study. Not-selected insurees in our case are group insurees that are insured “as they are”. Therefore, in our study we look on two groups of insurees: insurees with individual contracts and insurees with group contracts. We decided to differentiate them in this way in order to look if there is a phenomenon of the risk-selection here. The selected insurees are the ones who have individual contracts, because the insurance company screens them: they deliver a health statement and they may receive a reservation not to cover expenses connected to some particular illness, or be rejected. The not-selected insurees are the ones who have group contracts, because the majority of the group insurees are not screened, and thus are not subject to reservations or rejection.<sup>3</sup>

When it concerns the premiums, we cannot explain their relationship with the claims as we are limited by the data, but we know that individual insurees pay higher premiums than group insurees, and the greater number of people in the group contract, the cheaper are the premiums for their members, as they share the risk-pool. In the company we made our study for, as in the majority of Norwegian PHI companies, the difference in premiums is made by such adjusters as age (for individual policies) and number of customers (for group policies). There are no co-payments, but there is something called “basic” contract and additional modules. Reservation based on the health statements is an additional risk-adjuster for insurees with individual contracts and smaller group contracts (with less than 5 people). Thus there is big uncertainty considering the rest of group policyholders (with above 5 participants).

There are different factors pulling in different directions regarding the size of the claims. Due to the theory of risk-selection, the individual insurees will claim less than group insurees because the first ones are “picked” by the insurance company and the second ones are taken as a group without making a health check. On average, the health status screening should apply that the individual insurees are healthier than the group insurees.

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<sup>3</sup> If the data would allow us, we would have distinguished the group insurees into two subgroups: with fewer than 5 and with above 5 members, because the smaller groups applied the same rules considering health statement delivery and the reservations as individual insurees, while the larger groups are not a subject to a health check, and of this reason cannot neither be given reservation. However we are pressed to make more rough division.

On the other hand, the individual insurees might have knowledge of health risks that are not revealed by their health statements. Insurees of the same age with individual contracts have the same type of basic contract and the same price for premiums. Therefore, we can assume that there may be some space for adverse selection because of the health-unobservables. This could drive towards higher claims within individual contracts. The fact that very few people buy individual health insurance could be an indication that this is a selected group of people that buy PHI because they think they have higher probability to get sick.

Group contracts may have some additional adverse selection as well. The reason for this is that often only a group of employees in a firm is covered. It happens because the management might choose them or because many other employees (who feel confident about their health) drop insurance as a benefit and rather chooses a higher salary. This would raise claims within the group contracts. Additionally, majority of the group insurees are not checked, which means the average health state would be lower than in screened group. Lower average health status should imply higher health care expenses. However there is a factor pulling in the opposite direction: not all the employees are clear about the fact that they are insured and how to use insurance. Unlike these group insurees, the individuals are very clear about usage and aim of insurance because they buy the insurance in order to use it. The factor that they are being screened and chosen reduces the risks of higher claims.

So we see that there are various factors that pull in each direction. It is difficult to tell which effect is stronger and we need more research on this field. In the empirical section below we will test a working hypothesis that the risk-selection is the dominating factor and results in lower expected claims within individual than the group contracts.

# 4 Empirical study

## 4.1 Hypothesis

As mentioned in the introduction, our aim is to study claim patterns in the light of the theory of risk-selection. We hypothesize that the group policyholders claim more than individual policyholders because the former are not selected, whereas the latter are carefully scanned and those with bad health problems have been given reservations not to cover some particular illnesses or even have been rejected. To find out more about the claims and the risk-selection we run a regression to compare these two groups, their demand and claim patterns.

## 4.2 Data and descriptive statistics

We receive a data set from a Nordic insurance company. The data set contains a random sample of processed claims from people with individual and employer-paid contracts. We have approximately 6300 claims made by approximately 2200 people in the period 2007-2010. The descriptive statistics is presented in Table 2. The first three columns in the table are data over submitted claims; the last three columns are collapsed data per person. Not all of the variables are used in the analysis, but we consider that the data below gives a good general overview over the people who claimed. We divide them into categories: group contracts, individual contracts and all those who have received reservations (regardless the contract type). We divide variables into following sections; *Claims*, *Occupation*, *Geography*, *Age* and *Gender*, and *Contract*; and present an explanation for each category of variables below.



Table 2. Descriptive statistics of claims: PHI 2007-2010

Variable	Data on claims (2007-2010)			Aggregate data on people (2007-2010)		
	Group claims	Individual claims	Claims having reservations	Group policyholders	Individual policyholders,	Policyholders having reservations
<b>N, number of observations</b>	<b>5966</b>	<b>311</b>	<b>106</b>	<b>2036</b>	<b>163</b>	<b>46</b>
<b><u>Claims</u></b>						
Mean of claims	6630.78	10771.61	23279,98	-	-	-
Mean of aggregate claims per person	-	-	-	19429,89	20551,98	53686,48
Higher claims - D <sup>4</sup>	0.16	0.14	0,22	-	-	-
Higher aggregate claims - D	-	-	-	0,18	0,11	0,20
<b><u>Occupation - D</u></b>						
Primary sector	0,03	-	0,04	0,05	-	0,04
Secondary sector	0,25	-	0,15	0,34	-	0,13
Tertiary sector	0,71	-	0,32	0,61	-	0,39
Fishing	0,003	-	0,03	0,00	-	0,02
<b><u>Geography - D</u></b>						
Oslo	0,18	0,09	0,14	0,13	0,09	0,17
Big cities other than Oslo	0,49	0,48	0,27	0,4	0,5	0,29
Province/Smaller city	0,33	0,43	0,59	0,47	0,41	0,54
East	0,34	0,38	0,48	0,37	0,36	0,48

<sup>4</sup> “-D” mean dummy variable: 1 is true, 0 is false.

<b>West</b>	0,51	0,50	0,36	0,43	0,53	0,35
<b>North</b>	0,03	0,05	0,10	0,05	0,05	0,11
<b>Middle</b>	0,02	0,04	0,00	0,04	0,04	0,00
<b>South</b>	0,06	0,03	0,06	0,08	0,02	0,07
<hr/>						
<b><u>Age and gender</u></b>						
<b>Year of birth</b>	1965	1974	1966	1966	1967	1967
<b>Age when claimed</b>	44,34	35,64	43,30	-	-	-
<b>Kid (age&lt;18)-D</b>	0,00	0,21	0,00	0,00	0,26	0,00
<b>Adult -D</b>	1,00	0,79	1,00	1,00	0,74	1,00
<b>age20_39 -D</b>	-	-	0,46	0,38	0,31	0,43
<b>age40_59 -D</b>	-	-	0,43	0,53	0,40	0,43
<b>age60_79 -D</b>	-	-	0,10	0,09	0,01	0,13
<b>Mean age when claiming</b>	-	-	-	43,25	33,47	42,69
<b>Gender (1-M, 0-F)</b>	0,68	0,46	0,58	0,68	0,45	0,61
<hr/>						
<b><u>Contract</u></b>						
<b>Average number of applications</b>	-	-	-	2,93	1,91	
<b>Reservations -D</b>	0,01	0,16	1,00	0,01	0,12	1,00
<b>Contract type (1-Group, 0-Individual) - D</b>	1	0	0,53	1,00	0,00	0,59

### **4.2.1 Claims**

The first section of Table 2, *Claims*, needs detailed explanation. *Mean of claims* stands for the average size of the submitted claims. *Mean of aggregate claims per person* stands for the average size of the aggregate claims per person in the period 2007-2010. *A higher claim* is a dummy indicating submitted claims above 6835 NOK. 6835 NOK is the average of all submitted claims, and in our case it distinguishes high claims from low claims.

Correspondingly, *a higher aggregate claim* is a dummy representing aggregate claims per person higher than 19513 NOK. 19513 NOK is the average of all aggregate claims per person.

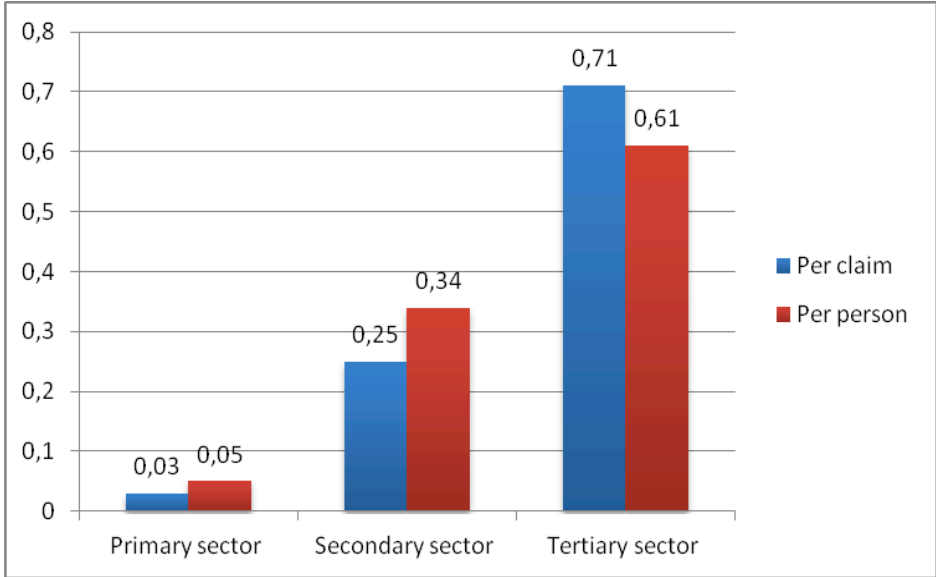
Group and individual policyholders claim for approximately equal aggregate sums in the period 2007-2010. 18 % of the group policyholders and 11 % of the individual policyholders submit higher than average aggregate claims. However, separate claims made by persons with group contracts are much smaller than the ones made by persons with individual contracts. It indicates that group policyholders claim small sums but often and thereby pool a quite high amount of money. We can see it from the variable *average number of applications*: group policyholders turn in three claims on average, while individual policyholders turn in only two. 20% of policyholders with reservations claim for higher than average aggregate sums. Given that their average claim is twice bigger than what is the average for the individual or group contracts, we can suppose that if the insurees get reservation for some particular health problem, they have many other health problems that are not taken into account by the insurance company.

### **4.2.2 Industrial sector**

We have variables concerning sector of occupation only for the group contracts. We do not have such information about the individual policyholders. Figure 5 shows the distribution of the sectors of occupation of the insurees with group contracts per submitted claim and per person. The proportions are curious here. There are 5 % of persons engaged in the industries of primary sector, 34 % of secondary sector and 61 % of tertiary sector; while the distribution of the claims is 3 %, 25 % and 72 % for primary, secondary and tertiary sector respectively. We see that people from tertiary sector claim more than people in primary or secondary sector. We assume that the factor of information could play a role here: information about

PHI is more spread among people working in the offices in tertiary sector than among people working in manufacturing and production. This is supported by the research made by Grepperud and Iversen (2011), where they found that people working in the financial sector have significantly greater percentage PHI policyholders than those working in other sectors.

Figure 5. Sectors of occupation per claim and per person

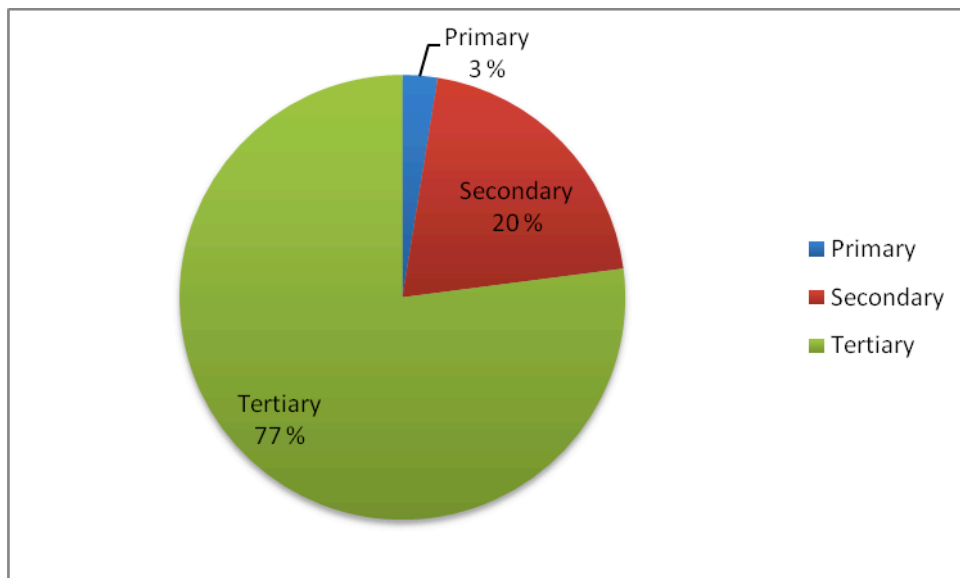


Our analysis has shown that the insurees from fishing industry (which is a part of primary sector) make generally higher claims than insurees working in other sectors. However, the number of the observables is too small and we cannot rely on it: 0,32 % of all the submitted claims come from people working in fishing industry.

As presented in Figure 6, the percentage of people who work within the three industrial sectors nationally is respectively 3 %, 20 % and 77 % (SSB, 2010). Percentage of people with claims from our data set is 3 %, 25 % and 72 % per primary, secondary and tertiary industry sectors, which, more or less, corresponds to the national numbers.<sup>5</sup>

<sup>5</sup> The national data from the source is not very precise: they have one common number for people working with mining and manufacturing, while the former one is a primary sector, and latter is a secondary sector. I registered that number to the secondary sector. Thus the real numbers have to be a bit higher for primary sector and a bit lower for secondary sector.

Figure 6. Sectors of occupation: national data for Norway in 2009 (SSB, 2010)



### 4.2.3 Geography

Figure 7 illustrates our distribution of the regions where the policyholders (for individual contracts) or the firms (for the group contracts) are registered: East 38 %, West 45 %, Middle 4 %, South 8 %, and North 5 %. West and East regions are leading. South, North and Middle are lagging behind. According to SSB (2011), see Figure 8, there are about 50 % of national population registered in the East, 26 % in the West, 9 % in the Middle, 6 % in the South, and 9 % in the North region. Thus we observe that East, North, and Middle regions are underrepresented, while South and West regions are overrepresented. In Figure 8, we sum up distribution of claiming policyholders by region and compare to national numbers of the population registered in the regions. We observe regional variations of the numbers of the insurees with individual and group contracts and the ones with reservations. North and East Norway have the highest number of policyholders with reservations compared to other two categories; West Norway has relatively more individuals; South Norway has more people with group contracts and the ones with reservations; Middle Norway has more or less equal percentage of people with individual and group contracts and does not have anybody with reservations.

Figure 7. Region of registration of claiming policyholders (without division into subgroups): South 8 %, East 38 %, West 45 %, Middle 4 %, and North 5 %

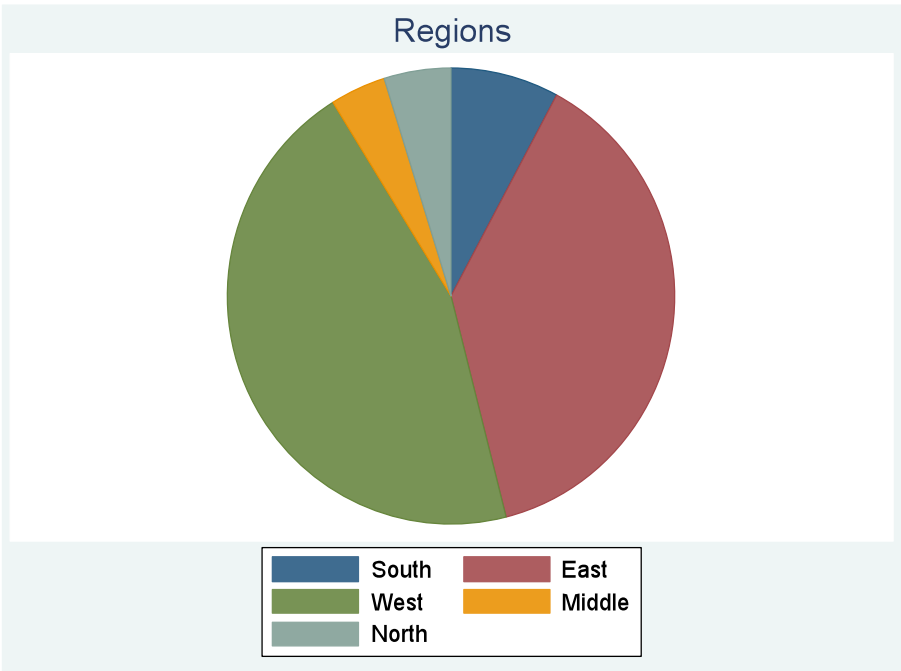
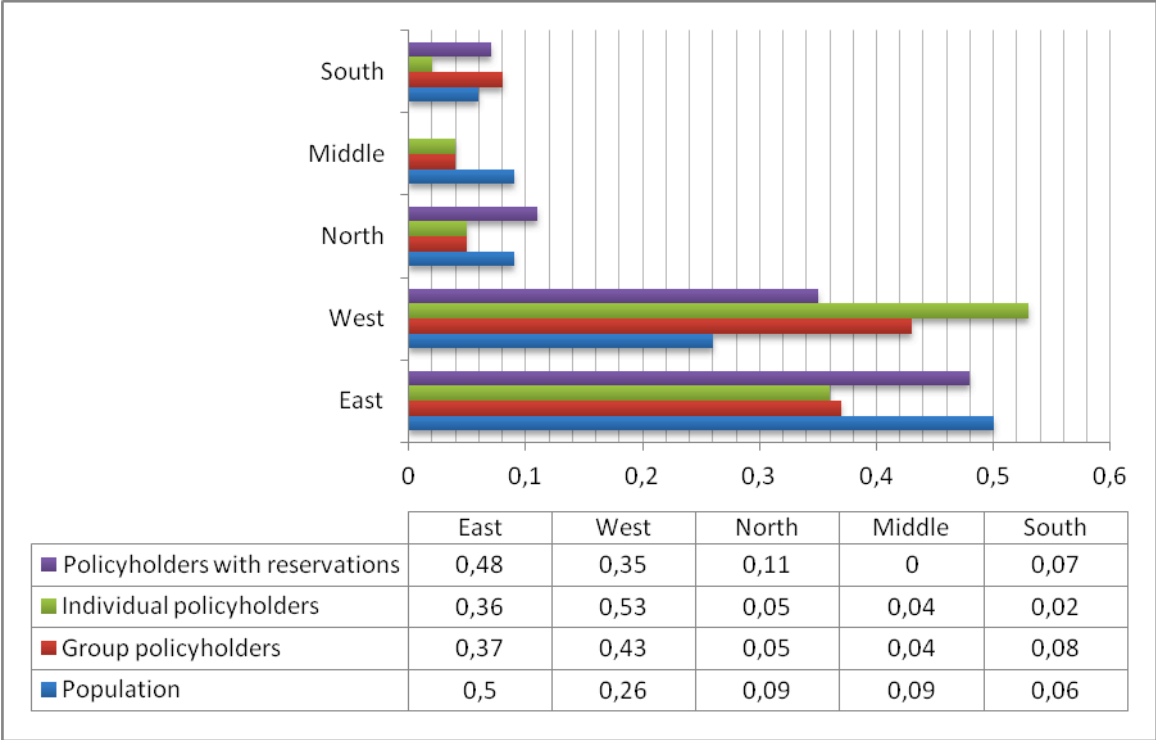


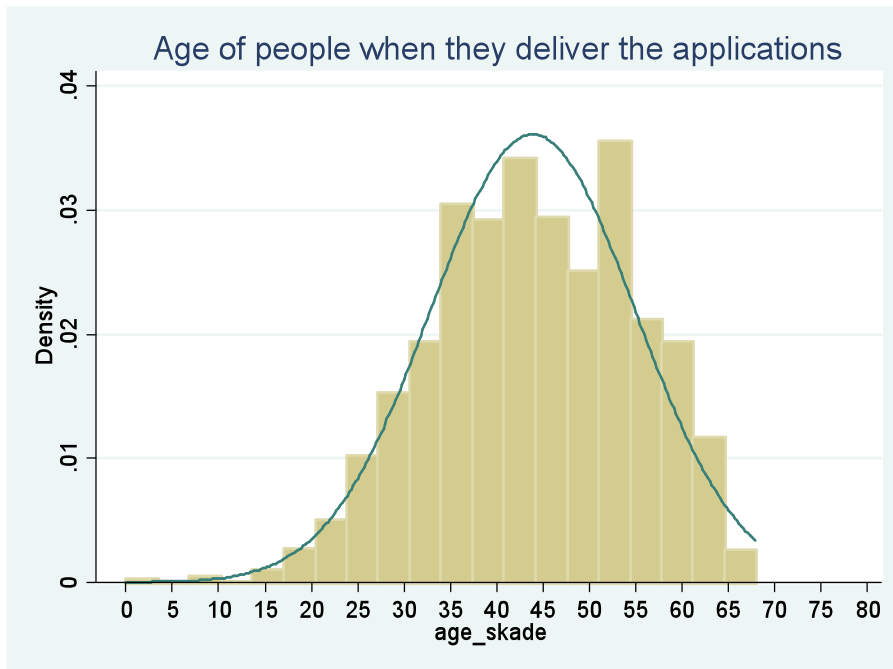
Figure 8. Distribution: different types of policyholders in regions and population (our data set and SSB, 2011)



## 4.2.4 Age

Figure 9 shows the age when people claim (without division into subgroups). It has approximately normal distribution, which is shown by the drawn curve. There we can see that majority of claiming people are between 35 and 55 years old.

Figure 9. Claim age



## 4.2.5 Types of contracts, coverage and reservations

As we can see in Figure 10 in our sample there are 7 % people with individual contracts and 93 % with group contracts. To compare with national numbers of the insurees we can use Table 1. We find following distribution between the individual insurees and group insurees: 2009 has 14% / 86%, 2010 has 12% / 88%, 2011 has 10% / 90%. These numbers indicate a trend: share of the group insurees grow, while share of the individual insurees fall by 2% each year during last three years. So, if we calculate approximate share of the insurees in 2007-2010 following the pattern of the trend, it should be 15% / 85%. That indicates that only 50% of the individual insurees claimed in the period 2007-2010, while the corresponding number for the group insurees was 91%. Unfortunately we do not have accurate data on the number of insurees in 2007-2009 to be able to support our conclusions.

Figure 10. Distribution of the policyholders by the contract type

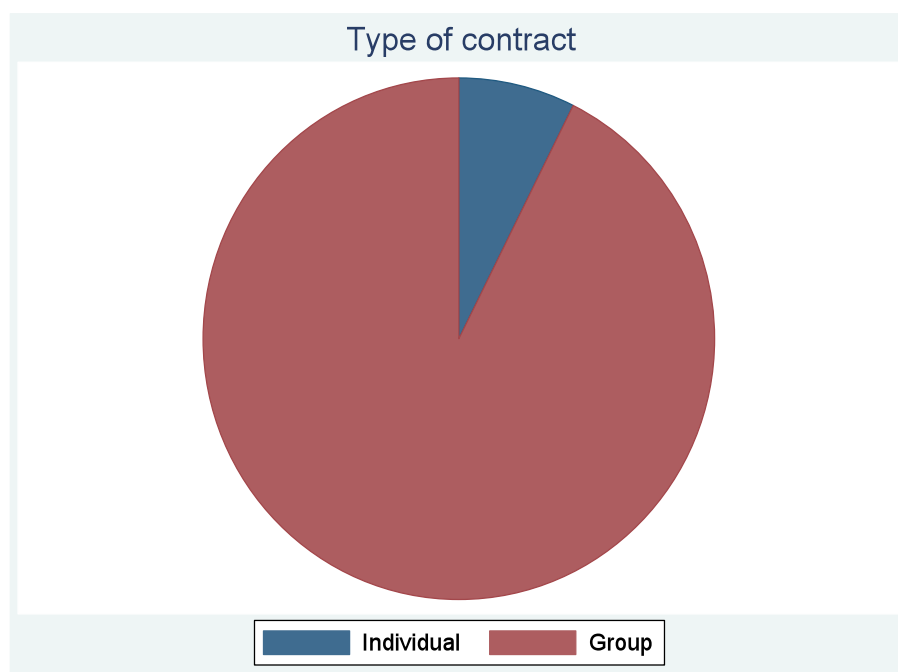


Table 3 presents an overview of the coverage types. 94 % of submitted claims account for the treatment insurance for the group insurees and 5 % for the individual insurees; as little as 0,75 % claims are for an operation warranty or a specialist treatment; and only 0,13 % are for rehabilitation. Co-insurance for the partners is more used by insurees covered by individual contracts (0,18%) as compared to 0,08 % for those covered by employer-paid contract.

Table 3. Coverage

<b>What type of coverage</b>	<b>%</b>	<b>Cum.</b>
Rehabilitation	0,13	0.13
Operation warranty /Specialist treatment	0,75	0.88
Treatment insurance - group	94,04	94.92
Treatment insurance/spouse - group	0,08	95.00
Treatment insurance - individual	4,83	99.82
Treatment insurance/spouse - individual	0,18	100.00

*Reservation* is a dummy and shows if the person has received a reservation from the insurance company not to cover expenses connected to some particular health problem. 2 % of the



people in our data set have received reservations. They have submitted only 1.7 % of all the claims. About 9 % of the claims are “zero claims” – filed but not compensated (when there is no valid reason for the compensation). Only 3 % from the 2% of the people with reservations make “zero-claims”. Thus to give reservation can be considered as a deterring measure against “zero-claims”.

We checked whether there are correlations between reservations and some particular industry codes but we didn't find any significant results. Then we checked with the help of *logit* analysis if there are any factors influencing the likelihood of having reservations. We controlled for age, gender, Oslo / other big city and regions, and did not find any significant effects. Then we run an OLS regression to see what factors influence size of the aggregate claims for the people with reservations. We have controlled for type of contract, gender, age, region, Oslo /other big city, occupation. We found a significant increase of people who come from North Norway and significant decrease of people who come from big cities other than Oslo. When segregating individual and group policyholders, we found out that group insurees claim for smaller aggregate sums if they come from Oslo, while individuals do so if they come from other big city than Oslo.

## 4.3 Empirical analysis

We have divided our empirical analysis in two sections. Section 4.3.1 is dedicated to the analysis of the claims. We have 6277 observations of the claims; among them there are 311 claims made by people covered by individual contracts and 5966 claims made by people covered by employer-paid contracts. Section 4.3.2 analyzes collapsed dataset where information about each person was aggregate. We have 2199 observations of people, where 163 are covered by the individual contracts and 2036 are covered by group contracts.

### 4.3.1 Analysis of claims

#### **Analysis of the factors that influence the size of the claims**

We use OLS regression with clustered standard errors by person since the same people deliver several of the claims and thus the data are correlated. The dependent variable is the size of the claims. We run regressions for three groups of data, as shown in Table 4: all claims, claims from groups and claims from individual policyholders. We have run different analyses, and came to the conclusion that not all the coefficients are robust to different specifications. We have chosen to control for such variables as *group*, *gender*, *age*, *geographical region*, *Oslo*, *big cities other than Oslo*, *industry sector* (for employer-paid contracts) and *reservations*. All the variables except the dependent variable and *age* are dummies. We expected the *group contract* to give significant effect on the claims when we analyze all the submitted claims in our data set, but it was not the case. However, there is significant positive effect of *age* and negative effect of *secondary* and *tertiary sectors*. Unfortunately, we cannot rely on the effect of the sector for the first regression as *sector* has observations only for the group contracts and not for the individual contracts and, thus, is strongly correlated with groups.

When we make the analysis of each type of contract separately (columns 4-5-6-7 of Table 4), we get a significant increase in claims the older the policyholder is, and it is important to notice that the increase is a lot higher for insurees with individual contracts than for the insurees with group contracts. Surprisingly, the *sector of occupation* and the *geographical area* do not have any significant effect on the claims for each type of the policyholders separately. At last, we get significant effect of *reservations* and that effect differs for group

and individual policyholders: negative for the group policyholders and positive for the individual policyholders.

Table 4. OLS regressions with clustered standard errors by person ID number. The dependent variable is claim size. There are three regressions: for all claims, for claims from group policyholders and for claims from individual policyholders. Statistical significance is denoted as follows: \* 1%, \*\* 5%, \*\*\*10%.

<i>Variables</i>	<i>Totals</i>		<i>Group contracts</i>		<i>Individual contracts</i>	
<i>Nr of observations</i>	<i>6277</i>		<i>5966</i>		<i>311</i>	
	<i>Estimate</i>	<i>Std Err</i>	<i>Estimate</i>	<i>Std Err</i>	<i>Estimate</i>	<i>Std Err</i>
<b>Group contract</b>	-7312,87	4950,53	-	-	-	-
<b>Gender (1-M, 0-F)</b>	688,76	1193,60	187,14	1078,68	1657,30	4795,72
<b>Age when claiming</b>	122,80*	30,08	127,50*	29,06	449,35**	220,83
<b>Kid (Age&lt;18)</b>	-2848,15	3643,09	-1166,40	815,60	11626,94	7252,60
<b>North</b>	8155,92	6794,39	1931,53	3321,43	85407,48	53977,70
<b>East</b>	-2838,83	1984,21	-2085,03	1946,26	-15888,77	10855,29
<b>West</b>	-549,71	1626,43	-984,25	1684,80	10356,35	7199,46
<b>Oslo</b>	7,95	663,71	-425,09	612,31	-2347,33	4528,10
<b>Other big cities than Oslo</b>	488,48	1412,62	1055,18	1466,13	-26969,05	17404,32
<b>Secondary</b>	3584,99**	1681,94	2560,85	1735,55	-	-
<b>Tertiary</b>	3755,50**	1885,03	2341,18	1685,81	-	-
<b>Primary</b>	4324,37	3278,53	4013,01	3604,76	-	-
<b>Reservation</b>	15163,48	12330,49	-1704,11**	976,13	25086,18***	14489,17
<b>Intercept</b>	4943,76	3961,19	-837,49	2418,77	-2978,21	10180,12

## **Logit analysis of the factors that influence likelihood of the higher claims than average**

We make logit analysis where dependent variable is a dummy indicating greater size of the claims than the average of all the submitted claims (6835 NOK). We will call it just “higher claims” to give it a shorter name. As shown in Table 5, we have controlled for the same variables as in the previous analysis: *type of contract, gender, and age, sector of occupation* (for group contracts), *region, Oslo /other big cities* and *reservations*. Surprisingly, *group contract* does not have any effect on the likelihood of higher claims. For both group and individual policyholders the likelihood of higher claims increases the older they are. The differences between them are as follows. For the group policyholders the likelihood of higher claims increases for males, while for the individual policyholders it increases for children and if they have reservations and decreases for policyholders from East Norway.

That decrease could be possibly explained by big number of medical institutions in East Norway, and thus shorter waiting lists and relatively small distances to the places of medical help compared to other regions. Aarbru’s (2010) overview of waiting times in different provinces in Norway supports this assumption. As to reservations, we assume that they increase the likelihood of higher claims possibly because policyholders with reservations have other major health problems that are not taken into account by the insurance company. Likelihood increases for children probably because majority of parents purchase PHI in case of poor health of the child (we observe that there are very few children with insurance).

We have done logit analysis as well for dummy age categories (all other variables than age are kept the same). The results are pretty similar as in the above described logit analysis. The likelihood of higher than average claims among group insurees is positively affected by *gender (male)* and *age group of 21-40 years old*. When considering the individual insurees, the likelihood is affected positively by *reservations* and affected negatively by *age group 21-40* and *East*.

Table 5. Logit analysis. The dependent variable is a dummy indicating higher claims than average (6835 NOK). There are three regressions: for all claims, for claims from group policyholders and for claims from individual policyholders. Statistical significance is denoted as follows: \* 1%, \*\* 5%, \*\*\*10%.

<i>Variables</i>	<i>Totals</i>		<i>Group contracts</i>		<i>Individual contracts</i>	
<i>Nr of observations</i>	<i>6277</i>		<i>5965</i>		<i>311</i>	
	<i>Estimate</i>	<i>Std Err</i>	<i>Estimate</i>	<i>Std Err</i>	<i>Estimate</i>	<i>Std Err</i>
<b>Group contract</b>	0,10	0,38	-	-	-	-
<b>Gender (1-M, 0-F)</b>	0,13***	0,08	0,14***	0,08	0,08	0,35
<b>Age when claiming</b>	0,01*	0,00	0,01*	0,00	0,06*	0,02
<b>Kid (Age&lt;18)</b>	0,11	0,43	0,00	(omitted)	1,69**	0,80
<b>North</b>	-0,14	0,22	-0,08	0,23	-1,03	1,02
<b>East</b>	-0,04	0,14	0,04	0,14	-1,45**	0,67
<b>West</b>	0,01	0,15	0,03	0,16	-0,38	0,57
<b>Oslo</b>	-0,03	0,12	-0,08	0,13	0,59	0,63
<b>Other big cities than Oslo</b>	-0,10	0,14	-0,08	0,15	-0,56	0,47
<b>Secondary</b>	0,04	0,34	0,03	0,34	-	-
<b>Tertiary</b>	-0,04	0,33	-0,04	0,33	-	-
<b>Primary</b>	-0,35	0,40	-0,34	0,40	-	-
<b>Reservation</b>	0,47***	0,25	0,23	0,34	1,08**	0,44
<b>Intercept</b>	-2,27*	0,26	-2,12*	0,38	-3,73*	1,17
<b>Log likelihood</b>	-2699,63		-2573,92		-117,80	

### 4.3.2 Analysis per person

In section 4.3.2 we analyze collapsed data set per person. We want to find effects on the size of the aggregate claims per person in the period 2007-2010.

#### **Analysis of the factors that influence the size of aggregate claims per person**

As shown in Table 6, we make OLS regressions of the aggregate data per person for three categories of insurees: all, groups and individuals. The dependent variable is the size of the aggregate claims for 2007-2010. As in the previous analyses, we control for the *contract type*, *gender*, *age*, *occupation*, *geographical area* and *reservations*. We expected that *group contract* would give a significant effect on the aggregate claim size. The estimate is negative, and it contradicts with the theory of risk-selection: since the group insurees are not checked, they are supposed to have greater average claim size. However the estimate is not significant. Analyzing group insurees, we found out that only the *age* has significant effect on the size of the aggregate claims. Insurance companies usually use *age* as a main factor of risk-assessment. Unexpectedly, neither *geographical area*, nor *gender*, nor *occupation* nor *reservations* have any significant effect on the size of the aggregate claims from the group insurees. We assume that the reason behind is that the group policyholders have special socio-economic characteristics. They all have full-time jobs, they are in working age (18-68 year old), and many of them have leader positions, regardless geographical area and occupation. In addition, they almost do not receive reservations (only 1 % of them have reservations compared to 12 % of individual insurees).

Considering estimates for individual policyholders, we observe that on the contrary to groups, the age does not have any significant effect on the aggregate claim size. We do not have any explanation for this. Only such factors as *reservations*, *North*, *big cities other than Oslo* do have positive significant effect on the aggregate claim size. The reasons for *North* being significant could be poor health state and distant location of the medical institutions. The research made by Statistic Norway (SSB) shows that there are more people with poor health in North Norway (SSB, 2009). We do not have any explanation for the effect of *big cities other than Oslo*. Regarding the effect on the size of the aggregate claims by *reservations*, we assume that the insurees with reservations have in practice more health problems that are not accounted for by the insurance company.

Table 6. OLS regression. The dependent variable is aggregate claim size. There are three regressions: for all claims, for claims from group policyholders and for claims from individual policyholders. Statistical significance is denoted as follows: \* 1%, \*\* 5%, \*\*\*10%.

<i>Variables/Nr of observations</i>	<i>Totals, 2199 obs.</i>		<i>Group contracts, 2036 obs.</i>		<i>Individual contracts, 163 obs.</i>	
	<i>Estimate</i>	<i>Std Err</i>	<i>Estimate</i>	<i>Std Err</i>	<i>Estimate</i>	<i>Std Err</i>
<b>Group contract</b>	-5819,03	19530,96	-	-	-	-
<b>Gender (1-M, 0-F)</b>	3546,71	3485,69	2602,63	3359,90	945,07	19951,63
<b>Age when claiming</b>	491,36*	146,51	515,28*	138,86	1014,16	1041,63
<b>Kid (Age&lt;18)</b>	-2888,29	13983,37	-7324,01	69158,24	27900,23	37644,65
<b>North</b>	18685,38**	8573,22	5751,04	8165,98	183167,40*	61984,84
<b>East</b>	-3998,99	5486,92	-2780,25	5178,38	-29642,33	43794,23
<b>West</b>	5495,73	5846,90	5244,73	5602,12	33210,45	40976,92
<b>Oslo</b>	6441,15	5623,65	6791,98	5349,73	-3866,16	36927,14
<b>Other big cities than Oslo</b>	7140,13	5361,87	9081,74	5223,47	63367,90**	29464,34
<b>Secondary</b>	-2474,34	18558,38	-5737,28	17098,86	-	-
<b>Tertiary</b>	5959,91	18404,34	2292,47	16951,21	-	-
<b>Primary</b>	2424,18	19993,29	1238,18	18423,44	-	-
<b>Reservation</b>	33910,30*	11506,51	-9937,87	13432,80	73957,42**	32840,23
<b>Intercept</b>	-7224,56	10326,76	-10032,92	18229,52	-13742,15	63679,43

## **Logit analysis of the factors that influence the likelihood of higher aggregate claims than average**

As shown in table 7, we run logit analysis of the aggregate data per person for three categories of insurees: all, groups and individuals. The dependent variable this time is a dummy indicating higher size of aggregate claims than average (19513). We control for *the contract type, gender, age, occupation, geographical area, and reservations*. As in the previous analysis, *the group contract* does not affect significantly the likelihood of higher size of the aggregate claims. However the coefficient for the *group contract*, which is positive, supports the theory of risk-selection: persons with group contracts do claim more often for higher size of the aggregate claims than individuals.

Unexpectedly, we get completely different significant effects on the likelihood of higher aggregate claim sums, when we analyze data for group and individual insurees separately compared to the previous analysis. It is not only *age*, but as well *gender (male)*, *west* and *big cities* have positive effect on the likelihood for the group policyholders. *Occupation* and *reservations* do not influence it at all. It is possible that *a big city* is an influential variable because life in the big cities is more stressful. Regarding *gender* and *age*, it is typical that demanding and risky positions in the firms are taken by males of middle age and above, which can be reflected on their health state. However it is only assumptions. For the individual policyholders only such factors as *age* and *reservations* have positive effect on the likelihood. Surprisingly, neither *geographical area* nor *gender* influences it. As we discussed earlier, there is significant number of reservations only in individual contracts. Reservations can be an indicator for more complex health problems that are not taken into account by the insurance company.



Table 7. Logit analysis. The dependent variable is a dummy indicating higher aggregate claims than average (19513). There are three regressions: for all claims, for claims from group policyholders and for claims from individual policyholders. Statistical significance is denoted as follows: \* 1%, \*\* 5%, \*\*\*10%.

<i>Variables</i>	<i>Totals</i>		<i>Group contracts</i>		<i>Individual contracts</i>	
<i>Nr of observations</i>	<i>2199</i>		<i>2035</i>		<i>163</i>	
	<i>Estimate</i>	<i>Std Err</i>	<i>Estimate</i>	<i>Std Err</i>	<i>Estimate</i>	<i>Std Err</i>
<b>Group contract</b>	0,77	0,64	-	-	-	-
<b>Gender (1-M, 0-F)</b>	0,38*	0,13	0,41*	0,13	0,07	0,54
<b>Age when claiming</b>	0,02*	0,01	0,02*	0,01	0,07**	0,03
<b>Kid (Age&lt;18)</b>	-1,53	1,06	0,00	(omitted)	0,15	1,43
<b>North</b>	0,10	0,35	0,12	0,36	0,17	1,68
<b>East</b>	0,21	0,22	0,26	0,23	-0,58	1,26
<b>West</b>	0,58*	0,22	0,55**	0,23	1,06	1,20
<b>Oslo</b>	0,43**	0,20	0,39***	0,20	1,23	0,92
<b>Other big cities than Oslo</b>	0,31	0,20	0,37***	0,21	-0,82	0,75
<b>Secondary</b>	-0,79	0,59	-0,82	0,60	-	-
<b>Tertiary</b>	-0,43	0,59	-0,45	0,59	-	-
<b>Primary</b>	-0,85	0,67	-0,85	0,67	-	-
<b>Reservation</b>	0,27	0,39	-0,23	0,55	1,43**	0,71
<b>Intercept</b>	-3,35*	0,40	-2,52*	0,65	-5,11*	1,84
<b>Log likelihood</b>	-977,06		-924,45		-47,90	

# 5 Discussion, conclusions and further research

## 5.1 Discussion

The division into group and individual contracts is coarse, but it gives us some picture of the claim patterns depending on the selection. If there had been data on the number of insured per contract, I would have divided people in data set in three groups – smaller groups with employer-paid contracts, bigger groups with employer-paid contracts and the individual contracts. The interesting thing would be to investigate the difference between those who deliver health statement and those who do not, because then we would talk about pure selection and solidarity. Unfortunately, I did not have available data for number of insured in the group contracts. Within this information available, the topic can be further investigated in future.

To calculate relative numbers for the selection profitability, we use the data on the claims for 2010. Since there is more data available for 2010, we can get more precise information for that year than for 2007, 2008 or 2009. Table 8 reveals all the numbers. To calculate the claim ratio in 2010, we count number of people who claimed in 2010 and divide it by number of all the customers of the insurance company in 2010. Further we want to calculate expected size of the aggregate claims per year 2010 per insuree with group and with individual contracts respectively. To do it, we calculate average sum of claims per person and average number of the claims per year for group and for individual insurees correspondingly with help of STATA. Thus the expected size of the aggregate claim per year per insuree registered in the insurance company in 2010, is approximated by the product of the claim ratio times average size of the aggregate claims in 2010.

Table 8. Relative numbers for claim ratio and expected size of the claims per person in 2010

<b>Type of contract</b>	<b>Claim ratio in 2010</b>	<b>Average size of aggregate claims per person in 2010, NOK</b>	<b>Average size of the claim in 2010, NOK</b>	<b>Average nr of claims per person in 2010</b>	<b>Expected size of aggregate claims per person in 2010, NOK</b>
Group	0,06	14434,00	6358,59	2,27	864,19
Individual	0,09	25128,00	14868,64	1,69	2300,81

According to the results above, the claim ratio of group policyholders who claimed in 2010 was 0.06, while the same ratio for the individual insurees was equal to 0.09. Furthermore, the average size of the aggregate claims per person in 2010, the average size of the separate claims in 2010 and the expected size of the aggregate claims per person insured in the insurance company are much higher for individuals than for groups. This contradicts with the theory of risk selection. The individual policyholders are the selected ones because they have to deliver the health statement and can be given reservations or can be even rejected. Group policyholders are required to bring the health statement only when less than five people are insured by the same group contract (thus we have only 1 % of group insurees with reservations compared to 12 % of individual insurees with reservations in our data set). Thus in average they are not as selected as the individual insurees. Hence, due to the risk-selection theory, the individual policyholders are supposed to have fewer claims as only the “good” ones are selected.

If we would use the average size of aggregate claims from descriptive statistics in 2007-2010 (see Table 2), where group and individual policyholders claim approximately the same amounts of money (19430 NOK and 20550 NOK for groups and individuals respectively), the difference in the expected size of aggregate claims per client would be much smaller, but still indicating greater sums for the individual policyholders due to higher claim ratio in 2010. We cannot explain why the numbers for 2010, presented in Table 8, differ so much from the numbers in the descriptive statistics for the whole sample, Table 2. We assume that claims and demand reveal some trends overtime that we did not take into account in our study. The study of these trends is left for future research.

According to both descriptive statistics for 2007-2010 data and estimates given in Table 8, the group policyholders claim in average more often than the individual policyholders, which is an indication for the theory of risk-selection. This could be explained by reservations, which are mostly given to the individual insurees. It is possible that without the reservations a number of claims would increase as well as their size. According to the average claim size in Table 2, the insurees with reservations claim for twice as big sum of money than individual insurees in general and three times greater sums than the average group insuree (6630 NOK, 10772 NOK and 23280 NOK for groups, individuals and persons with reservations respectively), which could indicate that the people who have already got a reservation might have more complex health problems.

Furthermore, according to the coefficient for *group contract* in Table 7, the group policyholders claim for higher than average aggregate sums more often than individual policyholder (though number is not significant), which is an indicator for the theory of risk-selection.

Age, sometimes regions, gender and reservations are the only factors that have significant effect on the size of the claims. We sum up all the significant results in Table 9. Age is a significant factor almost always, except for the aggregate claims for individuals. Reservations affect claims of individuals positively, while they either do not effect at all or have negative effect on the average claims from the group policyholders. The males with the group contracts have greater values of claims more often than the females, while gender does not affect claims of individual policyholders. The registration in some geographical areas has effect on the number and size of the claims from individual policyholders. Individuals from East Norway have less number of greater claims than individuals from other areas, while those from the North and other big cities than Oslo claim more often for higher aggregate sums. That goes together with the fact that people from North Norway have poorer health than people from other regions, and the medical institutions there are distant. Group policyholders from West Norway and from big cities in general claim for higher aggregate sums as well. However we do not have any good explanation for this.

Table 9. Overview of variables with significant effects on claims (“+” means positive effect, “-” means negative effect)

<b>Effect on what</b>	<b>Group contracts</b>	<b>Individual contracts</b>
Size of the claim	age +, reservation -	age +, reservation +
The likelihood of “high claim” (higher than average, which is 6835 NOK)	age +, gender (male) +	age+, reservation +, children+, east -
Size of the aggregate claims per person	age+	reservations+, north +, other big cities than Oslo +
The likelihood of “high aggregate claim” (higher than average, which is 19513 NOK)	age +, gender (male)+, west +, big cities +,	age+, reservation+

## 5.2 Conclusions and further research

The conclusions about profitability of risk-selection are not clear. We have several possibilities. First, the risk-selection could be not as profitable as expected. Second, the group policyholders, being united by special socio-economic characteristics, could have better health than individual policyholders (to answer this dilemma, we need more research to control for health state of the policyholders, which could be a topic for a future research). Third, there might be adverse selection in the individual contracts since there could be unobservable health differences that are not revealed through the health status statements. Fourth, not all the group insurees know that they have been insured as insurance is often assigned automatically when one starts to work. While individual insurees when subscribing have an intention to use insurance, perhaps because they think they have a high risk. These could be some of the explanations of lower claim ratio per person for group policyholders, and each of those assumptions deserves to be researched in future.

Furthermore, to analyze risk-selection as a complete phenomenon for the PHI companies, one could make cost benefit analysis, including administrative costs and the costs for the risk-assessment, for several Nordic PHI companies. PHI companies have a tendency to have higher administrative costs related to billing, contracting, marketing, analyzing premiums and prices, payment or refusal of the claims etc. (p 20, Mossialos, Dixon, 2002). This is especially relevant for the case of individual insurance where there are whole departments working with

analysis of the premiums and prices, checking health statements of the policyholders and designing contracts.

Besides, it is worth to make study about factors behind firms subscribing for group PHI. A similar study about connection between types of the jobs and the employee coverage was made in USA (Marquis, 2001). According to Marquis (p. 274-275, 2001) factors that influence the choice of the firms to buy insurance for the employees could be tax ratios, the concentration in the labor market, the mix of other employers, the size of the firm, the unionization degree, the type of the industry, and the degree of regulation. This kind of research would be very interesting to make in Norway too.

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