Demand for private health insurance and demand for health care by privately and non-privately insured in Denmark

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Health Economics Paper 2002:1

Abstract

Background: Since 1973, health care cost have been covered through a tax financed National Health Security. For certain types of health care, such as dental care, use of pharmaceuticals, medical aids, physiotherapy and chiropractor treatment, a co-payment has to be paid by the patient. A private health insurance association, 'danmark', emerged at the same time, and its role has primarily been to cover co-payments. To be insured it is required that the person is well, under 60 years of age, and is not using any pharmaceutical regularly.

Purpose of the study: It is the purpose of the present study to examine the determinants of membership of 'danmark', and to examine whether membership has any influence on demand for healthcare which is covered by the insurance. Moreover, it is a purpose to examine, whether membership varies systematically with income, education and health status which would be considered inequitable.

Data: The study is based on a nation-wide Health Interview Survey, "Sundhed og sygelighed i Danmark, 1994" (Health and Morbidity in Denmark,1994) by DIKE (The Danish Institute of Clinical Epidemiology). The survey is based on a sample of 6,001 adults, and interviews were obtained with 4,668 respondents.

Methods: Data were analysed by multivariate techniques. Membership was analysed using multiple choice - and sequential choice logistic regression. As to demand for health care, a two part decision was assumed: First, whether to see a health care provider or not, and secondly, conditioned on deciding to do so, deciding the number of visits or the amount of health care. This two part decision was analysed using a Tobit model. Alternative formulations, including hurdle- and count data models (Poisson, zero-inflated Poisson, negative binomial, zero-inflated negative binomial)

were also used. Though some differences were found using these models, their results correspond fairly well to the Tobit results.

Results: The probability of being insured increases with income, length of school education and length of vocational education. The probability is higher for females than for males and increases with age until the age limit of 60 years for enrolling in 'danmark'. Poor health reduces the probability of being insured. It is concluded that distribution of membership by socio-economic characteristics is unequal and that health related distribution of membership is also unequal.

The analysis of consumption is restricted to types of care with co-payment: dental care, chiropractor treatment, physiotherapy and pharmaceuticals. Use of these types of health care was slightly higher for those who were insured; the differences was significant at a 5% level for dental care and chiropractor treatment, although the insured had a better health status.

Content

		Page:
I	Introduction	5
II	Purpose and data	10
III	Demand for insurance in ‘danmark’	13
IV	Demand for health care among insured and non-insured	30
V	Conclusion	49
VI	Discussion	51
VII	Literature	54
VIII	Appendix	59

I. Introduction

The National Health Security and private health insurance.

Since 1973, health care cost have been covered through a National Health Security (Sygesikring) with universal and comprehensive coverage, financed through general taxation. The Danish health care system is based on the principle of a gate-keeper - the general practitioner - allowing early and continuous contact for all basic needs of treatment, supported by the specialized hospital ans specialist system. A referral system is rationing access from the primary level to the secondary level (Johansen, 1995). Citizens have an option of choosing between two groups of the scheme, Group 1 and Group 2. Members of Group 1 are assigned a GP within 10 kilometres from their home, and they can not change to another GP before 6 months after having been listed with a specific GP. For Group 1 members, medical care provided through a general practitioner, a specialist or a public hospital is free. It is required from Group 1 members, however, that they obtain a referral from a GP before seeking care from a specialist. In contrast, Group 2 members can choose a new GP whenever they want, and they do not need a referral to visit a specialist. In return, they must pay a certain share of the expenses for a consultation as co-payment. Other types of health care such as home nursing, a visit from a health visitor or dental care for children and young persons is also free. About 98 per cent have chosen Group 1 membership (Ministry of Health 1999), so the alternative group is almost insignificant, and it serves mostly as a safety valve for those who do not want to be assigned a specific GP or to request a referral before seeing a specialist. For other types of health care such as adult dental care, use of pharmaceuticals, whether prescribed or not, physiotherapy, medical aids or chiropractor treatment, a co-payment has to be paid. The co-payment varies with type and amount of payment. Medicine which has been approved for a public subsidy, has been subsidised with either 75% or 50%. (This rule was changed as of March 1st 2000).

It has been estimated that in 1994 the private payment by the citizens (mostly co-payment) amounted to about 17,4 % of the total running cost of health care, while the rest was financed through taxes (MEFA, 1996). The share increased to 18,8% in 1999 (Sundhedsministeriet 2001).

The non-profit insurance association 'danmark' was created in 1973, and until recently it has been nearly the only insurance company providing private health insurance in Denmark. It emerged from a number of sick funds which existed prior to 1973 when the sick funds were closed, and the public health insurance scheme was established. The role of 'danmark' is primarily to cover co-payments, and in some cases it also pays for health care with no public reimbursement. Actually, the insurance offers 4 different types of coverage (Sygeforsikringen 'danmark' 2001).

Group 1 is designed for Group 1 members of the National Health Security and provides coverage for services for which a co-payment is demanded (dental care or treatment by dental technicians, physiotherapy, chiropractor treatment, chiropody, spectacles, contact lenses, pharmaceuticals, medical aids and visit to health resorts).

Group 2 is designed for Group 2 members of the National health security, and it offers the same kind of coverage as Group 1 plus the co-payment demanded from Group 2 members.

Since 1990, "danmark" has also provided coverage for treatment at public hospitals outside the patient´s own county, or at private hospitals. The are a number of restrictions in the coverage, however.

Group 5 is mainly aimed at young people who typically have a smaller need for insurance coverage. Thus, the coverage and the premium is lower compared to the two former groups. Group 5 was introduced in 1980.

Members of *Group 8* are passive members and are not entitled to any benefit; the groups serves rather as a group which entitles members to be transferred later to one of the groups mentioned above, once they have become members. This group was introduced in 1992.

To be insured it is required that the person is well when entering, under 60 years of age, and is not using any pharmaceutical constantly. When insured, it is possible to change from one insurance group to another with a different premium and coverage.

There are few other insurance companies in Denmark which offer health insurance, mostly an insurance that releases a lump-sum in cash in case of a very serious or untreatable illness, or pays for treatment at private hospitals. From 1999, Group 5 members of 'danmark' have also been offered an insurance for treatment at a private hospital. There are no official figures from the companies, but it is shown by Pedersen (2000) that the number of insurance policies was insignificant before 1998.

'danmark' reimbursed 1,208 million DKK in 1997 which should be compared to the total health care cost of 72.3 billion DKK (Sundhedsministeriet, 1999). The reimbursement was composed as shown in Table 1.

Table 1. Reimbursement by the insurance company 'danmark', 1997. Million DKK. (1 EUR = 7.56 DKK).

GP, specialist, hospitalization, etc.	91.3
Dental treatment	480.7
Physiotherapy	42.9
Glasses, lenses	109.8
Chiropractor	35.2
Medicine	417.7
Chiropody	21.2
Funeral aid	8.9
Total	**1,207.6**

Source: Sygesikringen 'danmark' (1999).

Private payment has increased from about 15.5 % since 1985 (Christiansen et al., 1999), and there is a general expectation in the population that it might increase even further. This might be one of the reasons why the number of insured in "danmark" has increased steadily since it was established.

The distribution of insured in the population.

Earlier studies have shown that the distribution of health insurance premiums is progressive, that is, increases by income. Thus, Christiansen and Lauridsen (1997) calculated a Kakwani index of progressivity[1] (Kakwani 1977) for various types of health care financing, based on a household expenditure survey from 1987 by Danmarks Statistik and found the results shown in table 2. Income per equivalent adult in a household was calculated using a formula by Aronson et al. (1994), letting the two parameters be equal to 0.5[2].

Table 2. Kakwani index of progressivity in health care finance in Denmark, 1987. Various components of financing.

Direct taxation	Indirect taxation	Insurance premiums	Own payment total[3]	Macro weighted
0.0624	-0.1126	0.0313	-0.2654	-0.0063

[1] In short, a Kakwani index measures the extent to which a tax system departs from proportionality. Let a Lorenz diagram measure the cumulative proportion of income along the horozontal axis and the cumulative amount of income or payment on the vertical axis. Now, the index can be calculated from the area between two concentration curves in the diagram, one being the concentration curve related to post tax income, and the other to the after tax income. The indes varies from -2 to +1. A positive value of the index is associated with progressivity, zero with proportionality, and a negative with regressivity.

[2] Equivalised income was calculated as $\sqrt{\ }$ (Adults + 0.5*Children).

[3] The macro weights were the following in 1987: Direct taxes: 72.5%, indirect taxes: 12.2%, insurance premiums 1.5%, and own payment: 13.8%.

While the overall payment is slightly regressive, mostly due to the revenue stemming from indirect taxation, the insurance premiums are slightly progressive, that is, the upper income classes pay a higher share of the total amount of premiums, compared to their share of the total income. It should be noticed, however, that the premiums weighted only 1.5% of the total health care costs in 1987.

In the present study it will be considered inequitable if membership of 'danmark' varies systematically with income or education. It would also be considered inequitable, if the probability of membership varies positively with good health.

II. Purpose and data

Purpose

It is the purpose of the present study

- to examine the determinants of membership of the private insurance 'danmark',
- to examine whether the probability of an individual being member varies systematically with income, education and/or health status, and
- to examine whether membership has any influence on demand for health care which is covered by the insurance.

Data

The study is based on a on the nation-wide survey "Sundhed og sygelighed i Danmark, 1994" (Health and Morbidity in Denmark, 1994) by DIKE (The former Danish Institute of Clinical Epidemiology), (Kjøller et al., 1995). The survey is based on a sample of 6001 adults, and interview was obtained with 4,668 respondents. Respondents were selected by a random procedure among the adults who were 16 years or older, from a register of the Danish population by *Statistics Denmark*. The sample is representative for the adult population. Data included information on age, gender, length of education, income, household composition, health status, use of health care and insurance in 'danmark'. The information on education include information about length of school education (including high school) and length of vocational education (including both theoretical and/or practical education).

Characteristics of the sample

Some personal characteristics along by membership of 'danmark' is shown in Table 3. There are more females than males among the members.

In total, 27% of the sample was insured in 1994. According to 'danmark', 1.5 million of the total population was insured in 1998. Children below 16 years of age were insured with one of the parents without extra payment. The largest percentage of members was found in the age group between 35 and 64 years. The mean age was between 44 and 45 years.

Self-assessed health (SAH) was a question about the respondent's health in general with 5 response categories, 1 being the best category. 84.4% among the insured as compared to 77.1 % among the uninsured rated their health in one of the upper categories ("excellent" or "very good"), while only 3.9% among the insured as compared to 6.4% among the uninsured rated their health in the two lower categories as "poor" or "bad". As shown in table 3, the percentage having insurance varies systematically with SAH: 30% of those with very good health are members as contrasted to 18% among those with bad health.

The mean equivalised income was higher among insured (226.067 DKK versus 184.264 DKK among the uninsured), (p=0.00, t-test). Mean age was about equal (44.19 years among insured, compared to 44.69 years among uninsured), (p=0.41, t-test).

37.6% of the sample reported that they had a longstanding illness - 34.7% among the insured versus 39.0% among the uninsured. 25% of those with a long-standing illness were insured as compared to 28% among those without.

Table 3. Membership of 'danmark' and personal characteristics, 1994.

		% with Member-Ship	Total in sample	p**
Gender	Female	31	2426	
	Male	23	2237	< 0.01
Age	16-24	18	738	
	25-34	24	905	
	35-44	36	876	
	45-54	35	770	
	55-64	31	548	
	65-74	21	490	
	75+	14	336	< 0.01
SAH*	1	30	1840	
	2	28	1847	
	3	21	709	
	4	19	187	
	5	18	79	< 0.01
Longstanding illness				
	yes	25	1753	
	no	28	2910	< 0.01
Total		27	4663	

* Category 1 of SAH is very good (the best category). ** Chi square tests.

III. Demand for insurance in 'danmark'

Early studies of insurance choice in the US were made by Phelps (1976), Marquis and Phelps (1987), Keeler, Morrow and Newhouse (1977). van de Ven (1987) studied demand for health insurance while Propper (1989) studied the demand for private insurance in England and Wales, and Cameron et al. (1988, 1991) studied determinants of health insurance in Australia. As described by Mossialos et al. (2000), private insurance may either complement or supplement public coverage.

Hypotheses and variables.

The present study builds on earlier studies, and the analyses are organised with due consideration to the specific features of insurance in 'danmark' and the availability of relevant data. Demand for insurance should be understood as a prediction of enrollment in the private insurance as a member, depending on a number of explanatory variables. The variables which are expected to influence demand are shown in Table 4 along with the expected signs. As described above, to be insured requires that the individual is well and under the age of 60 when entering. But once the insurance has been taken out the person can continue being insured for the rest of his or her life.

The probability of a person being insured is expected to increase with age because of greater "need" for health care. However, the share of insured above 60 is expected to decrease with increasing age because of the age limitation of enrolling in 'danmark', and therefore the age-squared variable is expected to have a negative sign. Moreover, enrollment increased historically since the creation of 'danmark' in 1973. Women are known to use health care more than men. Children under the age of 16 could be insured with their parents without any extra premium, which gave an incentive for families with children to enroll. Length of schooling and further education are used as proxies for general knowledge which is assumed to affect the attitude towards insurance. Two health variables are used: self-assessed health with five categories, and a dummy for longstanding illness. Due to enrollment criteria, members are expected to be in better health compared to non-members, so bad health and longstanding health problems are expected to be negatively associated with membership of ‘danmark’. High income is an enabling factor and it is assumed to be positively associated with membership. Income is measured as income per equivalent adult using method by Aronson et al. (op.cit.) with both parameters set equal to 0.5.

Methodology.

Demand was analysed using logistic regression models due to the categorical nature of the response variable. We employ two model types: The *multinomial response logit model* (Nerlove and Press 1973; Long 1997) and the *ordered response logit model* (Zavoina and McElvey 1975, Long 1997).

The *multinomial response logit model* specifies

$$p(y_i=m \mid \mathbf{x}_i) = \exp(\mathbf{x}_i\beta_m) / \Sigma_{j=1..J} \exp(\mathbf{x}_i\beta_j) \text{ , } m=1 \text{ .. } J \text{ ,}$$

where $\mathbf{x}_i$ is the vector of covariates for respondent i, β_m the coefficient vector for choice m, and J the number of choices, with the standardization $\beta_J = \mathbf{0}$. Thus, a positive β indicates that the probability of choosing the alternative in question before the reference choice J increases when the covariate increases. The magnitude of β does not have any straight interpretation, however.

The goodness-of-fit of the model is analysed using the conventional LR test for all covariates. Significance of variable k implies the hypothesis $\beta_{1k} = \beta_{2k} = .. = \beta_{Jk} = 0$, which is easily tested using a Wald type test (see Long 1997). Further, we test for equality of outcomes. Two choices, say m and n, are indistinguishable if $p(y_i=m|\mathbf{x}_i) = p(y_i=n \mid \mathbf{x}_i)$ for all $\mathbf{x}_i$, which implies the hypothesis $\beta_m = \beta_n$. This hypothesis is tested for all pairs of choices using a Wald type test. Finally, in order to measure the

Table 4. List of variables and their expected sign. N = 4044.

Variable	Coding, units	Expected sign	Mean	SD
Age	Years	+ (? if Age^2 significant)	45.17	17.79
Age^2	Years^2	-		
FEMALE	Male=0, female=1	+	0.50	0.50
Number of children	Number	+	0.52	0.88
Years of schooling	Years	+	9.45	1.74
Vocational education	Years	+	2.02	1.59
SAH[a]				
excellent	Yes=1, no=0	(Omitted category)	0.40	0.49
good	Yes=1, no=0	-	0.40	0.49
fair	Yes=1, no=0	-	0.15	0.36
poor	Yes=1, no=0	-	0.04	0.20
bad	Yes=1, no=0	-	0.01	0.13
Longstanding illness	Yes=1, no=0	-	0.62	0.48
Income per equivalent Adult	1000 DKK	+	193.21	83.86
Membership				
group 1		(Response variable)	0.09	0.28
group 2			0.03	0.17
group 5			0.002	0.05
group 8			0.14	0.35
Not member	9		0.74	0.45

effect of changing covariates on the probabilities for the choices, we report the *discretionary change effects*. These are calculated as the change in probability for choice m when the covariate x_k changes its value from x_S to x_E ,

$$\Delta\, p(y{=}m \mid \mathbf{x}\,) / \Delta\, x_k = [p(y{=}m \mid \mathbf{x}\,,\, x_k{=}x_E) - p(y{=}m \mid \mathbf{x}\,,\, x_k{=}x_S)] / (x_E - x_S).$$

For a continuous variable, we let $x_S = \bar{x}_k$ and $x_E = \bar{x}_k+1$, while for a dummy variable $x_S = 0$ and $x_E = 1$, in both cases holding all other variables at their sample means.

A major shortcoming of the multinomial response logit model is the ignorance of an eventual ordering of choices. Such an ordering defined as "degree of insurance" may be relevant for the present case, as, in terms of insurance degree,

Group 2 > Group 1 > Group 5 > Group 8 > not member.

The *ordered response logit model* is able to handle this problem. It is specified by

$$p(y_i \leq j) = \Lambda(\mu_j - \mathbf{x}_i\beta)\ ,\ j=1\ ..\ J-1$$

or, equivalently,

$$p(y_i = 1) = \Lambda(\mu_1 - \mathbf{x}_i\beta)\ ,$$
$$p(y_i = j) = \Lambda(\mu_j - \mathbf{x}_i\beta) - \Lambda(\mu_{j-1} - \mathbf{x}_i\beta),\ 1<j<J, \text{ and}$$
$$p(y_i = J) = 1- \Lambda(\mu_{J-1} - \mathbf{x}_i\beta)\ ,$$

where Λ is the cumulated logistic distribution function, defined by

$$\Lambda(z) = \exp(z) / (1+\exp(z)),$$

while the μ_j's are parameters determining the thresholds between succeeding choices in an underlying unobserved utility-of-insurance function. Thus, a high μ_j determines a high utility of choice j, so that

$$0 \equiv \mu_{(2)} > \mu_{(1)} > \mu_{(5)} > \mu_{(8)} > \mu_{(\text{not member})}.$$

Due to a standardization requirement, one of the μ_j s must be restricted to a fixed value. We follow the SAS PROC LOGISTIC convention $\mu_J = 0$, where J indexes Group 2 membership. Therefore, all the μ_j s will be negative. The magnitude and signs of these do not have any interpretation, while the distance between μ_J and μ_{J+1} may be interpreted as the unconditional increase in latent utility by shifting from choice j to choice j+1.

An important restriction in this model as compared to the multinomial model is the *assumption of parallel probabilities*, expressed as equality of the regression parameter vector β for each choice, while only the thresholds vary. The assumption of parallel probabilities is tested using a Lagrange Multiplier test (see Long, 1997). Goodness-of-fit of the model is analysed using the conventional LR test for all covariates. Opposed to the multinomial model, significance of variable k is easily assessed using conventional asymptotic t values. Finally, in order to measure the effect of changing covariates on the probabilities of the choices, we report the discretionary change effects, calculated as for the multinomial model.

For the case of the multinomial model, we found it natural to define the base choice J to be "not member". Thus, significance of estimated parameters indicate differences with respect to probabilities of membership instead of non-membership. Unfortunately, while estimating the model, we encountered a complication. Due to the very low number of respondents in Group 5 (13 only) of which none reported their SAH to be poor (SAH=4) or very poor (SAH=5), the variables SAH4 and SAH5 could not be applied. Therefore, we combined these with the fair (SAH=3) variable. Thus, we defined the variable

SAH345 = 1, if SAH=3, 4 or 5 and 0 otherwise.

Results

The results are shown in Table 5. From the single-variable Wald tests it is inferred that number of children and presence of longstanding illness do not influence the probabilities of membership in either group. Further the choice was affected to some degree (but significantly weak) by self-assessed health; those reporting good health (SAH=2) and very good health (SAH=1) are indistinguishable, while those with neutral, poor and very poor health (SAH=3, 4, 5) differ significantly. Further, sex, income, number of school years, vocational education and age influence the probabilities of membership. A closer inspection of the coefficients for each *choice* reveals several interesting features. As females have higher probabilities of membership of Group 1 and 8 (as indicated by the highly significant positive coefficient to the gender variable), they do not differ significantly from males with respect to probabilities of Group 2 or 5 membership. Number of school years affects all membership probabilities except Group 5, while vocational education impacts Group 8 membership only. Age has the expected curvature effect on probabilities for Group 1 membership (with a top at 67 years), for Group 2 (with a top however at 97 (!) years, which merely indicates that the probability for this group increases monotonically over the sample range) and for Group 8 (with a top at 40 years), while no age effect is present for Group 5. Finally, neutral to very poor health reduces the probability of Group 8 and (weakly) Group 2 membership, while no effects were found for Groups 1 and 5.

The Wald tests for indistinguishability of choices reveal that Groups 5 and 8 are indistinguishable. We therefore combined these two Groups to one - in the following denoted as Group 5+8 - in order to increase the efficiency of the estimation. One further benefit was that we were able to apply all SAH categories separately.

Table 5. Multinomial response logit model with 4 insurance groups.

Variable	Estimate Group 1	Group 2	Group 5	Group 8	Wald for variables (df=4)
INTERCEPT	-8.741***	-13.719***	-5.513	-6.087***	261.36***
	(0.79)	(1.49)	(3.48)	(0.62)	
Female	0.573***	0.240	0.881	0.647***	59.43***
	(0.12)	(0.20)	(0.67)	(0.10)	
EQ_INC	0.006***	0.011***	0.009**	0.002***	113.69***
	(0.0009)	(0.001)	(0.004)	(0.0007)	
SCHOOLYR	0.130***	0.287***	0.149	0.082**	24.65***
	(0.04)	(0.07)	(0.26)	(0.04)	
VOCEDU	0.059	-0.116	0.248	0.096***	12.50**
	(0.05)	(0.07)	(0.23)	(0.04)	
AGE	0.130***	0.163***	-0.178*	0.162***	86.26***
	(0.02)	(0.05)	(0.11)	(0.02)	
AGE2	-0.001***	-0.001**	0.002	-0.002***	74.46***
	(0.0002)	(0.0004)	(0.001)	(0.0003)	
NUMCHILD	-0.005	0.229	-1.339	-0.020	4.85
	(0.08)	(0.15)	(0.91)	(0.05	
LSILL	-0.026	-0.351	-0.595	-0.131	4.24
	(0.14)	(0.22)	(0.70)	(0.11)	
SAH2	-0.022	-0.275	0.404	-0.179*	4.57
	(0.13)	(0.22)	(0.70)	(0.10)	
SAH345	-0.251	-0.513*	-0.378	-0.529***	12.91**
	(0.19)	(0.30)	(1.23)	(0.17)	
AGE EFF. TOP	67	95	55	40	

Baseline choice : Not member

LR test for covariates = 5952.42***(df=40)

Wald for indistinguishability(df=10):

Wald(1 vs 2)=35.37*** Wald(1 vs 5)=21.86** Wald(1 vs 8)=126.35***

Wald(2 vs 5)=32.93*** Wald(2 vs 8)=162.14*** Wald(5 vs 8)=14.68

Notes. Standard errors in parentheses. Significance at 1 (***), 5 (**) and 10 (*) per cent levels.

Table 6. Multinomial response logit model with 3 insurance groups.

Variable	Estimate Group 1	Estimate Group 2	Estimate Group 5+8	Wald for variables (df=3)
INTERCEPT	-8.737***	-13.714***	5.888***	256.78***
	(0.79)	(1.49)	(0.61)	
FEMALE	0.572***	0.239	0.650***	59.07***
	(0.12)	(0.20)	(0.10)	
EQ_INC	0.006***	0.011***	0.003***	110.65***
	(0.001)	(0.001)	(0.001)	
SCHOOLYR	0.130***	0.287***	0.082**	24.40***
	(0.04)	(0.07)	(0.04)	
VOCEDU	0.058	-0.117	0.098***	11.98***
	(0.05)	(0.07)	(0.04)	
AGE	0.130***	0.163***	0.153***	79.22***
	(0.02)	(0.05)	(0.02)	
AGE2	-0.001***	-0.001**	-0.002***	68.43***
	(0.0002)	(0.0004)	(0.0003)	
NUMCHILD	-0.005	0.228	-0.029	2.86
	(0.08)	(0.15)	(0.05)	
LSILL	-0.029	-0.359	-0.153	4.18
	(0.14)	(0.22)	(0.11)	
SAH2	-0.023	-0.278	-0.173*	4.04
	(0.13)	(0.22)	(0.10)	
SAH3	-0.232	-0.463	-0.431**	8.18**
	(0.20)	(0.32)	(0.17)	
SAH4	-0.373	-0.656	-0.693**	5.90
	(0.35)	(0.54)	(0.34)	
SAH5	-0.175	-0.666	-2.135**	5.00
	(0.47)	(0.78)	(1.02)	
AGE EFF. TOP	68	96	41	

Baseline choice : Not member

LR test for covariates = 5866.17***(df=36)

Wald for indistinguishability (df=12):

```
Wald(1 vs 2)=35.47***   Wald(1 vs 5+8)=127.59***
Wald(2 vs 5+8)=161.62***
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Notes. Standard errors in parentheses. Significance at 1 (***), 5 (**) and 10 (*) per cent levels.

Table 6 shows the re-estimated model. The results are largely the same as for the 5-choice case, with some further details on the impact from SAH: While SAH seems to have an almost ignorable overall effect (as seen from the Wald tests for SAH2 - SAH5), it is seen from the coefficients of the specific choices that neutral, poor and very poor health reduces the probability of Group 5+8 membership, and that this effect is strengthened with ill-health.

Table 7 presents the discretionary change effects on the probabilities. An average female has a 12.4 per cent units higher probability for any membership than an average male, mainly distributed with 8.8 per cent on Group 5+8 and 3.5 per cent on Group 1. Increasing income with DKK 20.000 increases the probability for Group 1 membership with (20*0.05) or 1 per cent unit. An additional year of schooling (added to the mean of 9.4) leads to a 2.36 per cent unit higher probability of any membership, while an additional year of further education increases the probability of Group 5+8 membership with 1.6 per cent units. Presence of very poor health reduces the probability of Group 5+8 membership with 18.6 per cent units. Finally, prob(xmean) shows that an average person has a conditional probability of 29.5 per cent units of any membership, distributed with 9.0 per cent to Group 1 1.9 per cent to Group 2, and 18.6 per cent to Group 5+8.

Next, we estimated the ordered response logit model. As suggested from the results for the multinomial model, Group 5 and Group 8 are indistinguishable. We therefore employed the modified choice sequence

Group 2 > Group 1 > Group 5+8 > not member.

The results are summarized in Table 8 and correspond well with those for the multinomial model. Number of children and presence of longstanding illness do not affect the probabilities of membership significantly. People with good SAH are not

Table 7. Multinomial response logit model. Discretionary changes effects.

Variable	Δ prob			
	Group 1	Group 2	Group 5+8	Sum
FEMALE	0.035	0.001	0.088	0.124
EQ_INC	0.0005	0.0002	0.0002	0.001
SCHOOLYR	0.009	0.005	0.009	0.024
VOCEDU	0.003	-0.002	0.015	0.016
AGE	0.004	0.002	-0.004	0.001
NUMCHILD	-0.0003	0.005	-0.005	-0.001
LSILL	0.001	-0.006	-0.022	-0.027
SAH2	0.001	-0.004	-0.025	-0.028
SAH3	-0.011	-0.006	-0.055	-0.073
SAH4	-0.019	-0.008	-0.081	-0.107
SAH5	0.004	-0.007	-0.164	-0.167
prob(xmean)	0.090	0.019	0.186	0.295

different from those with very good SAH, while those with fair, poor or very poor SAH are. Again, ill-health has a downward shifting effect on the probability of membership in any group. Females have an upward shift in probabilities of membership as compared to males. Income, number of school years and further education have upward shifting effects, while age has the expected curve-shaped effect with a top at the age of 60. The model LR indicates a strong significance of the covariates, while the LM test indicates the major weakness of the model, namely a strong implausibility of the parallel regression assumption. By construction, $\mu_{(2)}$ is 0, while the other μ_j s are negative. The distance between $\mu_{(not\ member)}$ and $\mu_{(5+8)}$ is close to the distance between $\mu_{(5+8)}$ and $\mu_{(1)}$, while there is a large distance from $\mu_{(1)}$ to $\mu_{(2)}$. This indicates an especially large jump in latent utility when moving from Group 1 to Group 2 membership.

Table 8. Ordered response logit model.

Variable	Estimate	Standard Error
$\mu_{(not\ member)}$	-8.642***	0.47
$\mu_{(5+8)}$	-7.161***	0.46
$\mu_{(1)}$	-6.089***	0.46
FEMALE	0.514***	0.08
EQ_INC	0.005***	0.0005
SCHOOLYR	0.151***	0.03
VOCEDU	0.058**	0.03
AGE	0.091***	0.01
AGE2	-0.0008***	0.0001
NUMCHILD	0.003	0.05
LSILL	-0.124	0.09
SAH2	-0.103	0.08
SAH3	-0.306**	0.13
SAH4	-0.454**	0.23
SAH5	-0.688*	0.36

Age eff. top = 60 years
LR test for covariates = 394***(df=12)
LM test for parallel probabilities
= 448.87***(df=24)

Notes. Significanse at 1 (***), 5 (**) and 10 (*) per cent levels. $\mu_{(2)}$ is restricted to 0.

Before leaving the ordered response model, we notice that the discretionary change effects reported in Table 9 largely corresponds with those reported for the multinomial model. A remarkable exception is the SAH variables, where the ordered response model provides a smaller estimate of the effect of ill-health on membership. Such a deviation was to be expected, as the coefficients for SAH4 and SAH5 in the multinomial model varied strongly across insurance groups.

As both income and number of years of schooling increases the probability of a person being member in either of the insurance groups, there exists an inequality in membership distribution. The general tendency is for ill-health to decrease the probability of being a insured as seen from the coefficient of the variable long-standing illness and self-assessed health less than good, and this is further a sign of inequality in membership distribution.

Table 9. Ordered response logit model. Discretionary changes effects.

Variable	Δprob			
	Group 2	Group 1	Group 5+8	Not member
SEX	0.015	0.041	0.050	-0.106
EQ_INC	0.0002	0.0003	0.0005	-0.001
SCHOOLYR	0.005	0.012	0.015	-0.032
VOCEDU	0.002	0.004	0.006	-0.012
AGE	0.001	0.002	0.002	-0.005
NUMCHILD	0.0001	0.0001	0.0003	-0.0005
LSILL	-0.004	-0.010	-0.012	0.026
SAH2	-0.003	-0.008	-0.010	0.021
SAH3	-0.008	-0.022	-0.030	0.060
SAH4	-0.011	-0.031	-0.043	0.085
SAH5	-0.015	-0.042	-0.063	0.120
prob(mean)	0.031	0.092	0.167	0.710

Concluding, we suggest to discard the ordered response model (while retaining it as a benchmark model and for comparison with the multinomial model). The shortcoming of the ordered response model, eventually, might be remedied using some model formulation in-between this model and the multinomial one, such as *the adjacent category model*, *the continuation ratio model* or *the stereotype model* (see Long (1997) for an overview and further references). Unfortunately, none of these are readily implemented in any available software package yet.

What happens inside 'danmark'?

The multinomial model necessarily assumes that one of the parameter vectors is restricted to 0 due to identification. We chose $\beta_J = \mathbf{0}$, J being the choice 'not member'. Then a significant parameter for a specific covariate on the probability of any choice indicates that the covariate has a significantly higher (or lower) effect on this choice *as compared to the choice of non-membership*. As an example, we found that females had a significantly higher probability than males for choosing Group 1 membership instead of non-membership. Likewise, we found that females have a higher probability than males for choosing Group 5+8 membership instead of non-membership. *But we could not clarify wether females have a different probability than males for choosing group 1 membership instead of Group 5+8 membership*. Actually it is a simple matter to examine this problem. The multinomial model may be re-estimated using Group 5+8 as the baseline choice. Then significant parameters indicate different probabilities for choosing Group 1 or Group 2 compared to Group 5+8. Next, we could use group 1 as the baseline group in order to clarify significant differences between Group 1 and Group 2 probabilities.

Using Group 5+8 membership as baseline choice provided the results in Table 10.

Significant effects on choosing group 1 compared to Group 5+8 were found for income, age and very poor SAH. An interpretation of these effects may be obtained from the discretionary change effects reported in Table 8. I:ncreasing income with DKK 1,000 increases the probability of Group 1 membership with 0.046 per cent units and the probability og Group 5+8 membership with 0.024 per cent units, leaving **Table 10. Multinomial response logit model. Baseline choice: Group 5+8.**

Variable	Estimate		
	Group 1	Group 2	Not member
INTERCEPT	-2.848***	-7.826***	5.888***
	(0.94)	(1.58)	(0.61)
FEMALE	-0.078	-0.411*	-0.650***
	(0.14)	(0.22)	(0.10)
EQ_INC	0.004***	0.009***	-0.003***
	(0.0010)	(0.0015)	(0.0007)
SCHOOLYR	0.048	0.205***	-0.082*
	(0.05)	(0.08)	(0.04)
FURTHEDU	-0.040	-0.215***	-0.098***
	(0.05)	(0.08)	(0.04)
AGE	-0.023	0.010	-0.153***
	(0.03)	(0.05)	(0.02)
AGE2	0.0009***	0.0010**	0.0019***
	(0.0003)	(0.0005)	(0.0003)
NUMCHILD	0.024	0.257*	0.029
	(0.09)	(0.15)	(0.05)
LSILL	0.123	-0.206	0.153
	(0.16)	(0.24)	(0.11)
SAH2	0.154	-0.105	0.173*
	(0.16)	(0.24)	(0.10)
SAH3	0.199	-0.032	0.431**
	(0.25)	(0.35)	(0.17)
SAH4	0.319	0.037	0.693**
	(0.47)	(0.62)	(0.34)
SAH5	1.960*	1.469	2.135**
	(1.10)	(1.27)	(1.02)
AGE EFF. PEAK	13	-5	41

Notes. Standard errors in parentheses. Significance at 1 (***), 5 (**) and 10 (*) per cent levels. See Table 7 for goodness-of-fit and tests for variable's significance.

a significant difference of (0.046-0.024) or 0.022 per cent units, which implies that rising income with DKK 40,000 increases the probability of choosing Group 1 compared to Group 2 with (40*0.022) or close to 1 percent. Similar calculations lead to the result that the probability of choosing group 1 compared to Group 5+8 is (0.4-(-16.4)) or 16.8 per cent units for a person with very poor SAH. That is, *conditioned on membership*, people with very poor health have a significant probability for transfer to the insurance group with full coverage. Finally, the probability of choosing Group 1 compared to Group 5+8 increases monotonically and accelerating with age.

Table 10 further shows that sex, income, school years, further education, age and number of children have a significant impact on the probability of choosing Group 2 compared to Group 5+8. Using Table 8, females have a negative tendency to insure in Group 2, as their probability of choosing Group 5+8 compared to Group 2 is (8.8-0.1) or 8.7 per cent units. Income has a negative effect, as an additional DKK 1,000 leads to a (0.024-0.019) or 0.005 per cent units higher probability of choosing Group 5+8 compared to Group 2. Similar negative effects are found for the number of school years (0.4 per cent units per year) and further education (1.7 per cent units per year). In contrast, age has a positive effect which is accelerated throughout the sample range of age. Finally, number of children has a positive effect, as an additional child increases the probability of Group 2 membership in advance of Group 5+8 membership with (0.5-(-0.5)) or 1.0 per cent units.

Table 11 shows the estimated multinomial choice logit model with Group 1 as baseline choice. Here we found that income, school years and further education affects the probability of choosing Group 2 compared to Group 1. Using table 8 again, the probability of choosing Group 2 compared to Group 1 falls with (0.046-0.019) or 0.025 per cent units when income rises with DKK 1,000 . An additional year of school reduces the probability with (0.9-0.5) or 0.4 per cent units, while an additional year of further education reduces the probability with (0.3-(-0.2)) or 0.5 per cent units.

Table 11. Multinomial response logit model. Baseline choice: Group 1.

Variable	Estimate		
	Group 2	Group 5+8	Not member
INTERCEPT	-4.978***	2.848***	8.737***
	(1.63)	(0.94)	(0.79)
SEX	-0.334	0.078	-0.572***
	(0.22)	(0.14)	(0.12)
EQ_INC	0.005***	-0.004***	-0.006***
	(0.002)	(0.001)	(0.001)
SCHOOLYR	0.157**	-0.048	-0.130***
	(0.08)	(0.05)	(0.05)
VOCEDU	-0.175**	0.040	-0.058
	(0.09)	(0.05)	(0.05)
AGE	0.033	0.023	-0.130***
	(0.05)	(0.03)	(0.02)
AGE2	0.0001	-0.0009***	0.0010***
	(0.0005)	(0.0003)	(0.0002)
NUMCHILD	0.233	-0.024	0.005
	(0.16)	(0.09)	(0.08)
LSILL	-0.330	-0.123	0.029
	(0.25)	(0.16)	(0.14)
SAH2	-0.255	-0.150	0.023
	(0.25)	(0.16)	(0.13)
SAH3	-0.231	-0.199	0.232
	(0.36)	(0.25)	(0.20)
SAH4	-0.283	-0.320	0.373
	(0.61)	(0.47)	(0.35)
SAH5	-0.491	-1.960*	0.175
	(0.87)	(1.10)	(0.47)
AGE EFF. EXT:	-150(PEAK)	13(TOP)	68(PEAK)

Notes. Standard errors in parentheses. Significance at 1 (***), 5 (**) and 10 (*) per cent levels. See Table 7 for goodness-of-fit and tests for variable's significance.

Conclusion

The probability of membership increases with income, years of schooling and age until the age of 60 years. There seems a tendency towards an inverse relationship between ill-health and the probability of being insured. When looking at the choice of membership groups, a more detailed picture emerge. Especially, conditioned on membership, the probability of choosing one of the groups with relatively high coverage seems to increase with poor health and age.

IV. Demand for health care among insured and non-insured

The effect of insurance on demand for health care has been studied to a large extent. Most well-known are the results from the Rand Experiment, reported by Manning et al. (1987) showing that utilisation increases with degree of coverage. Unlike most other studies, the Rand Experiment was based on a randomization of participants to health plans with different degrees of coverage. Propper (2000) studied the use of private health care as a function of its costs and benefits relative to state care.

Hypotheses, models and methodology

With reference to general demand theory use of health care is assumed to be negatively influenced by co-payments, while insurance against co-payments is assumed to offset this effect. A distinction must be made, however, between the influence on demand for a first contact to a provider for a given health problem, and the amount of health care used during the ensuing treatment. Thus, it can be expected that insured persons have a higher propensity to make contact to a provider. As to the medical decision by the provider - eventually in a joint decision by the provider and the patient - concerning the amount of care consumed once a contact has been made, the co-payment may or may not be taken into account. We assume as a working hypothesis that the co-payment is taken into account to a certain extent, and that this effect is proportional (up to a scale factor) to the effect of the co-payment on the probability.

Three hypotheses emerge from these considerations:

1) Insurance against co-payment is expected to affect the *probability* of using the types of health care for which co-payments are demanded.

2) Insurance against co-payment is expected to affect the *amount* of consumption of health care for which a co-payment is asked, once a contact has been made.

3) Insurance is expected to impact the probability and the amount proportionally (up

to s scale factor).

As described above, co-payment for health care is especially related to use of dental care, chiropractor treatment, physiotherapy and medicine. Following the hypotheses stated above, it is expected that the use of these services is higher for insured compared to non-insured due to a lower price. Therefore, use of these services have been analysed separately with two explanatory variables: membership of 'danmark' (in any group) as well as membership of Group 1 or 2 as explanatory variables.

Methodology

Due to the nature of the problem, a two-part decision was assumed. First, to see a health care provider or not and, secondly, the eventual number of visits provided a contact has been made.

One model of such a two part decision is the Tobit model, which combines a probit model (for the probability of seeing the provider) with a censored regression (for the number of visits, provided a contact is made). A central assumption of the Tobit model is the absence of a hurdle between the two parts of the decision. This corresponds to an assumption about absence of a supply-side or health care provider effect: The probability of an additional visit is affected by the same variables as those that explain a first contact to the provider, and the effects on the probability and number of visits are proportional.

The assumption is tested using a split-sample chi-square test- denoted PROBIT - for equality of the scaled Tobit estimates and the corresponding unrestricted probit estimates: Equality then implies absence of a hurdle; see Appendix.

A further number of specification tests were performed, including a LR test for co-variates, a RESET test for functional form, and tests for heteroscedasticity and normality; see Appendix for details on these as well as the Tobit model.

Especially, strong evidence of violation of the normality- and homoscedaticity assumptions led us to consideration of alternative, robust estimation. We considered two such procedures: The Powell (1986) STLS estimator and the Powell (1984) CLAD estimator (See also Buchinsky, 1994 and Johnston and DiNardo, 1997). Unfortunately, none of these methods applied to the present cases due to the high percentages of censored observations. Actually, both methods require that well below 50 per cent of the observations are censored.

As a further solution - and in order to provide 'bench-mark models' - we consider a number of count data models. These models may to some degree circumvent the heteroscedasticity - and non-normality problems attached to the Tobit model. An additional advantage of such models is that they address the event-count - as well as the seldom-occurrence nature of the observed number of visits to a health care provider. We consider several such models. As a beginning, the simple logit probability model as well as the Poisson regression model are reported. Due to the commonly found dispersion of the Poisson model, the negative binomial regression (NEGBIN) model is considered. Finally, due to the high degree of censoring in the number of visits it is naturally to consider zero-inflated versions of the Poisson as well as the NEGBIN model. The zero-inflated Poisson model (ZIP) consists of a Poisson regression model combined with a logit split function modelling the probability of zero visits. Replacing the Poisson part of the ZIP with a NEGBIN leads to the zero-inflated NEGBIN model (ZNEGBIN). See Long (1997), Cameron and Trivedi (1998), Agresti (1990,1996) for details. In order to facilitate evaluation of these models against each other, we provide LR tests for inflation (i.e. Poisson vs. ZIP and NEGBIN vs. ZNEGBIN), for dispersion (i.e. Poisson and ZIP vs. NEGBIN and ZNEGBIN) and for Poisson vs. the most general ZNEGBIN. Finally, to facilitate sensitivity analyses across models we report the sample means and quantiles of slopes. See the Appendix for details on count data models.

Analyses

The analysis of consumption is restricted to dental care, chiropractor treatment, physiotherapy, and prescribed drug. The variables which are expected to influence demand for health care are shown in Table 12. The core variables are membership of ‘danmark’ , measured by two variables to allow for a distinction between low and high coverage: DANMARK is coded 1 when the respondent is a member of any group, and otherwise 0. Likewise, DANMARK(1+2) is coded as 1 for Group 1 or Group 2 membership with the highest coverage, and otherwise 0. For short, the last group is denoted “full members”. The other variables are control variables and include income defined as household income per equivalent adult, length of formal school education and subsequent vocational education, and gender. A non-linear effect of age was expected, so three age variables were used. Health was measured by presence of a longstanding illness and self-evaluated health (SAH) in five categories (category “1" being the best).

Analysis of demand for dental care

The dependent variable is NUMDEN = number of visits to a dentist during the last 3 months.

Table 13 summarizes the results from a Tobit estimation of the demand for dental care. The first two columns present the estimated coefficients and the sample slopes for the number of visits, whereas the third and fourth columns present the scaled estimates, i.e. the coefficients for the probit part, specifying the probability of seeing a dentist, and the sample slopes for these probabilities. From the Estimate column it is seen that membership as well as full membership of ‘danmark’, further education, age, sex and self-assessed health significantly impact the tendency to see a dentist. Members of ‘danmark’ has an average of 0.24 more visits per 3 months, or (4*0.24), corresponding to approximately 1 additional visit per year. Full members further have an additional 0.14 visit every 3 months, or close to (2*4*0.14), corresponding to approximately 1 additional visit every second year. Likewise, the probability of seeing a dentist during the 3 months is 3.89 per cent units higher for members and (3.89+2.28) or 6.17 per cent units higher for full members. For age, the tendency to see a dentist has a peak at the age of 20 and a top at the age of close to 70. The slope for age is positive inside this range and highest around the age of 45, while it is negative outside this range. The magnitude of the age effect, however, is quite small. Thus at the 0.75 quantile, the slope of 0.005 - roughly - indicates that an additional 10 years of age only lead to (10*4*0.005) or 0.2 additional visits per year, or two additional visits during a 10-years period. The effect of further education is positive. On the average, 5 additional years of education thus leads to (5*4*0.0429) or close to 1 additional visit per year, while the probability of seeing a dentist within 3 months increases with (5*0.68) or 3.4 per cent units. Further, females have a higher (but weakly significant) propensity to see a dentist: The additional number of visits is (3*4*0.0747) or close to 1 additional visit during a period of 3 years whereas the probability of seeing a dentist during the 3 months period is 1.19 per cent units higher than for men. The effect of SAH is quite strong. Those with very poor SAH has on average (4*0.52) or 2 fewer visits per year than those with very good SAH. As it is a standard in Denmark to see a dentist regularly twice a year, this implies that people with very poor health do not see a dentist at all. The probability that these people visited a dentist during the 3 month period is 8.33 per cent units lower than for those with very good SAH. Opposed to this, those with poor SAH has (4*0.34) or more than 1 *additional* visit per year as compared to those with very good health, combined with a 5.34 per cent units *higher* probability of seeing a dentist within 3 months. A possible explanation of this feature could be that the SAH4 works as a proxy for tooth problems, thus leading to a higher tendency to see a dentist, whereas those with very poor SAH may be too ill to go to a dentist - or anywhere - at all.

The LR test for covariates suggests that the model is highly significant. The RESET test suggests adequacy of the chosen linear specification. Especially, this precludes

Table 13. Visits to a dentist. Tobit estimation.

Variable	-Number of visits-- Estimate	Slope	--------Probability of visits------- Scaled estimate	Slope of scaled
INTERCEPT	-1.6117		-0.5179	
	(1.105)		(0.355)	
EQ_INC	0.00010	0.0003	0.0003	0.00005
	(0.001)	[0.0002;0.0003]	(0.0002)	[0.00002;0.00008]
SCHOOLYR	0.0102	0.0033	0.0033	0.0005
	(0.047)	[0.0028;0.0038]	(0.015)	[0.0002;0.0008]
VOCEDU	0.1334***	0.0429	0.0429***	0.0068
	(0.044)	[0.0370;0.0492]	(0.014)	[0.0031;0.0099]
FEMALE	0.2322*	0.0747	0.0746*	0.0119
	(0.122)	[0.0644;0.0857]	(0.004)	[0.0055;0.0173]
AGE	-0.0826	-0.0011	-0.0265	0.0001
	(0.072)	[-0.0042;0.0052]	(0.002)	[-0.0003;0.0008]
AGE2	0.0027*		0.0009*	
	(0.002)		(0.0004)	
AGE3	-0.00002**		-0.000008**	
	(0.00001)		(0.000003)	
DANMARK	0.7603***	0.2446	0.2443***	0.0389
	(0.165)	[0.2109;0.2805]	(0.053)	[0.0180;0.0567]
DANMARK(1+2)	0.4478**	0.1441	0.1439***	0.0228
	(0.188)	[0.1242;0.1652]	(0.061)	[0.0106;0.0334]
LSILL	-0.0962	-0.0309	-0.0309	-0.0049
	(0.140)	[-0.0355;-0.0267]	(0.045)	[-0.0072;-0.0010]
SAH2	-0.2458*	-0.0791	-0.0790*	-0.0126
	(0.135)	[-0.0906;-0.0682]	(0.043)	[-0.0183;-0.0058]
SAH3	-0.2066	-0.0665	-0.0664	-0.0106
	(0.204)	[-0.0762;-0.0573]	(0.065)	[-0.0154;-0.0049]
SAH4	1.0439***	0.3359	0.3355***	0.0534
	(0.323)	[0.2896;0.3851]	(0.103)	[0.0247;0.0778]
SAH5	-1.6298***	-0.5244	-0.5238***	-0.0833
	(0.603)	[-0.6012;;-0.4522]	(0.194)	[-0.1214;-0.0386]

σ=3.11 (se=0.06) Logl=-5103.71 LR test for covariates=1529.63 (df=14, prob<0.001)
RESET=6.35 (df=2,prob=0.04) HETSC=673.33 (df=14,prob<0.001)
NORMAL=14088.18 (df=2,prob<0.001) PROBIT=10.29 (df=14,prob=0.74)
% noncensored=37.2 . Age turnpoints approx. 20 (peak) and 70 (top)

Notes. Asymptotic t values for estimates in parentheses. Sample Q25 and Q75 for slopes in square brackets.

the necessity of adjusting for interaction effects (Examples of such effects might be that the effect of membership depends on income level, SAH or sex). Further, the PROBIT test indicates absence of a hurdle effect. We may thus reject the presence of a health care provider effect on the expected number of visits.

Important weaknesses of the model is indicated by the NORMAL and HETSC tests. The normality assumption as well as the homoscedasticity assumption is strongly rejected. Thus, we investigated different count data models, which are summarized in Table 14.

A comparison of the logit model to the scaled estimates in Table 13 reveals a few differences with respect to variable significance and slopes. Most remarkable is the insignificance of SAH4 in the logit. Further, the effect of insurance is higher in the simple logit specification. This is further the case for the gender effect, the effects of school years and further education, and the very poor SAH effect. On the other hand, a similar comparison of the Poisson model and the Tobit shows that the effect of insurance on the expected number of visits is much lower for the Poisson specification. This also holds true for the gender effect as well as the effects of education and bad SAH, while the income effect is higher - and even significant - for the Poisson. Employing the NEGBIN framework, however, the LR(disp) test indicates a dispersion problem in the Poisson model, thus questioning the reliability of the estimated effects from this specification. Actually, the significance and the slopes from the NEGBIN model has a fair correspondence with the those of the Tobit model. Still, though, the insurance effects are smaller for the NEGBIN than for the Tobit.

The NEGBIN and the Poisson models suffer from the presence of a significant zero-inflation as indicated by the strongly significant LR(infl) test for the ZIP and the ZNEGBIN. Combining the indication of overdispersion in the Poisson model with this indication of zero inflation, we consider ZNEGBIN to be the optimal choice among

Table 14. Visits to a dentist. Count data models.

Variable	LOGIT	POISSON	NEGBIN	ZIP		ZNEGBIN	
				POISSON	LOGIT-SPLIT	NEGBIN	LOGIT-SPLIT
INTERCEPT	-0.4368	-0.8428**	-0.7130	-0.1025	4.0619*	-0.4991	19.216
	(0.646)	(0.423)	(0.499)	(0.509)	(2.247)	(0.697)	(0)
EQ_INC	0.0006	0.0006*	0.0006	0.0001	-0.0018	0.0003	0.0016
	(0.0005)	(0.0003)	(0.0004)	(0.0004)	(0.002)	(0.0003)	(0.004)
	[0.0001]	[0.0002]	[0.0002]	[0.0003]	[-0.0002]	[0.0001]	[00005]
SCHOOLYR	0.0127	-0.0074	-0.0086	-0.0625***	-0.2717***	-0.0304	-0.5051***
	(0.026)	(0.017)	(0.021)	(0.020)	(0.095)	(0.022)	(0.183)
	[0.0030]	[-0.0024]	[-0.0036]	[-0.0065]	[-0.0280]	[-0.0029]	[-0.0159]
VOCEDU	0.1032***	0.0424**	0.0435**	-0.0025	-0.2225***	0.0259	-0.2526
	(0.025)	(0.017)	(0.020)	(0.020)	(0.079)	(0.021)	(0.156)
	[0.0240]	[0.0140]	[0.0180]	[0.0249]	[-0.0229]	[0.0256]	[-0.0079]
SEX	0.1271*	0.1557***	0.1503***	0.1668***	0.0296	0.1577***	0.4333
	(0.069)	(0.046)	(0.055)	(0.055)	(0.216)	(0.056)	(0.396)
	[0.0296]	[0.0513]	[0.0621]	[0.1000]	[0.0030]	[0.0891]	[0.0136]
AGE	-0.0792*	-0.0190	-0.0301	-0.0080	-0.2250*	-0.0220	-1.5985***
	(0.043)	(0.027)	(0.032)	(0.032)	(0.124)	(0.053)	(0.264)
	[0.0014]	[0.0045]	[0.0049]	[0.0106]	[0.0027]	[0.0077]	[0.0008]
AGE2	0.0025***	0.0006	0.0009	0.0001	0.0042*	0.0006	0.0332***
	(0.001)	(0.001)	(0.0007)	(0.001)	(0.002)	(0.001)	(0.007)
AGE3	-0.00002***	-0.00001	-0.00001*	0.000002	-0.00002	-0.000003	-0.0002***
	(0.00001)	(0.000004)	(0.000005)	(0.000004)	(0.00002)	(0.00001)	(0.00005)
DANMARK	0.5082***	0.3629***	0.3657***	0.2835***	-0.5695	0.3313***	-1.2242
	(0.094)	(0.059)	(0.072)	(0.070)	(0.480)	(0.071)	(1.808)
	[0.1182]	[0.1197]	[0.1512]	[0.2436]	[-0.0586]	[0.2592]	[-0.0385]
DANMARK(1+2)	0.2642**	0.2166***	0.2303***	0.0331	-0.8174**	0.0857	-2.3982**
	(0.107)	(0.068)	(0.084)	(0.082)	(0.391)	(0.085)	(1.026)
	[0.0615]	[0.0714]	[0.0952]	[0.1177]	[-0.0841]	[0.1374]	[-0.0754]
LSILL	-0.0972	-0.0039	-0.0095	-0.0509	-0.0394	-0.0581	-0.4211
	(0.079)	(0.053)	(0.064)	(0.066)	(0.247)	(0.067)	(0.451)
	[-0.0226]	[-0.0013]	[-0.0039]	[-0.0269]	[-0.0041]	[-0.0240]	[-0.0132]
SAH2	-0.1700**	-0.1113**	-0.1087*	-0.0414	0.5922*	-0.0844	0.8733
	(0.076)	(0.052)	(0.062)	(0.062)	(0.316)	(0.062)	(0.554)
	[-0.0395]	[-0.0367]	[-0.0450]	[-0.0960]	[0.0610]	[-0.0850]	[0.0274]
SAH3	-0.1969*	0.0008	0.0137	0.2788***	1.2345***	0.1436	1.6953***
	(0.115)	(0.076)	(0.091)	(0.097)	(0.353)	(0.099)	(0.611)
	[-0.0458]	[0.0003]	[0.0057]	[0.0264]	[0.1271]	[0.0372]	[0.0533]
SAH4	0.0852	0.8717***	0.9864***	1.3643***	1.8017***	1.0566***	2.2347***
	(0.188)	(0.093)	(0.128)	(0.116)	(0.403)	(0.161)	(0.742)
	[0.0198]	[0.2874]	[0.4079]	[0.6326]	[0.1855]	[0.6195]	[0.0702]
SAH5	-1.0378***	-0.7981***	-0.7661**	0.0486	2.1900***	-0.3328	3.0790***
	(0.360)	(0.275)	(0.300)	(0.415)	(0.728)	(0.359)	(1.155)
	[-0.2414]	[-0.2632]	[-0.3168]	[-0.2300]	[0.2254]	[-0.3229]	[0.0967]
Logl	-2565.57	-4196.81	-3856.22	-4000.36		-3790.61	
LR(cov)	210.82	216.69	154.46	338.75		158.39	

{df;prob}	(14;<0.001)	(14;<0.001)	(14;<0.001)	(14;<0.001)	(14;<0.001)
LR(disp)			681.18		419.50
{df;prob}			(1;<0.001)		(1;<0.001)
LR(infl)				392.91	131.22
{df;prob}				(15;<0.001)	(15;<0.001)
LR(pois)					812.40
{df;prob}					(16;<0.001)

Notes. Standard errors in parentheses. Sample means for slopes in square brackets. Significance at 1 (***), 5 (**) and 10 (*) per cent levels.

the count data specifications. Actually, this model corresponds well with the Tobit results. The effects of insurance are very similar for the two models, as welll as the effects of income, gender and education, while the effects of age and SAH deviates slightly.

Finally, we notice that the significance patterns vary for the two models: Education, age full membership of 'danmark' and very poor SAH seem to influence the probability of seeing a dentist (i.e. the logit-split) rather than affecting the number of visits (i.e. the NEGBIN part). Concluding, this may be a slight indication of some hurdle effect.

Analysis of demand for chiropractor visits

Table 15 summarizes the Tobit results for chiropractor visits. The effects of insurance are especially strong for full members, having (2*4*(0.057+0.088)) or approximately 1 additional visit every second year as compared to non-members. Regarding health, the visitors to a chiropractor seem to be characterized by fair or even good SAH rather than poor SAH. The presence of longstanding diseases adds approximately 1 visit per 4 years and a 1.49 per cent higher probability for any visits during a three-month period. Age has the expected curvature effect with a top at the age of 50 years, though the magnitude of the effect is quite limited. Females have a slightly higher tendency to see a chiropractor, amounting to an additional visit per approximately 6 year and a 0.95 per cent units higher probability. Income school years and further education do not have significant impact.

Table 15. Visits to a chiropractor. Tobit estimation.

	--Number of visits--		--------Probability of visits-------	
Variable	Estimate	Slope	Scaled estimate	Slope of scaled
INTERCEPT	-25.2168***		-2.8387***	
	(5.114)		(0.533)	
EQ_INC	0.0061	0.0002	0.0007	0.00005
	(0.005)	[0.0001;0.0003]	(0.0006)	[0.00002;0.00006]
SCHOOLYR	-0.3300	-0.0101	-0.0372	-0.0024
	(0.288)	[-0.0138;-0.0045]	(0.032)	[-0.0033-0.0013]
VOCEDU	-0.2803	-0.0086	-0.0316	-0.0021
	(0.272)	[-0.0117;-0.0038]	(0.031)	[-0.0028;-0.0011]
SEX	1.2847*	0.0392	0.1446*	0.0095
	(0.750)	[0.0173;0.0535]	(0.083)	[0.0050;0.0129]
AGE	0.5067***	-0.0007	0.0570***	-0.0002
	(0.159)	[-0.0037;0.0026]	(0.017)	[-0.0010;0.0007]
AGE2	-0.0059***		-0.0007***	
	(0.002)		(0.0002)	
DANMARK	1.8728*	0.0572	0.2108*	0.0138
	(0.971)	[0.0253;0.0781]	(0.108)	[0.00770.0188]
DANMARK2	2.8661***	0.0876	0.3226***	0.0073
	(1.042)	[0.0387;0.1195]	(0.115)	[0.0039;0.0100]
LSILL	2.0240**	0.0618	0.2279***	0.0149
	(0.817)	[0.0273;0.0844]	(0.090)	[0.0079;0.0203]
SAH2	2.2138**	0.0676	0.2492***	0.0163
	(0.876)	[0.0299;0.0923]	(0.097)	[0.0086;0.0222]
SAH3	2.5224**	0.0771	0.2840**	0.0186
	(1.185)	[0.0341;0.1051]	(0.132)	[0.0098;0.0253]
SAH4	2.2987	0.0702	0.2588	0.0170
	(1.861)	[0.0310;0.0958]	(0.209)	[0.0089;0.0231]
SAH5	-1.4230	-0.0435	-0.1602	-0.0105
	(3.844)	[-0.0593;-0.0192]	(0.433)	[-0.0143;-0.0055]

σ=8.88 (se=0.70) Logl=-802.38 LR test for covariates=371.30 (df=13, prob<0.001)
RESET=0.64 (df=2,prob=0.72) HETSC=76.23 (df=13,prob<0.001)
NORMAL=416852.97 (df=2,prob<0.001) PROBIT=10.92 (df=,14 prob=0.69)
% noncensored=3.1 . Age turnpoint approximately 50 year.

Notes. Standard errors for estimates in parentheses. Sample Q25 and Q75 for slopes in square brackets. Significance at 1 (***), 5 (**) and 10 (*) per cent levels .

The RESET test indicates absence of non-linearities and interaction effects, and the PROBIT test points to absence of hurdle effects, while the HETSC and NORMAL tests indicate violation of the homoscedacity and normality assumptions.

Count data models for chiropractor visits are summarized in Table 16. The logit estimates and the scaled Tobit estimates correspond quite good. The same variables are significant for both models, and the slopes for these variables are fairly equal with the exception of full membership of ‘danmark’, where the logit reports a higher effect than the scaled Tobit. The Poisson model deviates especially by claiming significance of income and further education. However, the NEGBIN results end up with a LR(disp) value indicating strong dispersion in the Poisson. The NEGBIN, in turn, deviates from the Tobit with respect to significance of explanatory variables. Especially, the effects of insurance and gender are almost ignorable. On the other hand, the slopes for DANMARK, DANMARK(1+2) and FEMALE are almost equal for the two model.

Due to the obvious zero inflation problems in the Poisson and the NEGBIN, combined with the dispersion problem in the Poisson, we would prefer a ZNEGBIN model. Unfortunately, the results for this specification seem strongly unreliable. Especially, the logit-split seems implausible, as, for example, full membership should increase the probability of seeing a chiropractor with 262.57 per cent units (!). We believe that the Maximum Likelihood optimization routine converged to a sub-optimum, and suggest discarding the ZNEGBIN results.

The ZIP results seems to be more stable. An interesting difference between this model and the Tobit is that insurance has a strong effect in the logit-split, but not in the Poisson part. This might indicate that insurance increases the probability of seeing a chiropractor, but not the probability of further visits. However, the strong dispersion problem in the Poisson part, together with the strange behaviour of the ZNEGBIN, question the reliability of the ZIP model as an alternative to the Tobit.

Table 16. Visits to a chiropractor. Count data models.

	LOGIT	POISSON	NEGBIN	ZIP		ZNEGBIN	
				POISSON	LOGIT-SPLIT	NEGBIN	LOGIT-SPLIT

Variable							
INTERCEPT	-5.5801***	-5.9280***	-6.5206***	-1.2101	5.0165***	-8.6861***	-22.119*
	(1.263)	(0.662)	(1.795)	(0.748)	(1.285)	(2.038)	(13.45)
EQ_INC	0.0013	0.0033***	0.0030	0.0020***	-0.0009	0.0014	-0.0096
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.010)
	[0.00004]	[0.0004]	[0.0004]	[0.0003]	[-0.00003]	[0.0004]	[-0.0006]
SCHOOLYR	-0.1031	0.0123	-0.0462	0.1892***	0.1396*	0.2224*	1.8080*
	(0.074)	(0.038)	(0.115)	(0.042)	(0.076)	(0.132)	(0.968)
	[-0.0033]	[0.0014]	[-0.0064]	[0.0071]	[0.0050]	[-0.0065]	[0.1128]
VOCEDU	-0.0548	-0.1928***	-0.2192*	-0.1977***	0.0174	-0.3998***	-1.1347
	(0.071)	(0.037)	(0.107)	(0.043)	(0.072)	(0.114)	(0.715)
	[-0.0017]	[-0.0225]	[-0.0303]	[-0.0258]	[0.0006]	[-0.0285]	[-0.0708]
SEX	0.3294*	0.3619***	0.3529	0.0574	-0.3163	0.9567***	2.7139
	(0.193)	(0.102)	(0.294)	(0.121)	(0.195)	(0.329)	(1.693)
	[0.0104]	[0.0422]	[0.0487]	[0.0483]	[-0.0112]	[0.0681]	[0.1692]
AGE	0.1339***	0.1277***	0.1897***	-0.0070	-0.1338***	0.1835***	0.0269
	(0.042)	(0.021)	(0.057)	(0.026)	(0.042)	(0.068)	(0.189)
	[-0.0003]	[-0.0010]	[-0.0021]	[0.0020]	[0.0003]	[0.0012]	[0.0061]
AGE2	-0.0016***	-0.0015***	-0.0021***	0.0002	0.0016***	-0.0019***	0.0008
	(0.0004)	(0.0002)	(0.001)	(0.0003)	(0.0004)	(0.001)	(0.002)
DANMARK	0.4833**	0.6539***	0.6479*	0.1072	-0.4661*	0.0757	-3.7440
	(0.243)	(0.121)	(0.384)	(0.142)	(0.245)	(0.404)	(2.381)
	[0.0153]	[0.0762]	[0.0895]	[0.0652]	[-0.0166]	[0.0807]	[-0.2335]
DANMARK(1+2)	0.7629***	0.5787***	0.6451	-0.3124*	-0.8387***	-0.2952	-42.107
	(0.249)	(0.134)	(0.445)	(0.166)	(0.255)	(0.487)	(9156.2)
	[0.0241]	[0.0674]	[0.0891]	[0.0564]	[-0.0299]	[0.7643]	[-2.6257]
LSILL	0.4558**	0.4293***	0.8414***	-0.0067	-0.4644**	0.7465**	-0.6092
	(0.207)	(0.109)	(0.295)	(0.118)	(0.210)	(0.323)	(0.913)
	[0.0144]	[0.0500]	[0.1162]	[0.0513]	[-0.0165]	[0.1051]	[-0.0380]
SAH2	0.5940***	0.7565***	0.8466***	0.3507**	-0.5133**	1.5874***	4.3591**
	(0.230)	(0.131)	(0.317)	(0.152)	(0.234)	(0.372)	(1.857)
	[0.0187]	[0.0882]	[0.1169]	[0.0998]	[-0.0183]	[0.1159]	[0.2718]
SAH3	0.6123**	1.1812***	1.4383***	0.7988***	-0.4693	1.9632***	3.6220**
	(0.307)	(0.158)	(0.431)	(0.169)	(0.312)	(0.502)	(1.545)
	[0.0193]	[0.1377]	[0.1986]	[0.1489]	[-0.0167]	[0.1770]	[0.2259]
SAH4	0.4662	1.3554***	0.8818	0.9503***	-0.3132	0.3767	-14.129
	(0.490)	(0.215)	(0.676)	(0.230)	(0.494)	(0.615)	(272.1)
	[0.0147]	[0.1580]	[0.1218]	[0.1497]	[-0.0112]	[0.3161]	[-0.8811]
SAH5	-0.2725	-0.4389	-0.7823	-0.1522	0.2260	1.1000	23.474
	(1.046)	(0.722)	(1.269)	(0.927)	(1.104)	(2.336)	(1667.4)
	[-0.0086]	[-0.0512]	[-0.1080]	[-0.0437]	[0.0080]	[-0.3089]	[1.4638]

Continued...

Logl	-521.81	-1704.04	-783.10		-830.71		-761.87
LR(cov)	64.74	338.32	55.42		68.20		29.53
{df;prob}	(13;<0.001)	(13;<0.001)	(13;<0.001)		(13;<0.001)		(13;0.006)
LR(disp)			1841.89				137.69

{df;prob}	(1;<0.001)		(1;<0.001)
LR(infl)		1746.66	42.47
{df;prob}		(14;<0.001)	(14;<0.001)
LR(pois)			1884.35
{df;prob}			(15;<0.001)

Notes. Standard errors in parentheses. Sample means for slopes in square brackets. Significance at 1 (***), 5 (**) and 10 (*) per cent levels.

Analysis of demand for physiotherapist visits

The Tobit model for visits to a physiotherapist is summarized in Table 17. For this model no insurance effect was found. A strong gender effect was found, as females have (2*4*0.16) or approximately 1 additional visit per 2 year, together with a 1.68 per cent units higher probability for any visit during three months. School years have a significant - but very modest - effect; one additional year in school increases the probability with 0.59 per cent units. The effect of health is remarkable: Presence of longstanding illness leads to (4*0.21) or close to 1 additional visit per year and a 2.2 per cent units higher probability. The number of visits increases with falling SAH; thus, a person with very poor SAH is expected to have (4*0.74) or close to 3 extra visits per year than a person with very good SAH. Likewise, his probability of seeing a physiotherapist during three months is 7.64 per cent units higher.

The RESET test indicates adequacy of the linear functional form and, thus, precludes interaction effects, while the PROBIT test supports the hypothesis of absence of threshold effects. The HETSC test indicates a weak violation of the homoscedasticity assumption, while the NORMAL test strongly rejects the normality assumption.

A good correspondence was found between the Tobit versus the logit and the NEGBIN specifications of Count models. There was, however, some evidence of a threshold effect between the probability of seeing a physiotherapist but not the number of visits. These, in turn, are mainly determined by seriousness of the illness, as indicated by the significance of the poor and very poor SAH.

Table 17. Visits to a physiotherapist. Tobit estimation.

	--Number of visits--		--------Probability of visits--	
Variable	Estimate	Slope	Scaled estimate	Slope of scaled
INTERCEPT	-59.6194***		-3.0661***	
	(9.480)		(0.448)	
EQ_INC	0.0059	0.0002	0.0003	0.00003
	(0.010)	[0.0001;0.0003]	(0.0005)	[0.00001;0.00003]
SCHOOLYR	1.3765**	0.0573	0.0708***	0.0059
	(0.567)	[0.0258;0.0710]	(0.029)	[0.0032;0.0075]
VOCEDU	0.0240	0.0010	0.0012	0.00010
	(0.528)	[0.0005;0.0012]	(0.026)	[0.00006;0.00013]
SEX	3.9227***	0.1634	0.2017***	0.0168
	(1.491)	[0.0736;0.2024]	(0.076)	[0.0092;0.0213]
AGE	0.2994	-0.0006	0.0154	-0.00005
	(0.248)	[-0.0025;0.0024]	(0.013)	[-0.00030;0.00029]
AGE2	-0.0033		-0.0002	
	(0.002)		(0.0001)	
DANMARK	1.3689	0.0570	0.0704	0.0059
	(2.026)	[0.0257;0.0706]	(0.104)	[0.0032;0.0074]
DANMARK(1+2)	1.8825	0.0784	0.0968	0.0022
	(2.205)	[0.0353;0.0971]	(0.113)	[0.0012;0.0028]
LSILL	5.1293***	0.2136	0.2638***	0.0220
	(1.672)	[0.0962;0.2646]	(0.084)	[0.0121;0.0229]
SAH2	5.8931***	0.2454	0.3031***	0.0253
	(1.876)	[0.1105;0.3040]	(0.095)	[0.0139;0.0320]
SAH3	11.2140***	0.4671	0.5767***	0.0482
	(2.413)	[0.2103;0.5786]	(0.119)	[0.0264;0.0610]
SAH4	16.6232***	0.6924	0.8549***	0.0714
	(3.290)	[0.3117;0.8576]	(0.163)	[0.0392;0.0904]
SAH5	17.7855***	0.7408	0.9147***	0.0764
	(4.446)	[0.33350.9176]	(0.223)	[0.0419;0.0967]

Continued...

σ=19.44 (se=1.30) Logl=-1178.47 LR test for covariates=497.27 (df=13, prob<0.001)
RESET=8.83 (df=2,prob=0.15) HETSC=24.51 (df=13,prob=0.027)

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NORMAL=518943.19 (df=2,prob<0.001)   PROBIT=16.32 (df=14,prob=0.2942)
% noncensored=4.2 . Age turnpoint approx. 40 years.
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Notes. Asymptotic t values for estimates in parentheses. Sample Q25 and Q75 for slopes in square brackets. Significance at 1 (***),
5 (**) and 10 (*) per cent levels

Turning next to the count data models reported in Table 18, we found a good correspondence between the Tobit versus the logit and NEGBIN specifications, as the significance levels of the variables are approximately equal across these models. Opposed to this, the Poisson seems to be too optimistic with respect to significance. This may be due to the strong dispersion, as indicated from the LR(disp) test for the NEGBIN. Regarding magnitude of effects, the slopes for the NEGBIN and the logit are fairly close to the Tobit and the scaled Tobit slopes.

The strong indication of zero inflation in the Poisson and NEGBIN models led to estimation of the ZIP and ZNEGBIN models. For the ZIP case, the logit-split strongly resembles the simple logit as well as the scaled Tobit with respect to significance and slopes, while the Poisson part seems to share the over-optimism found for the simple Poisson. Finally, the ZNEGBIN logit-split strongly resembles the simple logit as well as the scaled Tobit results, while the NEGBIN part deviates from the simple NEGBIN as well as the Tobit by indicating that the explanatory variables hardly impacts the number of visits.

Concluding, there seems to be some evidence of a threshold effect between the probability of seeing a physiotherapist and the probability of further visits. The explanatory variables affect the probability of seeing a physiotherapist, but not the number of visits. These, in turn, are mainly determined by seriousness of the illness, as indicated by the significance of poor and very poor SAH.

Table 18. Visits to a physiotherapist. Count data models.

	LOGIT	POISSON	NEGBIN	ZIP		ZNEGBIN	
				POISSON	LOGIT-SPLIT	NEGBIN	LOGIT-SPLIT
Variable							
INTERCEPT	-5.7822***	-5.8574***	-5.2809***	0.1240	5.7456***	0.0905	5.4368***
	(0.986)	(0.360)	(1.710)	(0.362)	(0.988)	(1.002)	(1.007)
EQ_INC	0.0005	-0.0001	0.0018	-0.000002	-0.0005	-0.0002	-0.0005
	(0.001)	(0.0004)	(0.002)	(0.0004)	(0.001)	(0.001)	(0.001)
	[0.00002]	[-0.00003]	[0.0006]	[0.0002]	[-0.00002]	[0.00008]	[-0.00002]
SCHOOLYR	0.1410**	0.1930***	0.2228**	0.0552***	-0.1400**	0.0497	-0.1355**
	(0.063)	(0.021)	(0.112)	(0.021)	(0.063)	(0.064)	(0.064)
	[0.0061]	[0.0608]	[0.0802]	[0.0628]	[-0.0059]	[0.0543]	[-0.0058]
VOCEDU	0.0222	-0.0788***	-0.1043	-0.0817***	-0.0233	-0.1086**	-0.0362
	(0.061)	(0.021)	(0.094)	(0.020)	(0.061)	(0.055)	(0.062)
	[0.0010]	[-0.0248]	[-0.0375]	[-0.0208]	[-0.0010]	[-0.0237]	[-0.0015]
SEX	0.4235**	0.7476***	0.5628**	0.2861***	-0.4196**	0.2749	-0.3902**
	(0.169)	(0.062)	(0.280)	(0.065)	(0.169)	(0.168)	(0.172)
	[0.0182]	[0.2354]	[0.2025]	[0.2297]	[-0.0178]	[0.1978]	[-0.0166]
AGE	0.0281	0.0856***	0.0345	0.0434***	-0.0273	0.0452*	-0.0219
	(0.029)	(0.011)	(0.047)	(0.010)	(0.029)	(0.027)	(0.029)
	[0.000001]	[-0.00007]	[-0.0004]	[0.0022]	[0.00003]	[0.0022]	[0.0002]
AGE2	-0.0003	-0.0009***	-0.0003	-0.0004***	0.0003	-0.0004	0.0003
	(0.0003)	(0.0001)	(0.0005)	(0.0001)	(0.0003)	(0.0003)	(0.0003)
DANMARK	0.1809	0.2037***	0.1984	0.0400	-0.1799	0.1206	-0.1643
	(0.227)	(0.078)	(0.404)	(0.080)	(0.227)	(0.225)	(0.230)
	[0.0078]	[0.0641]	[0.0714]	[0.0701]	[-0.0076]	[0.0948]	[-0.0070]
DANMARK(1+2)	0.2051	0.0914	0.2529	-0.0375	-0.2058	0.0130	-0.2054
	(0.245)	(0.084)	(0.439)	(0.087)	(0.245)	(0.238)	(0.249)
	[0.0088]	[0.0288]	[0.0910]	[0.0515]	[-0.0087]	[0.0628]	[-0.0087]
LSILL	0.5838***	0.6008***	0.7350***	0.0508	-0.5834***	0.0447	-0.5823***
	(0.188)	(0.069)	(0.319)	(0.073)	(0.188)	(0.191)	(0.191)
	[0.0251]	[0.1892]	[0.2645]	[0.2000]	[-0.0248]	[0.1806]	[-0.0248]
SAH2	0.6601***	0.8991***	1.0415***	0.2373***	-0.6547***	0.1829	-0.6364***
	(0.223)	(0.091)	(0.328)	(0.092)	(0.223)	(0.230)	(0.227)
	[0.0284]	[0.2831]	[0.3747]	[0.2865]	[-0.0278]	[0.2394]	[-0.0271]
SAH3	1.2642***	1.5383***	1.5663***	0.2640**	-1.2588***	0.2859	-1.2322***
	(0.264)	(0.101)	(0.462)	(0.104)	(0.264)	(0.266)	(0.268)
	[0.0543]	[0.4843]	[0.5636]	[0.4847]	[-0.0534]	[0.4421]	[-0.0525]
SAH4	1.7010***	2.3397***	2.1446***	0.7027***	-1.6950***	0.6549**	-1.6405***
	(0.346)	(0.113)	(0.721)	(0.116)	(0.346)	(0.327)	(0.350)
	[0.0731]	[0.7366]	[0.7717]	[0.7721]	[-0.0720]	[0.6745]	[-0.0698]
SAH5	1.8433***	2.4835***	2.1451**	0.6767***	-1.8375***	0.7133*	-1.7774***
	(0.456)	(0.137)	(1.044)	(0.677)	(0.456)	(0.405)	(0.461)
	[0.0792]	[0.7819]	[0.7718]	[0.8077]	[-0.0780]	[0.7320]	[-0.0757]

Continued...

Logl	-655.68	-4466.84	-1209.64	-1407.86	-1154.25

LR(cov)	92.65	1491.98	53.37	189.70	27.71
{df;prob}	(13;<0.001)	(13;<0.001)	(13;<0.001)	(13;<0.001)	(0.010)
LR(disp)			6514.40		507.22
{df;prob}			(1;<0.001)		(1;<0.001)
LR(infl)				392.91	110.78
{df;prob}				(14;<0.001)	(14;<0.001)
LR(pois)					6625.19
{df;prob}					(15;<0.001)

Notes. Standard errors in parentheses. Sample means for slopes in square brackets. Significance at 1 (***), 5 (**) and 10 (*) per cent levels.

Summary of the three analyses

For all three models, the RESET test indicates adequacy of the linear functional form and, thus, precludes interaction effects, while the probit test supports the absence of threshold effects. The HETSC test indicates a weak violation of the homoscedasticity assumption, while the NORMAL test strongly rejects the normality assumption. Turning next to the count data models, we found a good correspondence between the Tobit versus the logit and NEGBIN specifications, as the significance levels of the variables are approximately equal across these models. Opposed to this, the Poisson seems to be too optimistic with respect to significance. This may be due to the strong dispersion, as indicated from the LR(disp) test for the NEGBIN. Regarding magnitude of effects, the slopes for the NEGBIN and the logit are fairly close to the Tobit and the scaled Tobit slopes.The strong indication of zero inflation in the Poisson and NEGBIN models led to estimation of the ZIP and ZNEGBIN models. For the ZIP case, the logit-split strongly resembles the simple logit as well as the scaled Tobit with respect to significance and slopes, while the Poisson part seems to share the over-optimism found for the simple Poisson. Finally, the ZNEGBIN logit-split strongly resembles the simple logit as well as the scaled Tobit results, while the NEGBIN part deviates from the simple NEGBIN as well as the Tobit by indicating that the insurance variables hardly impacts the number of visits.

Analysis of demand for prescribed drug

Regarding demand for prescribed drugs, we do not have information on consumption volume, but only the answer yes/no to usage of prescription drugs (PD) during a period of 2 weeks. The results from a probit estimation is shown in Table 19.

The probability of using PD is significantly influenced by gender, school years, age and health, while income, further education and membership of 'danmark' is without significant importance. It was not surprising that the age effect showed to be monotonically increasing throughout the sample range. We therefore chose a linear specification in age.

From the discretionary changes effects it is seen that females have an 11 per cent units higher probability of PD. An additional year of schooling increases the probability with 1.5 per cent units, while an additional year of age (added to the sample mean age of 45) increases the probability with 0.77 per cent units. Poor and very poor SAH increases the probability of using PD with close to 40 per cent units. Presence of longstanding illness further adds 26.4 per cent units to the probability.

Finally, the conditional probability of using PD for an average person is 28.8 per cent units, which is close to the sample proportion of prescribed drugs users.

Table 19. Probit analysis of prescription drugs usage

Variable	Estimate	Discretionary change Effect	Mean of variable
INTERCEPT	-1.915***		
	(0.222)		
SEX	0.326***	0.111	0.500
	(0.047)		
EQ_INC	-0.0002	-0.0001	193.1
	(0.0003)		
SCHOOLYR	0.043**	0.015	9.450
	(0.018)		
VOCEDU	-0.011	-0.004	2.026
	(0.018)		
AGE	0.022***	0.008	45.22
	(0.002)		
DANMARK	0.110	0.038	0.263
	(0.067)		
DANMARK(1+2)	-0.040	-0.013	0.117
	(0.090)		
LSILL	0.751***	0.264	0.376
	(0.050)		
SAH2	0.304***	0.105	0.396
	(0.054)		
SAH3	0.659***	0.245	0.148
	(0.074)		
SAH4	1.026***	0.391	0.041
	(0.126)		
SAH5	0.980***	0.375	0.016
	(0.196)		
LOG L	-1945.07		
LR	1202.24***		

Sample proportion of users = 32.4% (N=4044)

Prob(user|x mean) = 28.78%

Note. Standard errors in parentheses. Significance at 1 (***) and 5 (**) per cent levels.

V. Conclusions.

As a matter of methodology, we generally found that the Tobit specification worked satisfactorily as compared to count data models. The presence of hurdle effects and impacts of non-normality - which was the main argument for discarding the Tobit specification compared to count data - and hurdle models - seemed to be very limited.

Regarding the determinants of health care demand, Table 20 summarizes some results from the Tobit estimations in Tables 13, 15 and 18, and from the probit estimation in Table 19.

Table 20. Significant determinants of health care demand.

Variable	Dentist	Chiropractor	Physiotherapist	Prescribed drug
EQ_INC				
SCHOOLYR			++	++
VOCEDU	+++			
FEMALE	+	+	+++	+++
AGE		+++		+++
AGE2	+	---		*
AGE3	--	*	*	*
DANMARK	+++	+		
DANMARK(1+2)	++	+++		
LSILL		++	+++	+++
SAH2	-	++	+++	+++
SAH3		++	+++	+++
SAH4	+++		+++	+++
SAH5	---		+++	+++

Notes. +(++)(+++) indicates positive impact with 10(5)(1) per cent significance; -(--)(---) indicates negative impact with 10(5)(1) per cent significance; * indicates that variable was omitted.

Insurance has a significant effect on the demand for dental care and chiropractor care. The insurance effect consists of two parts as all members have a higher demand than non-members, while Group 1 and 2 members have an additional demand.

Presence of longstanding diseases (i.e. objective ill-health) increases the demand for chiropractor and physiotherapist visits and prescribed drugs. Low SAH increases the demand for physiotherapist visits and prescribed drugs, while a higher demand for chiropractor visits is found for those with fair to good health only. For dental care, an excessive demand is found for those with poor SAH, while those with very poor SAH has a lower demand.

Females have a higher demand than males for any health care. This is especially true for physiotherapist care and prescribed drug.

The age effect varies among types of health care. For dental care, the demand falls until the age of 20, then rises until the age of 40, where after it falls again. For chiropractor care, the demand tops at the mid-forties. An similar - but insignificant - pattern were found for physiotherapist treatment, while the demand for prescribed drug increases monotonically with age.

Finally, the income effect was found to be insignificant, while school years and further education had some positive impact on the demand; the former on physiotherapist care and prescribed drug, the latter on dental care.

VI. Discussion

Demand for health insurance

As the study is based on survey data, the information on membership relates to individuals who have decided to enroll as a member at some earlier date. For some, the decision may have been taken up to 25 years ago, while others in the sample have enrolled recently. Those, who have enrolled, are continuously confronted with a decision either to continue membership or to abandon it. Therefore, actual membership reflects an initial decision to enroll and later decisions to continue or stop being a member. The survey data are therefore the result of a sequence of former decisions.

Those who enrolled can be assumed to have been well initially, but some might have acquired a longstanding illness by increasing age. Still, the health condition of the members can *a priori* be expected to be better than the health of the non-members. In general, this was confirmed in the analysis.

A survey from 1989 (Olivarius et al. 1990) showed that Group 2 members of the National health Security had a higher income and a better social condition compared to Group 1 members, and the average age was older. There were also signs that their health was better, as the frequency of their contacts to general practitioners were lower, compared to Group 1 members. 67% of the members were also members of the insurance association "danmark" (see below) which covers most of the co-payment, compared to 14% of Group 1 members. A similar picture could be expected for those who have enrolled in 'danmark' and it is confirmed by our results.

Membership of 'danmark' correlates positively with income and length education, so there seems to be a higher inclination to enroll among higher socio-economic groups in society. Likewise, the degree of insurance correlates positively with income and length of education. Given that health insurance creates a commodity which reduces of the risk of larger income loss, this self-selection favours the higher socio-economic groups. Moreover, these are the most healthy, who have a smaller risk of being excluded from membership because of their state of health, compared to those who belong to lower socio-economic groups. Consequently it can be concluded that there exists a *socio-economic inequality* in membership distribution in disfavour of the poor and less educated.

Moreover, as those who are the most healthy have the highest probabilities of being insured, and have the highest probability of being member of Group 1 or 2 with the highest coverage, it can be concluded that there also exist a *health-related inequality in insurance.*

The choice of membership may be endogenous to a certain extent as it is possible - when being a member - to shift to another group within a short notice and thus benefit from a higher coverage when substantial health care costs are anticipated. The possible endogenous nature of membership and choice of membership group does not affect this conclusion.

That the probability of being insured is increasing with good health, income and education is not surprising, as there exist empirical evidence for a positive correlation between these three ("health, wealth and wisdom"), (Zweifel, 2000). However, the amount of use, once a contact was made to a caregiver, appeared to depend only marginally on insurance against co-payment.

Demand for health care

The study clearly demonstrated an effect of co-payment on utilization. Co-payment has as one of its functions to reduce the effect of moral hazard - or rather to reduce "excess demand" when price is low or zero. The very existence of a voluntary insurance against co-payment seems illogical, and it is to be expected that utilization of health care increases due to the insurance.

The analysis of demand for health care indicates that the probability of using either of four types of health care associated with co-payments is higher for those who are insured. This is especially noteworthy as the insured were required to be well when they enrolled as insured members. This finding must be interpreted cautiously, however, as it is unknown to which extent enrollment and choice of insurance group is exogenous. However, enrollment is not possible for persons who are suffering from a permanent illness or uses medicine constantly, and this requirement limits the possibility of such an effect. When being a member, there is a possibility for changing membership group. In the present study, the two groups with highest coverage were aggregated in one variable, DANMARK(1+2), so changes from Group 5 or 8 to the aggregated group may have taken place when increased health care expenditure were anticipated.

Moreover, the amount of use, once a contact was made to a caregiver, appeared to depend only marginally on insurance. There were some - but only weak and inconclusive - evidence that the insurance effect is less profound for the amount of use than the probability of a contact.

VII. Literature

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VIII. Appendix.

Censored regression: The Tobit model.

The *censored regression model* or *Tobit model* is usually specified in terms of a latent index variable:

$$(1) \qquad y_i^* = x_i'\beta + \epsilon_i$$

$$(2a) \qquad y_i = 0 \text{ , if } y_i^* \leq 0$$

$$(2b) \qquad y_i = y_i^* \text{ , if } y_i^* > 0$$

where y_i^* is the unobserved preference for health care service, y_i the observed number of visits, x_i a K-vector of explanatory variables (including a constant term) with regression coefficients β, and ϵ_i a white-noise disturbance.

An Ordinary Least Squares (OLS) estimation on (1) would provide the desired relationship between the covariates x_i and y_i^*. However as only y_i is observed according to (2a-b), this regression cannot be performed. Simply regressing y_i on x_i by OLS will ignore the censoring in $y_i = 0$ and lead to non-censured estimation. Rather, for a censored regression one specify

$$(3a) \qquad E(y_i^* \mid x_i) = x_i\beta$$

but in terms of the observed y_i

$$(3b) \qquad E(y_i \mid x_i , y_i > 0) = \Phi(x_i'\beta/\sigma)*(x_i'\beta + \sigma\lambda_i)$$

where $\Phi(x_i'\beta/\sigma)$ measures the probability of y_i being positive, λ_i is the inverse Mills ratio, and σ the standard deviation of $E(y_i)$. The inverse Mills ratio is defined as

$$\lambda_i = \phi(x_i'\beta/\sigma) \,/\, \Phi(x_i'\beta/\sigma)$$

which assumes a value of 0 when no observations are censored and increases monotonically with the percentage of censored observations. Clearly, when no observations are censored, (3b) will assume the value $x_i'\beta$, leading to OLS. It is clear from (3a) that the regression parametres β measures the slope of $E(y_i^*)$ as

$$d\, E(y_i^*)/d\, x_i = \beta.$$

However, for the censured observations this does not hold true, as

$$d\, E(y_i \mid x_i\,,\, y_i > 0)/d\, x_i = \beta{*}\Phi(x_i'\beta/\sigma)$$

i.e. the slope is β multiplied by the probability of the observation being non-censored. We calculated the slopes for each person in the sample and report the sample means and quantiles of these.

An important specification issue in the Tobit model is the presence or absence a hurdle effect. That is, is the probability for y being positive generated by the same mechanisms as the expected value of y? An evaluation of this may be performed by comparing the parameters of P(y positive), that is β/σ, to the unrestricted estimates from a logistic probit regression. These parameters should not be different in the absence of threshold effects. To address the adequacy of this restriction, we employed a split-sample χ^2 test as follows: Split the sample randomly into two equally sized subsamples. For the first subsample, estimate an unrestricted probit parameter vector α_P. For the second subsample, estimate a Tobit model and calculate the scaled parameter vector α_T. For α_P the covariance matrix

Σ_P is readily obtained. For α_T the covariance matrix Σ_T is calculated using the Delta method (see Greene 2000). Finally, the test size

$$\text{PROBIT} = (\alpha_T\text{-}\alpha_P)'(\Sigma_T - \Sigma_P)^{-1}\,(\alpha_T\text{-}\alpha_P)$$

follows a χ^2 distribution with K degrees of freedom under the null of equal parameters.

Adequacy of the functional form of the regression model is a further central necessity for proper estimation. Several violations may be hypothesized, including omitted squares, interactions and other non-linearities. A convenient omnibus test for the functional form is the Ramsey (1969) RESET test, which we incorporated in a Likelihood Ratio form: Estimate the Tobit, calculate $x_i'\beta$, and repeat the estimation of the Tobit with the squares and triples of these values as additional explanatory variables. The RESET test is simply a LR test for the latter model against the former.

A further specification issue is the assumption of homoscedasticity and normality of the disturbances. As violations of these assumptions lead to biased estimation (Greene 2000) we test for normality using the Chesher and Irish (1987) LM test (which we here name NORMAL) and for homoscedasticity using a Breusch-Pagan type LM test derived by Greene (Greene 2000) which we here name HETSC. For detailed derivations of both tests (which are straightforward but tedious and uninformative), see Greene (op.cit).

Count data models

The Poisson model is defined by assuming that the number of events follows the Poisson distribution

$$P(y_i \mid \mathbf{x}_i) = \exp(-\mu_i)\,\mu_i^{yi} / y_i!$$

with a conditional mean depending on individual characteristics,

$$\mu_i = E(y_i \mid \mathbf{x}_i) = \exp(\mathbf{x}_i\beta).$$

A major shortcoming of the Poisson model is the assumed equidispersion,

$$\mathrm{var}(y_i) = E(y_i) = \mu_i.$$

In practice, the variance is often greater than the mean, leading to overdispersion. A popular attempt to resolve this problem is to employ the negative binomial (NEGBIN) model where the mean μ_i is replaced by a random variable $\tilde{u}_i$ defined by

$$\tilde{u}_i = \exp(\mathbf{x}_i\beta + \epsilon_i)$$

where ϵ_i is a random error assumed to be uncorrelated with $\mathbf{x}_i$. If $E(\epsilon_i) = 0$ is assumed it follows that the conditional mean is the same as for the Poisson model, whereas the conditional variance will differ (see Long 1997 for a derivation).

A common restriction for the Poisson and the NEGBIN models is the assumption that zero outcomes are generated by the same data generating process as the positive ones. In many occasions the zero outcomes may arise from one of two regimes. In one regime, the outcome is always zero. In the other, the usual Poisson or NEGBIN is at work which can produce zero as well as positive outcomes. As an example, consider the number of visits to a dentist within 3 months. The first regime consists of respondents without tooth problems and who may have visited the dentist before the 3 month period, while the second regime is made up of those who should see a dentist but who actually refrain from doing so due to for example low income. Thus, define

$$P(y_i{=}0) = P(\text{regime 1}) + P(\text{regime 2}) \times P(y_i{=}0 \mid \text{regime 2})$$
$$= \Psi_i + (1- \Psi_i) \times P(\text{regime 2})$$

where the split function Ψ_i = P(regime 1) is determined by a model:

$$\Psi_i = \Lambda(\mathbf{z}_i\gamma) = \exp(\mathbf{z}_i\gamma) \,/\, (1+\exp(\mathbf{z}_i\gamma))$$

while $\mathbf{z}_i$ may be the same as $\mathbf{x}_i$ (which we assume for the present investigation).

For the positive cases,

$$P(y_i{=}j) = P(\text{regime 2}) \times P(y_i{=}j \mid \text{regime 2}) = (1-\Psi_i) \times P(y_i{=}j \mid \text{regime 2}) \text{ , } j=1,2,....$$

Replacing $P(y_i{=}j \mid \text{regime 2})$ with the Poisson or NEGBIN probabilities leads to the Zero Inflated Poisson (ZIP) and NEGBIN (ZNEGBIN) specifications. For both models (see Greene 2000)

$$E(y_i \mid \mathbf{x}_i) = (1-\Psi_i)\mu_i$$

whereas - naturally - the conditionally variances differ (see Long 1997).

For the Poisson and NEGBIN models, the slopes for the expected number of events are calculated as

$$d\,\mu_i \,/\, d\,\mathbf{x}_i = \exp(\mathbf{x}_i\beta)\beta \text{ ,}$$

while for the logit model,

$$d\,P(y_i = 1 \mid \mathbf{x}_i) / d\,\mathbf{x}_i = d\,\Lambda_i / d\,\mathbf{x}_i = \Lambda_i(1-\Lambda_i)\beta$$

For the ZIP and the ZNEGBIN models, the slopes for the expected number of events are

$$\begin{aligned} d\,E(y_i \mid \mathbf{x}_i) / d\,\mathbf{x}_i &= [d\,(1-\Psi_i) / d\mathbf{x}_i]\mu_i + (1-\Psi_i)\,[d\,\mu_i / d\,\mathbf{x}_i] \\ &= -\Lambda_i(1-\Lambda_i)\gamma + (1-\Lambda_i)\exp(\mathbf{x}_i\beta)\,\beta. \end{aligned}$$

while the slopes for the split probabilities are

$$d\,\Psi_i / d\,\mathbf{x}_i = d\,\Lambda_i / d\,\mathbf{x}_i = \Lambda_i(1-\Lambda_i)\gamma\ .$$

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ISSN 1600-4000