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Individuals' preferences for GPs

Choice analysis from the establishment of a list patient system in Norway

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1. Introduction

When individuals[1] need to see a general practitioner (GP) because of a health problem, they initially have to choose which GP they want to visit. Because the relationships between patients and doctors usually are long term, the initial choice of a GP may be important to people. From the medical literature[2] we know that factors of importance to this choice are practice characteristics like physical accessibility and waiting time for an appointment, as well as attributes of the doctor, such as age and gender. We also know that aspects of the doctor-patient relationship are the most important determinants of satisfaction among patients. Earlier analysis in this field are stated preference studies based on questions regarding hypothetical GPs or questions about the GP an individual has already chosen (see for instance Vick and Scott 1998, Scott and Vick 1999 and Veale et al. 1995). From these analyses we obtain an impression of what individuals mean by a "perfect" GP or what ideal characteristics the "perfect" GP should have. None of the studies are based on individuals' actual choice of GPs and hence they do not take account of individuals' opportunities in the decision process.

The purpose of this paper is to gain more knowledge concerning individuals' preferences for alternative GPs within a municipality. We have data on the population's first, second and third choice of GPs. The data stem from the entry form the inhabitant filled in as a result of the implementation of a list patient system in general practice in Norway. To assess the potential demand for GPs[3] or individuals' request for a position on a certain GP's list, we formulate and estimate a structural demand model based on probabilistic theories of

[1] Individuals, inhabitants, persons, and patients are used synonymously throughout the paper.
[2] A short review of this literature can be found in Scott (2000).
[3] Dagsvik et.al. (2001) inspired us to model the individual's choice of a GP with this kind of model.

individual choice behaviour. The model originates from the work of Luce (see for instance Luce, 1959 and Block and Marschak, 1960). Such models are successfully used to obtain knowledge of people's preferences for different transportation vehicles.

We raise the question of whether individuals' choice of GPs is informed or purely random, as well as the question of whether observable demographic characteristics of a GP can tell us anything about the person who wants him or her as a personal physician. We find systematic dependencies between characteristics of an individual and characteristics of his or her choice of a GP. But we also find that the random part plays a major role in the choice process. In the last part of the paper we discuss policy implications of our findings. Central points are both how local health authorities can use the information on rankings to put together collegiums of GPs that serve the need – or the demand – of the inhabitants in the best way, and how a payment system for GPs should be designed if our results should be taken into account.

2. Model

Neoclassical economists view individuals' choice as deterministic, i.e. individuals are able to rank alternatives in a consistent and unambiguous manner and they choose the alternative that is ranked first. In contrast to this approach, psychologists interpret individuals' choice as the outcome of a probabilistic process. This is in part caused by observed inconsistencies in human behaviour. One explanation for the inconsistencies is that such behaviour reflects fluctuations that are inherent in the process of evaluating alternatives (p. 13 in Anderson, de Palma and Thisse 1992).

One class of models of probabilistic choice are the models of discrete or quantal choice, of which the logit model is one type. The logit model is a useful tool to analyse whether an individual's choice of a GP is made at random or based on known characteristics of the GPs in the area. This can be explored by displaying some of the properties of this model (see for instance Anderson, de Palma and Thisse 1992).

Let

(1) $U_{nm}(i) = V_{nm}(i) + \varepsilon_{nm}(i)$

be individual n's utility of choosing GP i in municipality m. Here, $V_{nm}(i)$ is the deterministic part of the utility function and $\varepsilon_{nm}(i)$ is the stochastic part that takes account of unobservable factors influencing the individual's choice. The random term may capture aspects that are random to the individual, and also effects of variables that are perfectly known to the individual but unobserved by the analyst, for instance the GP's personality and the relationship between the GP and his patients. Because individuals choose GPs within their resident municipality the feasible alternatives differ between municipalities. C_{nm} is the feasible choice set facing individual n in municipality m. $n = 1, 2, \ldots, N_1, N_1+1, \ldots N_{2, \ldots,} N_5+1, N_6$. $i = 1, 2, \ldots, I_1, I_1+1, \ldots I_{2, \ldots,} I_5+1, I_6$. m = 1, 2, …6. The indexing means that the inhabitants (GPs) in municipality $m = 1$ are the individuals $n = 1,2,\ldots,N_1$ ($i = 1,2,\ldots,I_1$). Similarly, inhabitants (GPs) in municipality $m = 6$ are the individuals $n = N_5+1,\ldots,N_6$ ($i = I_5+1,\ldots,I_6$).

We assume that the individuals in the population are statistically identical and independent. Let $P_{nm}(i)$ be the probability that individual n chooses alternative i from a sample of size I_6. If

$\varepsilon_{nm}(i)$ follows an extreme value distribution $P(\varepsilon_{nm}(i) \le x) = \exp(-e^{-\frac{x}{\sigma}})$, where σ is a positive constant, the resulting choice probabilities are given by (Luce 1959):

$$(2) \qquad P_{nm}(i) = Pr(U_{nm}(i) = \max_{s \in C_{nm}} U_{nm}(s)) = \frac{\exp(V_{nm}(i)/\sigma)}{\sum_{s \in C_{nm}} \exp(V_{nm}(s)/\sigma)}$$

As can be seen, the choice probabilities are constructed from the principle of maximization of individual utilities.

When $\sigma \to \infty$ the variance of $\varepsilon_{nm}(i)$ tends to infinity. It then follows that the deterministic part of the utility $V_{nm}(i)$ is totally dominated by the stochastic term $\varepsilon_{nm}(i)$. In this case the model contains no information, and has no predictive power. All the alternatives then become equally probable and the choice of GP is made on a purely random basis, i.e. the preferences are extremely uncertain.

When $\sigma \to 0$, the variance of $\varepsilon_{nm}(i)$ tends to zero. In this case all the information about preferences is contained in the deterministic part of the utility function, $V_{nm}(i)$ and the characteristics of the different alternatives are perfectly known. Hence, there is no uncertainty in the preferences and the model is reduced to a neoclassical deterministic model.

We assume that individuals' preferences are independent of each other. Let $P_{nm}(i, j, k)$ be the probability that an individual *n* living in municipality *m* shall rank GP *i* on top, *j* second best and *k* third best.

(4) $P_{nm}(i,j,k) = P(U_{nm}(i) > U_{nm}(j) > U_{nm}(k))$.

When the random variable is extreme value distributed, the implied model has the structure[4]:

$$(5)\quad P_{nm}(i,j,k) = \frac{\exp(V_{nm}(i))}{\sum_{s \in C_{nm}} \exp(V_{nm}(s))} \frac{\exp(V_{nm}(j))}{\sum_{s \in C_{nm} \setminus \{i\}} \exp(V_{nm}(s))} \frac{\exp(V_{nm}(k))}{\sum_{s \in C_{nm} \setminus \{i,j\}} \exp(V_{nm}(s))}$$

Equation (4) is the product of three logit models. The three numerators of the expression are related to respectively individual *n*'s first, second, and third GP choice. The denominator reflects the different choice sets in the three steps of the ranking. In the first step all GPs in the individual's choice set are included, in the second step the first choice is removed from the choice set and in the third step the first and the second choice are removed from the choice set.

The likelihood function is given by:

$$(6)\quad L = \prod_{n} (P_{nm}(i,j,k))^{Y_{ijkn}}$$

where $Y_{ijkn} = 1$ if individual *n* ranks alternative *i* on top, *j* second best and *k* third best, and 0 otherwise. Let L^* be the estimated likelihood and L_0 the likelihood when all choices are purely random. As a measure of the goodness of fit we can therefore employ[5]:

[4] The model is a Luce model for ranking. The development of this model started with Luce (1959). In Beggs et al. (1980) an application of this model can be found.

[5] This measure is closely related to McFaddens ρ^2 .

(7) $\rho^2 = 1 - \frac{\log L^*}{\log L_0}$

where $\log L_0 = \sum_{m=1}^{6} (N_m - N_{m-1}) \log\left(\frac{1}{(I_m - I_{m-1})} \frac{1}{(I_m - I_{m-1}) - 1} \frac{1}{(I_m - I_{m-1}) - 2}\right)$.

$(N_m - N_{m-1})$ are the number of observations (individuals) in municipality *m*, and

$(I_m - I_{m-1})$ are the number of GPs in the choice set in municipality *m*.

When $\rho^2 = 1$ (σ=0), the covariates explain all the variation in the data, i.e. there is no uncertainty in the preferences. In the other extreme, ($\rho^2 = 0$) , the deterministic part of the model has no predictive power. This information will be used in the empirical testing of how well the model fits the data.

3. Data and hypotheses[6]

Our data stem from the implementation of the list patient organization of general practice in Norway[7]. The whole sample constitutes 59119 inhabitants in 12 municipalities. The municipalities are representatively chosen according to centrality[8] (Sundvoll and Kvalstad 2002). The inhabitants are free to choose among all the GPs practising in their resident municipality. On an entry form everybody was asked to fill in their ranking of GPs. Hence we

[6] The data used in the analysis are taken from Statistics Norway (SSB) and The National Insurance Administration (RTV). NSD have prepared the data for analytical purposes. Neither RTV, SSB nor NSD are responsible for the empirical analysis or the interpretations of the findings in the paper.

[7] When the inhabitants needed a doctor before the new organization was implemented, they were free to choose among all GPs in the municipality. The reform implies that every inhabitant in the municipality is given a personal GP, and that every GP is given a distinct list of patients to serve.

[8] Statistics Norway classifies Norwegian municipalities according to centrality. The measure captures the size of the population, population density and the distance to the nearest city of a certain size. The most central municipalities are given the value 7 in this index, the least central is given value 1.

know an individual's first, second and third most preferred GP. Characteristics of inhabitants and GPs are known to us. We know age and gender of the inhabitants and we know age, gender, stated list size of the GPs and also whether he or she is a specialist in general practice. It's important to note that the characteristics of the GPs were not explicitly given to the inhabitants on the entry form. Even if individuals do not have exact information on these variables, we assume that they have some idea of them. This is in itself an interesting point: do the inhabitants collect this kind of information before they rank the GPs or do they simply make random choices? The following hypotheses are made about the impact of the variables on individuals' choices:

1. It is often claimed that GPs "get old with" their patients. We would therefore expect a correspondence between the age of the GP and his patients. An age difference variable is included to take account of this hypothesis.
2. Individuals' seem to prefer continuity in their relationship to a GP. Older GPs have most likely been practicing in the area for a long period and are probably both well known in the population and have been personal doctors for many inhabitants before the reform. We therefore expect that the older the GP is, the more persons want to be listed in his practice. We include a variable for the GP's age to take account of this hypothesis.
3. From the literature we know that female doctors have more female patients than male doctors. We would therefore expect females to prefer female doctors.
4. After medical school medical doctors can continue their education and become a specialist. We expect GPs with a speciality in general practice to become a more experienced doctor and therefore be more popular than GPs without that speciality. The variable speciality accounts for whether a GP has undertaken further education in general practice.

5. Before the new organization was implemented each GP was asked to state the number of people he would like to have on his list. Since GPs' preferred workload varies, the preferred number of people on the list is likely to vary between GPs. One obvious interpretation is that GPs preferring long lists have full-time practices with daily access, while GPs preferring shorter lists have part-time practices with poorer access. We use stated list size as an indicator of accessibility and we expect individuals to prefer GPs with a long list.

In Table 1, the characteristics of the GPs and the potential patients in the sample are reported. About 70 % of the individuals in the chosen municipalities filled in the form. Females filled in more GP choices than males, and the older the inhabitant is and the longer seniority[9] he or she has with the first choice GP, the fewer GPs are filled in on the form. On average, individuals who filled in three choices have about ½ year shorter seniority with his or her first choice GP than the rest of the sample. The inhabitants who refused to fill in any GP choices are younger than the average and a majority of them are men. From the literature we know that young men use doctors less frequently than the average population. It therefore seems likely that those in the sample who did not fill in the form have less experience with GPs and also a lesser need for a GP than the rest of the population.

From an analysis of the organization of general practice in Norway, Finnvold (1997) found that in some municipalities the turnover among GPs is quite high. In brief he states that GPs in these municipalities are changing patients and not vice versa[10]. As a measure of high turn-over or instability among GPs he used the share of GPs in the municipality who are paid a

[9] On the form the individuals were asked to report the number of years before the list patient system was implemented they had used their first choice GP as a personal doctor.
[10] The normal situation would be that inhabitants change doctors because they are dissatisfied with their previous doctor.

fixed salary[11] and the share of GPs who are interns[12]. As a measure of stability he uses the share of GPs who are privately practising. It follows that a municipality with a high degree of stability has a lower share of GPs on a fixed salary, a lower share of interns and a higher share of privately practising GPs than the average. These municipalities are usually centrally located municipalities. We would expect that individuals living in municipalities with a high turnover to a lesser extent know the GPs practising in the area and hence that they to a lesser extent than others have bothered filling in the form. Table 2 shows that these hypotheses find support in the data: the higher the degree of turnover the fewer GP choices are filled in. Those who refused to fill in any GP choices live in the municipalities with the highest turnover of GPs. On average, individuals who filled in three choices live in municipalities with more GPs practising and also more female doctors, i.e. their choice set is larger than for the rest of the sample. Average list size is often used as an indicator of an individual's accessibility to general practice. It is interesting to note that individuals who made three choices live in areas where GPs have a longer average list size (lower GP density) than in the rest of the sample. This points to an important distinction, namely that if there are few GPs to choose among - and at the extreme, no one you prefer - it does not help if the accessibility to the available GPs is good. It then seems that important explanations of whether an individual fills in the form as well as how many choices he or she made are influenced by the organization of general practice in the municipality and also by the number of GPs practising in the area.

[11] In the old system GPs were either municipal employees on a fixed salary or they were privately practising paid partly by fee for service. The fixed salary positions were the least popular, among other things because the expected income was lower.

[12] In Norway, medical doctors have to practice one year as interns before they are authorized. Half of this period they have to work in general practice. Because rural municipalities historically have had problems in finding enough GPs, interns are more frequently used as GPs in these areas than in more urban areas. It follows that municipalities with interns working in general practice get new doctors every ½ year.

Table 1: Characteristics of GPs and patients in the sample. St.dev. in parenthesis.

Variable	Whole sample	Filled in three GP choices	Filled in two GP choices	Filled in one GP choice	Did not fill in form	Not included in the new system[13]
Patient gender	0.50 (0.50)	0.47 (0.50)	0.46 (0.50)	0.48 (0.50)	0.55 (0.50)	0.56 (0.50)
Patient age	47.58 (18.65)	45.30 (17.05)	49.08 (18.18)	51.45 (18.57)	43.74 (18.87)	54.16 (22.43)
Years of seniority with 1st choice GP[14]	7.69 (8.63)	7.06 (8.46)	7.15 (8.08)	8.94 (8.99)		
Gender 1st choice GP	0.81 (0.39)	0.79 (0.41)	0.81 (0.39)	0.82 (0.39)		
Age 1.choice GP	48.50 (9.03)	47.89 (9.38)	48.30 (9.07)	49.04 (8.83)		
Stated list size 1st choice GP	1238.05 (334.07)	1227.07 (281.65)	1249.34 (339.63)	1242.79 (355.09)		
Actual list size 1st choice GP	1288.54 (384.54)	1277.18 (330.40)	1302.95 (388.65)	1291.32 (408.51)		
Specialist	0.62 (0.48)	0.63 (0.48)	0.62 (0.49)	0.64 (0.48)		
n	59119	10289	11605	18915	17999	311

[13] Inhabitants are free to choose not to participate in the list patient system.
[14] This measure is only reported for inhabitants who filled in their first GP choice.

Table 2: Characteristics of the municipalities in the sample. St.dev. in parenthesis.

Variable	Whole sample	Filled in three GP choices	Filled in two GP choices	Filled in one GP choice	Did not fill in form	Not included in the new system
Number of GPs in the municipality	6.91 (3.46)	7.44 (3.06)	6.91 (3.32)	6.94 (3.59)	6.59 (3.58)	6.90 (3.47)
Number of female GPs in the municipality	1.08 (0.83)	1.13 (0.86)	1.09 (0.86)	1.05 (0.81)	1.06 (0.81)	1.22 (0.807)
Average list size in the municipality[15]	1409.39 (522.74)	1465.90 (530.39)	1438.36 (485.78)	1436.62 (523.46)	1330.54 (532.26)	1366.86 (479.99)
Index of centrality for the municipality	4.88 (2.35)	5.52 (1.82)	5.12 (2.16)	4.91 (2.41)	4.33 (2.54)	4.88 (2.44)
Share interns in the municipality	0.08 (0.1)	0.05 (0.07)	0.09 (0.10)	0.08 (0.10)	0.09 (0.10)	0.10 (0.10)
Share GPs on fixed salary in the municipality	0.16 (0.19)	0.12 (0.13)	0.12 (0.14)	0.17 (0.20)	0.20 (0.23)	0.16 (0.21)
Share privately practising GPs in the municipality	0.73 (0.21)	0.80 (0.12)	0.77 (0.14)	0.73 (0.23)	0.68 (0.26)	0.69 (0.23)
n	59119	10289	11605	18915	17999	311

The empirical analysis consists of inhabitants who made three GP choices; this constitutes about 17 % of the whole sample. Individuals in this sub-sample live in the most central municipalities with the highest degree of stability among GPs, a GPs' average list size is longer in these municipalities and the absolute number of GPs to choose among is higher. A larger proportion of the GPs are females. A majority of the inhabitants who filled in three

[15] A municipality's GP density is the inverse of average list size in the municipality. It is calculated by dividing the total number of GPs by 10000 inhabitants. The calculation does not take account of how much each GP works and as such it may be biased.

choices are females and they are younger than the rest of the sample. The chosen GPs are about ½ year older, want 10 fewer persons on the list and more of them are females than in the whole sample. In other words, individuals in this sub-sample have more options when they make their choices than the average population. To a lesser extent than the rest of the sample they experience supply-side limitations in the process of choosing a GP. One advantage of using this sub-sample is that we can focus on people's choices and not their limited opportunities in the choice process.

4. Estimation and results

We choose a linear specification of the systematic part of the utility function (1).

$$(7)\quad V_{nm}(i) = \mathbf{Z_{nm}}(i)\boldsymbol{\beta} = \beta_1 A(i) + \beta_2 (A_n - A(i))^2 + \beta_3 G_n(i) + \beta_4 S(i) + \beta_5 L(i)$$

where $\mathbf{Z_{nm}}(i)$ is a vector consisting of the attributes of GP i relative to individual number n in municipality m. From the description of the data and the hypothesis in section 3, it follows that the attributes $\mathbf{Z_{nm}}(i)$ are both related to the GP and to the individual. Here, *A(i)* is the age of the GP and A_n the age of the individual, $G_n(i)$ is a dummy which equals one if the GP and the individual are of the same gender, zero otherwise, *S(i)* is a dummy which equals one if the GP has a speciality in general practice, and is zero otherwise, and *L(i)* is the number of persons the GP would like to have on his list (list size). $\boldsymbol{\beta}$ is a vector of unknown parameters. Because σ cannot be identified, it is no loss of generality to assume σ to equal one and absorb it in the $\boldsymbol{\beta}$ - coefficient.

Because the number of individuals who filled in three GP choices is quite small in municipalities where the number of GPs is less than or equal to three, we decided to omit the five smallest municipalities from the analysis. We also left out one municipality with five GPs practising because all the GPs were men. Our net sample now constitutes 9361 individuals in 6 municipalities[16]. In the largest municipality, 12 GPs are practising while there are 4 in the smallest. In the programming and empirical analysis the software program TSP (TSP 4.5) is used. All parameters are sharply estimated and with the expected sign. The results show (Table 3):

1. The smaller the age difference between a GP and an individual is, the higher is the probability of choosing that GP.
2. The probability of choosing a GP is higher the older the GP is.
3. If a GP and an individual are of the same gender, the probability of choosing the GP increases.
4. A GP with a long stated list size has a higher probability of being chosen than GPs with shorter lists. This tendency is rather weak in magnitude.
5. If the GP is a specialist in general practice, the probability of being chosen increases.

The goodness of fit is measured by (7). We calculate ρ^2 to be 0.19, which means that the model explains the data 19 % better than if individuals are assumed to make purely random choices. Hence, there are systematic dependencies between characteristics of an individual and characteristics of his or her choice of GP, but the random part of the model also plays a major role in the choice process.

[16] Compared to the whole sample of those who made three choices it follows that the chosen sub-sample is located in municipalities with more GPs practising and also more female doctors (see tables A1 and A2 in appendix). The turnover of GPs, the centrality of the municipalities and the composition of the population according to age and gender are at about the same level.

Table 3: Results of the empirical analysis.

Variable	Estimate	Standard error	t-statistics
Age difference	- 0.0002	0.0001	- 14.7309
Age	0.0036	0.0005	7.2444
Gender, dummy	0.5743	0.1114	50.5257
List size	0.0005	0.0001	3.8680
Speciality	0.2752	0.0137	20.1228

Number of observations = 9361

Log likelihood = - 45188.8, $\log L^0$ = 55617, Schwarz B.I.C. = 45211.7, $\rho^2 = 0.19$

When we use the sub-sample where individuals filled in only one GP choice in the analysis, the results are similar (Table 4). In this sub-sample two additional municipalities are included, and in both municipalities three GPs are practising. The total number of observations in this analysis is 15556.

Table 4: Results of the empirical analysis based on the results on the sub- sample where individuals made one choice.

Variable	Estimate	Standard error	t-statistics
Age difference	-0.0005	0.0000	-18.1016
Age	0.0242	0.0011	21.4968
Gender, dummy	0.7319	0.0268	27.2860
List size	0.0019	0.0003	60.4511
Speciality	0.7528	0.0263	28.6329

Number of observations = 15556.

Log likelihood = - 26808.4, $\log L^0$ = 31412.5, Schwarz B.I.C. = 26832.5, $\rho^2 = 0.15$.

It may seem strange that both age and age difference are included in the analysis. We therefore carried out the analysis without the age variable (Table 5). As can be seen, the effect of the variables corresponds to those reported in Table 3, but ρ^2 is slightly smaller.

Table 5: Results of the empirical analysis when we omit the age variable.

Variable	Estimate	Standard error	t-statistics
Age difference	- 0.0002	0.0000	- 12.1047
Gender, dummy	0.5298	0.1126	47.0654
List size	0.0008	0.0000	10.7868
Speciality	0.3279	0.0105	31.2623

Number of observations = 9361.

Log likelihood = - 45732.6, $\log L^0 = 55617$, Schwarz B.I.C. = 45750.9, $\rho^2 = 0.18$

From the analysis in Table 3, we find that the probability that an individual with certain characteristics will rank GP *i* on top, GP *j* second and GP *k* third. To illustrate our findings we can present an example of a municipality with three GPs practising. GP A is a 45 year-old female doctor who is a specialist in general practice. Her stated list size is 1500. The two other GPs are men. GP B is 50 years old, he is a specialist in general practice and his stated list size is 1700. GP C is 35 years old and his stated list size is 1800. GP C is not a specialist in general practice. In Table 6 we have calculated the probability of three different individuals making different rankings of the three GPs. We see three interesting patterns:

1. All three inhabitants have a higher probability of choosing one of the rankings than the others; the 50 year-old woman has the highest probability of choosing A first, B second and C third, while the 35 year-old man as well as the 75 year-old man prefer the rank ordering B, C, A.
2. All three inhabitants have a very small probability of choosing one of the GPs on top; the female does not prefer GP C on top, while the two men do not prefer the female GP.
3. The inhabitants seem to be indifferent between some of the rankings. For instance, the female inhabitant is indifferent between choosing A, C, B and B, A, C and the 75 year-old man is indifferent between B, A, C and C, B, A.

It is also interesting to note that even though the youngest male inhabitant is of the same age as GP C he prefers a rank ordering with the oldest GP first. One explanation might be that the oldest GP has a speciality in general practice, while the youngest does not.

Table 6: Example of how different individuals make different choices in a municipality with 3 GPs practising[17].

Example of inhabitant	Prob. of rank order A, B, C	Prob. of rank order A, C, B	Prob. of rank order B, C, A	Prob. of rank order B, A, C	Prob. of rank order C, B, A	Prob. of rank order C, A, B
Female 50 years old	0,277	0,199	0,096	0,209	0,085	0,134
Male 35 years old	0,125	0,099	0,262	0,172	0,226	0,116
Male 75 years old	0,140	0,087	0,270	0,207	0,200	0,095

GP A: Female, 45 years old, stated list size 1500, specialist in general practice.
GP B: Male, 50 years old, stated list size 1700, specialist in general practice.
GP C: Male, 35 years old, stated list size 1800, not a specialist in general practice.

5. Discussion

We find that the model does not explain all the variation in the data and that the random part plays a major role in the choice process. This component might capture both omitted variables and other sources of uncertainty[18]. The data used in the analysis stem from the very first dataset made available. At this stage, four characteristics of the GPs and two of the inhabitants are available to us. The random component may therefore capture omitted variables. In the future more information on the GPs from national registries will be available. We will

[17] A similar calculation is made on the basis of the analysis of individuals who made one choice on the entry form (see Table A3 in Appendix). We find that individuals in this sample have stronger preferences for one or two rank ordering than was the case for individuals who filled in three choices. This result corresponds to our hypothesis when we described the whole sample.
[18] A discussion of the different sources of uncertainty can be found in Manski (1977).

probably have data on whether they are of Norwegian[19] origin, whether they were paid a fixed salary in the former system and the number of services they provide to the average individual on the list (service intensity)[20]. We would expect that if these variables were included in the analysis, the model would explain a larger portion of the data.

It seems that a GP's personality and how individuals perceive the doctor's medical qualifications are the most important factors underlying the random component. Based on hypothetical scenarios describing GP visits, Scott and Vick (1999) and Vick and Scott (1998)[21] found that the most important attribute of the doctor-patient relationship is "being able to talk to the doctor", followed by patients' understanding of "doctors' explanation of information". This information may typically be observed for potential patients either by reputation in the municipality or by the individual's own experience with that doctor. Because individuals' personality and experience vary, the way individuals perceive a certain GP will vary and therefore a general characterization of a certain GP's personality will most likely not make sense. Even if we could agree on a personality variable, this kind of information would not be available through national registries. Analysing doctor-patient relationships therefore requires other analytical methods than the stochastic ranking model used in this paper.

Because we believe doctor-patient relationships to be very important in the process of individuals' ranking of GPs, we plan to analyse the importance of them based on Statistics Norway's questionnaire survey of a representative sample of the Norwegian population. In this survey 6000 individuals have answered several questions about the implementation of the

[19] In recent years there has been a general scarcity of medical doctors in Norway. A consequence of this situation is that many foreign doctors are working in general practice. Frequently it is reported that medical doctors from other countries cause linguistic and cultural problems for their patients. We therefore expect that people prefer to be listed by Norwegian doctors.
[20] In the literature it is often discussed whether the practice style between these two groups differ, and it is, for example, claimed that GPs with a fixed salary offer their patients longer consultations.
[21] See also Grogan et al. (1995).

list patient system. They are, for instance, asked to give their most important of three stated reasons why they rank their first choice doctor first. The three possibilities capture physical accessibility, the GP's medical qualifications and continuity in the relationship to a GP. The respondent is also asked to answer five statements regarding GPs[22]. The statements capture aspects like medical confidence and waiting time to obtain a consultation. We believe that results from this analysis will further contribute to the understanding of why individuals' preferences for GPs differ, and hence be an interesting supplement to this paper.

Our initial hypothesis was that individuals would attach importance to physical accessibility to the GP's office when they choose a GP. For instance, we thought that individuals would prefer to be listed by a GP with an office close to where they live and also that they prefer a GP office made accessible to the disabled. From the data we found that all the included GP offices were adapted to accommodate the disabled, and therefore it did not make sense to include this variable in the analysis. To account for the individual's residential address relative to the GP's practice address, we tried to include a dummy variable taking the value one if a GP's office and an individual's home address had the same postal code and zero otherwise. Since the extent of an area covered by a postal code varies, it may be the case that a geographical area of a certain size has ten different postal codes while another area of the same size has only one. Hence, this variable did not make any sense in the analysis. Instead, the meaning of accessibility will be analysed on the basis of the questionnaire survey mentioned above.

We use stated list size as an indicator of access to the GP and we found that individuals prefer GPs with long preferred lists to GPs with shorter preferred lists. However, this effect may also

[22] The answering categories range from totally agree to totally disagree (five categories).

be interpreted as an effect of individuals preferring continuity in the relationship to their GP. This may occur because GPs who stated a long preferred list size most likely also had a long list and many patients to care for ahead of the reform. The effect may therefore capture the possibilities that individuals choose the GP they are used to, i.e. that they prefer continuity in the doctor-patient relationship. The fact that we found older GPs to be more popular than younger GPs, can also be interpreted as individuals' preferences for continuity in the relationship to a GP. It therefore seems important that the health authorities aim at achieving stability among GPs. The importance of stability among GPs is also reflected in the way the population filled in the entry form. We found that the higher turnover there was among GPs, the lower was the share of the population that filled in three choices on the form; i.e. they may not have bothered to fill in the form because the possibility of getting the GP they prefer is rather small. It follows that the population faces very different choice sets when choosing GPs in a country like Norway with small municipalities and rural districts.

To allocate GPs to all inhabitants of Norway, the health authorities made a GP distribution algorithm. The main factors in the algorithm that determines the actual matching between individuals and GPs are the individuals' seniority with their first choice GP and the distance from their home address to the GP's office. Because we know the GP each inhabitant is actually assigned due to the algorithm, an idea for further work is to compare individuals' preferred ranking from our model to the actual outcome. An interesting question is whether the distribution algorithm takes account of the findings regarding individuals' preferences in this paper.

6. Conclusion

To obtain more knowledge about the characteristics different individuals emphasize when choosing a GP, we have estimated a stochastic model for ranking. As far as we know, such ranking models have not previously been used in the health economic literature. From the model we analyse whether the systematic or the random part of the utility function dominates in explaining how people choose a doctor. All the estimated parameters are sharply estimated and have the expected sign. Hence, we found systematic features that influence the population's choice of GPs, i.e. people's choices of GPs are not purely random.

82.9 % of the inhabitants in our data set were allocated their first choice GP as a personal doctor, and only 11.2 % did not get any of their GP choices fulfilled. It then seems that the actual composition of the GPs' lists follow from individuals' preferences[23]. We found that female doctors have more females and older GPs have more elderly on their lists. In the literature (see for instance Carr Hill et al. 1996 or Windmeijer and Santos Silva 1997) it is often claimed that the elderly and females are more frequent users of medical doctors than the average person. It then follows that some GPs may have a heavier patient load than the average. In the negotiations on the remuneration system for GPs this was an important concern of the Norwegian Medical Association. They argued that GPs should not suffer an economic loss because they treat patients with a considerable need for health services. The fee-for-service component therefore constitutes 70 % and the per capita component 30 % of an average GP's income and this composition is intended to take account of differences in patient load. This implies that GPs with a long list of healthy individuals and GPs with a shorter list of people with a greater need for health care face the same income possibilities. An

[23] Norwegian GPs are not allowed to refuse patients who want to be listed in his or her practice, i.e. no cream-skimming occurs.

alternative way to compensate GPs with a heavy patient load is to differentiate the per capita component, i.e. pay a larger sum per capita if the person on the list is female or elderly[24].

We found that inhabitants in a municipality make very different rankings of GPs. The analysis shows that women prefer female doctors while men prefer males. It also seems that individuals prefer that the age difference between themselves and the doctor should be as small as possible. One policy implication of these findings is that the collegiums of GPs in a municipality should reflect the age and gender composition of the population. Because it seems that individuals prefer continuity in their relationship to a GP, it also seems important that the health authorities aim at achieving stability among GPs.

[24] Discussions of the advantages and disadvantages of different systems of remunerating GPs can be found in Maynard et al. (1986) and in Donaldson and Gerard (1989). In Scott and Hall (1995) a review of the literature regarding the effect of different payment systems for GPs can be found.

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Appendix:

Table A1:

Variable	Filled in three GP choices	Sample used
Patient gender	0.47 (0.50)	0.47 (0.50)
Patient age	45.30 (17.05)	45.02 (16.98)
Years of seniority with 1st choice GP	7.06 (8.46)	7.34 (8.6)
Stated list size 1st choice GP	1227.07 (281.65)	1268.63 (255.96)
Actual list size 1st choice GP	1277.18 (330.40)	1319.75 (309.66)
Gender 1st choice GP	0.79 (0.41)	0.77 (0.42)
Age 1st choice GP	47.89 (9.38)	47.94 (9.04)
Specialist	0.63 (0.48)	0.65 (0.48)
n	10289	9361

Table A2:

Variable	Filled in three GP choices	Sample used
Number of GPs in the municipality	7.44 (3.06)	7.68 (3.10)
Number of female GPs in the municipality	1.13 (0.86)	1.24 (0.82)
GP density in the municipality	1465.90 (530.39)	1490.34 (549.82)
Index of centrality for the municipality	5.52 (1.82)	5.48 (1.89)
Share interns in the municipality	0.05 (0.07)	0.06 (0.07)
Share GPs on fixed salary in the municipality	0.12 (0.13)	0.10 (0.13)
Share privately practising GPs in the municipality	0.80 (0.12)	0.81 (0.12)
n	10289	9361

Table A3: Example of how different individuals make different choices in a municipality with 3 GPs practising. Based on the results of the sub-sample where individuals made one choice

Example of inhabitant	**Prob. of rank order A, B, C**	**Prob. of rank order A, C, B**	**Prob. of rank order B, C, A**	**Prob. of rank order B, A, C**	**Prob. of rank order C, B, A**	**Prob. of rank order C, A, B**
Female 50 years old	0.381	0.104	0.075	0.330	0.050	0.060
Male 35 years old	0.110	0.074	0.313	0.175	0.238	0.089
Male 75 years old	0.129	0.008	0.216	0.598	0.042	0.007

GP A: Female, 45 years old, stated list size 1500, specialist in general practice.
GP B: Male, 50 years old, stated list size 1700, specialist in general practice.
GP C: Male, 35 years old, stated list size 1800, not a specialist in general practice.