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Willingness to Pay for Online Physician Services

ABSTRACT

This paper evaluates consumers' preferences for online physician services. Online physician services refer to physician services that can be purchased through an electronic network using a personal computer. The article first develops a theoretical model, which is used to create testable hypotheses. Consumers' preferences for online services are evaluated using the willingness to pay (WTP) method. We use the open-ended question type to measure consumers' willingness to pay for online physician services. Results show that income, distance to the nearest physician, and general interest in information technology significantly explain willingness to pay for online physician services. Each of these variables has a positive effect on willingness to pay. Healthier and younger individuals are also willing to pay more than less healthy and older individuals, but these results are not statistically significant. The mean value of willingness to pay for online services is estimated to be 11 Euros per visit.

Key words: *willingness to pay, physician services, online services*

1 INTRODUCTION

Various goods and services can be purchased on the Internet nowadays. This has been the result of recent technological progress in the field of information and communication technologies (Sitra, 1998). Technological progress has created electronic home pages and shopping sites, which

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consumers can utilize when purchasing goods and services. Besides providing new shopping sites, Internet also provides price information for consumers in a relatively fast way. All in all one can say that this progress has lowered transaction costs. A consumer thinking of purchasing a book does not have to visit a bookstore in person, but it is possible to purchase the book through a computer network. Or the same person planning to purchase the book from a bookstore might find relevant information regarding availability and prices of the book in different bookstores from the Internet.

Health care has not been insulated from this development. Health information is available also in the Internet and one can purchase some health care services, like physician consultations, there. In Finland, disparities of access to services have been a major problem especially between urban and rural areas and e-health services could be seen as one possible way to support better access to services. From the beginning of March 2005 The Finnish Ministry of Social Affairs and Health implemented the timeframes for access to healthcare, but the role of e-health services is still unclear in the legislation. If a municipality can not arrange a visit to a public health centre, one possible solution could be a physician visit via Internet. The new legislation guarantees access by phone to health centre but the Internet could be a good alternative in this respect too.

Our aim in this paper is to assess consumers' willingness to pay for online physician services. Online physician services refer to physician services that can be purchased through an electronic network using a personal computer. The context of this study is the Finnish health care system, which is mainly financed by public taxation and households' out-of-pocket fees. All Finnish inhabitants are entitled to public health services, but they can also choose between public and private sector. At both sectors, an adult patient pays some out-of-pocket fees for physician services, which are lower in the public sector than in the private sector. Out of pocket fees for public physician visits vary from 0 Euro (children under 15 years) to 11 Euros per visit and there are no fees after the third annual visit. An alternative pricing scheme currently available in the public health care is to pay 22 Euros per year. National health insurance reimburses a certain percentage of physician fees for the users of private health care services.

Main motivation for this study was the lack of information on consumers' utility from online health services. A recent attitude survey from United States shows that many respondents indicate an interest in using Internet for clinical purposes (Anderson, 2004). Still little is known[1] about consumers' utility from online health services, or e-health services more generally, although valuations influence consumption decisions and hence the future development of online health

1 We conducted a search from two databases using search words e-health, willingness to pay, consumers' e-health, and online health services. Articles that were found dealt mainly with consumers' willingness to search information from Internet and consumers' attitudes toward e-health services but no study concerning consumers' valuations of e-health services was found.

care. Previous evaluation studies have mainly concentrated on willingness to pay for specific treatments (see Diener et al., 1998) or health care programs (see e.g. Olsen and Donaldson, 1998). Results of our study might be useful in predicting the development of e-health services but may also provide information and guidance for public decision-makers and any policy decisions the government may make with respect to online service provision.

The rest of the paper is organized as follows. Following section displays objectives of the study. Section 3 discusses the concept of willingness to pay and then develops an economic model on willingness to pay for online physician services. In the end of the section, we also go through various ways of measuring willingness to pay. Section 4 displays data used and hypothesis tested in the empirical analysis, and fifth section reports empirical methods and results. In the final sections 6 and 7 we present some concluding remarks.

2 OBJECTIVES OF THE STUDY

The study has three objectives. Our aims are

1. to develop an economic model on willingness to pay for online physician services,
2. to assess willingness to pay for online physician services, and
3. to explain the observed variation of willingness to pay for online physician services using socio-economic variables.

3 WILLINGNESS TO PAY: CONCEPT AND MEASUREMENT

The willingness to pay method has been used quite extensively in environmental and transport economics (see e.g. Johansson, 1987, and Samples and Hollyer, 1990) over the last decades. Applications of the method in health economics have also been increasing recently. Diener et al. (1998) found 48 willingness-to-pay studies, which were published during the years 1984–96. In another review, Olsen and Smith (2001) reviewed 71 studies published during the years 1985–1998. When compared to the number of published cost-effectiveness studies, the above numbers are still low (Pritchard, 1998).

Willingness to pay measures changes in consumers' utility in monetary units. Two concepts, which have been used to measure willingness to pay, are equivalent variation and compensating variation (see Diener et al., 1998, and Drummond et al., 1997). Equivalent variation measures the amount of money needed at current prices to compensate a change in prices and/or income for a consumer. Compensating variation measures the amount of money needed at new prices to compensate a change in prices and/or income. Third concept, which can be used to quantify changes in consumers' welfare, is consumer surplus. It can be shown (see Varian, 1992) that under quasi-linear utility function the consumer surplus measure is equivalent to compensating variation and equivalent variation measures[2].

In the next subsection we present a simple model on willingness to pay for online health services. With the model we aim at finding variables, which could be used to explain the variation of willingness to pay for online physician services in the empirical data. The model builds on quasi-linear preferences and defines willingness to pay for online physician services as consumer surplus. The model also incorporates a feature which we consider essential in differentiating online physician services from physician visits; while the distance to a chosen health care provider causes travelling costs for a consumer choosing physician visit, it is natural to assume that such costs are not present if the consumer decides to use online physician services.

3.1 Modeling willingness to pay for online physician services

Following the literature on horizontal product differentiation (see e.g. Tirole, 1988), we consider a continuum of consumers dwelling in a linear city. This modeling approach is chosen because it explicitly considers traveling cost of consumers. Another attribute which differentiates consumers from each other is their health state h. Therefore, each individual is indexed by a pair (x,h), where x is individual's location in the city and h is individual's health. We assume that the length of the city is one, and that health varies in the range [0,1]. We apply the usual convention from health economics that the worst and the best health states map to 0 and 1, respectively. In addition, it is further assumed that individuals are uniformly distributed in the location-health square.

Let us consider a situation in which there is a single physician in the linear city, assumed to be located at one extreme of the city, at zero. The physician can provide health services in two ways. Individuals can visit the physician personally and have their medical condition checked, or they can purchase an online health service from the physician via computer network. Let variables $\tilde{s}$ and $\tilde{p}$ denote prices of the visit to the physician and the online physician service, respectively. These prices are defined relative to income level y as $\tilde{s}$ = s/y and $\tilde{p}$ = p/y, where s and p are unit prices of the physician visit and the online physician service. For similar price definition, see Propper (2000). An individual with health state h derives utility levels $u_v(h)$ and $u_o(h)$ from the personal visit to the physician and from the online physician visit, respectively. It is assumed that above utility functions are multiplicatively separable in health so that $u_j(h) = u_j(1\text{-}h)$ where j = v,o. This formulation captures the idea that utility from health services is decreasing in the individual's health state and individuals in the worst (best) health state obtain highest (zero)

2 Empirical studies demonstrate that this result might not hold true in a survey data (Borisova et al., 2003). The problem of such studies is that quasi-linearity of preferences of those being surveyed must be taken as assumed.

utility from the use of health services. We further assume that $u_v > u_o > 0$, and each individual values the personal physician visit more than the online physician service.

Traveling through the city costs each individual t units of money. Traveling costs are added to the unit price of the service whenever an individual visits the physician personally. If an individual decides to use online physician services, traveling costs are assumed to be zero.

Let us first derive the demand for online physician services. An individual with location and health (x,h) purchases online services if and only if indirect utility from the online service exceeds that from the personal visit to the physician. This occurs when

(1) $u_o(1-h) - \tilde{p} \geq u_v(1-h) - \tilde{s} - t\,x.$

The above condition (1) implies that all individuals for whom the inequality

(2) $x \geq (1/t)\,[\tilde{p} - \tilde{s} - (1-h)d] = x(h)$

holds true decide to use the online service. The term $d = u_o - u_v$ measures the utility difference between the online service and the physician visit and is strictly negative by assumption. The demand for online services can be derived using the condition (2). The following proposition characterizes the demand for online services under the condition that the traveling cost exceeds the utility difference between the online service and the face-to-face visit to the physician. The assumption ensures that the slope of the line x(h) is less than one (in absolute value) and it is made to simplify the analysis. The proof of the proposition can be found in Appendix.

Proposition Suppose that $0 < t + d$. Then the demand for online physician services, denoted as D(p,s,y), is defined as

1	$, p \leq s + yd$
$1 + (1/(2tdy^2))[p - s - yd]^2$	$, s + yd < p \leq s$
$(1/(ty))[s + ty + (1/2)dy - p]$	$, s < p \leq s + y(t + d)$
$-(1/(2tdy^2))[yt - (p - s)]^2$	$, s + y(t + d) < p \leq s + yt$
0	$, p > s + yt.$

It can be checked that the demand function for online services, D(p,s,y), is a continuous function in its own price p.

We define willingness to pay for online services, denoted as WTP, as consumer surplus (see e.g. Varian, 1992)

(3) $WTP(s,y) = \int D(z,s,y)dz,$

where the definite integral is defined over the interval [0,(s+yt)]. The resulting willingness to pay depends on the sign of the term s + yd, where $d = u_o - u_v$. Using the demand function derived above and the definition (3), willingness to pay for online services simplifies to

(4) $WTP(s,y) = s + (y/2)[t + d] + i(s+yd)^3/(6tdy^2)$,

where i = 1 if $s + yd \leq 0$ and i = 0 otherwise.

Following predictions concerning willingness to pay for online physician services can be made under the assumption made in the proposition. We show in Appendix that willingness to pay for online services increases as the price of the physician visit increases and as income grows. Both of these results are intuitive because it is expected that the demand for online services grows as consumers get wealthier and/or as the substitute for online services, physician visits, becomes more expensive.

Although willingness to pay does not depend on health or the distance to the nearest physician, it is possible to conclude on the basis of the condition (2) that more healthy people and those living further away from the nearest physician are the ones who more likely than unhealthy and those living closer to the nearest physician use online services. Therefore, we expect willingness to pay to be higher for more healthy and for individuals living further away from the nearest physician. We test all these predictions in the empirical part of this study.

3.2 Measurement issues

There are four ways to measure willingness to pay in economic evaluation: open-ended, take-it-or-leave-it (or alternatively discrete choice), payment card, and bidding games types of questions. Open-ended question type asks the respondent the amount of money he/she is willing to pay for a specified good or service. Take-it-or-leave-it question proposes a bid for the good and asks if the respondent is willing to pay that price. Payment card technique lists a range of prices and the respondent is asked to mark the maximum amount of money he/she is willing to pay. Bidding games offer a sequence of values for the respondent who answers either yes or no to the proposed bid. The sequence of values finally converges to the estimate about individual's willingness to pay. These different techniques have been assessed widely in the literature (see Johannesson et al., 1996, Klose, 1999, Mitchell and Carsson, 1989, NOAA panel, 1993, O'Brien and Gafni, 1996, and Russel et al., 1995).

According to the NOAA panel (1993) guidelines, take-it-or-leave it questioning should be used in evaluation studies. Maybe the strongest argument for the use of the method is that it resembles real life situations in which decisions are made. Some critique towards the method has also been raised. First, the take-it-or-leave question method may not be consistent with the theoretical idea that willingness to pay measures the maximum utility derived from goods and services (Russel et al., 1995). Secondly, the selected domain of bids may not be consistent with the real domain in the sample (Hanemann, 1984).

We chose the open-ended method for this study, because there is little information on willingness to pay for online health services and the open-ended question technique is a good method for obtaining first estimates. Furthermore, the open-ended method is easier to apply than other, more laborious and expensive, methods. Open-ended questions have been criticized because respondents may find it difficult to answer the willingness to pay question if they are unfamiliar with goods being evaluated (Mitchell and Carson, 1989). We concentrate on health care services, which should be familiar to most people. Basic interest in our study is the method of delivering physician services. Services are provided through an email connection and/or online discussion area between a patient and a physician, but not for example through a video connection. We also expect that Finnish people are familiar with the Internet as a tool to deliver services, because information and communication technology is widely utilized in Finland for example in banking services (Statistics Finland, 2001).

4 DATA AND HYPOTHESIS

Data were collected in September 2000. Questionnaires were mailed to 1500 randomly selected individuals (25–85 years) in Kuopio area, Finland. The willingness to pay question that was used in the questionnaire was

Suppose that you or your child contracts a disease. You may visit a physician or obtain the same service through a computer network from your personal computer. What is the maximum amount you would be willing to pay for the online physician service?

Totally 773 individuals returned the questionnaire, providing us a 51.5 percent response rate. Due to the relatively high response rate, we decided not to conduct a second round survey.

Comparison of the sample structure and general structure of population in Kuopio was made. In particular, this comparison was made in terms of gender and age variables. Figures in Table 1 show that older population is over-represented in our sample.

To correct the bias this may cause on results, all variables used in the empirical analysis were weighted by the factor

$$(5)\quad w_i = \frac{POP_i/POP}{N_i/N}.$$

Variables POP and POP_i measure the size of the total population and the number of people in age group i in Kuopio area. Variables N and N_i measure the corresponding variables in our

TABLE 1. Kuopio population and respondents.

	Total population (25–85) in Kuopio (N= 57 495)		Respondents	
	N	%	N	%
Gender				
Men	26 759	47	341	44
Women	30 736	53	430	56
Age				
25–34	11 641	20	89	12
35–44	13 064	23	116	15
45–54	13 625	24	106	14
55–64	8 619	15	150	19
65–74	6 627	11	160	21
75–85	3 919	7	151	19

Source: Population structure. Statistics Finland 2001:6

sample. Population was divided into 6 age groups according to Table 1. The weights w_i were then applied in these classes.

We also collected data on several socio-economic variables in order to better understand respondents' answers. Information on income, distance to the nearest physician, age, gender, and perceived health were gathered. To obtain information on individual's interest in information technology, we also asked whether or not individuals owned a computer and their general interest in information technology. These variables are defined in Table 2 and described statistically in Table 3. Descriptive statistics are computed using the original data set with missing values removed. Data on individuals' income were collected from the regional tax office in Kuopio.

On the basis of the theoretical model presented in previous section we formulated the following hypotheses

1. Willingness to pay for online physician services increases as income grows.
2. Willingness to pay for online physician services increases as distance to the nearest physician increases.
3. Willingness to pay for online physician services increases as health state improves.

In order to test the above hypotheses, the next section estimates an empirical model in which willingness to pay (WTP) for online services is explained by income (INCOME), distance to the nearest physician (DISTANCE) and health (HEALTH). We also add variables measuring general interest in information technology (INTEREST) and the ownership of a computer (COMP) into the model. These two variables approximate individuals' interest and access to online services and

TABLE 2. Variables and their description.

Variable	Description	Type	Theoretical range
WTP	Willingness to pay for online services, €	Continuous	≥ 0
INCOME	Individual's annual gross income, €	Continuous	≥ 0
DISTANCE	Distance to the nearest physician, kilometres	Continuous	≥ 0
GENDER	Gender	Discrete	{1,2} 1 = Male 2 = Female
AGE	Age	Continuous	≥ 0
HEALTH	Individual's perceived health status	Discrete	{1,2,3,4,5} 1= very good health 2= good health 3= normal health 4= bad health 5= very bad health
COMP	Have a computer/do not have a computer	Discrete	{0,1} 0 = individual does not have a computer 1 = individual has a computer
INTEREST	General interest in information technology	Discrete	{1,2,3} 1 = individual shows no interest 2 = individual shows some interest 3 = individual shows very much interest

TABLE 3. Descriptive statistics.

Variable	Mean	Standard deviation	Minimum	Maximum
WTP	9.50	20.557	0	336.38
INCOME	17449.41	15214.38	0	258991.41
DISTANCE	4.088	7.281	0	80.00
GENDER	1.523†	0.500†	1	2
AGE	57.00	16.228	26	85
HEALTH	2.591†	0.847†	1	5
COMP	0.419†	0.494†	0	1
INTEREST	1.665†	0.646†	1	3
N = 535				

† Mean values and standard deviation for discrete variables are computed as weighted average using frequencies as weights.

we expect them to have a positive impact on willingness to pay. We also add age (AGE) and gender (GENDER) variables into the model in order to see if there is any change in willingness to pay between different generations and women and men. Men and women bought equally through the Internet in Finland (Statistics Finland, 2001) at the end of the year 1999. The computer skills of younger generations are assumed to be better than the skills of previous generations. Younger generations have also been keener in seeking health information from the Internet than older generations (Dierks, 2000).

5 EMPIRICAL METHODS AND RESULTS

We begin our empirical analysis by estimating the following linear regression model on willingness to pay for online physician services, WTP:

(6) $WTP_i = \beta_0 + X_i\beta + \varepsilon_i$.

In the above model variable X contains variables INCOME, DISTANCE, GENDER, AGE, HEALTH, COMP and INTEREST, β_0 and β are unknown parameter vectors, and ε is the error term of the statistical model.

As the benchmark case, the above model (henceforth Model 1) was first estimated by applying the ordinary least squares (OLS) method. We imposed the usual assumptions on the error term ε and explanatory variables (see e.g. Greene, 2003). After removing missing values from the data set, the final data set contained 535 observations.

The results of the estimation are presented in the second column of Table 4. Independent variables in the model jointly explain the variation of willingness to pay in a statistically significant way, which is demonstrated by the value of the F-test. The coefficient of determination, R^2, shows that the independent variables of the model explain approximately 22 percent of the variation of willingness to pay for online services. Moreover, three individual variables explain the variation of willingness to pay for online services. First, income has a statistically significant and positive impact on willingness to pay. This effect is very small though. Second, distance to the nearest physician has a positive and statistically significant impact on willingness to pay for online services. Third, willingness to pay for online physician services increases as general interest in information technology increases. Health and age variables both have a negative parameter estimate but neither of the two estimates differs from zero in a statistically significant way. These results are intuitive and approximately consistent with our hypothesis presented in the above section. The estimated model predicts that the mean willingness to pay for online services is approximately 11.3 Euros.

TABLE 4. Results of estimation, Model 1 and Tobit model.

Variables	Model 1	Tobit	Marginal effects[3]
CONSTANT	5.827 (16.157)[1]	–139.455*** (27.258)	–68.585*** (12.356)
INCOME	0.0002***[2] (0.00006)	0.0003*** (0.00009)	0.0001*** (0.00004)
DISTANCE	3.846*** (0.596)	3.930*** (0.882)	1.933*** (0.442)
GENDER	6.453 (7.838)	11.420 (11.891)	5.617 (5.848)
AGE	–0.340 (0.501)	–0.0563 (0.760)	–0.028 (0.374)
HEALTH	–3.291 (5.688)	–4.096 (8.599)	–2.014 (4.230)
COMP	7.218 (9.721)	13.436 (14.696)	6.608 (7.228)
INTEREST	15.036** (6.623)	38.090*** (10.249)	18.733 *** (5.026)
N	535	535	
R^2	0.217		
Log (Likelihood)		–2902.630	
F-test (model significance)	20.83 ***		
LR-test (model significance)		151.808***	
Sigma (σ)		168.947*** (7.248)	
Mean WTP	11.3 €	11.04 €[4]	

1) Standard errors of estimates in parenthesis
2) *** = significant at 1 percent significance level
   ** = significant at 5 percent significance level
   * = significant at 10 percent significance level
3) Marginal effects are computed at the mean values of the independent variables
4) Mean value is computed using the formula
   $E(y) = \Phi(x_i'\beta/\sigma)\,[x_i'\beta + \sigma(\phi(x_i'\beta/\sigma)/\Phi(x_i'\beta/\sigma)),$
   where ϕ and Φ are pdf and cdf of the standard normal distribution.

The fact that some of the estimates are not statistically significant may be due to high correlation between the independent variables. We found some correlation between the variables in the original data, but correlations were relatively small (less than 0.6 in absolute value). In particular, correlations between the variable AGE and some other independent variables were observed. In the weighted data observed correlations increased but remained still below the level (all correlations less than 0.75 in absolute value) which is considered as harmful for the estimates of the linear model (see e.g. Hill et al., 1997). In addition, we ran a regression in which the AGE variable was regressed on other independent variables of the model. The estimated unadjusted coefficient of determination of the model was 0.35. This allows us to conclude that multicollinearity is not a problem in this study.

There is another aspect of the Model 1, which deserves attention. Several respondents in the sample answered that they are not willing to pay anything for online services. There were 236 such individuals in our sample, which is approximately 44% of the final sample used in the analysis. Because of zero observations the above OLS estimates are biased and inconsistent (see e.g. Greene, 2003).

In order to handle the censored dependent variable properly, we estimated the Tobit specification of the Model 1. We assumed that the random term in the Tobit model is normally distributed. Estimation results of the Tobit model are presented in the third column of Table 4. Income, distance to the nearest physician, and general interest in information technology significantly explain the variation of willingness to pay for online physician services in the Tobit model. In this respect, the results are similar to the OLS estimates of the Model 1.

The last column of Table 4 displays the marginal effects of the independent variables in the Tobit model. Income has a positive impact on willingness to pay for online physician services. Although the impact on the expected value of willingness to pay is small, the impact is statistically significant, but smaller than in the Model 1. Second, individuals are willing to pay more for online services as they live further away from the nearest physician. Again, the impact of the variable DISTANCE is smaller than in the Model 1. Third, the effect of general interest in information technology is to increase willingness to pay in a statistically significant way. In this case the marginal effect is higher than in the Model 1. Furthermore, age and health have the expected impact on willingness to pay, but the marginal effects on willingness to pay are not statistically significant.

The mean value of willingness to pay in the Tobit model was also evaluated. All the independent variables were used to compute the prediction of the model and the variables were evaluated at their weighted mean values. Using the unconditional mean (utilizing both censored and uncensored observations) of the Tobit model, the mean willingness to pay for online services was estimated to be approximately 11 Euros. This is not too much different from the predictions of the Model 1.

Previous analysis is based on weighted independent and dependent variables. We also ran the above regressions using the original data. What was observed was that explanatory powers of the models dropped. In the Model 1, the coefficient of determination decreased to 0.05. In the Tobit model the variable DISTANCE was not a statistically significant independent variable. Otherwise the results were qualitatively similar than the results reported above.

Finally, one might consider if the decision-making process of individuals concerning their willingness to pay occurs in two stages. Individuals might first decide whether or not they are willing to pay anything for online physician services and then, at the second stage, they decide on the level of willingness to pay. This approach to decision-making allows one to apply two-part models of health econometrics (see Jones, 2000, and Sintonen and Linnosmaa, 2000). Two-part models make it possible to consider separate effects of independent variables on these two distinct decisions. In our study the model consists of two equations. In the first equation, the probability of positive willingness to pay was regressed on the independent variables present in the Model 1. Probit modelling techniques were utilized here. In the second equation, strictly positive levels of willingness to pay were regressed on the independent variables using the OLS technique. The second equation will be called Model 2.

TABLE 5. Results of estimation, Two-part model .

Variables	Model 2	Probit	Marginal effects[3]
CONSTANT	34.342 (28.973)[1]	–0.691*** (0.189)	–0.271*** (0.075)
INCOME	0.0002***[2] (0.00008)	0.00000096 (0.0000008)	0.00000038 (0.00000031)
DISTANCE	4.469*** (0.796)	–0.00052 (0.0081)	–0.000205 (0.0032)
GENDER	13.911 (11.558)	0.017 (0.0929)	0.0066 (0.036)
AGE	–0.002** (0.742)	0.00033 (0.006)	0.00013 (0.0023)
HEALTH	–3.526 (8.200)	–0.027 (0.069)	–0.0107 (0.027)
COMP	6.747 (14.120)	0.114 (0.112)	0.044 (0.044)
INTEREST	2.634 (10.560)	0.382*** (0.078)	0.149*** (0.030)
N	299	535	
R^2	0.182		
Log (Likelihood)		–305.904	
F-test (model significance)	9.27***		
LR-test (model significance)		122.424***	
Mean WTP	20.26 €		

1) Standard errors of estimates in parenthesis
2) *** = significant at 1 percent significance level
** = significant at 5 percent significance level
* = significant at 10 percent significance level
3) Marginal effects are computed at the mean values of the independent variables

Table 5 reports the results of the two-part model. Results of Model 2 are presented in the second column of the table and the results of the Probit model and the associated marginal effects are displayed in the third and fourth columns. Let us first consider the results of the Probit model. The variables present in the model jointly explain the probability of positive willingness to pay. What comes to individual variables, it appears that only the variable INTEREST explains the probability of positive willingness to pay. The marginal effect of the variable is also positive and statistically significant.

The results of Model 2 show that income and distance to the nearest physician explain strictly positive levels of willingness to pay. Both of these variables have positive impact on the dependent variable. Moreover, older people are less willing to pay for online services than younger people, but the estimated negative effect is small. What is worth of noticing here is that general interest in information technology is not related to willingness to pay for online physician services. This allows us to conclude that general interest in information technology explains the probability of positive willingness to pay while income and distance to the nearest physician explain positive levels of willingness to pay.

Model 2 can also be used to estimate the mean willingness to pay. In this sub-sample, the mean willingness to pay is approximately 20 Euros. This is expected because the sub-sample does not contain zero values of willingness to pay.

6 DISCUSSION AND CONCLUSION

More widespread use of information technology is an integral part of development strategies in many countries. There seems to be a consensus among policymakers in Finland that Finnish society should be developed so that peoples' basic needs would be better accounted for. It is further believed that this development should be based on increased utilization of modern information and communication technology (Sitra, 1998). Whether these strategies are successful or not depends on how committed individual citizens are to this development. One measure for the strength of the commitment is the value that individuals place on new technology and its applications. This valuation is also influencing individuals' willingness to utilize and pay for new technology.

This study measured and explained willingness to pay for online physician services. We applied survey methodology and the open-ended question format to measure willingness to pay for online services. The questionnaire was sent to 1500 randomly selected individuals in Kuopio area, Finland. Approximately 52% of the questionnaires were returned after the first round, which was considered a reasonable response rate. It seems that we have managed to avoid the problem of low response rate typically observed in studies applying open-ended questions (Johannesson et al., 1996).

We found that willingness to pay for online physician services was affected by income, distance to the nearest physician, and general interest in information technology. All these variables had a positive and statistically significant impact on willingness to pay. Results also showed that general interest in information technology explains the probability of positive willingness to pay, and income and distance to the nearest physician explain positive levels of willingness to pay. Furthermore, it was found that age and health had negative and positive impacts on willingness to pay, respectively, but neither of these variables was statistically significant. All these results were consistent with theoretical hypotheses.

Mean willingness to pay was found to be approximately 11 Euros. At the time the survey research was carried out, prices for online consultation services in Finland ranged from 20 to 45 Euros (Atuline, 2001). These prices exceed the estimated mean willingness to pay for online services in this study. In our sample there were several individuals who were not willing to pay anything for online services, which reduced the estimated mean willingness to pay. The estimated mean willingness to pay in the model, which did not include zero answers, was approximately 20 Euros. This estimate is closer to the actual prices but does not exceed them very much. There were also 93 individuals in our sample whose willingness to pay for online physician services exceeded market prices. Our interpretation of these observations is that online firms focus their operation on specific segments of consumers.

Willingness to pay answers may be biased downward for two reasons. First, respondents may not be willing to pay for online services if they consider a visit to a public sector physician as an alternative to online services. Furthermore, some answers may also reflect opinions that health care should not be developed into the direction where information technology is more increasingly utilized but the production of health care should be kept labour-intensive. Large number of zero answers may reflect that, and some of them are probably protest zeros. We do not expect any 'warm glow' effects to be present in data, causing an upward bias to respondents' valuations (see Diamond and Hausman, 1994, and NOAA panel, 1993).

There are at least three issues that should be taken into account in the future research. First, take-it-or-leave-it questions should be applied in similar study designs. Second, it should be observed that several physician services cannot be purchased via Internet but patients need to visit their physicians personally. For example, if one has a skin problem it may be necessary that the individual meets a physician face-to-face since it is impossible to describe the health problem in an electronic mail. This suggests that online services are not always substitutes for physician visits. Third, the open-ended question covered both respondents and their children's health issues which may also cause some bias to the answers. Liu et al. (2000) have shown that mothers' willingness to pay for the protection of their children's health is twice as high as mothers' willingness to pay for their own health protection. It is important that future research would concentrate on more specific services and patient groups in which the substitution between physician visits and online services is a real possibility.

7 MANAGERIAL IMPLICATIONS

Willingness to pay surveys and their ability to contribute policy making has been criticized because of problems in the validity of measures (Diamond and Hausman, 1994). Despite the possible bias in estimated willingness to pay, results of willingness to pay studies can still provide information for management of health care sector or for cost-benefit analyses (Johannesson et al., 1996). Based on our results, further development of online services in health care is encouraged. Some patient groups could benefit from online services considerably, and this development process could happen both in private and public health care sectors.

Equal access to health services has been the basic value and principle in the Finnish health care and, if the use of online services expands in the future, it would also be important to consider how equity principle could be ensured also in this regard. Some sicknesses and patients groups are not suitable for online health care services, but the distribution of patients for online health services and for physician visits can make the health service structure more efficient and that way even support equal access principle in the Finnish health care.

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APPENDIX

1) Proof of the Proposition

Following the notation in the text, let us denote $d = u_o - u_v$. The assumption $u_v > u_o$ implies that $d < 0$, and the line

$$x(h) = (1/t)[\tilde{p} - \tilde{s} - (1\text{-}h)d]$$

is decreasing in health state h. Let us first consider the extreme cases in which no consumer and all consumers demand online health services. If $\tilde{p} > \tilde{s} + t$, then $x(h) > 1$ for all feasible health states h because

$$x(1) = (1/t)(\tilde{p} - \tilde{s}) > (1/t)(\tilde{s} + t - \tilde{s}) = 1$$

and x(h) is strictly decreasing in health state h. Therefore, when $\tilde{p} > \tilde{s} + t$, there is no consumer who would use online health services and the demand is zero. Given that prices are defined relative to income, the condition $\tilde{p} > \tilde{s} + t$ can be rewritten as $p > s + yt$. On the other hand, if $\tilde{p} \leq \tilde{s} + d$, then $x(0) \leq 0$ and, since x(h) is decreasing in health, it holds true that $x(h) < 0$ for all feasible health states other than zero. Therefore, all consumers use online health services and the demand is unity. Using the price definitions, the condition $\tilde{p} \leq \tilde{s} + d$ can be rewritten as $p \leq s + yd$.

Suppose next that $\tilde{s} + d < \tilde{p} \leq s$. In this case it holds true that $x(0) > 0$ and $x(1) \leq 0$. The demand for online services is now given as

$$D(\tilde{p}, \tilde{s}) = 1 - (1/2)(1/t)[\tilde{p} - \tilde{s} - d](1/d)[\tilde{s} + d - \tilde{p}] = 1 + 1/(2td)[\tilde{p} - \tilde{s} - d]^2,$$

which proves the case $\tilde{s} + d < \tilde{p} \leq \tilde{s}$. Using the price definitions, one can rewrite the condition as $s + yd < p \leq s$ and the corresponding demand as

$$D(p,s,y) = 1 + 1/(2tdy^2)[p - s - yd]^2,$$

Derivation of the demand for online services can be done similarly for the other price regions present in the proposition. This completes the proof.

2) Comparative static analysis

Let us assume that $t + d > 0$ holds true. Then

$$WTP(s,y) = s + (y/2)[t + d] + i(s+yd)^3/(6tdy^2),$$

where i = 1 if $s + yd \leq 0$ and i = 0 otherwise. Suppose first that $s + yd > 0$ and i = 0. Then it is immediately clear that willingness to pay for online services increases as income or the price of the physician visit increases. Let us then consider the more complicated case in which $s + yd \leq 0$ and i = 1. Now

$$WTP(s,y) = s + (y/2)[t + d] + (s + yd)^3/(6tdy^2).$$

The partial derivative of willingness to pay with respect to s, WTP_s, is given as

$$WTP_s = 1 + (s + yd)^2/(2tdy^2).$$

Now $WTP_s \geq 0$ whenever the condition

$$s^2 + 2yds + y^2d(d + 2t) \leq 0$$

holds true. Denote $f(s) = s^2 + 2yds + y^2d(d+2t)$. When $t + d > 0$, then $f(s) \leq 0$ for all s for which $0 \leq s \leq -dy$ because the lower root of the equation f(s) = 0, $y(-d-\sqrt{2(-d)t})$, is negative and the higher root, $y(-d+\sqrt{2(-d)t})$, exceeds –dy. Therefore, willingness to pay increases as the price of the physician visit increases.

Let us then study how willingness to pay changes as income changes. The partial derivative of willingness to pay with respect to y, WTP_y, is given as

$$WTP_y = ½(t + d) + [(s + yd)^2(dy - 2s)]/(6tdy^3)$$

The last term of WTP_y is positive because the terms $6tdy^3$ and $(s + dy)^2(dy - 2s)$ are both negative. The term $6tdy^3$ is negative because $d < 0$ and the term $(s + dy)^2(dy - 2s)$ is negative for all $0 \leq s \leq -dy$. The first term in WTP_y is positive by the assumption $t + d > 0$. Therefore, the willingness to pay increases as income grows. This completes the comparative static analysis.